Botanical Assessment for the proposed upgrade of the DR 1688 & DR 1699 between Calitzdorp and Oudtshoorn, Western Cape Province

Botanical Surveys & Tours

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Report prepared for Guillaume Nel Environmental Consultants

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, 2010.

Appointment of Specialist

David J. McDonald of Bergwind Botanical Surveys & Tours CC was appointed by Guillaume Nel Environmental Consultants to provide specialist botanical consulting services for the proposed site for a renewable energy project in the Northern Cape. The consulting services comprise a study of the vegetation along the DR 1699 and DR 1688 roads in the Western Cape Province and the potential impact of upgrading these roads on the roadside vegetation.

Details of Specialist

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Expertise

Dr David J. McDonald:

- Qualifications: BSc. Hons. (Botany), MSc (Botany) and PhD (Botany)
- Botanical ecologist with over 30 years' experience in the field of Vegetation Science
- Founded Bergwind Botanical Surveys & Tours CC in 2006
- Has conducted over 300 specialist botanical / ecological studies
- Has published numerous scientific papers and attended numerous conferences both nationally and internationally (details available on request)

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, financial or other interest in the proposed development apart from fair remuneration for the work performed.

Conditions relating to this report

The content of this report is based on the author's best scientific and professional knowledge as well as available information. Bergwind Botanical Surveys & Tours CC, its staff and appointed associates, reserve the right to modify the report in any way deemed fit should new, relevant or previously unavailable or undisclosed information become known to the author from on-going research or further work in this field, or pertaining to this investigation

This report must not be altered or added to without the prior written consent of the author. This also refers to electronic copies of the report which are supplied for the purposes of inclusion as part of other reports, including main reports. Similarly, any recommendations, statements or conclusions drawn from or based on this report must make reference to this report. If these form part of a main report relating to this investigation or report, this report must be included in its entirety as an appendix or separate section to the main report.

Curriculum Vitae – Appendix 2.

THE INDEPENDENT PERSON WHO COMPILED A SPECIALIST REPORT OR UNDERTOOK A SPECIALIST PROCESS

I **David Jury McDonald**, as the appointed independent specialist hereby declare that I:

- act/ed as the independent specialist in this application;
- regard the information contained in this report as it relates to my specialist input/study to be true and correct, and
- do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed in terms of the NEMA, the Environmental Impact Assessment Regulations, 2010 and any specific environmental management Act;
- have and will not have no vested interest in the proposed activity proceeding;
- have disclosed, to the applicant, EAP and competent authority, any material information that have or may have the potential to influence the decision of the competent authority or the objectivity of any report, plan or document required in terms of the NEMA, the Environmental Impact Assessment Regulations, 2010 and any specific environmental management Act;
- am fully aware of and meet the responsibilities in terms of NEMA, the Environmental Impact Assessment Regulations, 2010 (specifically in terms of regulation 17 of GN No. R. 543) and any specific environmental management Act, and that failure to comply with these requirements may constitute and result in disqualification;
- 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;
- have ensured that the names of all interested and affected parties that participated in terms of the specialist input/study were recorded in the register of interested and affected parties who participated in the public participation process;
- have provided the competent authority with access to all information at my disposal regarding the application, whether such information is favourable to the applicant or not; and
- am aware that a false declaration is an offence in terms of regulation 71 of GN No. R. 543.

Note: The terms of reference must be attached.

Signature of the specialist:

Bergwind Botanical Surveys & Tours CC

Name of company:

17 September 2014

Date:

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1. Introduction

1.1 Scope

The Western Cape Department of Transport & Public Works intends to surface Divisional Road (DR)1699 (also known as Station Road) at Calitzdorp and to rehabilitate and resurface DR 1688, the 'Old Concrete Road' between Calitzdorp and Oudtshoorn in the Little Karoo.

Details of the proposed road-works are given in the Draft Basic Assessment Report (GNEC, July 2013) and summary of the activities are as follows:

- Divisional Road 1699 will be upgraded from a gravel road to an asphalt-surfaced road. It starts at the intersection with Divisional Road 1688 and continues for 1.20km to where it intersects with Divisional Road 1661 near the Calitzdorp Station.
- Divisional Road 1688 is the original road which linked Calitzdorp to Oudtshoorn and also provides access to the well-know Calitzdorp Spa. It was constructed more than 60 years ago (circa 1952) and is made of concrete. The concrete has degraded and become severely cracked. The road starts at the intersection with Trunk Road 31/6 (also known as R62) at Calitzdorp and runs in a south-easterly to easterly direction for 43.07 km. The rehabilitation would start at km 1.07 and end at the intersection with Trunk Road 31/6 at km 43.7. Three sections of the road are recognized: Section 1 from km 1.07 to km 4.68 would be rehabilitated to a Class 3 road with 2 x3.4m surfaced lanes, 2 x 0.9m surfaced shoulders and 2 x 0.6m gravel shoulder. Section 2 from km 4.68 to km 15.18 would be rehabilitated to a Class 4 road with 2 x 3.4m surfaced lanes and 2 x 0.9m gravel shoulders and Section 3 from km 15.18 to km 43.07 would be rehabilitated to a Class 4 road with 2 x 3.4m surfaced lanes and 2x 0.9 gravel shoulders.

Pertinent to this study is that disturbed and compacted gravel road shoulder is graded annually and very little vegetation occurs within 2.5 m of the edge of the road. It is envisaged that the road upgrade would be restricted to the compacted and degraded road verge/shoulder. The vegetation beyond the compacted shoulder to the road reserve fence and continuous with the vegetation on the agricultural land would not be affected by the road-building activities.

Bergwind Botanical Surveys & Tours CC (Dr D.J. McDonald) was commissioned to survey and assess the vegetation and habitat found in the road reserves of the above road sections to inform the process for authorisation to carry out the proposed activities. The assessment

takes careful note of the requirements and recommendations of CapeNature (Western Cape Province), Department of Environment Affairs and Nature Conservation, Northern Cape and the Botanical Society of South Africa for proactive assessment of biodiversity of sites where there is a proposed change of land use or potential impact (positive or negative) on natural vegetation. The study follows published guidelines for evaluating potential impacts on the natural vegetation in an area earmarked for some form of development (Brownlie 2005, De Villiers *et al.* 2005) as well as the guidelines for specialists in the Western Cape Province.

1.2 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.
- Provide a report on any sensitive plant species or vegetation identified in the road reserve (the principal objective).
- Identify and assess potential impacts of the construction, operational and closure/decommissioning phases.
- Identify and assess any cumulative impacts arising from the proposed project.

