Botanical Assessment for the proposed construction of Oxidation Ponds at Loubos, Dawid Kruiper Local Municipality, Northern Cape Province

Rhigozum trichotomum

Botanical Surveys & Tours

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Report prepared for EnviroAfrica

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National Legislation and Regulations governing this report

This is a 'specialist report' and is compiled in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended, and the Environmental Impact Assessment Regulations, 2014, as amended.

Appointment of Specialist

David J. McDonald of Bergwind Botanical Surveys & Tours CC was appointed by EnviroAfrica, to provide specialist botanical consulting services for the assessment of the areas of the proposed construction of oxidation ponds near the small town of Loubos, Dawid Kruiper Local Municipality, Northern Cape Province.

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Expertise

Dr David J. McDonald:

- Qualifications: BSc. Hons. (Botany), MSc (Botany) and PhD (Botany)
- Botanical ecologist with over 40 years' experience in the field of Vegetation Science.
- Founded Bergwind Botanical Surveys & Tours CC in 2006
- Has conducted over 400 specialist botanical / ecological studies.
- Has published numerous scientific papers and attended numerous conferences both nationally and internationally (details available on request)

Curriculum Vitae – Appendix 2.

Independence

The views expressed in the document are the objective, independent views of Dr McDonald and the study was carried out under the aegis of, Bergwind Botanical Surveys and Tours CC. Neither Dr McDonald nor Bergwind Botanical Surveys and Tours CC have any business, personal, commercial or other interest in the proposed development apart from fair remuneration for the work performed.

Conditions relating to this report

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Declaration of independence:

I David Jury McDonald, as the appointed Specialist hereby declare/affirm the correctness of the information provided or to be provided as part of the application, and that I:

- in terms of the general requirement to be independent:
  - other than fair remuneration for work performed in terms of this application, have no business, financial, personal or other interest in the development proposal or application and that there are no circumstances that may compromise my objectivity; or
  - am not independent, but another specialist (the "Review Specialist") that meets the general requirements set out in Regulation 13 has been appointed to review my work (Note: a declaration by the review specialist must be submitted);
- in terms of the remainder of the general requirements for a specialist, have throughout this EIA process met all of the requirements;
- have disclosed to the applicant, the EAP, the Review EAP (if applicable), the Department and I&APs all material information that has or may have the potential to influence the decision of the Department or the objectivity of any report, plan or document prepared or to be prepared as part of the application; and
- am aware that a false declaration is an offence in terms of Regulation 48 of the EIA Regulations, 2014 (as amended).

Signature of the specialist:

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Name of company:

17 April 2019

Date:

CONTENTS

1. Introduction

Loubos is a small town in the near vicinity of Hakskeen Pan in the Dawid Kruiper Local Municipality, Northern Cape Province. Hakskeen Pan has been chosen by the Bloodhound Project. The project aims to use a supersonic car to attempt to break the land speed record. The location, size and flatness of Hakskeen Pan is ideal for this purpose. The project has attracted international attention and will draw numerous participants, both as part of the project team as well as spectators. This will mean a significant influx of people into an area that presently does not have adequate facilities to cater for the processing of waste water.

The proposed construction of oxidation ponds near Loubos is aimed at addressing the need for necessary waste-water treatment facilities.

This report provides a description of the vegetation found at the alternative sites considered for the oxidation ponds. The report places the vegetation in a regional context from a conservation perspective and the investigation follows published guidelines for evaluating potential impacts on the natural vegetation as they pertain to the study area (Brownlie 2005; Cadman *et al.* 2016). In addition, the requirements and recommendations of Department of Environment and Nature Conservation, Northern Cape Province and the Botanical Society of South Africa for proactive assessment of biodiversity of proposed development sites have also been considered.

2. Terms of Reference

- Provide a broad, baseline description of the vegetation of the study area, placing it in a regional context. Reference should also be made to any bioregional maps of the area.

- Describe the vegetation communities and associated conservation value/sensitivity of the study area and identify any areas of specific concern (e.g. high sensitivity and/or conservation status).

- Provide specific information relating to the vegetation in the study area, with reference to any species of special concern and their conservation status, which can be used as baseline information for the assessment of potential impacts of the proposed project.

- Identify, describe and assess the impacts of the proposed activities on the vegetation.

- Recommend appropriate, practicable mitigation measures that will reduce all major (significant) impacts or enhance potential benefits, if any.

3. Study Area

3.1 Location

The study area is located in the far northwest of the Northern Cape Province in the Dawid Kruiper Local Municipality, on Remainder of Farm Mier No. 585 near the town of Loubos. Loubos lies east of Rietfontein that is close to the South Africa-Namibia border and west of the towns Mier and Klein Mier. It lies northwest of Hakskeen Pan (Figures 1 & 2). Figure 3 presents an aerial view (satellite image) of the Loubos area; not that the town lies west of the red dunes consisting of Kalahari sand.

Figure 1. The location of Loubos (arrow and white dot) in the Dawid Kruiper Local Municipality (dark red shading), which in turn is in the Northern Cape Province (cream shading).

Figure 2. The location of Loubos in the northwestern corner of the Northern Cape Province close to the border with Namibia.

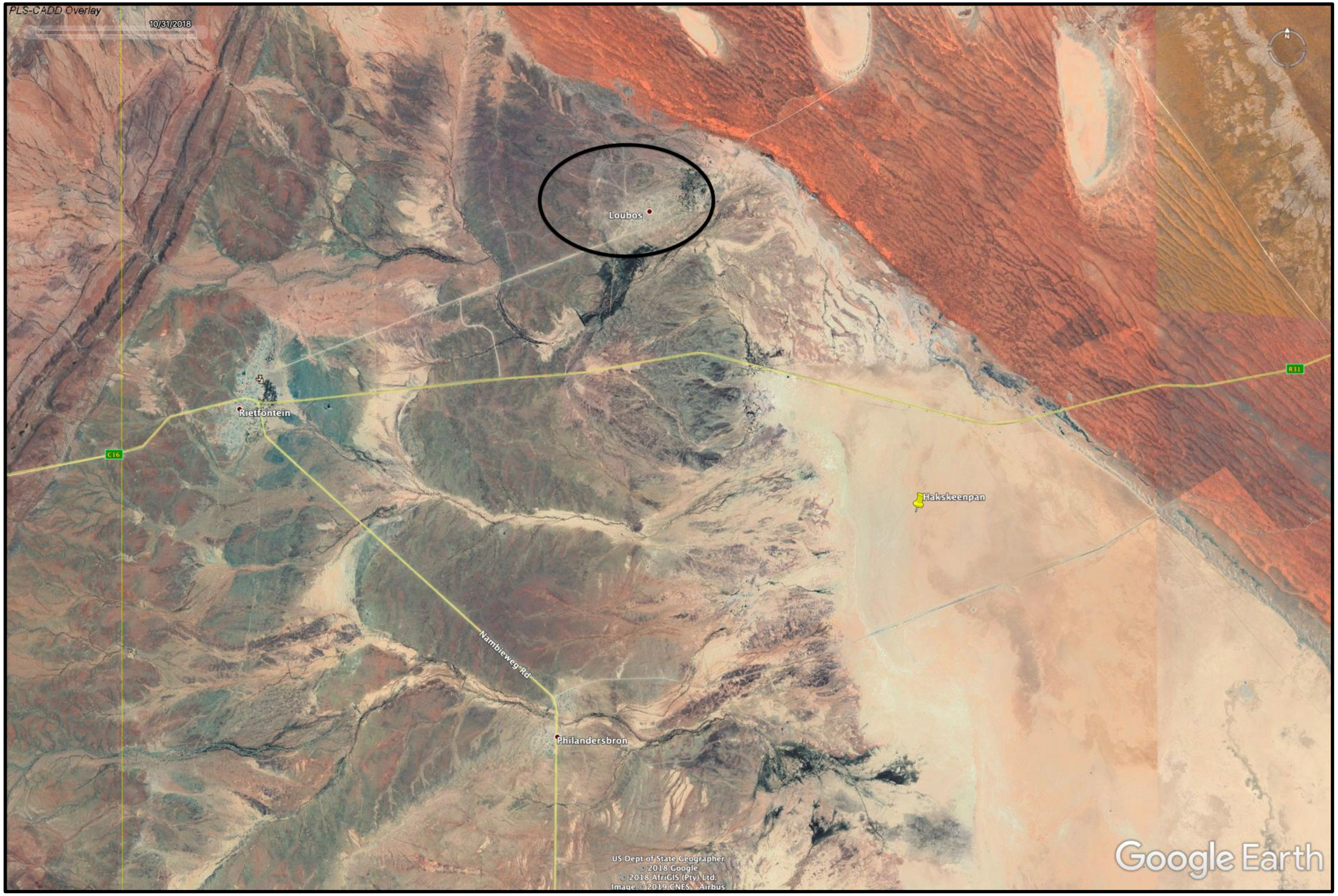

Figure 3. Aerial image (Google Earth ™) showing Loubos lying northwest of Hakskeen Pan and northeast of Rietfontein. Note the red dunes of the Gordonia Formation (Kalahari Sand) found east and north of Loubos.

3.2 Geology, Topography and Soils

The geology of the study area at Loubos consists of Cenozoic Kalahari Group sediments of the Mokalanen Formation consisting of calcretes and the Obobogorop Formation consisting of pebble and boulder clasts derived from Dwyka Group tillite, that overly the calcretes. The red sands of the Gordonia Formation (referred to as Kalahari sand) do not occur at Loubos (Partridge *et al.* 2006). This is clearly seen in the image in Figure 3.

