NICK HELME BOTANICAL SURVEYS
PO Box 22652 Scarborough 7975
Ph: 021 780 1420 Fax: 021 780 1868 cell: 082 82 38350 email: botaneek@iafrica.com
VAT Reg. # 4930216892

IMPACT ASSESSMENT FOR PROPOSED NEW ESKOM KUDU 400kV POWERLINE FROM ORANJEMUND SUBSTATION TO JUNO SUBSTATION.

BOTANICAL REPORT

Revision 1

Prepared for: Strategic Environmental Focus, Cape Town

Client: Eskom

13 November 2006

EXECUTIVE SUMMARY

This report describes the vegetation along the proposed 400km long powerline route. At least twenty different vegetation types are traversed, none of which is regarded as a threatened vegetation type on a national basis (Rouget et al 2004), but there are a number of very sensitive botanical areas. The entire length of Alternative E (preferred alternative at the time) was travelled over four days in May 2006, and eleven botanically sensitive areas along the route were mapped, and are indicated in this report. In October 2006 a further two routes were presented for assessment – Alternative F was proposed by National Parks Board, and Alternative G was identified at a workshop with Eskom and all specialists, plus there was an additional option suggested by SANParks of connecting to the grid at Springbok, directly from Gromis.

For the 130km route from Oranjemund to Gromis susbstations no alternatives were presented, which is problematic, as the construction of a major new powerline in parts of this section is assessed as likely to have a High negative impact on the very sensitive dwarf succulent flora. Due to the lack of alternatives in this section this possibly creates a "No Go" situation for the entire project, from an IA process point of view. Numerous mandatory mitigation measures are put forward for this section in order to reduce impacts to an acceptable Moderate negative, including a requirement for a minimum 120ha formal conservation area as a biodiversity offset.

In the greenfields section from Gromis to Juno three of the seven alternatives asssessed (Alternative A, C, and F) were identified as having potentially High negative botanical impacts that could not be effectively mitigated, which means that these are fatal flaws for these Alternatives. Alternative B is assessed as having a Medium negative impact, due to its extra length and hence greater ecological footprint, through a moderately sensitive area. The remaining three Alternatives (D, E, and G) have very similar overall botanical impacts, which were assessed as Low to Medium negative after mitigation. Most of the impacts are direct impacts associated with construction of the powerline (pylon footings and stays) and associated new access tracks. These direct impacts (loss of natural vegetation, including potentially rare or localised species) are likely to be very limited in extent, but largely permanent in these specific areas of impact. The only significant indirect impact identified was possible erosion of access tracks, which can cause further loss of vegetation.

The proposed powerline passes through a globally important botanical area known as Namaqualand, which is part of the Succulent Karoo biome, the world's biologically richest semi-arid area. The Gariep Centre of Endemism would be traversed by the section from Oranjemund to Gromis. Plant growth tends to be highly seasonal (from Apr – September). Numerous rare and localised plant species are found along the route, but these are not evenly distributed, and tend to be clustered in the High Sensitivity areas identified in the maps in this report.

All High Sensitivity areas require special mitigation, including a detailed walk-down at the pylon placement stage; placing of pylons outside all rocky outcrops, quartz patches, gravel patches, and wetlands; location of construction camps and laydown (storage) areas outside sensitive areas; employment of an ECO to oversee all work in sensitive areas; Search and Rescue of all translocatable plant species within footprints in sensitive areas; construction outside the growing season in all High Sensitivity areas; and a minimum 100ha offset conservation area in the Oranjemund substation area.

From a botanical point of view the preferred alternatives are Alternatives D, E, or G. However, it is suggested that a slight modification be made to Alternative E, where the southern portion from southwest of Nuwerus should instead follow the direct route of Alternative A all the way to Juno. In this case Alternative E would be preferred ahead of B, and the most direct of the viable options, and thus presumably the cheapest. Alternatives D and G avoid most sensitive areas, and are on a par with a modified Alternative E as preferred alternatives.

Alternative	Overall Impact after mitigation
Alternative A	High –ve
Alternative B	Medium –ve
Alternative C	High –ve
Alternative D	Low to Medium -ve
Alternative E	Low to Medium -ve
Alternative F	High –ve
Alternative G	Low to Medium –ve

Table 3: Table showing overall regional botanical impacts associated with the seven alternatives, after mitigation. **Note that this impact refers to only the greenfields section south of Gromis.**

TABLE OF CONTENTS

1. INTRODUCTION AND STUDY AREA

This botanical assessment was commissioned in order to help inform decisions regarding an application to construct a new Eskom 400kV Transmission powerline from the substation at Alexander Bay (Oranjemund Substation) to the Juno substation near Vredendal. The length of this proposed powerline is about 400km. The northernmost 130km of the powerline from Oranjemund substation to Gromis substation (east of Kleinzee) would follow an existing powerline and servitude, with the remainder being a "greenfields route", with no existing powerlines or servitudes along most of this 270km stretch. No alternative routes were assessed for the initial section from Alexander Bay to Kleinzee, as the most appropriate route was deemed (bu the client) to be along the existing servitude. For the section south of Gromis substation 5 alternatives were initially proposed for investigation, with a further alternative (E) being proposed at the authority and specialist meeting shortly before the release of the Final Scoping Report (FSR) in May 2006. The FSR concluded that Alternatives C (CapeNature) and E (most recent) were likely to have the least environmental impact, and suggested that a 3km wide corridor be investigated in more detail during the Impact Assessment, for these two alternatives.

2. BRIEF

The purpose of this study was to assess the environmental impact of the proposed Eskom Kudu Transmission line on the vegetation along the route. This entailed the following:

1. A description of the vegetation along the route;
2. Identification of sensitive / unique plant habitats and species;
3. Identification of potential impacts;
4. Identification of mitigating measures;
5. Recommendations regarding the most feasible and lowest impact route.