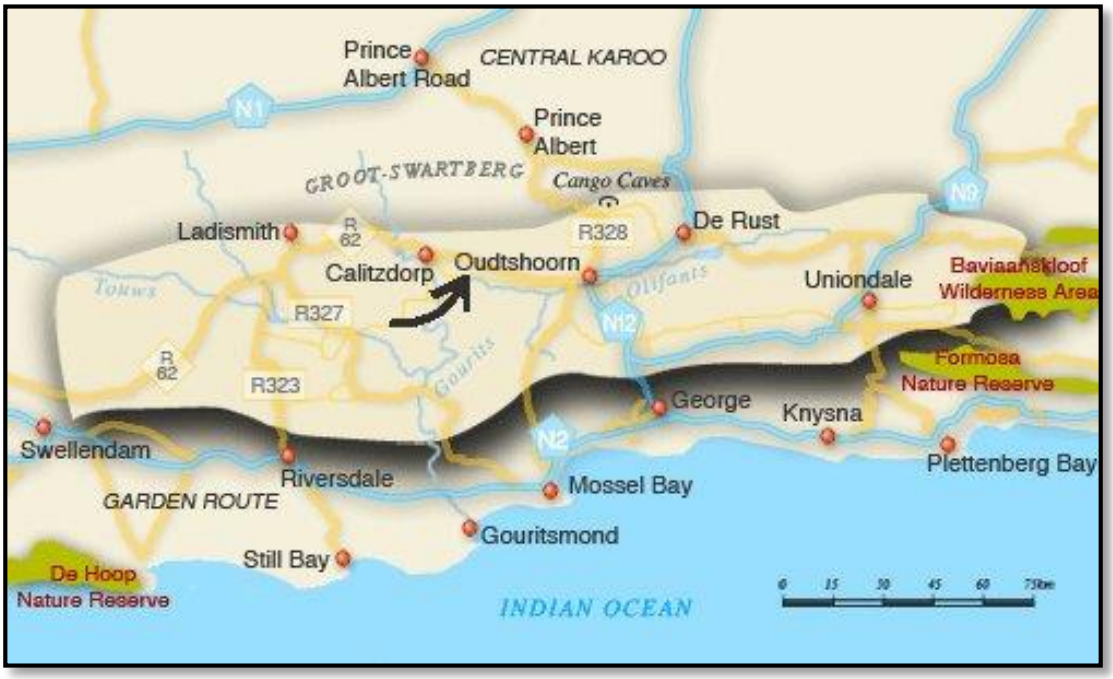

Figure 1. Location of the between Calitzdorp and Oudtshoorn in the Little Karoo, Western Cape Province.

1.3 Assumptions and Limitations

The survey of the vegetation along the DR 1699 and DR 1688 was intentionally delayed until spring to ensure that the vegetation was in the best condition. Unfortunately, rainfall in the study area prior to the visit in mid-August 2014 had been low and there had been a 'black frost' not long before. The result was that contrary to expectations the vegetation was in a dry and dormant state with very few plants actively growing and in flower. This presented some limitations to the survey, however, since the main objective was to determine if there were any sensitive plants close to the road i.e. within 2 m of the edge of the road, the general dry condition of the vegetation did not influence the conclusions of the survey much.

2. Project Area

2.1 Locality

The DR1699 and DR 1688 roads are located in the central Little Karoo from Calitzdorp eastwards to approximately 10 km from Oudtshoorn (Figure 1). The main study area i.e. of DR 1688 follows the valleys of the Gamka River and Olifants River.

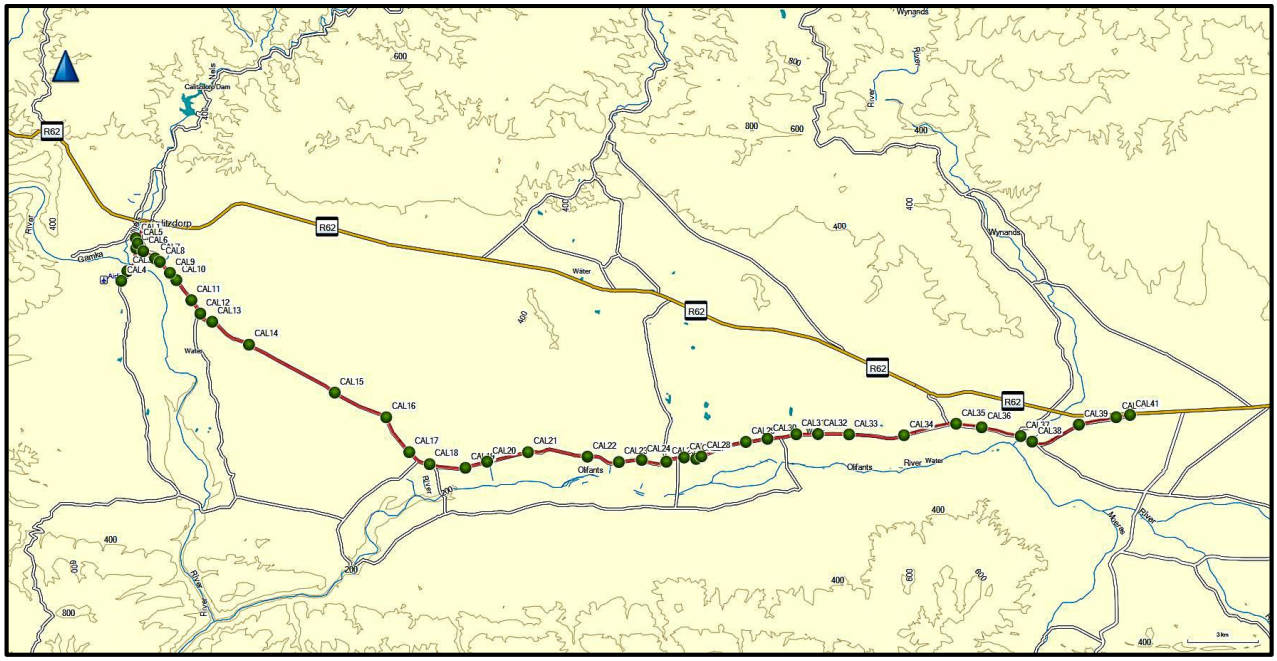

Figure 2. Topographical map of the area through which the respective roads (red lines), DR1699 and DR 1688 extend between Calitzdorp and Oudtshoorn, Western Cape Province. The sample waypoints are shown with green icons (CAL#).