The soils at Loubos are gravelly to rocky with some sandy areas. They are mostly calcic soils (Fey, 2010).

The topography in the Alternative 5 area is shallowly undulating because it is located in a wide seasonal watercourse (also known as a mekgacha (Mucina *et al.* 2006)) (Figure 4). The other parts of the study area generally flat (Figure 5) with occasional narrow and shallow seasonal watercourses.

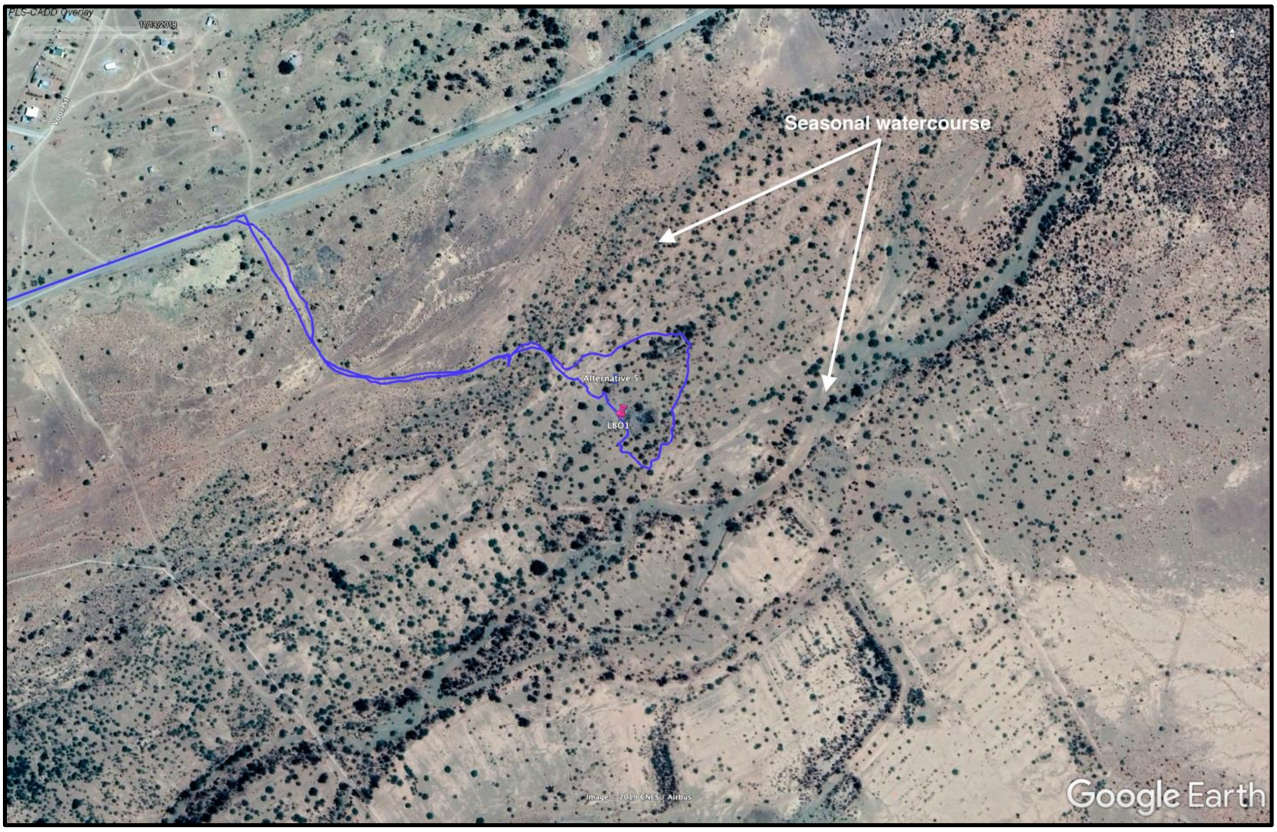

Figure 4. The location of Alternative 5 within an area of seasonal drainage.

Figure 5. Alternatives 1—4 are in areas that are generally flat.

3.3 Climate

Mean annual precipitation (MAP) for Kalahari Karroid Shrubland is 156 mm (Figure 6) (Mucina *et al.* 2006 in Mucina & Rutherford, 2006). The summers are generally hot with rain falling mainly in late summer to autumn. The winters are dry and cold. The climate is therefore classified as arid.

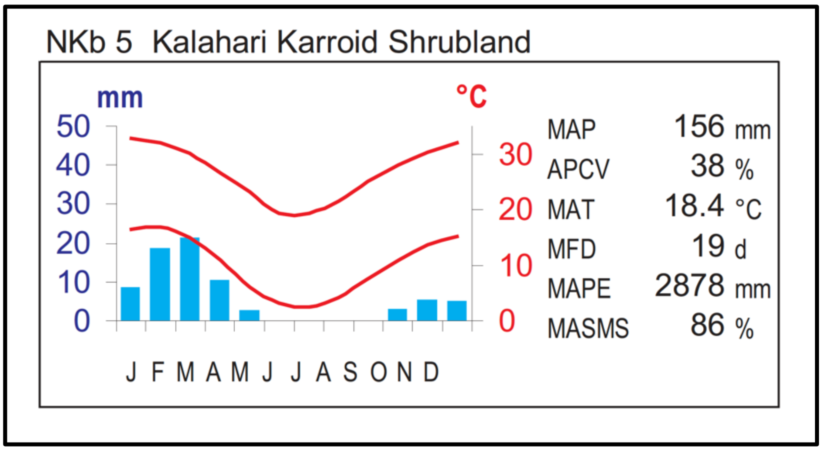

Figure 6. Climate diagram for Kalahari Karroid Shrubland (from Mucina *et al.* 2006 in Rutherford & Mucina, 2006) showing MAP – Mean Annual Precipitation; ACPV = Annual Precipitation Coefficient of Variance; MAT = Mean Annual Temperature; MFD = Mean Frost Days; MAPE = Mean Annual Potential Evaporation; MASMA = Mean Annual Soil Moisture Stress

4. Evaluation Method

The study area was visited at the end of October 2018. No rain had been recently experienced and the area was extremely dry (still in a protracted drought). The survey was started at the Alternative 5 location (see Figures 4, 7 & 9). A hand-held Garmin ® GPSmap 62s and the cell-phone app Gaia GPS were used to track the sampling route, recording waypoints and for purposes of locating specific positions of importance (Figures 7—10). During the survey notes, together with a photographic record, were compiled for the vegetation and landscape. (Some of the photographs are included in this report; those not included may be accessed from the author on request).

5. Limitations and Assumptions

Season of the survey was an important or limitation since the vegetation at the time of the survey was not in optimal condition. The vegetation is thus described here based on a habitat approach. Comparison of the respective alternative sites (see below) allowed for an acceptable level of assessment to be made with a moderate to high level of confidence.

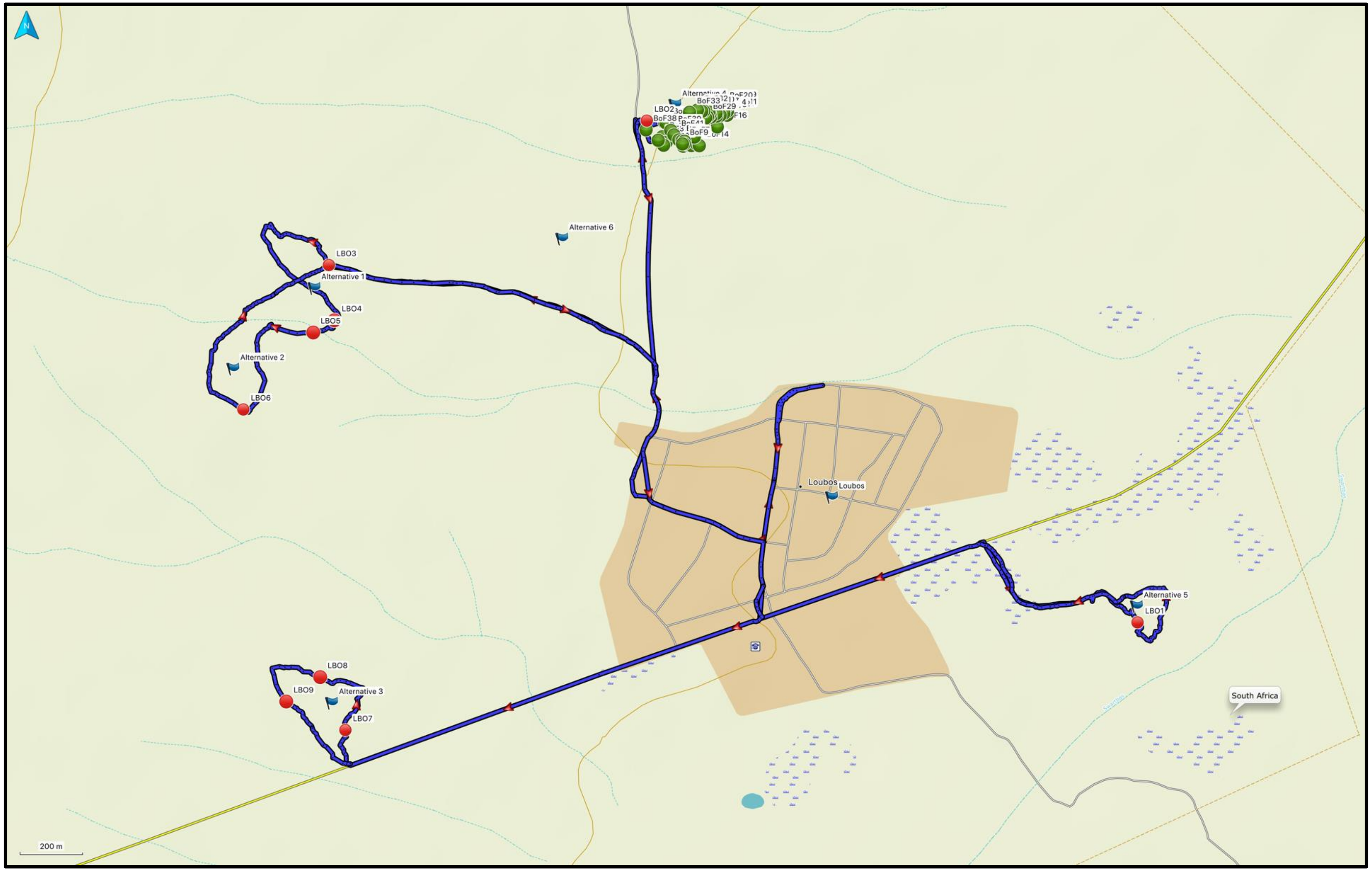

Figure 7. Topographic map of the Loubos study area indicating the track followed during the survey of the vegetation at Alternative sites (1—5) for the proposed oxidation ponds. The sample waypoints are given as LBO# and specific sites of *Boscia foetida* subsp. foetida trees at Alternative 4 are labeled BoF# (see Figure 8 for magnification).