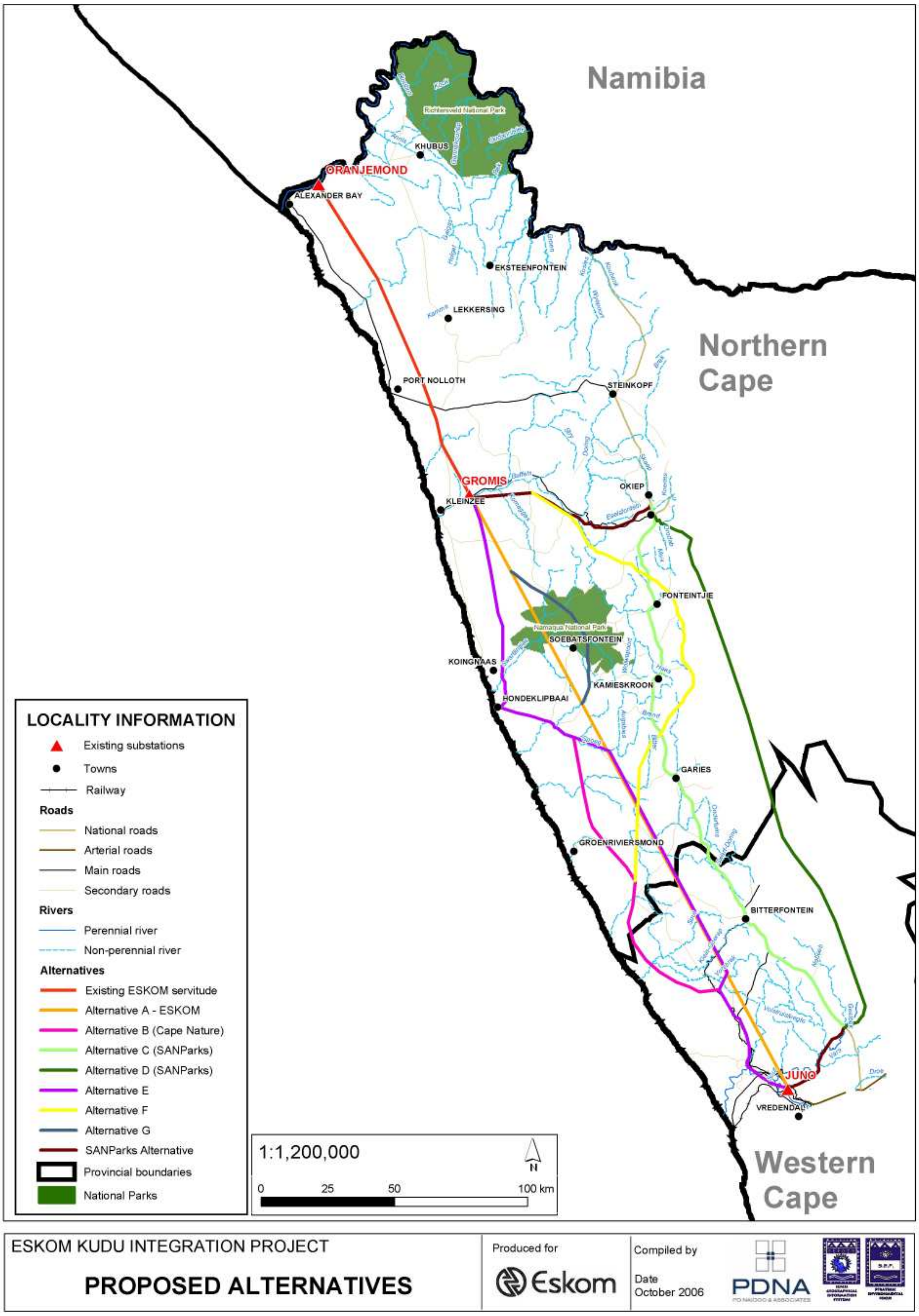

Figure 1: Overview of the alternative routes assessed.

3. STUDY APPROACH

3.1 Information sources

The information used in this study was based on the following:

1. A literature review (SA vegetation map; NSBA), and discussions with Dr Philip Desmet, an acknowledged expert on the vegetation of the Succulent Karoo and Namaqualand.
2. A site visit;
3. Professional judgement based on experience gained with similar projects.

3.2 Assumptions and Limitations

1) The fieldwork was done during over the period 16 -19 May 2006, at the start of the winter growth season. A significant number of bulb, annual, and perennial species were thus not recorded, due to the plants not yet being in an identifiable state. A number of these species may be of conservation concern. In order to compensate for this shortcoming the habitat approach was used, whereby habitat integrity, rarity and vulnerability was used as a surrogate for determining conservation value, along with identification of well known special habitats such as quartz patches. Much of this interpretation is thus based on my previous experience in the area.

2) The scale of the project and length of time available for the site visit was a limitation. Very large areas had to be covered in a limited period, and thus the habitat approach was deemed the most useful approach, whereby special habitats were identified along the proposed route.

3) The proposed alignments cross mostly private property onto which, in some instances, no access could be gained; furthermore about 10-20% of the length of the alternatives could not be accessed by any existing roads, so that the closest I got to certain areas was 3 or 4km. In many instances this was adequate, as I was able to assess the route with binoculars and would have been able to identify special habitats even at this range. However, in a few places I was unable to actually see the terrain and I was thus not able to confirm or deny the presence of special habitats in these areas, which constitute maybe 10% of the route.

4). An assumption in terms of the routing between Gromis and Oranjemund substations is that the new line will run east of the existing line, and within 100m of the existing line (H. Lochner – pers. comm.).

5). Some of the plant specimens collected were not yet identified by the time the report had to be written, and some of these may be of conservation concern, but they should all be covered using the habitat based approach that was taken.

6) The Scoping report was a desktop exercise that did not describe the preferred routes in any detail.

7) Details on footings and bases for the pylons were sourced from the geotechnical specialist report, presented at a workshop in Pretoria in October 2006. At this meetings it was stated that the loose sandy soils would require significant concrete footings for the stays, at least 4m

deep, necessitating mechanical excavators and the removal of about $15m^3$ of sand per hole. This sand would then have to be dumped somewhere, concrete mixers would need to be brought onto site, and it was unclear what would happen to the excavated sand replaced by the concrete.
8) Large parts of Alternatives C, D, and F were not specifically groundtruthed for this study, but I am familiar with large parts of these routes from previous studies. I also consulted with Dr Philip Desmet, an acknowledged expert on the vegetation of the region, regarding these alternatives. He and I have recently completed an extensive survey of the vegetation of the Kamiesberg (Helme & Desmet 2006) for SKEP, which has informed this assessment.

One of the problems with this type of asessment is that a minor shift in the line (100m east or west) can make a substantial difference to the overall impact, but at this stage exact footprits and alignments are not known, and thus an assessment so early on has to be very "broad brush". Furthermore, the lack of alternatives in the section from Oranjemund to Gromis is regarded as a major problem, and is potentially a fatal flaw.

However, it is felt that overall a relatively accurate assessment of the sensitive areas along the route was obtained, and should be sufficient to identify constraints, and allow for mitigation at the planning stage. Furthermore, much of the actual impact mitigation will occur at the construction and operational stage.

3.3 List of abbreviations

EIR	Environmental Impact Report
EMP	Environmental Management Plan
NSBA	National Spatial Biodiversity Assessment

3.4 Methodology

The SA vegetation map (Mucina & Rutherford 2003) was consulted for vegetation types. The alternative routes were discussed with Dr Philip Desmet, who is an acknowledged expert on the vegetation of the area. Thereafter a four day fieldtrip was conducted, which covered most of the route of Alternative E. As part of this fieldwork the entire servitude from Oranjemund substation to Gromis substation was driven with Mr Hans Lochner of Eskom. South of Gromis the route of Alternative E was followed as closely as possible, using all available roads and tracks. Sensitive areas were mapped directly onto the hardcopy 1:250 000 topocadastral maps provided (with routes superimposed), and digital photographs of representative and/or sensitive areas were taken (not all of which appear in this report). Plants identifications were made using available literature, relevant experts, and the Compton Herbarium at Kirstenbosch.

4. DESCRIPTION OF THE AFFECTED ENVIRONMENT

4.1 General overview of affected environment

The proposed powerline virtually traverses the entire South African length of Namaqualand. Namaqualand is both a magisterial district and a region - part of southern Africa's Karoo – Namib region, a "province" in plant geographical terms that stretches from southern Angola to the western Free State (Cowling & Pierce 1999). The province is divided into three subregions (or biomes): Namib Desert, Nama Karoo (summer rainfall), and Succulent Karoo (winter rainfall). Namaqualand falls largely within the Succulent Karoo, which is characterised by low (<400mm/yr) but fairly predictable winter rainfall, along with summer drought. Coastal areas (up to 40km inland) often experience regular sea fogs, especially in the northern areas. The distinctive characteristic of the Succulent Karoo is its predominance of dwarf shrubs with succulent leaves. Elements of the Cape Floristic Region (Fynbos) extend north into Namaqualand, such as in the form of Namaqualand Sand Fynbos.