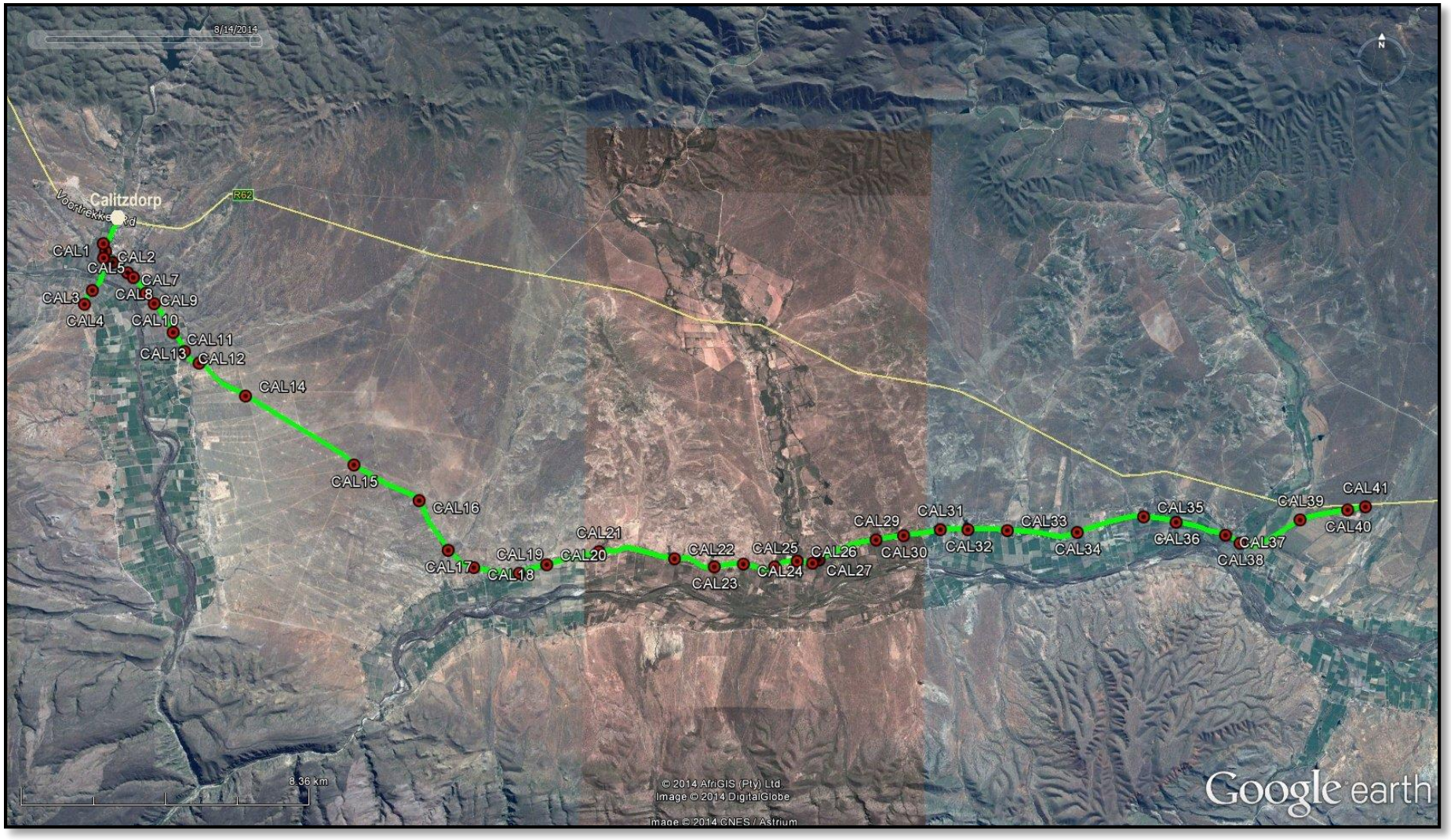

Figure 3. An aerial image (Google Earth ™) of the terrain through which the DR 1699 and DR 1688 (green lines) extend.

2.2 Topography, Geology, and Soils

The landscape between Calitzdorp and Oudtshoorn is one of rolling hills and open flat plains. The DR 1688 is aligned more or less at the interface between the low hills and the lower-lying river valley sediments (alluvium) of the Gamka River and Olifants River. The underlying geology consists of shales, mudstones and siltstones of the Bokkeveld Group. The soils are of varied structure and texture but mainly loamy-silty.

2.3 Climate

The region of the study area in the Little Karoo is in a rain-shadow and has aseasonal rainfall, receiving rain in every month of the year but with peaks in autumn (April) and early summer (October) (Figure 4). Mean annual precipitation is 288 mm. Mean monthly maximum temperature is highest in January and February (30 °C) with the winter low of 4 – 5 °C experienced in June, July and August (Figure 5). These climate parameters contribute to the region being classified as semi-arid.

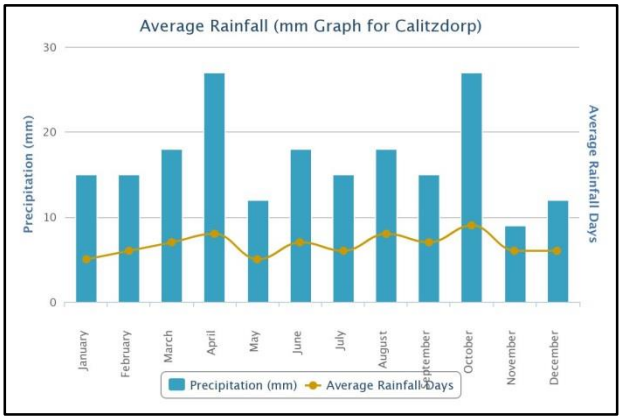

Figure 4. Average monthly rainfall for Calitzdorp

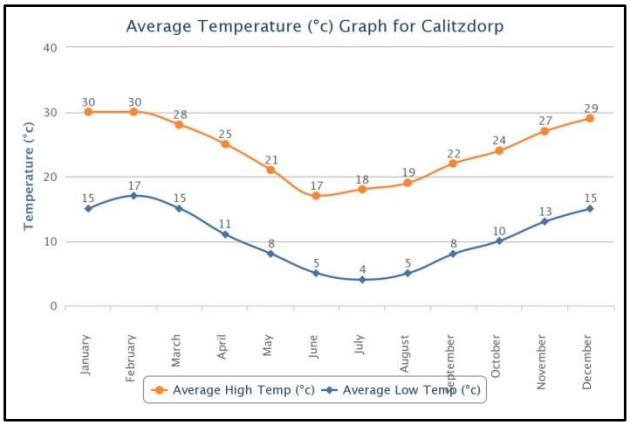

Figure 5. Average monthly temperature for Calitzdorp.

3. Evaluation Method

The DR 1699 and DR 1688 were surveyed on 13 & 14 August 2014. The route was driven by motor vehicle and the vegetation sampled at irregularly spaced waypoints. The waypoints were subjectively determined depending on the vegetation present or perceived changes in the habitat alongside the road. The sampling intensity was roughly one sample per kilometre. As noted above the vegetation was not in optimal condition, however, adequate plant material, sometimes in a dry state, was available over most of the survey route to be able to make meaningful observations. Photographs of each sample site were taken for analysis after field-work was completed.