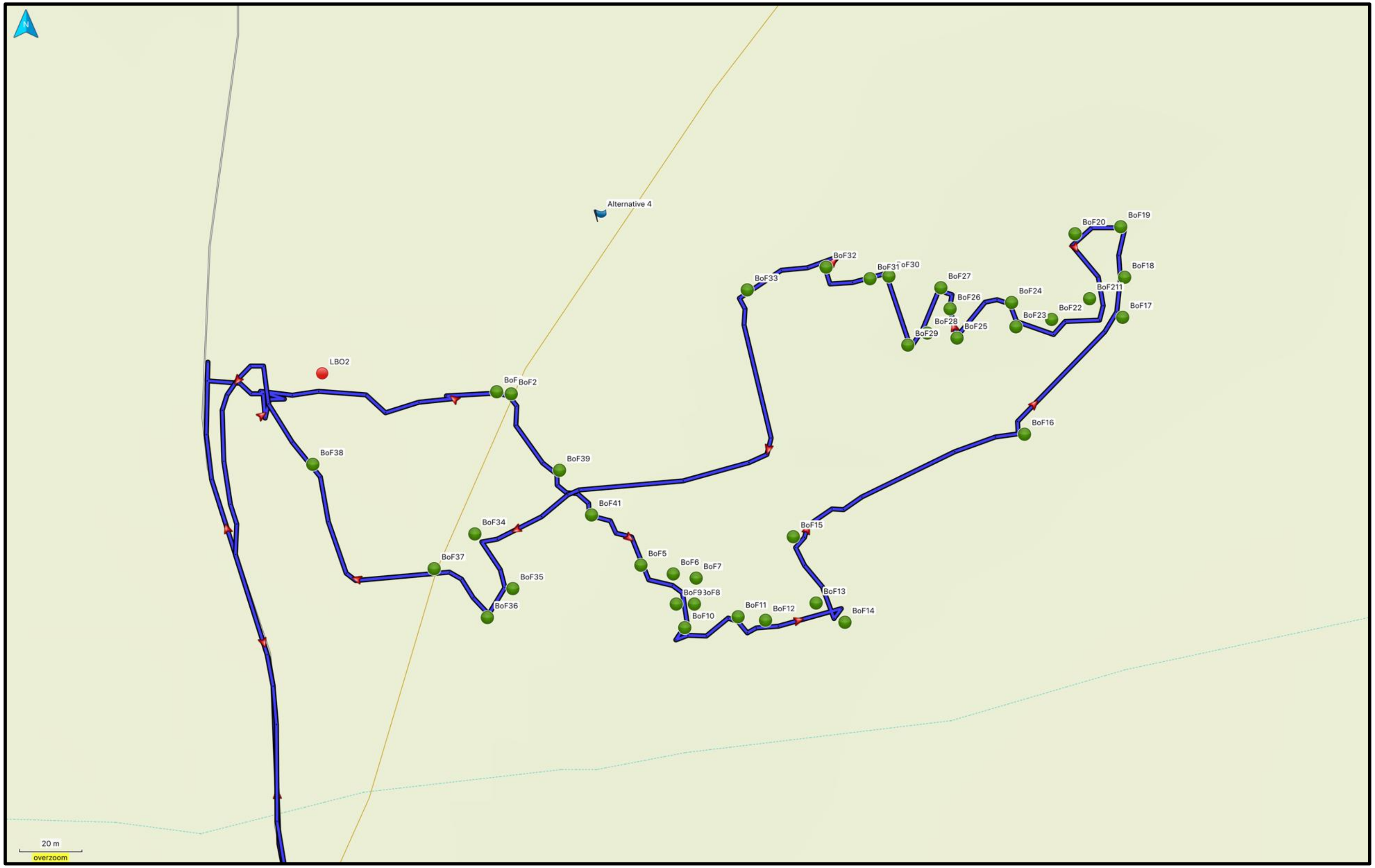

Figure 8. Magnified view of the survey track and waypoints at Alternative 4; the waypoints BoF# are the locations of *Boscia foetida* subsp. *foetida* trees (see Table 1).

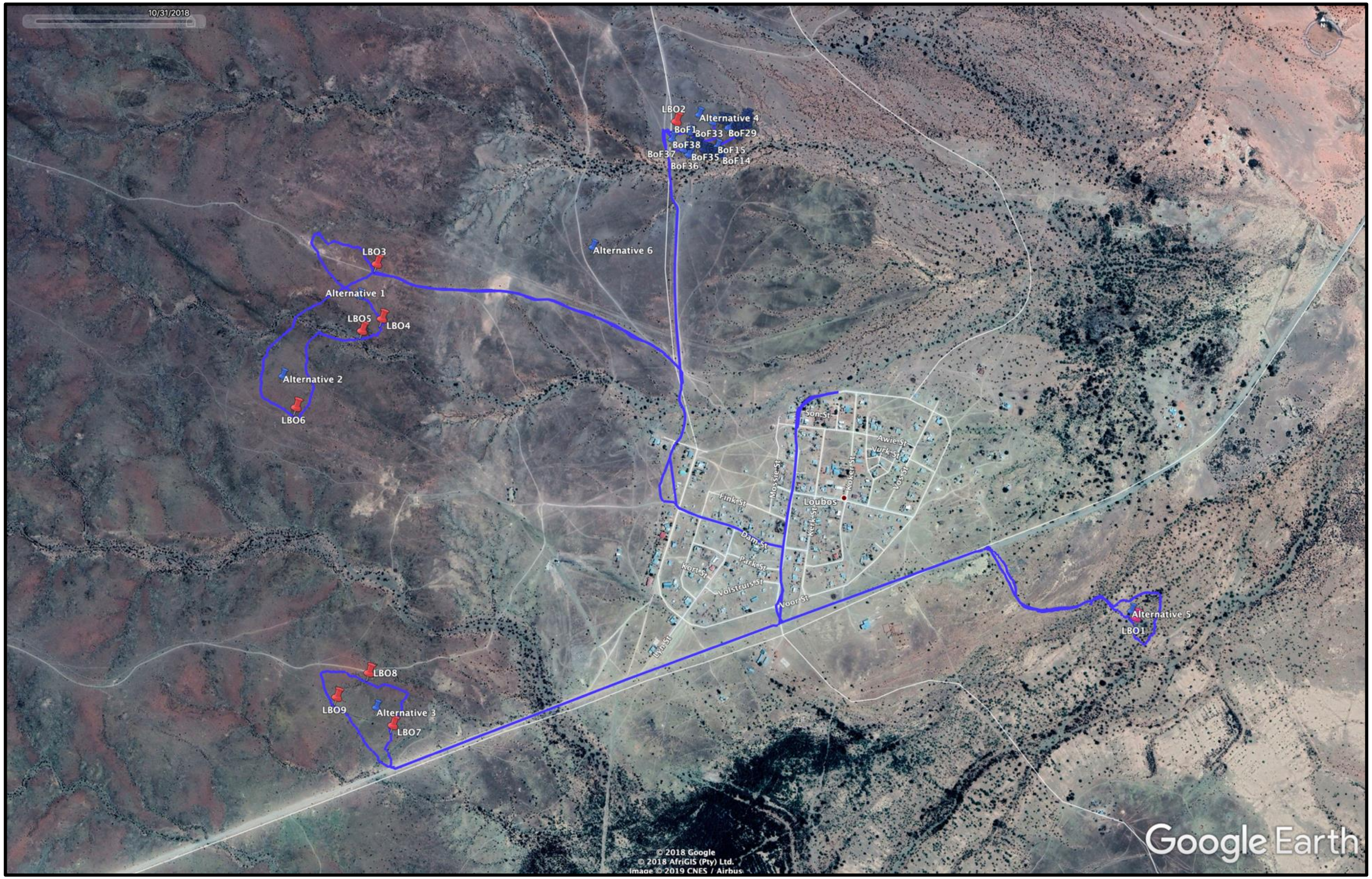

Figure 9. Aerial photograph (Google Earth ™) of the Loubos study area indicating the track followed during the survey of the vegetation at Alternative sites (1—5) for the proposed oxidation ponds. The sample waypoints are given as LBO# (red pins) and specific sites of *Boscia foetida* subsp. foetida trees at Alternative 4 are labeled BoF# (blue pins) (see Figure 9 for magnification).