One of the outstanding features of both Namaqualand and the Cape Floristic Region are very high degrees of plant and invertebrate endemism (species restricted to that area). Namaqualand has a very rich flora of about 3000 species, and about half of these are found nowhere else (Cowling & Pierce 1999). The Succulent Karoo is acknowledged as the most biologically rich semi-arid region in the world (Cowling & Pierce 1999). Both the Succulent Karoo and the Fynbos biomes have been recognised as critical global biodiversity hotspots (Conservation International 2001; Van Wyk & Smith 2001). The section from Oranjemund substation to the Kwakanab river is part of the Gariep Centre of Endemism, identified by Van Wyk and Smith (2001). This Centre of Endemism has the richest diversity of succulent plants on earth, and a large number are restricted to this region (Van Wyk and Smith 2001).

It should thus be clear that the study area spans a globally unique area of the highest conservation value. Within the region are further small "hotspots" of plant diversity and endemism, and the identification of these was the primary focus of this study.

The following broad brush description follows the route of Alternatives B and E (overlapping with A in many areas) from north to south.

4.2 The route in detail

4.2.1 Oranjemund Substation to Gromis Substation

No alternative alignments were presented for assessment in this area, and thus all proposed routes would have to use this alignment. A High negative impact associated with this section of the route would thus be viewed as a fatal flaw for the entire project.

From Figure 2 it should be clear that the line crosses numerous vegetation types in its northern area from Oranjemund to Gromis substations. There are in fact eight different vegetation types mapped in this area (Mucina & Rutherford 2003). All eight are regarded as Least Threatened vegetation types in terms of the NSBA (Rouget et al 2004), although it should be pointed out that very few are formally conserved to any significant degree, and are thus vulnerable to potential transformation (especially by mining). National conservation targets for these vegetation types are thus still far from being met. The section from Oranjemund substation to the Kwakanab river is part of the Gariep Centre of Endemism, identified by Van Wyk and Smith (2001). This Centre of Endemism has the richest diversity of succulent plants on earth, and a large number are restricted to this region (Van Wyk and Smith 2001).

The two most sensitive vegetation types are in the extreme north in the vicinity of Alexander Bay, and are West Gariep Plains Desert and West Gariep Lowlands Desert (see Figure 2). These habitats refer to the windswept gravel plains that are such a feature of the area close to the Orange river (see Plate 1). Although at first glance these areas appear to be without much vegetation they in fact support numerous rare and endemic plant species which are seldom more than a couple of centimetres tall. In a brief survey at least ten localised endemic plant species were noted along the existing track, including *Neopatersonia falcata, Massonia sessiliflora, Juttadinteria deserticola, Fenestraria rhopalophylla, Pelargonium sibthorpifolium, Euphorbia ramiglans* (see Plate 2)*, Sarcocaulon patersonii*, *Ferraria schaeferi*, and *Othonna furcata*. It is possible that there could be as many as twenty rare species in this area. Figure 3 indicates the extent of this sensitive area, which is certainly one of the three most sensitive areas along the entire route, and would rank high as one of the most sensitive areas in Namaqualand, with exceptionally high levels of local plant endemism (estimated at up to 30%), and exceptionally high levels of rare species. Portions of this habitat have already been severely disturbed or transformed by mining and infrastructure (eg. the airport at Alexander Bay), emphasising the threatened nature of this habitat.

Secondly, the calcrete (kalk) pan at Witbank (see Figure 3) is regarded as a sensitive area, although much less so than the area near Alex Bay. Species include *Zygophyllum cordifolium, Salsola aphylla, Cheiridopsis* sp.*, Sarcocaulon patersonii*, and *Lycium cinerum*. No known rare species were recorded here, but there is a low – moderate possibility of such species occurring.

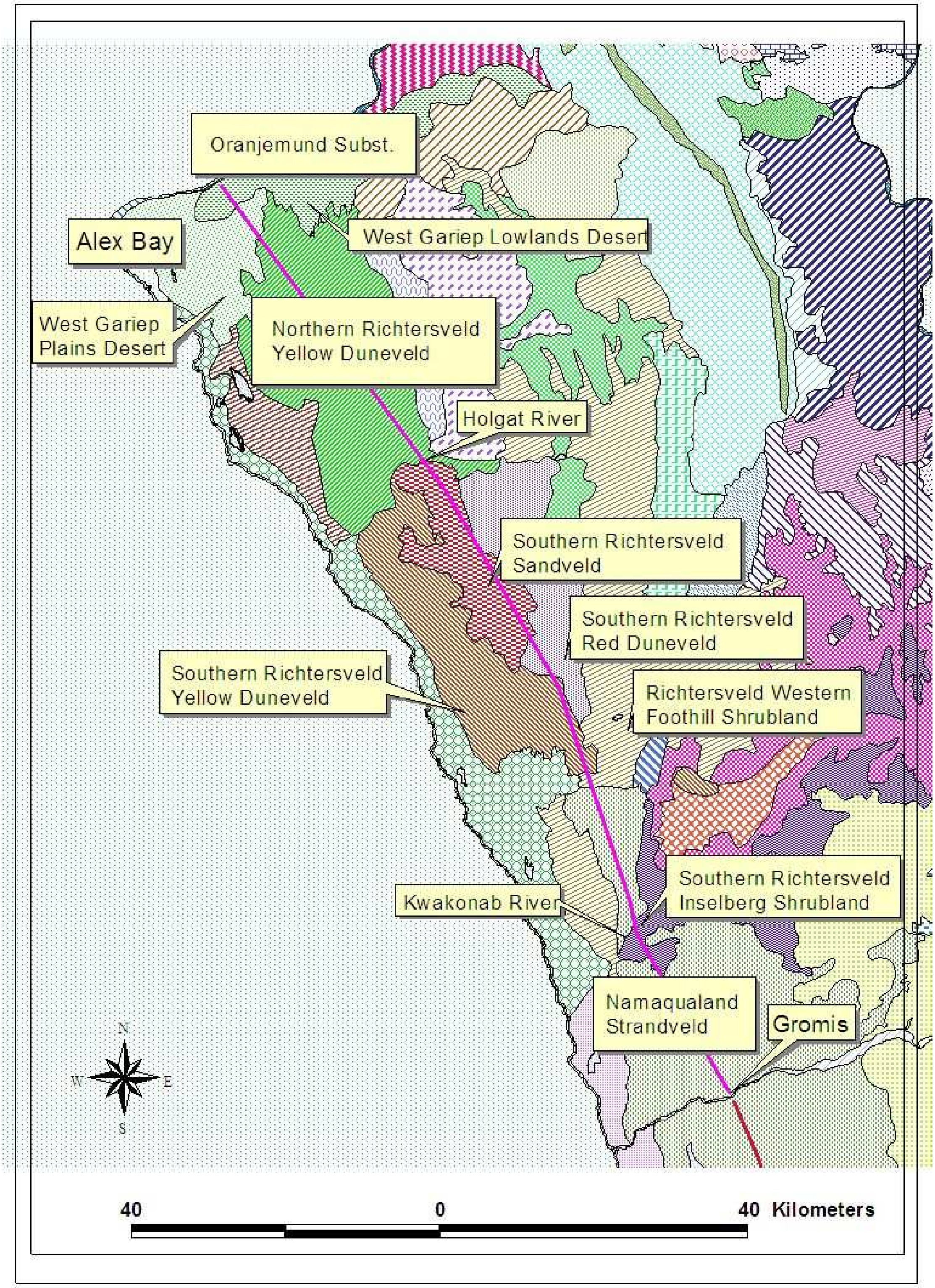

Figure 2: Map showing vegetation types along the powerline route along existing servitude and line from Oranjemund Substation to Gromis Substation.