4. Results

4.1 The Vegetation

Biogeographically the study area falls within the Succulent Karoo Biome (Rutherford & Westfall, 1994; Low & Rebelo, 1996; Van Wyk & Smith, 2005; Mucina & Rutherford, 2006). According to the National Vegetation Map (Mucina, Rutherford & Powrie, 2005) and the description of vegetation types for the Succulent Karoo (Mucina *et al.* 2006), two vegetation types are found in the study area, Eastern Little Karoo (SKv11) and Muscadel Riviere. Vlok *et al.* (2005) published a more detailed study of the vegetation of the Little Karoo with many more vegetation units narrowly defined. Portion of the Little Karoo vegetation map (after Vlok *et al.* 2005) is given in Figure 7. The vegetation types found where the DR 1699 and DR 1688 are aligned are as follows, in order from west to east:

- Calitzdorp Gravel Apronveld
- Gamka River & Floodplain
- Calitzdorp Gannaveld
- Volmoed Gannaveld
- Greylands Apronveld
- Oudtshoorn Gannaveld
- Grootkop Arid Spekboomveld

Reference should be made to Vlok *et al.* (2005) for descriptive details of each of these units or to Vlok & Schutte-Vlok (2010) for broader-scale general types such as Apronveld Gannaveld, Spekboomveld etc.

4.2 Vegetation units and disturbance regime of the road reserve of the DR1699 and DR 1688

The vegetation encountered at the sample waypoints has been assigned to the above seven units defined by Vlok *et al.* (2005) based mainly on geographical location. Species composition of the roadside vegetation has been so transformed that it seldom resembles that of the original vegetation in its undisturbed condition.

Historically the vegetation of the road reserve of the DR 1699 and DR 1688 has been heavily impacted by various negative activities but most of all by removal or disturbance of natural vegetation under the banner of '*maintenance*'. This activity has had a long-term negative effect with little truly natural vegetation persisting in the road reserves. Elements of the respective vegetation types are found but the road verges on both sides of the roads have been compacted and scraped. The result is an extremely disturbed condition with extremely low botanical sensitivity close to the road edges. Further away from the road but within the road reserves, varying levels of disturbance were found. In some places the vegetation was intact and ecologically functional whereas in others it was invaded by alien shrubs or semi-woody species such as *Atriplex lindleyi* subsp. *inflata* (blasiebrak) or woody shrubs such as mesquite (*Prosopis glandulosus*). Exotic trees have also been planted in places which have significantly altered the ecology.

A selection of waypoints with descriptive notes is given with illustrations in Table 1 to represent the different habitats found on the DR 1699 and DR 1688 routes.

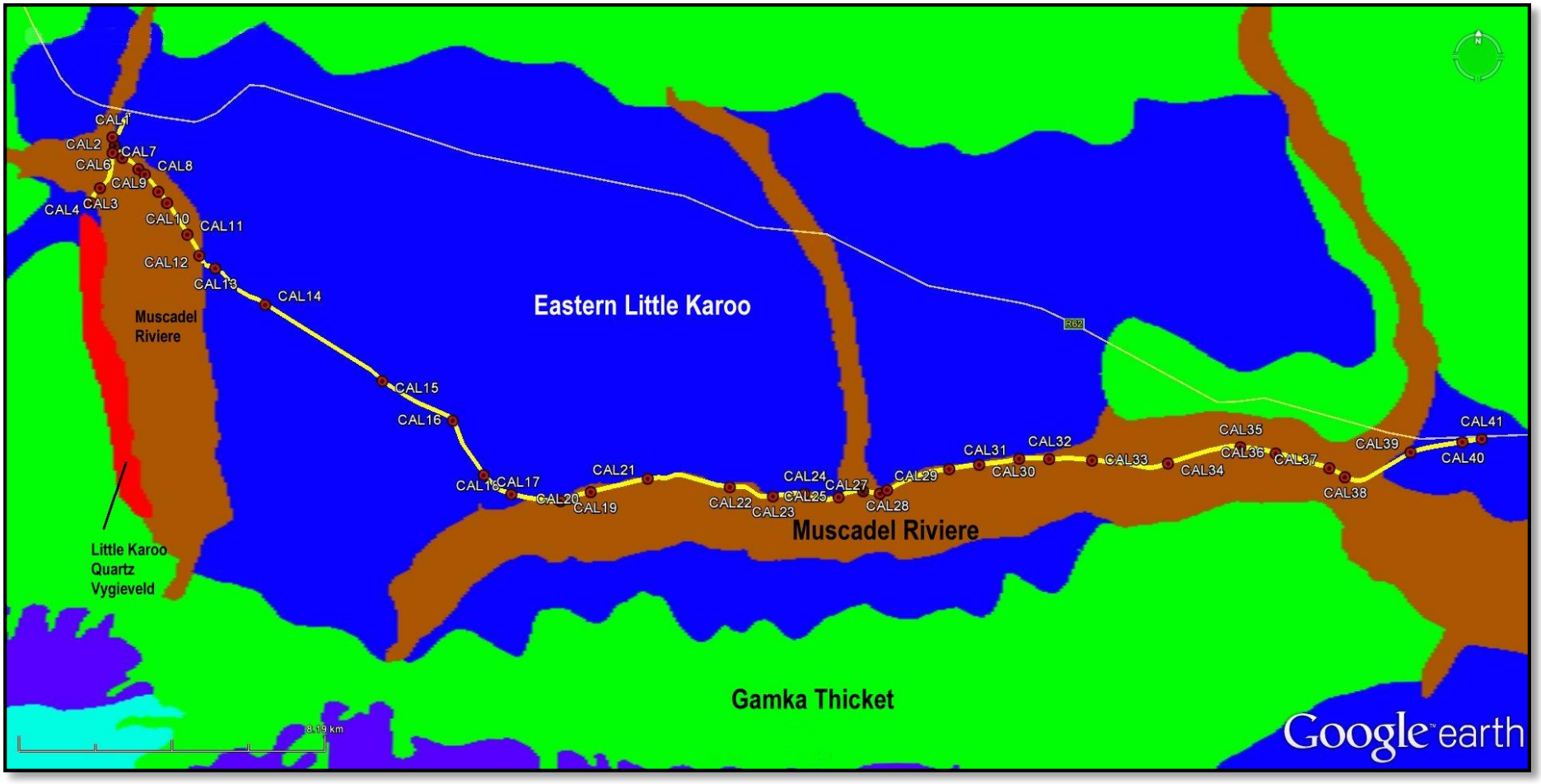

Figure 6. Portion of the Vegetation Map of South Africa, Lesotho & Swaziland (Mucina *et al*. 2005), showing the various vegetation types found along the road routes. The vegetation map is superimposed on a Google Earth ™ image with the roads marked as yellow lines and the waypoints as red dots CAL#