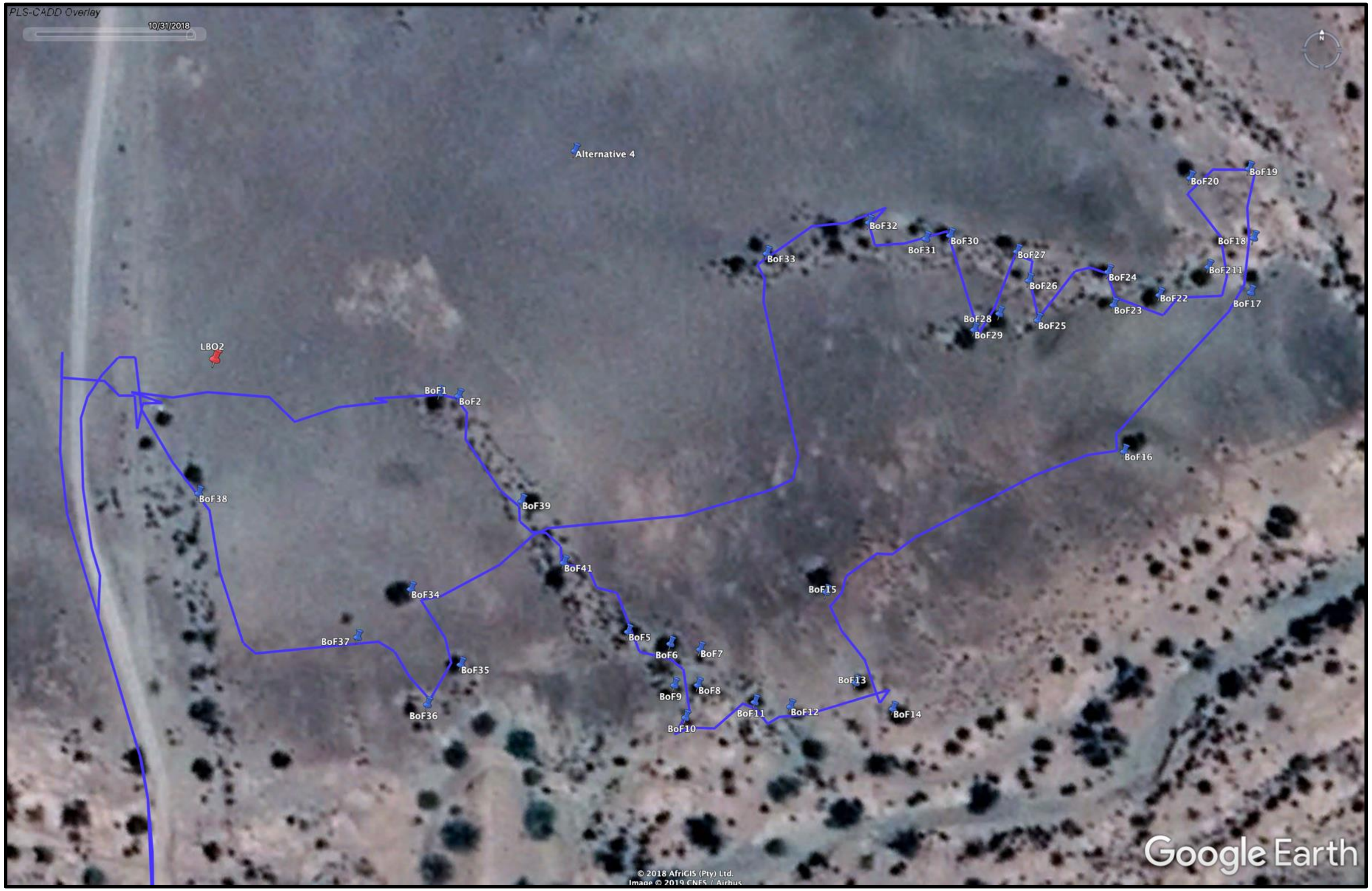

Figure 10. Aerial photograph (Google Earth ™) with magnified view of the survey track and waypoints at Alternative 4; the waypoints BoF# are the locations of *Boscia foetida* subsp. *foetida* trees (see Table 1).

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6. The Vegetation

6.1 General description

The vegetation found in the immediate surrounds of Loubos where the oxidation ponds would be constructed is Kalahari Karroid Shrubland which fall into the Bushmanland and West Griqualand Bioregion of the Nama Karoo Biome. It is a low karroid shrubland with taller shrubs in the drainage lines. It is found on gravel plains as opposed to the vegetation found on sandy soils, the so-called Gordonia Duneveld that falls within the Kalahari Duneveld Bioregion of the Savanna Biome. However, it is in this vegetation type that karroid elements meet and mix with northern, savannah floristic elements meaning that this vegetation is transitional between Karoo and Savanna.

Although a number of grass species are listed by Mucina *et al.* (2006) as occurring in Kalahari Karroid Shrubland, almost no grass was found in the Loubos study area. This is ascribed to both the very dry conditions but also to the heavy grazing, mainly by goats. The low shrub component was also lacking and relatively few species were recorded. This is also ascribed to severe grazing pressure in a hyper-arid environment.

Descriptions of the five alternative oxidation pond sites follow. A sixth alternative was originally identified but was screened out for being too close to Loubos village.

6.2 The vegetation at Alternative 1

The area of Alternative 1 is represented by waypoint LBO3 (S 26° 42' 10.2" E 20° 05' 59.5") and is on a rough gravel plain where a two-spoor track runs. The vegetation is sparse on the gravel plain with the dominant species being *Rhigozum trichotomum* (driedoring), with scattered specimens of *Boscia foetida* subsp. *foetida* (Figure 12) (Van Wyk & Van Wyk, 2013; Van Rooyen, 2001). A few other notable species were recorded namely, *Aptosimum spinescens*, *Zygophyllum* cf. *rigidum* (Figure 14), one plant of the enigmatic *Hoodia gordonii* (bitterghaap; muishondghaap) (Figure 12 & 13) and a single tree of *Parkinsonia africana* (green hair tree) (Figure 15).

The Alternative 1 site is heavily grazed by goats which could partly account for the sparse vegetation, particularly with respect to herbaceous plants.

Waypoint LBO4 (S 26° 42’ 15.9” E 20° 06’ 00.1”) is at the limit of the Alternative 1 area; it should only extend to this point to ensure that the seasonal drainage lines are buffered. Waypoint LBO5 (S 26° 42’ 17.1” E 20° 05’ 57.8”) is at a season drainage line that lies between the Alternative 1 and Alternative 2 sites. This drainage line must be avoided.

Figure 11. The rough, sparsely vegetated gravel plain at the Alternative 1 site.

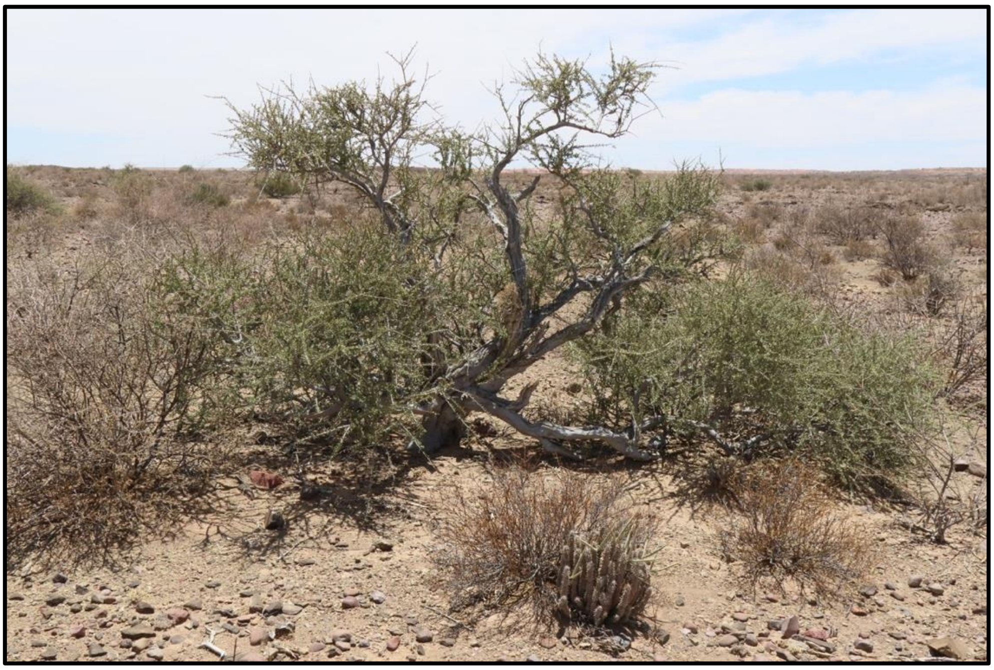

Figure 12. A *Boscia foetida* subsp. *foetida* tree (stinkbos) with *Rhigozum trichotomum* (driedoring) shrubs and a single plant of *Hoodia gordonii* (Bitterghaap; muishondghaap) in the foreground.

Figure 13. *Hoodia gordonii* (bitterghaap or muishondghaap) with horn-like fruits.

Figure 14. *Zygophyllum* cf. *rigidum* well grazed by goats.

Figure 15. *Parkinsonia africana* (green hair tree)

6.3 The vegetation of Alternative 2

Waypoint LBO6 is within the Alternative 2 site. It has similar vegetation and habitat condition to that found at the Alternative 1 site. The soil surface is covered with small rocks and bedrock occurs at the surface in places (Figure 16). The vegetation is dominated by *Rhigozum trichotomum* that is patchy and nowhere dense. There was no grass but *Aptosimum spinescens,* in a very dehydrated state, was recorded.