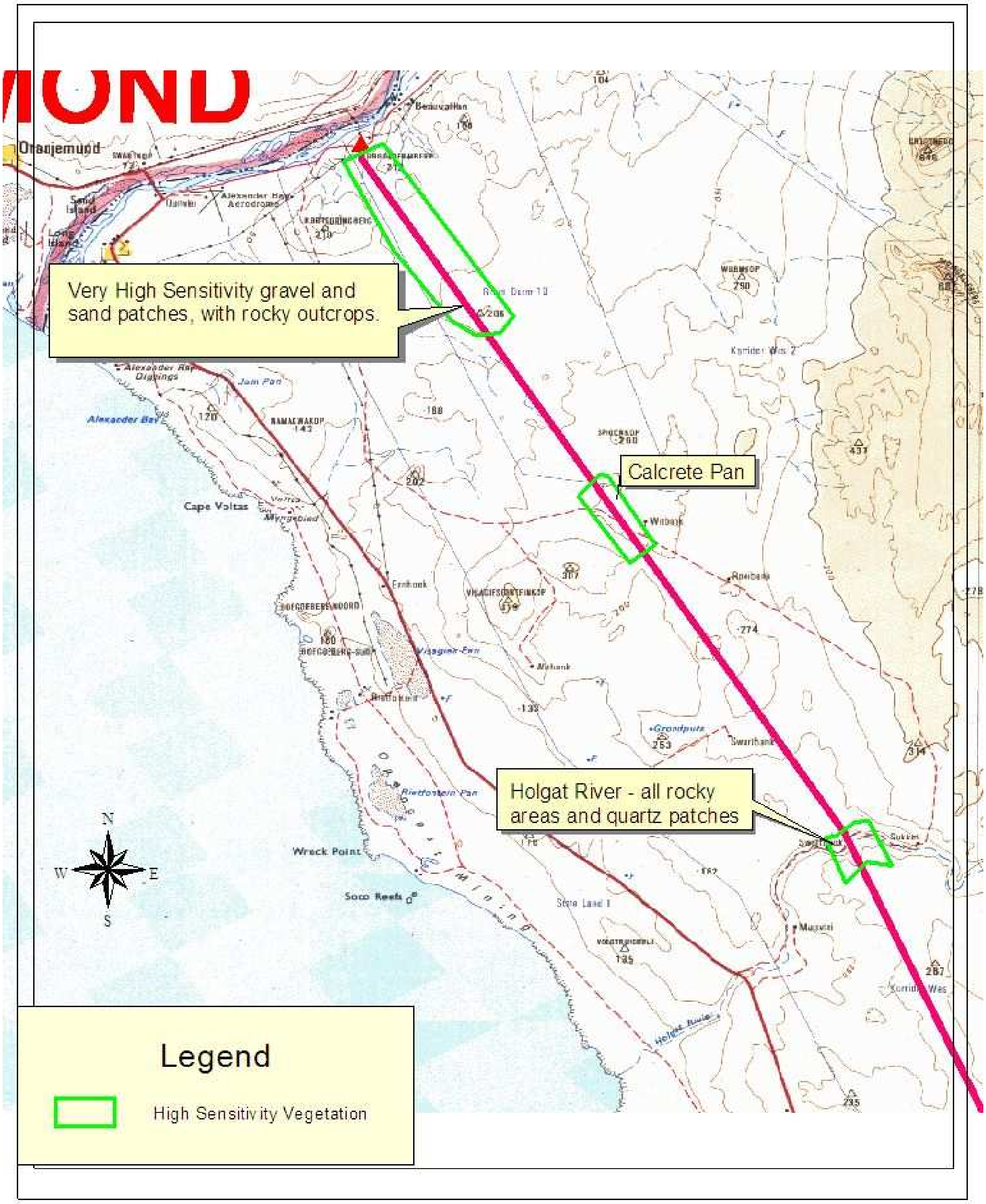

Figure 3: Map of High Sensitivity areas along route in area from Oranjemund Substation to Holgat River.

Plate 1: View of High Sensitivity gravel and sand plains which extend up to 10km south of Oranjemund Substation. The existing Eskom powerline and service road is visible, along with the Orange river. Although sparsely vegetetated, numerous rare, endemic, inconspicuous, and very vulnerable plant species occur in this area.

Plate 2: *Euphorbia ramiglans* is a largely subterranean species (5cm tall) restricted to the western Richtersveld, and was photographed 2km south of the Oranjemund substation.

Thirdly, the crossing of the Holgat River (see Figure 3) is a High Sensitivity area, with numerous steep slopes and rocky outcrops (see Plate 3). The rocks support a multitude of succulents, many of which could be rare or localised. There are also small quartz patches on the southern edge, which must be avoided.

Plate 3: View north across Holgat River gorge, showing existing powerline and High sensitivity rocky outcrops. The service track runs to the right of the photo.

The sensitive areas are separated by areas of low sensitivity, such as low-growing forms of Namaqualand Strandveld, with widespread, common species represented.

Figure 4 indicates the extent of the final sensitive area on this section, which lies at the crossing of the two valleys of the Kwakonab river, which are about 1km apart. The southern extent of this sensitive area is where the Gromis – Kwakonab 66kV line splits off. Harder clay soils occur in this area, with a higher proportion of Mesembryanthemaceae (vygies) than in the nearby Strandveld. There are also rocky outcrops and quite extensive quartz patches (see Plate 4), which support numerous succulents and bulbs, some of which are rare and localised, such as *Oxalis crocea*, which is only known from the original collection near Steinkopf in about 1940.

Figure 4: Map of High sensitivity areas between Port Nolloth road and Gromis substation.

Plate 4: View north over Kwakonab river valley, showing existing powerline and sensitive quartz patches with vygies in foreground.

4.2.2 Gromis Substation to southeast of Hondeklipbaai

Various alternatives run south and east from Gromis substation, but this description covers the main route south (B and E).

The vegetation south of the Buffels River is typical tall Namaqualand Strandveld of Low sensitivity.