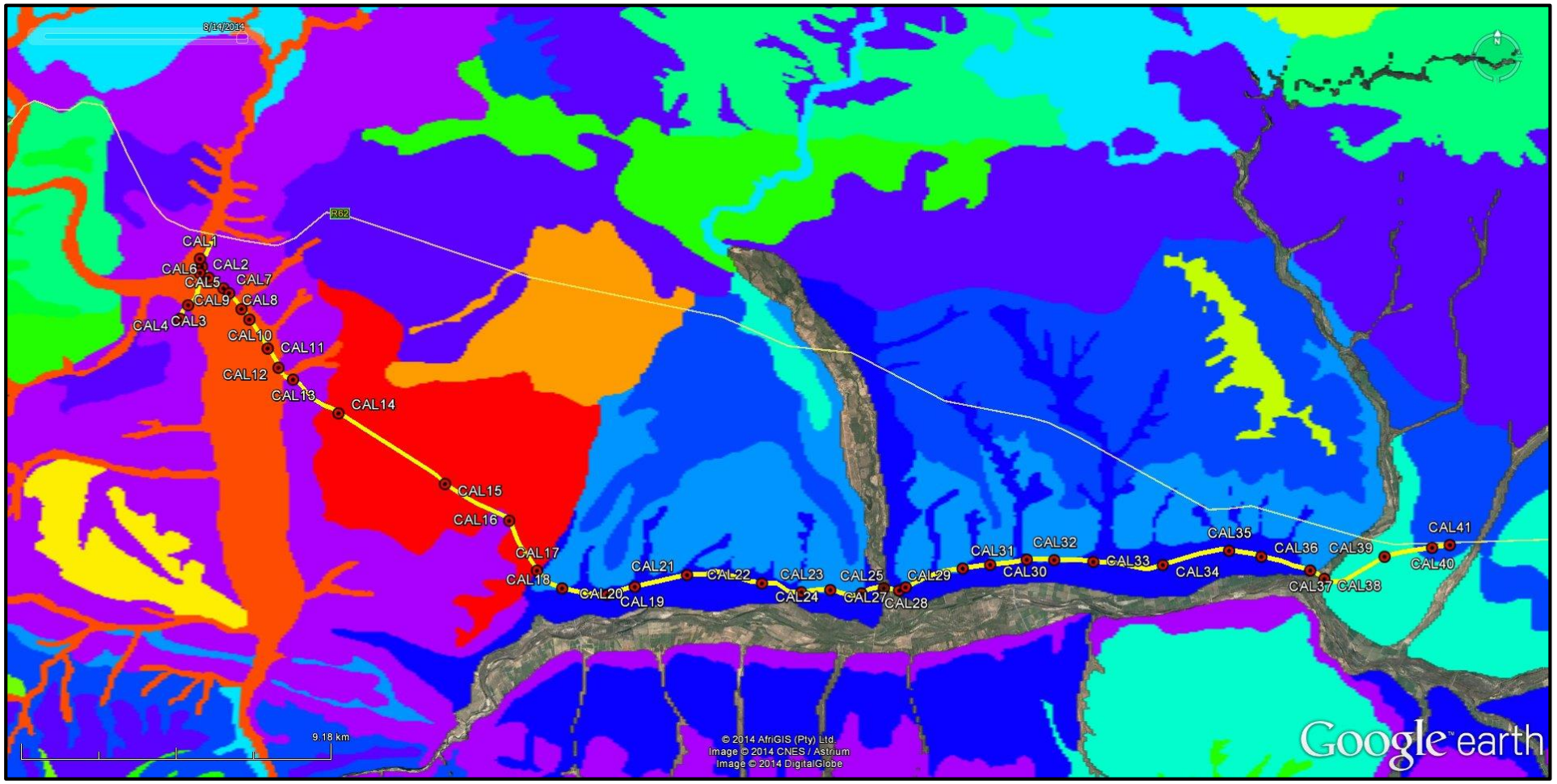

Figure 7. Portion of the vegetation map of the Little Karoo (Vlok *et al.* 2005). Vegetation types (units) affected are as follows: Purple – Calitzdorp Gravel Apronveld; dark orange – Gamka River & Floodplain; Red – Calitzdorp Gannaveld; Dark blue – Volmoed Gannaveld; Light blue – Greylands Apronveld; Light green-blue – Oudtshoorn Gannaveld; Mid-blue – Grootkop Arid Spekboomveld. The vegetation map is superimposed on a Google Earth ™ image with the roads marked as yellow lines and the waypoints as red dots CAL#

Table 2. Selected waypoints with descriptions of vegetation along DR 1699 and DR 1688 roads between Calitzdorp and Oudtshoorn. The vegetation types in green are those from the Vegetation of South Africa, Lesotho and Swaziland (Mucina *et al.* 2006) and those in red are the types recognized by Vlok *et al.* (2005).

Waypoint	Vegetation Unit	Brief descriptive notes		Illustration
CAL5	**Muscadel Riviere** **Calitzdorp Gravel Apronveld**	On Station Road (DR1699). The vegetation along the road verge is all weedy and not sensitive.		
CAL6	**Muscadel Riviere** **Calitzdorp Gravel Apronveld**	This waypoint is located alongside the disused railway track. The roadside vegetation is dominated by Atriplex lindleyi subsp. inflata. Other species found were *Euphorbia mauritanica, Lycium* sp., *Acacia karoo* and an invasive exotic cactus species.		

Waypoint	Vegetation Unit	Brief descriptive notes		Illustration
CAL9	**Muscadel Riviere** **Gamka River &** **Floodplain**	At this waypoint both sides of the road are highly disturbed. The road reserve on the north-east side is overrun with weedy species, mainly *A. lindleyi* subsp. *inflata*. The southwest side has shrubby *Osteospermum* sp. The exotic fodder plant lucerne (*Medicago sativa*) is found along the edge of the road.		
CAL13	**Eastern Little Karoo** **Calitzdorp Gravel** **Apronveld**	This waypoint is located at Remhoogte Kloof. The vegetation is less disturbed here than elsewhere with the majority of the plant species in the road reserve indigenous. A road cutting is found on the north-west side of the road and the following species were recorded: *Blepharis capensis, Dimorphotheca cuneata, Drosanthemum hispidum, Felicia* sp., *Galenia africana, Malephora lutea, Osteospermum clandestinum, Pentzia incana, Plantago lanceolata* (exotic), *Senecio paniculatus* and *Tetragonia fruticosa.*		

Waypoint	Vegetation Unit	Brief descriptive notes		Illustration
CAL15	**Eastern Little Karoo** **Calitzdorp Gannaveld**	This waypoint is just short of km 11. The road verge is compacted and highly disturbed. The vegetation in the road reserve is uniform over a long distance being dominated by grass (*Setaria* sp.). Other species recorded here include *Atriplex semibaccata, Cynodon dactylon, Euphorbia burmanii, Gazania lichtensteinii, Malephora lutea, Mesembryanthemum* (*Psilocaulon*) *junceum, Pentzia incana, Plantago lanceolata, Pteronia pallens, Ruschia* sp. and *Zygophyllum retrofractum.*		
CAL18	**Eastern Little Karoo** **Greylands Apronveld**	Near Badshoogte railway siding. On the south-west side of the road is a large corrugated iron store. On the north-east side of the road, the first 2m are highly disturbed and are either grassy or devoid of vegetation. The ±2 m-wide band of vegetation along the fence-line is dominated by *Malephora lutea* with patches of *Atriplex lindleyi* subsp. *inflata*.		