Figure 16. The gravelly, rocky terrain supporting sparse shrubs at the Alternative 2 site.

Tall shrubs include *Boscia foetida* subsp. *foetida* and *Catophractes alexandri* (trumpet thorn) (Family: Bignoniaceae) (Mannheimer & Curtis, 2009) (Figure 17) the latter being found mainly along drainage lines and in a dormant condition at the time of the survey. No grass was found in the area at all.

The Alternative 2 site would be acceptable for construction of the oxidation ponds as long as the uneven topography on the west side of the area as well as the season drainage line is avoided.

Figure 17. The thorny shrub, *Catophractes alexandri* (trumpet thorn), with white flowers and rough woody fruit, that has a wide distribution from southern Angola, through Namibia, central Botswana and into the Northern Cape Province and Limpopo Province. These photos were taken in Etosha National Park, Namibia.

6.4 The vegetation of Alternative 3

The vegetation of the Alternative 3 site is once again similar to that of the Alternative 1 and Alternative 2 sites. The site was sampled at waypoints LBO7 (S 26° 42' 57.8" E 20° 06' 01.3"), LBO8 (S 26° 42' 52.4" E 20° 05' 58.5") and LBO9 (S 26° 42' 54.9" E 20° 05' 58.5"). The terrain is a rough, rocky, gravelly plain with sparsely scattered *Boscia foetida* subsp. *foetida* trees (Figure 18). The most common shrub is *Rhigozum trichotomum* which tends to be most abundant along drainage lines (Figure 19).

Figure 18. The rough, rocky and gravelly plain at the Alternative 3 site.

Figure 19. *Rhigozum trichotomum* is the dominant shrub at Alternative 3, with scattered *Boscia foetida* subsp. *foetida* small trees.

Plant species occurring in the area of Alternative 3 include, *Aptosimum spinescens, Kleinia longifolia, Leucosphaera bainesii, Lycium* sp., *Parkinsonia africana* and *Zygophyllum* cf. *rigidum. Catophractes alexandri* commonly occurs along the drainage lines with *Boscia foetida* subsp. *foetida*.

The Alternative 3 site is acceptable for construction of the oxidation but only if the seasonal drainage lines can be avoided.

6.5 The vegetation of Alternative 4

The Alternative 4 site is north of Loubos and is situated on a gravel plain with virtually no vegetation (Figure 20) except for a few scattered shrubs of *Zygophyllum* cf. *rigidum* that were not positively identifiable due to their droughted and heavily grazed condition (Figure 21). Other species of interest include *Kleinia longifolia*, *Aptosimum spinescens* and *Cadaba aphylla*.

Along the shallow drainage lines, the dominant shrub is *Rhigozum trichotomum* (driedoring) (Figure 22) with shrubs and small trees of *Boscia foetida* subsp. *foetida*. Table 1 presents the waypoints of the *B. foetida* subsp. *foetida* trees recorded. No protected *Boscia albitrunca* trees were found.

This area would be suitable and acceptable for the oxidation ponds if the drainage lines with *Boscia foetida* subsp. *foetida* are avoided.

A few young invasive mesquite (shrubs) occur in this area and should be eradicated, particularly if construction proceeds here.

Figure 20. The wide-open gravel plain at the Alternative 4 site, dissected by only a few drainage lines.

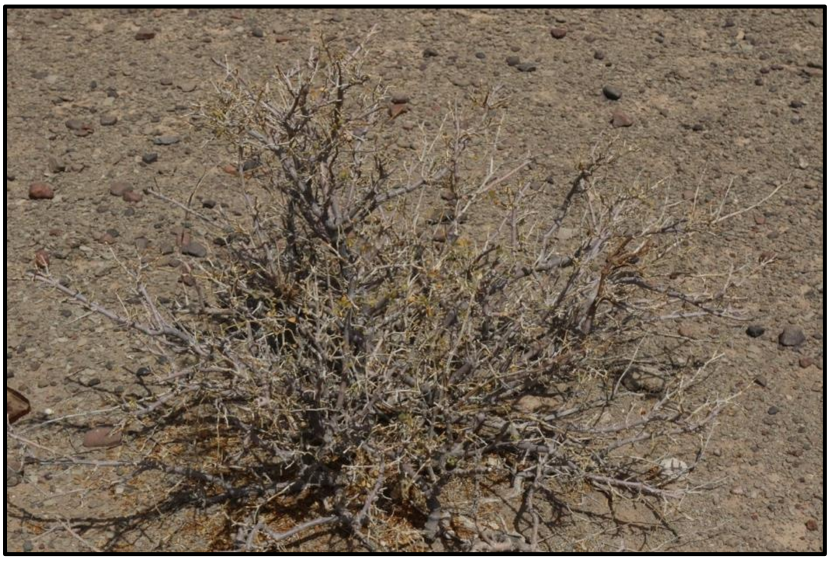

Figure 21. Heavily grazed and dehydrated shrub of *Zygophyllum* cf. *rigidum*.

Figure 22. *Rhigozum trichotomum* (driedoring) is the most prevalent shrub, particularly along seasonal drainage lines.

Figure 23. A small but old tree of *Boscia foetida* subsp. *foetida* (stinkbos).

Figure 24. Leaves and velvety fruits of *Boscia foetida* subsp. *foetida* (stinkbos)

Table 1. Locations of *Boscia foetida* subsp. *foetida* trees in the Alternative 4 area, mainly along drainage lines.

Waypoint	Latitude	Longitude
BoF1	S 26° 41’ 55.6”	E 20°06’ 36.0”
BoF2	S 26° 41’ 55.6”	E 20°06’ 36.1”
BoF3	S 26° 41’ 56.4”	E 20°06’ 36.6”
BoF4	S 26° 41’ 56.9”	E 20°06’ 37.0”
BoF5	S 26° 41’ 57.4”	E 20°06’ 37.5”
BoF6	S 26° 41’ 57.5”	E 20°06’ 37.9”
BoF7	S 26° 41’ 57.5”	E 20°06’ 38.1”
BoF8	S 26° 41’ 57.8”	E 20°06’ 38.1”
BoF9	S 26° 41’ 57.8”	E 20°06’ 37.9”
BoF10	S 26° 41’ 58.0”	E 20°06’ 38.0”
BoF11	S 26° 41’ 57.9”	E 20°06’ 38.6”
BoF12	S 26° 41’ 58.0”	E 20°06’ 38.9”
BoF13	S 26° 41’ 57.8”	E 20°06’ 39.4”
BoF14	S 26° 41’ 58.0”	E 20°06’ 39.8”
BoF15	S 26° 41’ 57.1”	E 20°06’ 39.2”
BoF16	S 26° 41’ 56.1”	E 20°06’ 41.7”
BoF17	S 26° 41’ 54.9”	E 20°06’ 42.8”
BoF18	S 26° 41’ 54.5”	E 20°06’ 42.8”
BoF19	S 26° 41’ 53.9”	E 20°06’ 42.8”
BoF20	S 26° 41’ 54.0”	E 20°06’ 42.3”

BoF21	S 26° 41' 54.7"	E 20°06' 42.4"
BoF22	S 26° 41' 54.9"	E 20°06' 42.0"
BoF23	S 26° 41' 55.0"	E 20°06' 41.6"
BoF24	S 26° 41' 54.7"	E 20°06' 41.6"
BoF25	S 26° 41' 55.1"	E 20°06' 41.0"
BoF26	S 26° 41' 54.8"	E 20°06' 40.9"
BoF27	S 26° 41' 54.6"	E 20°06' 40.8"
BoF28	S 26° 41' 55.0"	E 20°06' 40.7"
BoF29	S 26° 41' 55.1"	E 20°06' 40.4"
BoF30	S 26° 41' 54.4"	E 20°06' 40.2"
BoF31	S 26° 41' 54.5"	E 20°06' 40.0"
BoF32	S 26° 41' 54.3"	E 20°06' 39.6"
BoF33	S 26° 41' 54.6"	E 20°06' 38.7"
BoF34	S 26° 41' 57.1"	E 20°06' 35.7"
BoF35	S 26° 41' 57.6"	E 20°06' 36.1"
BoF36	S 26° 41' 57.9"	E 20°06' 35.9"
BoF37	S 26° 41' 57.4"	E 20°06' 35.3"
BoF38	S 26° 41' 56.4"	E 20°06' 34.0"

6.6 The vegetation of Alternative 5

The area of Alternative 5 is represented by waypoint LBO1 (S 26° 42' 46.8" E 20°07' 27.4"). As noted above, the topography is shallowly undulating due to the seasonal wash but this is difficult to detect at a local scale; when on the site the area appears flat, with minimal relief (Figures 25 & 26). The soil is light-brown and sandy an appeared to be moderately deep.

The area is sparsely vegetated on the ground and this may partly be ascribed to it being grazed by goats and donkeys, as well as to the long drought (Figure 27). The dominant plant species is the exotic invasive *Prosopis glandulosa* var. *torreyana* (honey mesquite) (Henderson, 2001).The mesquite ranges in size from low bushes to well-developed tall shrubs and small trees (Figure 28).

Figure 25. The access track used to reach the Alternative 5 site. It lies on undulating terrain of a seasonal drainage zone.

Figure 26. General view of the terrain at the Alternative 5 site.

Figure 27. Donkeys and goats have significantly overgrazed the area of the Alternative 5 site.

Figure 28. A multi-stemmed tall shrub of *Prosopis glandulosa* var. *torreyana* (honey mesquite).