The first area of special sensitivity is some of the northernmost extent of Namaqualand Sand Fynbos, which occupies a relatively small area in the Heidons area, some 12km northeast of Koingnaas (see Figure 5). This vegetation type is characterised by the presence of typical Fynbos elements such as restios (Cape reeds) and even proteas. Typical species include *Thamnochurtus bachmanii, Willdenowia incurvata* (sonkwasriet), *Stoebe nervigera, Nylandtia spinosa*, and *Leucadendron brunioides*. Rare species include *Aspalathus obtusata*, which is only known from three collections, and has not previously been found north of Brand se Baai, plus *Eriospermum arenosum*, which is now Red Data Book listed as Vulnerable (Helme & Raimondo – in prep.).

Plate 5: View of northernmost Namaqualand Sand Fynbos near Heidons.

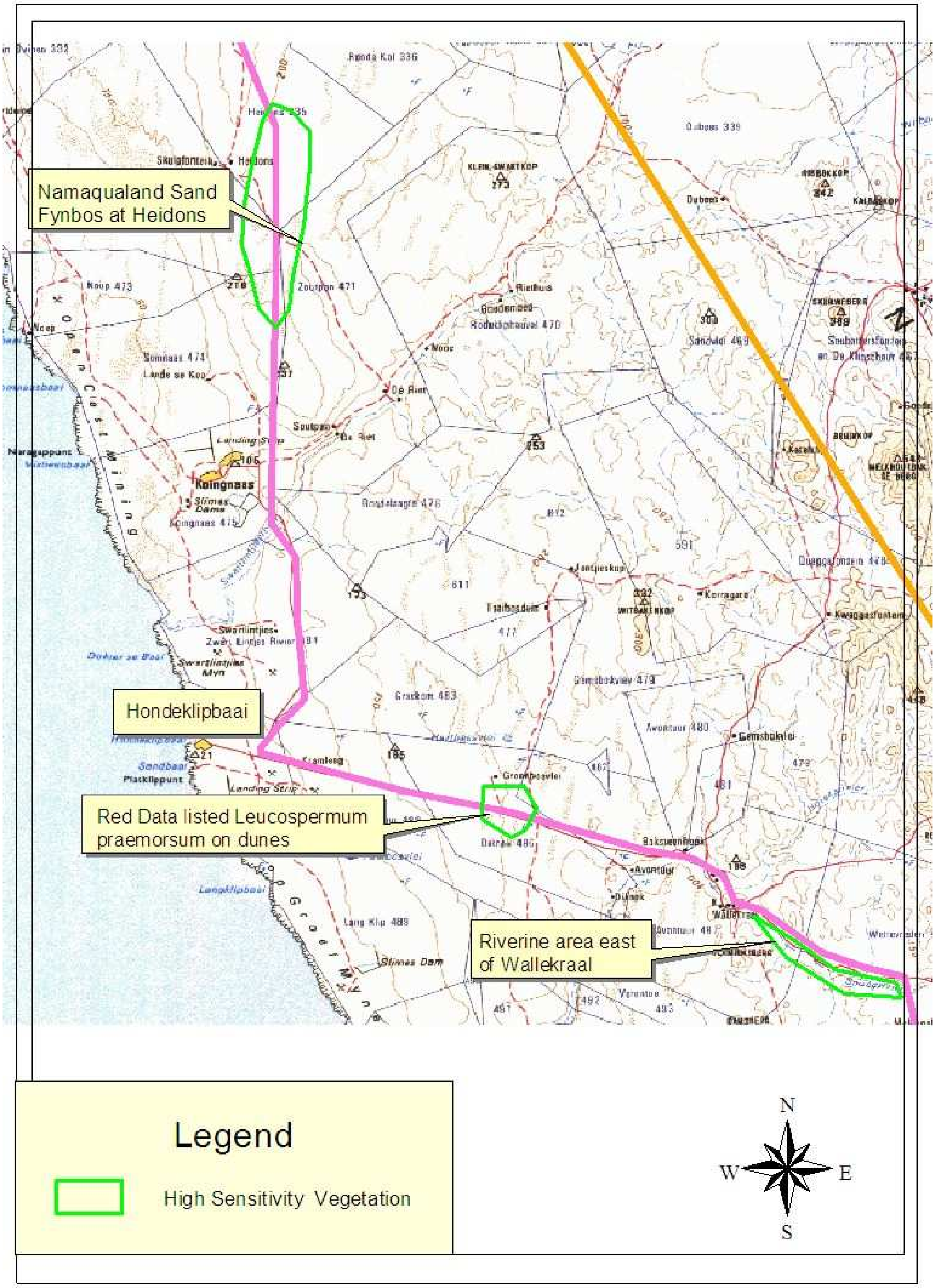

Figure 5: Map of High sensitivity areas in the Hondeklipbaai region.

The area around Hondeklipbaai has been heavily disturbed by diamond mining, and the next sensitive area occurs about 14km east of Hondeklipbaai, where the road cuts through north-south trending dunes on the farm Diknek. On these dunes are Fynbos elements, including the northernmost, and very isolated, population of the Red Data Book listed *Leucospermum praemorsum* (see Plate 6). This species has recently been listed as Vulnerable (Rebelo et al – in prep.), and there is a small population on the dunes, mostly south of the road.

Plate 6: The Red Data listed *Leucospermum praemorsum* (pincushion) occurs on the dunes east of Hondeklipbaai. The main Garies - Hondeliklipbaai road is visible in the background.

The final sensitive area in this region is the granitic river course of the Spoegrivier in the area immediately east of Wallekraal, up to Ouplaas. The riverine vegetation is in good condition and should not be disturbed.

South of this point the Alternatives B and E diverge, with the former taking a more coastal route via the Kotzersrus Sandveld, and the latter taking a direct route through the Hardeveld (Namaqualand Heuweltjieveld). Quite large areas of the latter are either cultivated or heavily grazed, and are of Low conservation value. The Alternative B was not followed in any detail from this point south, until it again joins Alternative E.