Waypoint	Vegetation Unit	Brief descriptive notes		Illustration
CAL19	**Muscadel Riviere** **Volmoed Gannaveld**	At km 17 milepost. The road reserve is mostly highly disturbed and dominated by grasses. At this point there is a road cut into a bank. The bank supports natural vegetation which would not be affected by the road upgrade activities. No sensitive vegetation (including no geophytes) is found within 2 m of the edge of the road.		
CAL24	**Muscadel Riviere** **Greylands Apronveld**	At the Langverwag Kontant Winkel and Postal Agency. This area is extremely disturbed on the south-west side of the road and the road verge is devoid of vegetation on the north-east side. A band of vegetation ± 2m wide is found along the fence. It is also disturbed but consists of low succulent shrubs and grasses. It has low botanical sensitivity.		

Waypoint	Vegetation Unit	Brief descriptive notes		Illustration
CAL26	**Muscadel Riviere** **Olifants River & Floodplain**	On the south side of the road the road reserve has a thicket of *Acacia karoo* and *Zygophyllum foetidum* with the road verge having weedy grasses and lucerne. (The road reserve vegetation had been recently burnt by and accidental fire). On the north side of the road the road verge and reserve up to 6 m from the carriageway is highly disturbed. Beyond that to the fence is 'vygieveld' with *Drosanthemum hispidum, Galenia africana Malephora lutea, Mesembryanthemum* (*Psilocaulon*) *junceum, Osteospermum incanum* and *Salsola kali.*		
CAL29	**Muscadel Riviere** **Greylands Apronveld**	Near km 29 milepost. The road verge on both sides was very dry and disturbed. The grass *Fingerhuthia africana* is common in the zone immediately north of the road verge. Other notable species are *Lycium ferocissimum, Agave americana* (exotic) and *Zygophyllum* sp.		

Waypoint	Vegetation Unit	Brief descriptive notes		Illustration
CAL39	**Eastern Little Karoo** **Oudtshoorn Gannaveld**	At the km 41 milepost, the road verge on both sides was dry and devoid of vegetation. From ± 2m from the edge of the road to the fence on the north side the vegetation is in reasonable condition but dry at the time of sampling. Species recorded on the north side were *Drosanthemum hispidum* (dominant), *Zygophyllum cf. retrofractum* (co-dominant), *Salsola kali, Eragrostis sp. Galenia africana, Mesembryanthemum guerichianum, Asparagus sp.* and *Atriplex vestita.* Grass is more abundant on the south side but the species were not identified because they were dry. Other plant species on the south side include *Acacia karoo, Atriplex semibaccata, Drosanthemum hispidum, Felicia cf. filifolia, Gazania lichtensteinii, Lycium ferocissimum, Medicago sativa, Nemesia fruticans, Plantago lanceolata, Pteronia sp., Lycium ferocissimum* and *Rapistrum rugosum.*		
CAL40	**Eastern Little Karoo** **Grootkop Arid Spekboomveld**	At this waypoint which was less than 1 km from the intersection with the R62 the vegetation is in better condition than at most other sample waypoints. The road verge on both sides is less disturbed and better covered with vegetation. Species recorded include, *Chrysocoma ciliata, Cotyledon orbiculata, Drosanthemum hispidum, Eriocephalus ericoides, Felicia filifolia, Galenia africana, Gazania lichtensteinii, Malephora lutea, Medicago sativa, Plantago lanceolata, Pteronia incana, Selago* sp., *Senecio burchellii* and *Zygophyllum* sp.		

4.3 Conservation Status

One of the principal reasons for this investigation is that the conservation status of Muscadel Riviere vegetation is listed as Critically Endangered A1 and that of Eastern Little Karoo as Vulnerable A1 in the National List of Threatened Ecosystems (Government Gazette, 2011). A request was made by CapeNature to determine how much influence the road upgrade project may have on the conservation of these ecosystems.

The threat status of Little Karoo ecosystem units as assigned to the classification of Vlok *et al.* (2005) is presented in Figure 8. The Critical Biodiversity Area map is presented in Figure 9. The roads in question traverse areas of high threat status ranging from Vulnerable to Critically Endangered (Figure 8), however, they only impinge on Critical Biodiversity Areas (CBAs) and Ecological Support Areas in a few places (Figure 9), mostly being aligned along the margins of CBAs (Skowno *et al.* 2010)

It must be emphasized that despite threatened status of the ecosystems through which the roads are aligned, the overall impression is that the vegetation within the road reserves is in poor, transformed condition and has low botanical sensitivity. **It does not make any meaningful contribution to the conservation of the various vegetation or ecosystem types**.