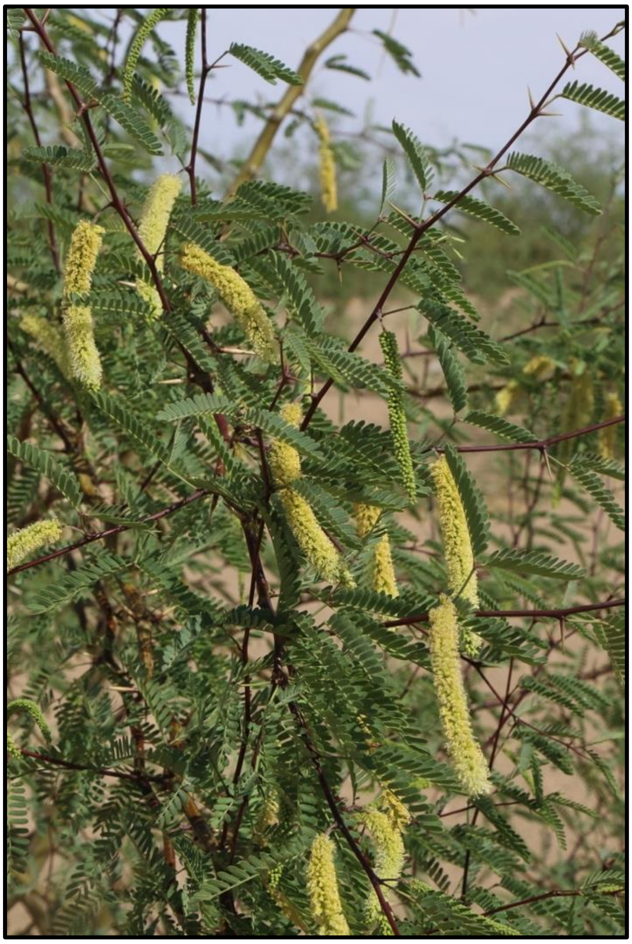

Figure 29. Close-up of flowers and leaves of honey mesquite (*Prosopis glandulosa* var. *torreyana*) and aggressive invasive species in semi-arid and arid habitats.

Apart from the dominant mesquite, tress of *Vachellia erioloba* (camel thorn) [a protected tree species] occur as scattered individuals of moderate age (Figure 30). Three other notable shrubs were recorded namely *Vachellia hebeclada, Leucosphaera bainesii* (Figure 31) and *Lycium* sp.

Figure 30. *Vachellia* (Acacia) *erioloba* (camelthorn) – a protected tree species that occurs a scattered in the Alternative 5 area.

Figure 31. *Leucosphaera bainesii*

Figure 32. A refuse tip within the area of Alternative 5.

The habitat of Alternative 5 is generally in poor condition due mostly to invasive plants, grazing by livestock and tracks but also to the use of the area for dumping of refuse (Figure 32). Despite the poor condition of the area, however, the fact that it is within a seasonal drainage indicates that there could be periodic flooding. It is therefore my view that for non-botanical (ecological) reasons, the site should not be considered for the construction of the proposed oxidation ponds.

7. Conservation Status

Kalahari Karroid Shrubland is not listed in the National List of Threatened Ecosystems and it is thus Least Threatened. In addition, the critical biodiversity area map shapefile for the Northern Cape Province was overlaid on the study area using Google Earth ™ (Figure 33) and it was found that four of the alternative sites (1—4) are located in an area mapped as 'Other Natural Areas' whereas Alternative 5 is located in an area mapped as Critical Biodiversity Area Category 2 (CBA2).

As noted above, the Alternative 5 site is within a seasonal watercourse and since it is mapped as a CBA2, this is further reason for the site to be avoided. Since alternatives 1—4 are in a zone that is not considered to be botanically and ecologically sensitive, the conservation status is not high and any of these sites could be selected on this basis.

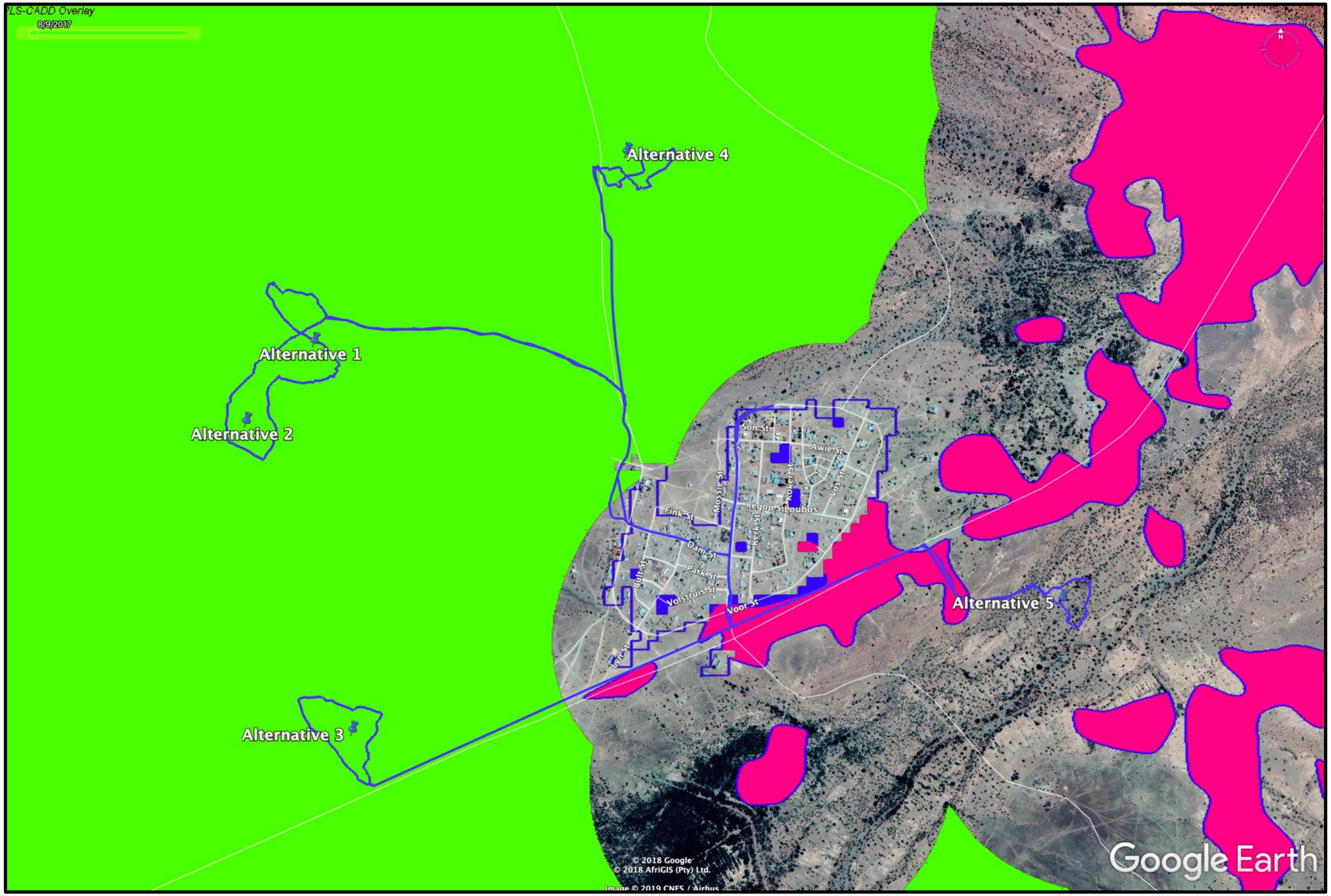

Figure 33. Portion of the Critical Biodiversity Areas map for the Northern Cape Province overlaid on a Google Earth ™ image for the Loubos area. The green shading represents 'Other Natural Areas', the pink shading represents CBA1 areas and the unshaded area represents CBA2.

8. Impact Assessment

Impacts on the vegetation are assessed for the construction and operation of the proposed oxidation ponds near Loubos. Five alternatives and the No Go alternative are assessed.

8.1 'No Go' Alternative

In the case of the **"No Go" alternative,** the oxidation ponds would not be built and there would be no change to the *status quo*. The natural veld would persist around Loubos and there would be continued grazing by livestock, mainly goats. The 'no development' alternative or 'No Go' alternative would thus have a minimal further (negligible) impact on the natural vegetation with no significant further loss in the short- to long-term.

The 'No Go' alternative is included in Table 2.

8.2 Direct Impacts

Direct impacts are those that would occur directly on the vegetation of any of the sites considered as a result of the proposed construction of the oxidation ponds. The rating system used is given in Appendix 1. In addition to determining the individual impacts using various criteria, mitigation is also brought into the assessment.

The impacts of the proposed oxidation ponds on the vegetation and habitat are considered with respect to loss of vegetation type and habitat including plant species due to construction and operational activities. Ecological processes are intrinsic to the habitat and are not separated here for assessment but rather the assessment incorporates the effect on ecological processes as part of the affected habitat.

This assessment is restricted to the 'terrestrial' vegetation but takes note of the seasonal drainage lines (seasonal watercourses) that should be avoided and buffered in all cases. The assumption in the assessment is that this would be the case and that the siting of the ponds would be distance from any watercourses.

The impact assessment (Table 2) indicates that the probable impacts on the Kalahari Karroid Shrubland at Alternative 1—4 would be similar (**Low negative prior to mitigation and Very low negative after mitigation**). The impacts at Alternative 5 are somewhat higher although still only **Medium negative** before mitigation. Since Alternative 5 is located in a seasonal drainage it is recommended that this site should be avoided and therefore the mitigation would be avoidance (the highest measure in the mitigation hierarchy).