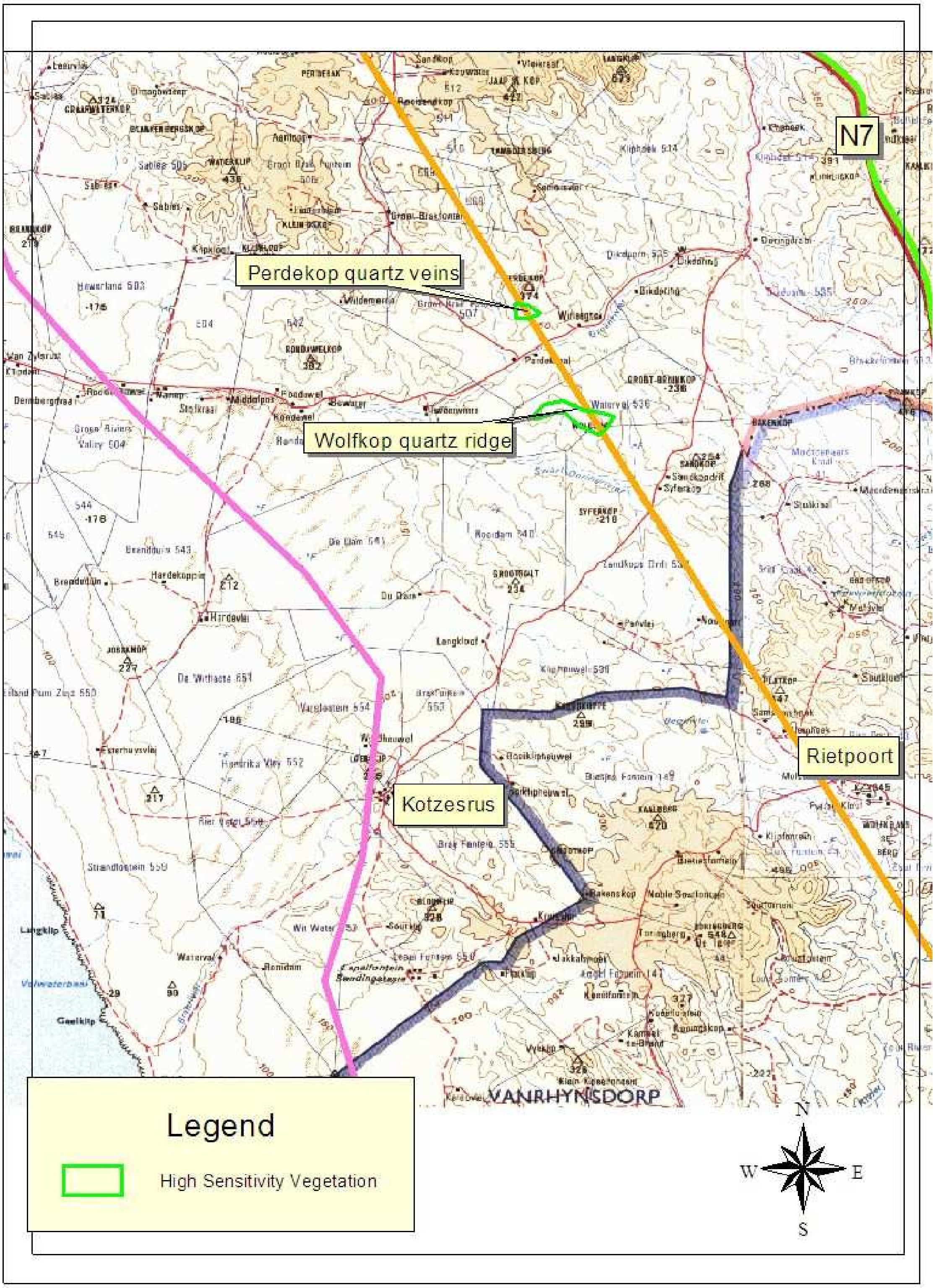

Figure 6: Map of High Sensitivity areas along route E (orange) in the Rietpoort area.

4.2.3 Hondeklipbaai to Juno

North of Rietpoort settlement, just south of Perdekop, on the farm Groot Brak Fontein, are two quartz ridges or veins that appear to be directly within the alignment of Alternative E (here also part of original Eskom Alternative A; Figure 6). These are likely to be sensitive areas that support various localised succulent species, and should not be disturbed. They were not explored in detail during this study, but appear to be quite small (less than 2ha each), and should thus be easy to avoid.

About 5km south of this is another, much larger quartz outcrop on the farm Waterval 536. This appears to be marked Wolfkop on the map, but was not explored due to locked farm gates. The koppie presents extensive quartz exposure of about 10ha in extent, and should be avoided, as it is likely to support many localised succulents. The powerline appears to cross the eastern edge of the ridge.

From here all the way south to Juno substation there are no sensitive areas in the Namaqualand Heuweltjiveld along Alternative A (Figure 6), and it is thus the preferred botanical alternative for this section of the route. Alternative E (and thus B, as they are the same in this southern area) crosses one sensitive area indicated in Figure 7.

At the point where Alternative E diverts west to join the Lutzville – Brand se Baai tar road (split point A) three different alternatives (Alternatives i and ii, plus pink Alternative in Figure 7) have been proposed in this study for Eskom to consider. None of the alternatives crosses any sensitive areas, and all are thus equally viable from a botanical point of view. In addition, there is also the direct Alternative A, which also does not cross any sensitive areas, and avoids all farmlands in the Olifant River valley.

Alternative E crosses a western portion of the Jaagleegte quartz patches, just south of the railway/road crossing near the Namakwa Sands' Mineral Separation Plant (MSP). This area is partly disturbed, and is relatively narrow, and could probably be spanned with minimal impact, but nevertheless it is a sensitive area where care must be taken. Just to the north, immediately east of the MSP, there is very little space between the main tar road and the adjacent tailings dump, as there is already a 66kV powerline in this gap, and Eskom will have to look at this carefully.

A further alternative in this area could be to follow the existing 66kV servitude from the MSP to Juno, which crosses the sensitive but partly saline (and thus less diverse) Jaagleegte quartz patches, but does not cross any other sensitive areas. There is an existing service track along this line.