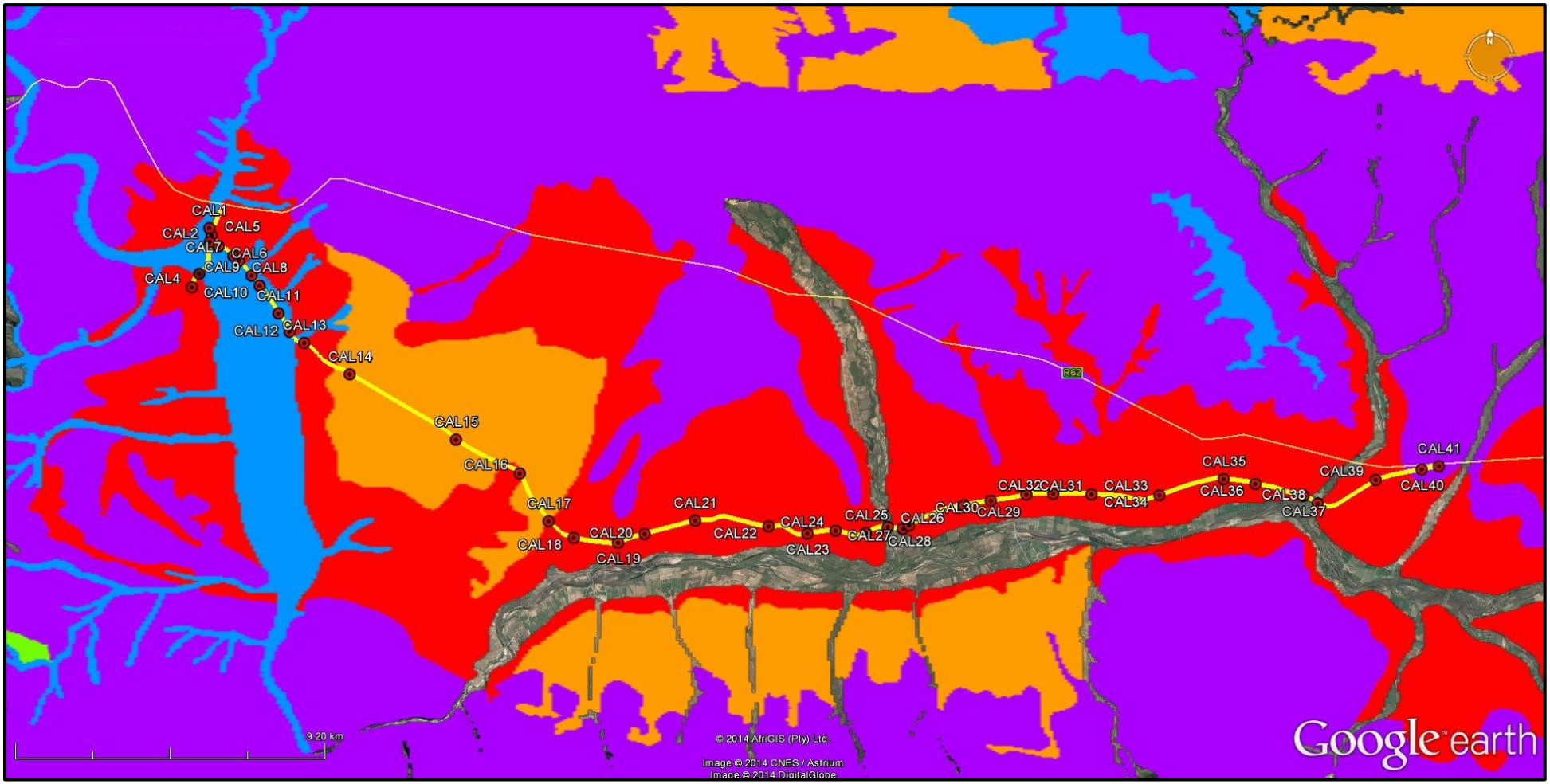

Figure 8. Threat status of the ecosystems between Calitzdorp and Oudtshoorn in the Little Karoo. Blue = Vulnerable; Orange = Endangered; Red = Critically Endangered. The map is superimposed on a Google Earth ™ image with the roads marked as yellow lines and the waypoints as red dots CAL#.

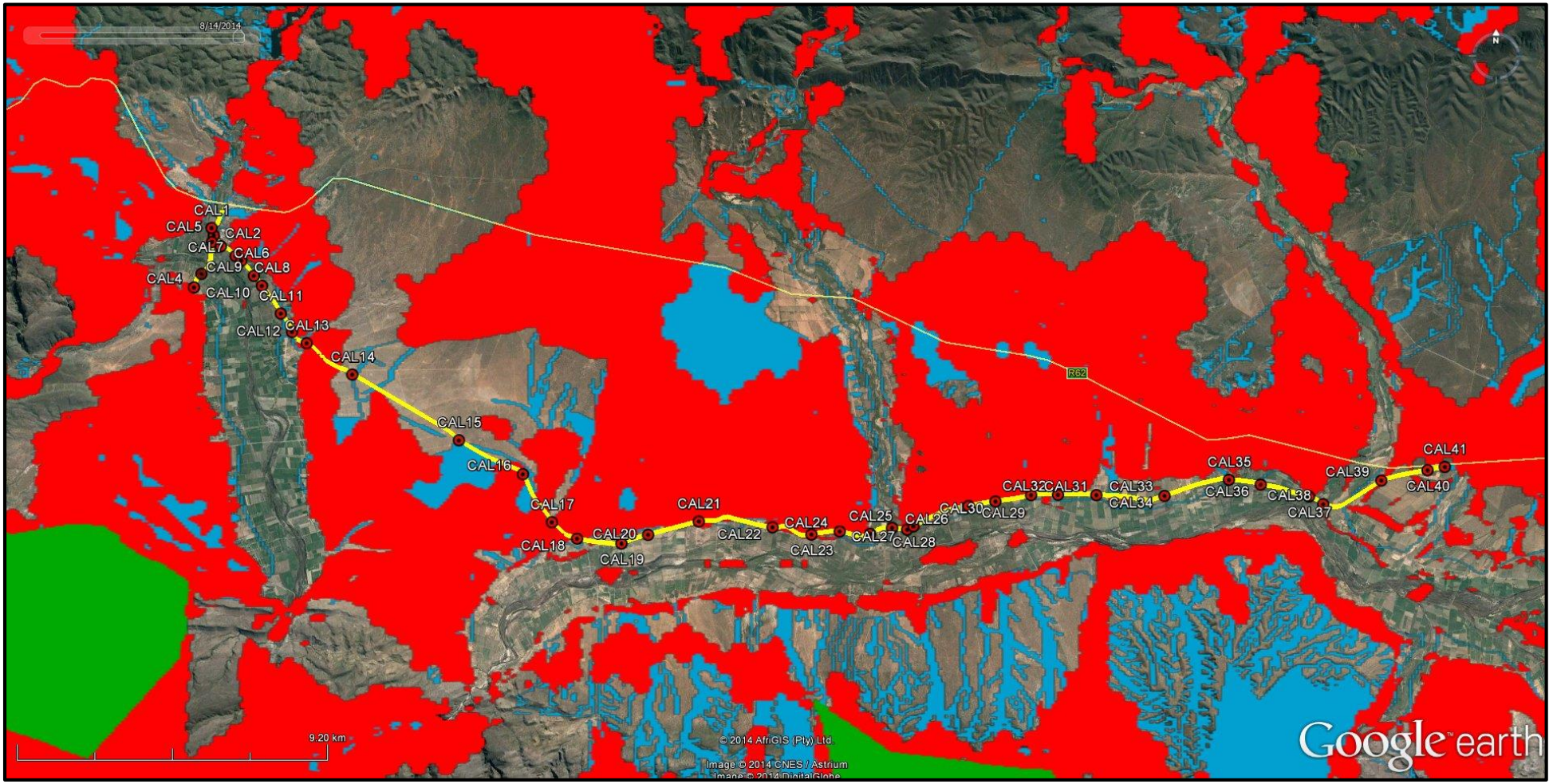

Figure 9. Critical Biodiversity Areas (CBA's) and Ecological Support Areas (ESA's) map (after Skowno *et al.* 2010) for the study area in the Little Karoo. Red = Critical Biodiversity Areas; Blue = Ecological Support Areas. The vegetation map is superimposed on a Google Earth ™ image with the roads marked as yellow lines and the waypoints as red dots CAL#.

5. Assessment of Impacts

Impacts on the vegetation of the DR 1699 and DR 1688 are assessed collectively following the methodology in Appendix 1.

Three types of impacts are assessed:

- **Direct impacts:** Impacts occurring directly on the vegetation of the road reserves as a result of the proposed road-building activities.
- **Indirect impacts:**
- **Cumulative impacts**: impacts caused by several projects, strategic actions and existing trends (e.g. loss of habitat of a specific type).

6. Direct Impacts

The impacts on the vegetation and habitat in the road reserves are considered for two identified potential impacts which are:

- Loss of vegetation type and habitat including plant species due to road-building activities

- Loss of ecological processes e.g. fragmentation of habitat, loss of pollinators etc.