The similarity of the vegetation in terms of type and habitat condition of the sites at Alternatives 1—4 is so similar that there is no overriding criterion that suggests that one alternative should be favoured above the rest. Construction and operation of the oxidation ponds at any one of these alternative sites would have more-or-less equal negative impacts on the very sparse vegetation.

Table 2. Impact and Significance – Loss of natural vegetation during construction and operation of the oxidation ponds at Loubos.

CRITERIA	'NO GO' ALTERNATIVE		Alternative 1		Alternative 2		Alternative 3		Alternative 4		Alternative 5	
Nature of direct impact (local scale)	**Loss of Kalahari Karroid Shrubland**											
	WITHOUT MITIGATION	WITH MITIGATION	WITHOUT MITIGATION	WITH MITIGATION	WITHOUT MITIGATION	WITH MITIGATION	WITHOUT MITIGATION	WITH MITIGATION	WITHOUT MITIGATION	WITH MITIGATION	WITHOUT MITIGATION	WITH MITIGATION
Extent	Local		Local		Local		Local		Local		Local	
Duration	Long-term		Long-term		Long-term		Long-term		Long-term		Long-term	
Intensity	Low	N/A	Low	Low	Low	Low	Low	Low	Low	Low	Medium	Medium
Probability of occurrence	Low	N/A	High	High	High	High	High	High	High	High	Medium	Medium
Confidence	High	High	High	High	High	High	High	High	High	High	High	High
Significance	Low negative	N/A	Low negative	Very low negative	Low negative	Very low negative	Low negative	Very low negative	Low negative	Very low negative	Medium negative	Low negative
Nature of Cumulative impact	**Loss of Kalahari Karroid Shrubland**											
Cumulative impact prior to mitigation	Not applicable		Low negative		Low negative		Low negative		Low negative		Medium negative	
Degree to which impact can be reversed	Not applicable		Low		Low		Low		Low		Low	
Degree to which impact may cause irreplaceable loss of resources	Not applicable		Very low		Very low		Very low		Very low		Medium	
Degree to which impact	Not applicable		Low		Low		Low		Low		Medium	

can be mitigated						
Proposed mitigation	None	Avoid any drainage lines	Avoid any drainage lines	Avoid any drainage lines	Avoid any drainage lines	Avoid this Alternative completely
Cumulative impact post mitigation	Not applicable	Very low negative	Very low negative	Very low negative	Very low negative	Low negative
Significance of cumulative impact (broad scale) after mitigation	Not applicable	Very low negative	Very low negative	Very low negative	Very low negative	Low negative

8.3 Mitigation

Given the sparse vegetation and low sensitivity habitat, the requirement for mitigation would be low. The only mitigation necessary in the case of Alternatives 1—4 would be to avoid the seasonal drainage lines and to ensure that they are buffered i.e. treated as watercourses and construction should not be within 32 m of the drainage lines. If this is properly applied and the season watercourses are protected, the mitigation would lower the impacts to **Very Low Negative** for Alternatives 1—4.

8.4 Residual Impacts

Residual impacts are those impacts remain after the implementation of mitigation measures. In the case of Alternatives 1—4, the residual impacts would be the limited loss of Kalahari Karroid Shrubland. The residual impacts would be Low to Very Low Negative. Residual impacts for Alternative 5 would be nil due to avoidance of the site.

8.5 Cumulative Impacts

Kalahari Karroid Shrubland is not heavily impacted by agriculture except for grazing. It is thus generally not transformed unless grazing pressure is extremely high. The cumulative effect of loss of a relatively small area of the Kalahari Karroid Shrubland due to the imposition of the oxidation ponds in the landscape will have a very limited to negligible cumulative impact.

9. Conclusions and Recommendations

Five alternative sites were surveyed and assessed for the proposed Loubos oxidation ponds. The vegetation of these sites at Alternatives 1—4 is very similar and the negative impacts of the construction and operation of the oxidation ponds would, for practical purposes, be the same. In all cases, drainage lines should be avoided and buffered. Alternative 5 should be avoided.

A nominal ranking of the Alternative 1—4 site would be to select Alternative 1 first, Alternative 4 second and then Alternative 3 and finally Alternative 2. This ranking is based mainly on terrain characteristics and access rather than on plant community characteristics since the latter are similar across the sites.

No threatened plant species were found at any of the sites and since Alternative 5 is recommended for avoidance, no protected Vachellia erioloba (camel-thorn) trees would be affected.

It is thus concluded that the construction and operation of the oxidation ponds can be supported from a botanical viewpoint at any of the Alternative 1—4 sites.

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Report submitted: 17 April 2019

Appendix 1: Convention for assigning significance ratings to impacts.

Specialists will consider seven rating scales when assessing potential impacts. These include:

- extent;
- duration;
- intensity;
- status of impact;
- probability;
- degree of confidence; and
- significance.

In assigning significance ratings to potential impacts before and after mitigation specialists are instructed to follow the approach presented below:

1. The core criteria for determining significance ratings are “extent” (Section 6.3.1), “duration” (Section 6.3.2) and “intensity” (Section 6.3.3). The preliminary significance ratings for combinations of these three criteria are given in Section 6.3.7.

2. The status of an impact is used to describe whether the impact will have a negative, positive or neutral effect on the surrounding environment. An impact may therefore be negative, positive (or referred to as a benefit) or neutral.

3. Describe the impact in terms of the probability of the impact occurring (Section 6.3.5) and the degree of confidence in the impact predictions, based on the availability of information and specialist knowledge (Section 6.3.6).

4. Additional criteria to be considered, which could “increase” the significance rating if deemed justified by the specialist, with motivation, are the following:

- Permanent / irreversible impacts (as distinct from long-term, reversible impacts);
- Potentially substantial cumulative effects (see Item 7 below); and
- High level of risk or uncertainty, with potentially substantial negative consequences.

5. Additional criteria to be considered, which could “decrease” the significance rating if deemed justified by the specialist, with motivation, is the following:

    - Improbable impact, where confidence level in prediction is high.

6. When assigning significance ratings to impacts *after mitigation*, the specialist needs to:

    - First, consider probable changes in intensity, extent and duration of the impact after mitigation, assuming effective implementation of mitigation measures, leading to a revised significance rating; and

    - Then moderate the significance rating after taking into account the likelihood of proposed mitigation measures being effectively implemented. Consider:

        - Any potentially significant risks or uncertainties associated with the effectiveness of mitigation measures;

- The technical and financial ability of the proponent to implement the measure; and
- The commitment of the proponent to implementing the measure, or guarantee over time that the measures would be implemented.

7. The cumulative impacts of a project should also be considered. “Cumulative impacts” refer to the impact of an activity that may become significant when added to the existing activities currently taking place within the surrounding environment.

8. Where applicable, assess the degree to which an impact may cause irreplaceable loss of a resource. A resource assists in the functioning of human or natural systems, i.e. specific vegetation, minerals, water, agricultural land, etc.

9. The significance ratings are based on largely objective criteria and inform decision-making at a project level as opposed to a local community level. In some instances, therefore, whilst the significance rating of potential impacts might be “low” or “very low”, the importance of these impacts to local communities or individuals might be extremely high. The importance which I&APs attach to impacts must be taken into consideration, and recommendations should be made as to ways of avoiding or minimising these negative impacts through project design, selection of appropriate alternatives and / or management.

The relationship between the significance ratings after mitigation and decision-making can be broadly defined as follows (see overleaf): substance

Significance rating	**Effect on decision-making**
VERY LOW; LOW	Will not have an influence on the decision to proceed with the proposed project, provided that recommended measures to mitigate negative impacts are implemented.
MEDIUM	Should influence the decision to proceed with the proposed project, provided that recommended measures to mitigate negative impacts are implemented.
HIGH; VERY HIGH	Would strongly influence the decision to proceed with the proposed project.

1. Extent

“Extent” defines the physical extent or spatial scale of the impact.

Rating	**Description**
LOCAL	Extending only as far as the activity, limited to the site and its immediate surroundings. Specialist studies to specify extent.
REGIONAL	Western Cape. Specialist studies to specify extent.
NATIONAL	South Africa
INTERNATIONAL	

2. Duration

“Duration” gives an indication of how long the impact would occur.

Rating	**Description**
SHORT TERM	0 - 5 years
MEDIUM TERM	5 - 15 years
LONG TERM	Where the impact will cease after the operational life of the activity, either because of natural processes or by human intervention.
PERMANENT	Where mitigation either by natural processes or by human intervention will not occur in such a way or in such time span that the impact can be considered transient.

3. Intensity

"Intensity" establishes whether the impact would be destructive or benign.

Rating	Description
ZERO TO VERY LOW	Where the impact affects the environment in such a way that natural, cultural and social functions and processes are not affected.
LOW	Where the impact affects the environment in such a way that natural, cultural and social functions and processes continue, albeit in a slightly modified way.
MEDIUM	Where the affected environment is altered, but natural, cultural and social functions and processes continue, albeit in a modified way.
HIGH	Where natural, cultural and social functions or processes are altered to the extent that it will temporarily or permanently cease.

4. Loss of resources

"Loss of resource" refers to the degree to which a resource is permanently affected by the activity, i.e. the degree to which a resource is irreplaceable.

Rating	Description
LOW	Where the activity results in a loss of a particular resource but where the natural, cultural and social functions and processes are not affected.
MEDIUM	Where the loss of a resource occurs, but natural, cultural and social functions and processes continue, albeit in a modified way.
HIGH	Where the activity results in an irreplaceable loss of a resource.