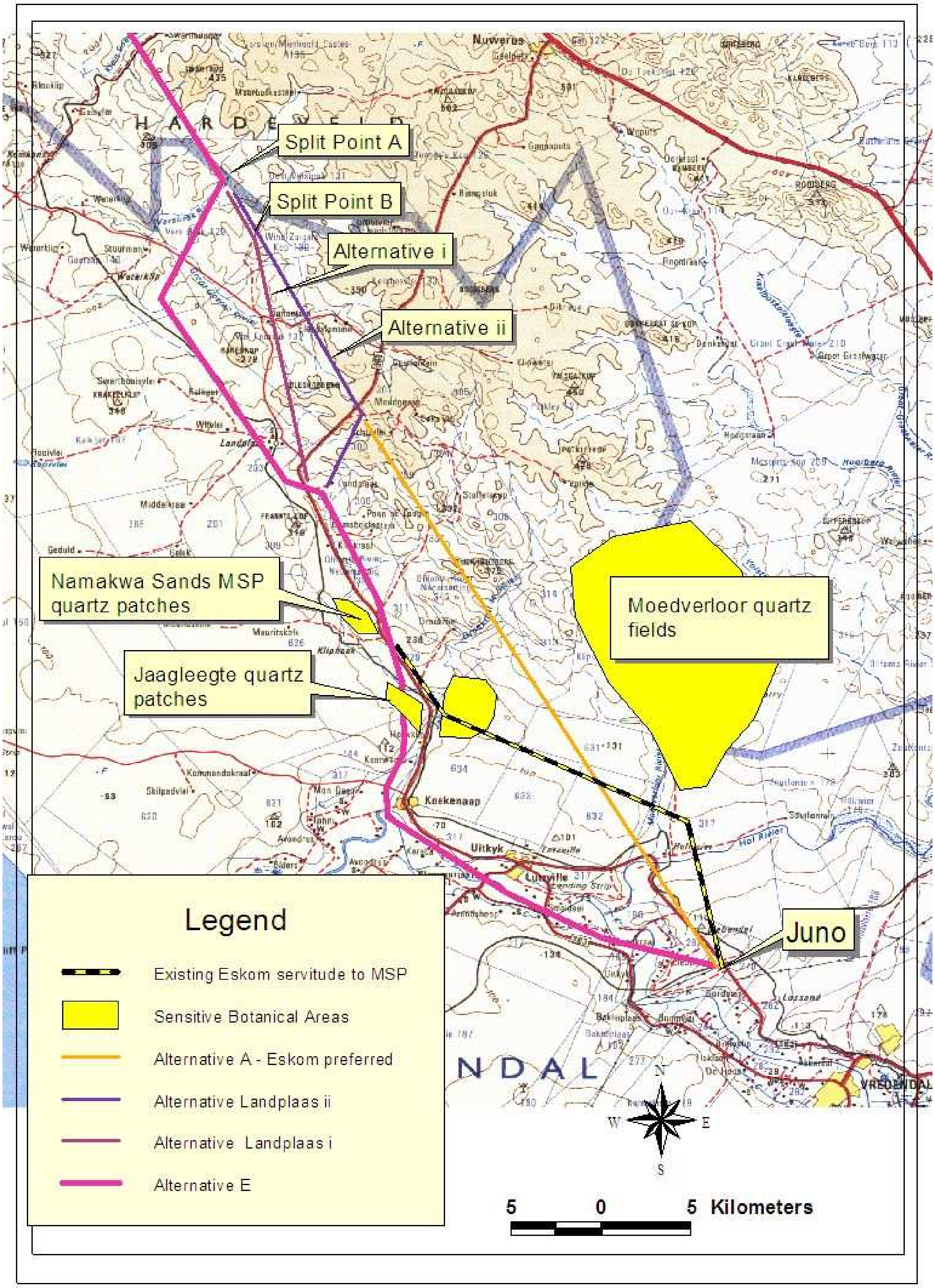

Figure 7: Map of sensitive areas and possible alternative deviations in southern sector.

4.3 Brief description of all alternatives

Alternative A (Eskom proposal): This is the shortest route, being a straight line from Gromis to Juno substations, and is thus the preferred routing for Eskom, as it would probably be the cheapest to build. The primary "No Go" area traversed by this route is the Riethuis – Oubees Quartz Vygieveld within the Namaqua National Park (northeast of Koingnaas). Numerous rare plants are endemic to this area, and due to the nature of the substrate both the plants and the habitat will be irreparably damaged by a powerline and associated tracks, and the habitat cannot be adequately rehabilitated. For this reason this route must be considered as a No Go alternative, in its current form. The remainder of the route passes over low rolling (mostly granite) hills of low to moderate sensitivity and small patches of high sensitivity (such as quartz ridges). In the extreme south (last 40km) this route is in fact the preferred route from a botanical perspective.

Alternative B: This is the alternative proposed by CapeNature, and is one of the preferred routes, with relatively few areas of botanical concern. However, in the area around Kotzesrus there are extensive patches of Namaqua Sand Fynbos, which is a biogeographically important vegetation type with a relatively restricted occurrence, and some of these may be negatively impacted by the powerline and associated new service track. The primary area of concern for this route is likely to be the Knersvlakte Quartz Vygieveld in the vicinity of the Jaagleegte river, around the Namaqua Sands MSP some 5km north of Koekenaap, although this is a fairly saline example of quartz patch vegetation, and these are known to be of lower conservation value than the less saline examples (P. Desmet – pers. comm.). This route is longer than Alternative E, and will therefore be more expensive, and will have a greater ecological footprint (longer sections of new access road, and more pylon positions).

Alternative C: This is one of the alternatives suggested by SANParks, and runs inland along the N7 from Springbok to the Ratelkop area in the Knersvlakte. The first section would follow an existing, but very mountainous and botanically sensitive servitude to Springbok from Kleinzee. This alternative runs straight through the Knersvlakte Quartz Vygieveld for well over 100km, and in fact crosses the core area of the proposed Knersvlakte Biosphere Reserve. The line would not only have a huge visual impact in this area, and all along the N7 highway, but would have a significant negative impact on the very sensitive vegetation in the Knersvlakte. This vegetation supports numerous rare and endemic plant species, and once the habitat is damaged by vehicles does not rehabilitate effectively. The Knersvlakte is regarded as perhaps the global hotspot for dwarf succulent plant species, and the entire area is a major national and global conservation priority. For these reasons this Alternative is considered a No Go option.

Alternative D: This is the second SANParks proposal, and runs from Springbok into Bushmanland, and then crosses the width of the southern Knersvlakte and joins the

Alternative C. This route is very long (and therefore expensive). Botanically it traverses a sensitive, unavoidable, granite and Nama quartzite escarpment west of Steinkopf, sensitive (but easily avoided) granite hills southeast of Springbok, passes east of the main areas of sensitivity in the Kamiesberg, through western Bushmanland (few sensitive areas except pans and rocky outcrops), and then crosses the eastern Knersvlakte, following an existing powerline, fairly close to the Sishen – Saldanha railway line. The route is likely to have a Medium negative impact, as due to its length it has a greater ecological footprint, and it traverses some sensitive areas, but it could be considered. The section through the Knersvlakte is not an issue, as the route does not include significant quartz fields or key botanical areas (P. Desmet – pers. comm.).

Alternative E: This alternative was decided upon fairly recently and is a combination of Alternatives A and B, and is one of the preferred alternatives. The main difference from Alternative B is that from Wallekraal to north of Koekenaap it runs further inland, cutting across the rolling granite hills of the Hardeveld, which support Namaqualand Heuweltjieveld. This area is potentially less sensitive than the Sandveld in the Kotzesrus area, traversed by alternative B, and was proposed for this reason. In addition, it is shorter, and therefore has a smaller direct footprint. The route may need to be slightly modified in its southern extent, to avoid the Quartz Vygieveld north of Koekenaap, and thus the best route may be to continue south on alignment A all the way to Juno.

Alternative F (Kamiesberg route): This alternative was proposed by SANParks, and runs inland from Gromis, up the Buffels river valley, up the escarpment northwest of Kamieskroon (sensitive granite hill area), and then through the rugged Kamiesberg highlands, which has been identified as a Centre of Plant Diversity (Van Wyk and Smith 2001), and has recently been the subject of a detailed study which has shown that it supports at least 55 true endemic plant species, and a further 55 near endemics (Helme and Desmet 2006), making it a regional hotspot for plant endemism. Many species are rare, and restricted to Renosterveld valleys, which is also exactly where a powerline would be likely to be routed. This proposal should thus be rejected as a No Go option on botanical grounds.

Alternative G (Soebatsfontein route): This route was proposed at the workshop as an alternative to F, and is essentially a variation of Alternative A, designed to avoid the most sensitive botanical areas in the Namaqua National Park, which occur in the Riethuis quartz fields. The route runs via Oubees se Sand, to inland of Soebatsfontein, at the western base of the escarpment, and actually avoids all areas of High botanical sensitivity, and will not have more than a Medium negative impact on any one system, and will not cross any unique botanical features.

5. IMPACT ASSESSMENT

5.1 Section from Oranjemund – Gromis substations

a) Nature of the impact : The primary long term impacts associated with such a project are direct loss of natural vegetation under the pylon bases, where the stays are grounded, along the access tracks and in "laydown areas", and in construction camps. Tracks and laydown areas are technically not a permanent loss of vegetation, as without regular driving these tracks will rehabilitate in most areas, except in quartz patches. Both these impacts occur at construction stage. It has become evident from discussion with the geotechnical specialist that construction of the proposed line in areas of deep sand (such as in much of the section from Oranjemund to Gromis substations) will necessitate the excavation of large holes in order to bury huge quantities of concrete, which are required to stabilise the 45m tall powerlines. Each stay (or guyrope) requires a hole approximately 4m wide and 4m deep, but in reality these have much larger disturbance footprints, as the loose sand does not allow for vertical walls, and the excavated sand also has to be placed to one side. This loose sand then blows away and will impact on surrounding natural vegetation, perhaps smothering some of the plants. For every pylon there are four such holes, and heavy vehicles (offroad concrete mixers, steel carrying trucks, offroad cranes, etc.) have to drive between all the points, effectively creating a 1ha node of disturbance around every pylon. New lines will mean new access tracks, even if the existing one is used as the main access track in and out of the general area.