These impacts are applied collectively to the two major vegetation types in the study area as given in the National Vegetation Map (Figure 6) and classification (This is to align with the National List of Threatened Ecosystems).

6.1 Loss of Eastern Little Karoo vegetation

There would be no further loss of Eastern Little Karoo vegetation due to impacts from road-building. The impact is thus rated as of LOW NEGATIVE significance without and with mitigation (Table 2).

Table 2. Impact: Loss of Eastern Little Karoo vegetation due to proposed road-work activities along DR 1699 and DR 1688.

CRITERIA	WITHOUT MITIGATION	WITH MITIGATION
Extent	Regional	Regional
Duration	Long-term	Long-term
Intensity	Low	Low
Probability	Highly probable	Highly probable
Confidence	High	High
Significance	Low negative	Low negative
Cumulative impact	Low negative	Low negative
Nature of Cumulative impact	No loss of Eastern Little Karoo habitat within road reserves on both sides of the DR 1699 and DR1688	
Degree to which impact can be reversed	Not applicable	
Degree to which impact may cause irreplaceable loss of resources	Very low	
Degree to which impact can be mitigated	Low – not required	

6.2 Loss of Muscadel Riviere vegetation

Road-work activity would be restricted to the current alignment of the roads and would not require incursion into undisturbed vegetation. Consequently no further loss of Muscadel Riviere vegetation is anticipated and the impact is rated as LOW NEGATIVE. No mitigation measures would be required (Table 3).

Table 3. Impact: Loss of Muscadel Riviere vegetation along the DR 1699 and DR 1688 roads due to proposed road-works.

CRITERIA	WITHOUT MITIGATION	WITH MITIGATION
Extent	Regional	Regional
Duration	Long-term	Long-term
Intensity	Low	Low
Probability	Highly probable	Highly probable
Confidence	High	High
Significance	Low	Low
Cumulative impact	Low	Low
Nature of Cumulative impact	No loss of Muscadel Riviere vegetation within road reserves on both sides of the DR 1699 and DR1688	
Degree to which impact can be reversed	Not applicable	
Degree to which impact may cause irreplaceable loss of resources	Very low	
Degree to which impact can be mitigated	Moderate	

6.3 Loss of ecological processes

Ecological processes vary from one vegetation type to the next and from one habitat to the next. Karoo vegetation therefore has different ecological processes to fynbos vegetation. However, it is prudent here to make only a general statement about potential loss of ecological processes. In the Karoo vegetation the impacts of loss of ecological processes in the area studied would be low mainly because the study is restricted to the road reserve. The road could be seen as a barrier between areas of natural vegetation or habitats e.g. creating a discontinuity between riverine habitats and upland, drier habitats. However, within the road reserve itself impacts on ecological processes are like to be small and are generalised as LOW NEGATIVE (Table 4).

Table 4. Impact: Loss of ecological processes along the DR 1699 and DR 1688 roads due to proposed road-works.

CRITERIA	WITHOUT MITIGATION	WITH MITIGATION
Extent	Regional	Regional
Duration	Long-term	Long-term
Intensity	Low	Low
Probability	Highly probable	Highly probable
Confidence	High	High
Significance	Low negative	Low negative
Cumulative impact	Low negative	Low negative
Nature of Cumulative impact	No net loss of ecological processes within road reserves on both sides of the DR 1699 and DR1688	
Degree to which impact can be reversed	Low	
Degree to which impact may cause irreplaceable loss of resources	Low	
Degree to which impact can be mitigated	Moderate	

7. Mitigation Measures

- The most important mitigation measure would be to avoid causing any further disturbance of the vegetation within the road reserve. It is acknowledged that the verge of the road (a strip of 2 – 3 m wide) would, in future, be kept clear of vegetation for safety and visibility purposes. However, there is no need to disturb the vegetation in the zone between the verge and the boundary fences. Although the latter zone is generally in poor condition, this condition can be improved by minimising disturbance which would allow the shrubs to regenerate, create greater cover and enhance species diversity and the functioning of ecological processes in the roadside vegetation.
- Where disturbance is unavoidable, areas that are disturbed must be monitored by an Ecological Control Officer and once construction is completed, such areas must be treated appropriately to enhance regeneration of the roadside vegetation. This could be done by collecting seed from plants in the same community in nearby undisturbed vegetation which could be sown on disturbed areas.

- Weedy species such as *Galenia africana (kraalbos)*, *Atriplex semibaccata*, *Atriplex* lindleyi subsp. *inflata* (blasiebrak), *Prosopis glandulosa* (mesquite) and most importantly *Salsola kali* (Russian tumbleweed; rolbos) should be selectively removed prior to construction to inhibit further spread of these species along the road by construction activities. After construction these species should be actively controlled to prevent competition with more desirable species.
- Stockpiling of road-building material must be confined to strictly demarcated areas such as at existing lay-bys to limit the distribution of this material in the road reserve.
- Extreme care must be taken to ensure that no fires are started by road crews that can spread into the roadside vegetation.

8. Indirect Impacts

With an improved surface and design the DR 1688 in particular would support more traffic. Greater attention to the enhancement of biodiversity with better plant cover and habitat within the road corridor would positively contribute to developing the tourist potential of this route. This would also be beneficial to small mammals and birds (Rijkwaterstaat (RWS), Dienst Weg- en Waterboukunde, 1995), particularly in areas where habitat has been lost due to cultivation of private property adjacent to the roads.

9. Cumulative Impacts

Negative cumulative impacts, particularly if mitigation measures are strictly applied, would predictably be low. There would be minimal loss of natural vegetation of the types described. With careful and improved management of the road reserves during and post construction the roadside habitat could be improved which would result in positive cumulative impacts.

10. Conclusions

The present generally poor condition of the vegetation in the road reserves of the DR 1699 and DR1688 means that there is nothing of concern from a botanical perspective and that proposed road-building activities would have low negative impacts. The road reserve is however, despite its poor condition, an important zone of natural or semi-natural habitat that should be managed to encourage a diversity of plant species. Road-building activities must therefore be approached

with caution to ensure that there is no further degradation of the habitat. The management plans and procedures for the DR 1688 must be revised post-construction to establish an improved management regime that will enhance the roadside vegetation and habitat.

No 'Red List' or species of conservation concern (SCC) or endemic species were encountered during the survey. This is attributed to two factors: (1) the scope of the survey was such that it was confined to the generally highly disturbed road reserves (2) poor condition of the vegetation related to the lack of rainfall and harsh winter conditions immediately preceding the site visit. It is nevertheless thought to be highly unlikely that species of conservation concern would be impacted by the proposed road upgrade.

General mitigation measures must be carefully noted and applied to ensure limitation of the anticipated negative impacts that the project may have.

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Report submitted: 17 September 2014

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 Firm: Bergwind Botanical Surveys & Tours CC. (Independent consultant)

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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
- Nine 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:

- South Africa Association of Botanists
- 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 website: www.bergwind.co.za