5. Status of impact

The status of an impact is used to describe whether the impact would have a negative, positive or zero effect on the affected environment. An impact may therefore be negative, positive (or referred to as a benefit) or neutral.

6. Probability

"Probability" describes the likelihood of the impact occurring.

Rating	Description
IMPROBABLE	Where the possibility of the impact to materialise is very low either because of design or historic experience.
PROBABLE	Where there is a distinct possibility that the impact will occur.
HIGHLY PROBABLE	Where it is most likely that the impact will occur.
DEFINITE	Where the impact will occur regardless of any prevention measures.

7. Degree of confidence

This indicates the degree of confidence in the impact predictions, based on the availability of information and specialist knowledge.

Rating	Description
HIGH	Greater than 70% sure of impact prediction.
MEDIUM	Between 35% and 70% sure of impact prediction.
LOW	Less than 35% sure of impact prediction.

8. Significance

"Significance" attempts to evaluate the importance of a particular impact, and in doing so incorporates the above three scales (i.e. extent, duration and intensity).

Rating	**Description**
VERY HIGH	Impacts could be EITHER: of ***high intensity*** at a ***regional level*** and endure in the ***long term***; OR of ***high intensity*** at a ***national level*** in the ***medium term***; OR of ***medium intensity*** at a ***national level*** in the ***long term.***
HIGH	Impacts could be EITHER: of ***high intensity*** at a ***regional level*** and endure in the ***medium term***; OR of ***high intensity*** at a ***national level*** in the ***short term***; OR of ***medium intensity*** at a ***national level*** in the ***medium term;*** OR of ***low intensity*** at a ***national level*** in the ***long term***; OR of ***high intensity*** at a ***local level*** in the ***long term***; OR of ***medium intensity*** at a ***regional level*** in the ***long term.***
MEDIUM	Impacts could be EITHER: of ***high intensity*** at a ***local level*** and endure in the ***medium term***; OR of ***medium intensity*** at a ***regional level*** in the ***medium term***; OR of ***high intensity*** at a ***regional level*** in the ***short term***; OR of ***medium intensity*** at a ***national level*** in the ***short term***; OR of ***medium intensity*** at a ***local level*** in the ***long term***; OR of ***low intensity*** at a ***national level*** in the ***medium term;*** OR of ***low intensity*** at a ***regional level*** in the ***long term.***
LOW	Impacts could be EITHER of ***low intensity*** at a ***regional level*** and endure in the ***medium term***; OR of ***low intensity*** at a ***national level*** in the ***short term***; OR of ***high intensity*** at a ***local level*** and endure in the ***short term***; OR of ***medium intensity*** at a ***regional level*** in the ***short term***; OR of ***low intensity*** at a ***local level*** in the ***long term***; OR of ***medium intensity*** at a ***local level*** and endure in the ***medium term.***
VERY LOW	Impacts could be EITHER of ***low intensity*** at a ***local level*** and endure in the ***medium term***; OR of ***low intensity*** at a ***regional level*** and endure in the ***short term***; OR of ***low to medium intensity*** at a ***local level*** and endure in the ***short term.***
INSIGNIFICANT	Impacts with: Zero to very low intensity with any combination of extent and duration.
UNKNOWN	In certain cases it may not be possible to determine the significance of an impact.

9. Degree to which impact can be mitigated

This indicates the degree to which an impact can be reduced / enhanced.

Rating	**Description**
NONE	No change in impact after mitigation.
VERY LOW	Where the significance rating stays the same, but where mitigation will reduce the intensity of the impact.
LOW	Where the significance rating drops by one level, after mitigation.
MEDIUM	Where the significance rating drops by two to three levels, after mitigation.
HIGH	Where the significance rating drops by more than three levels, after mitigation.

10 Reversibility of an impact

This refers to the degree to which an impact can be reversed.

Rating	**Description**
IRREVERSIBLE	Where the impact is permanent.
PARTIALLY REVERSIBLE	Where the impact can be partially reversed.
FULLY REVERSIBLE	Where the impact can be completely reversed.

Appendix 2: Curriculum Vitae

Dr David Jury McDonald Pr.Sci.Nat.

Name of Company: Bergwind Botanical Surveys & Tours CC. (Independent consultant)

Work and Home Address: 14 A Thomson Road, Claremont, 7708

Tel: (021) 671-4056 **Mobile:** 082-8764051 **Fax:** 086-517-3806

E-mail: dave@bergwind.co.za

Website: www.bergwind.co.za

Profession: Botanist / Vegetation Ecologist / Consultant / Tour Guide

Date of Birth: 7 August 1956

Employment history:

- 19 years with National Botanical Institute (now SA National Biodiversity Institute) as researcher in vegetation ecology.
- Five years as Deputy Director / Director Botanical & Communication Programmes of the Botanical Society of South Africa
- Six years as private independent Botanical Specialist consultant (Bergwind Botanical Surveys & Tours CC)

Nationality: South African (ID No. 560807 5018 080)

Languages: English (home language) – speak, read and write
Afrikaans – speak, read and write

Membership in Professional Societies:

- International Association for Impact Assessment (SA)
- South African Council for Natural Scientific Professions (**Ecological Science, Registration No. 400094/06**)
- Field Guides Association of Southern Africa

Key Qualifications :

- Qualified with a M. Sc. (1983) in Botany and a PhD in Botany (Vegetation Ecology) (1995) at the University of Cape Town.
- Research in Cape fynbos ecosystems and more specifically mountain ecosystems.
- From 1995 to 2000 managed the Vegetation Map of South Africa Project (National Botanical Institute)
- Conducted botanical survey work for AfriDev Consultants for the Mohale and Katse Dam projects in Lesotho from 1995 to 2002. A large component of this work was the analysis of data collected by teams of botanists.

- **Director: Botanical & Communication Programmes** of the Botanical Society of South Africa (2000—2005), responsible for communications and publications; involved with conservation advocacy particularly with respect to impacts of development on centres of plant endemism.

- Further tasks involved the day-to-day management of a large non-profit environmental organisation.

- **Independent botanical consultant** (2005 – to present) over 300 projects have been completed related to environmental impact assessments in the Western, Southern and Northern Cape, Karoo and Lesotho. A list of reports (or selected reports for scrutiny) is available on request.

Higher Education

Degrees obtained
and major subjects passed:

B.Sc. (1977), University of Natal, Pietermaritzburg
Botany III
Entomology II (Third year course)

B.Sc. Hons. (1978) University of Natal, Pietermaritzburg
Botany (Ecology /Physiology)

M.Sc - (Botany), University of Cape Town, 1983.
Thesis title: 'The vegetation of Swartboschkloof, Jonkershoek, Cape Province'.

PhD (Botany), University of Cape Town, 1995.
Thesis title: 'Phytogeography endemism and diversity of the fynbos of the southern Langeberg'.

Certificate of Tourism: Guiding (Culture: Local)
Level: 4 Code: TGC7 (Registered Tour Guide: WC 2969).

Employment Record:

January 2006 – present: Independent specialist botanical consultant and tour guide in own company: **Bergwind Botanical Surveys & Tours CC**

August 2000 - 2005 : Deputy Director, later Director Botanical & Communication Programmes, Botanical Society of South Africa

January 1981 – July 2000 : Research Scientist (Vegetation Ecology) at National Botanical Institute

January 1979—Dec 1980 : National Military Service

Further information is available on my company website: www.bergwind.co.za

Appendix 3: Botanical Assessment Content Requirements of Specialist Reports, as prescribed by Appendix 6 of GN R326.

Regulation	Content as required by NEMA	Specialist Report Section/Annexure Reference
1 (1) (a)	Details of- (i) The specialist who prepared the report; and	Cover & Page 2
	(ii) The expertise of that specialist to compile a specialist report, including a CV.	Appendix 2
1 (1) (b)	A declaration that the specialist is independent in a form as may be specified by the competent authority.	Page 4
1 (1) (c)	An indication of the scope of, and purpose for which, the report is prepared.	Page 6
1 (1)(cA)	An indication of the quality and age of base data used for the specialist report.	Page 12
1 (1)(cB)	A description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change.	Page 17—28
1 (1) (d)	The duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment.	Page 12
1 (1) (e)	A description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used.	Page 12
1 (1) (f)	Details of an assessment of the specifically identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives.	Pages 31—35
1 (1) (g)	An identification of any areas to be avoided, including buffers.	Page 35
1 (1) (h)	A map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers.	Pages 13—16; 30
1 (1) (i)	A description of any assumptions made and any uncertainties or gaps in knowledge.	Page 12
1 (1) (j)	A description of the findings and potential implications of such findings on the impact of the proposed activity or activities.	Pages 17—28
1 (1) (k)	Any mitigation measures for inclusion in the EMPr.	Page 35
1 (1) (l)	Any conditions for inclusion in the environmental authorisation.	N/A
1 (1) (m)	Any monitoring requirements for inclusion in the EMPr or environmental authorisation	N/A

Regulation	Content as required by NEMA	Specialist Report Section/Annexure Reference
1 (1) (n)	A reasoned opinion- (i) whether the proposed activity, activities or portions thereof should be authorised; and	Page 35
	(iA) regarding the acceptability of the proposed activity or activities; and	Page 35
	(ii) If the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan	Page 35
1 (1) (o)	A description of any consultation process that was undertaken during the course of preparing the specialist report	N/A
1 (1) (p)	A summary and copies of any comments received during any consultation process and where applicable, all responses thereto	N/A
1 (1) (q)	Any other information requested by the competent authority	N/A