The only real botanical impact at the operational stage is servicing of the lines, where vehicles drive on the existing access tracks, and impacts are thus minimal at this stage. This analysis thus covers both stages, but is concerned primarily with the construction stage, as this is when 80% of the impact occurs.

Something seldom considered, but worth considering here, is the decomissioning of the line, which may have a significant negative impact, and may effectively double the overall impact, meaning that the overall impact will certainly be High negative.

b) Scale: The scale of the direct impact is at the local level (access tracks and pylon footings and stays). However, it is important to point out that over 70% of the plant species that will be impacted do not occur outside Namaqualand, and that any impact to them within the study areas thus also has a national and global indirect impact in terms of their national and global populations and status. This is particularly the case in the area 15km south of Oranjemund substation, where it is estimated that as much as 30% of the vegetation is locally endemic (ie. occurs only there, within 20km of Alexander Bay).

c) Duration: Impacts associated with loss of vegetation around and within the concrete pylon and stay footing areas can be regarded as permanent, whilst loss of vegetation and habitat quality associated with the access tracks is long term, but can usually be reversed over time. However, in this very arid, windswept climate it could take many decades for the disturbed area to rehabilitate, as this is largely dependant on good recruitment after a good rainfall season. It is thus possible that the 30 year lifespan of the powerline could be less than the time it takes to adequately rehabilitate the disturbed areas.

d) Intensity: The intensity of the impacts ranges from Medium (tracks) to High (footings).

e) Probability: The probability of the impacts occurring will be Definite.

f) Significance before mitigation: The significance of the impacts is likely to be **Medium High to High negative.**

g) Significance with mitigation: The significance of the impacts is likely to be **Medium negative.** See discussion under offsets, which must be undertaken along with all other mitigation proposed.

h) Confidence: Medium to High.

Table 1: Overall Impacts on vegetation along route : Oranjemund to Gromis

	Source of impact	Nature of impact	Scale	Duration	Intensity	Probability	Confidence	Significance	
								Without mitigation	With mitigation
Construction	Clearance of vegetation for construction of pylon footings and stays	Loss of vegetation, which may include rare or endemic species, especially in the sensitive areas identified in the maps	Local; but of national significance	Permanent	High	Definite	High	Medium High to High -ve	Medium -ve
	Construction of new access tracks on >70% of route	Loss of vegetation, which may include rare or endemic species, especially in the sensitive areas identified in the maps	Local	Long term	Medium	Definite	Medium	Medium High to High -ve	Medium High -ve
Operation	Vehicular damage to plants within access tracks	Loss of vegetation, which may include rare or endemic species, especially in the sensitive areas identified in the maps	Local	Long term	Medium	Definite	High	Low to Medium -ve	Low to Medium –ve
	Long term erosion along tracks	Development of gulleys and washaways, with possible loss of vegetation	Site	Long term	Low	Probable	High	Low – Medium -ve	Low -ve

5.1.1 Mitigation for this section

- It could be argued that the likely botanical impacts in this area could be sufficiently High negative for this to mean a No Go. I believe that a 30yr lifespan for a powerline in this area does not justify the permanent and long term loss of a portion of a suite of unique, endemic plant species of global conservation significance (and their associated invertebrate fauna). It is unlikely that more than 20% of the known populations of any one species will be lost due to powerline construction, but the cumulative impact (along with mining and other infrastructure projects in the area) is high, as large areas have already been lost. Basic environmental best practise requires the avoidance of the impact as first choice, followed by minimisation. As the impacts cannot effectively be minimised or reduced in this case avoidance would be the preferred option.

- Should the project go ahead in this area *extreme care* must be taken to minimise impacts. Significant damage *will* be caused, whatever is done, due to the nature of the terrain, very slow rates of rehabilitation, and density of rare and localised plant species.
- Reduction of Impacts:
  - At the walkdown stage the botanist should be required to identify and locate the exact pylon positions in all sensitive areas identified in this report.
  - An ECO must be present throughout the construction process in all sensitive areas, and it is Eskom's responsibility to ensure that this ECO is fully briefed by the botanist beforehand.
  - Construction work here must be undertaken in summer (Oct – April), when most plants are dormant, and least likely to be damaged.
  - Vehicular activity must be minimised in the sensitive areas.
  - All laydown and storage areas, and contractors camps, must be located outside sensitive areas.
  - Search and Rescue of all possible translocatable species must be conducted by the ECO on all footprints in sensitive areas, prior to disturbance.

- Offsets:

There will be an unavoidable residual negative impact, which is most effectively mitigated by a biodiversity offset (Ten Kate et al 2004). An offset is considered mandatory mitigation in this case, due to the sensitive nature of the area. An appropriate offset would be to formally conserve a portion of similar habitat (adjacent if possible) that is conservation worthy and under threat. A possible option would be to increase the servitude width in the 12.5km south of Oranjemund substation, to at least 1000m. This area should then be rezoned Open Space 3 if possible, and registered as a Private Nature Reserve, in order to secure some conservation status for this very vulnerable area. Alternatively, a portion of the farm Grootderm 10, not less than 100ha in extent should be purchased immediately south of the Oranjemund substation. This area should then be rezoned Open Space 3 and registered as a Private Nature Reserve, and negotiations entered into with the Northern Cape environmental authorities about securing a higher, formal conservation status for this area (such as a Stewardship Contract). Eskom must be responsible for erecting signage indicating the boundaries of this conservation area. Alternatively, the land could be transferred to Northern Cape conservation, and registered in their name.

A significant offset of at least 100ha as a conservation area would help secure an example of this important vegetation type, which would be a positive effect of the proposed development. However, this needs to be balanced against the loss of vegetation within the pylon footprint, and thus the overall impact could be reduced to

Medium negative, after mitigation. An offset of this type would be the only way to reduce the impacts to an acceptable level.

5.2 Detailed impact assessment of Alternative B, D, E and G (preferred alternatives)

Not all routes have been analysed in detail, as Alternatives A, C, and F have been shown to have a potentially High negative botanical impact (see Sect. 7), and should thus be rejected by the authorities. Alternative B is fairly similar to Alternative D, E, and G in terms of its botanical impacts, but because of its greater length through a moderately sensitive area it has a slightly greater ecological footprint and level of impact.

a) Nature of the impact : The primary long term impacts associated with such a project are direct loss of natural vegetation under the pylon bases, where the stays are grounded, along the access tracks and in “laydown areas”, and in construction camps. Tracks and laydown areas are technically not a permanent loss of vegetation, as without regular driving these tracks will rehabilitate in most areas, except in quartz patches. Both these impacts occur at construction stage. It has become evident from discussion with the geotechnical specialist that construction of the proposed line in areas of deep sand (such as in much of the section from Oranjemund to Gromis substations) will necessitate the excavation of large holes in order to bury huge quantities of concrete, which are required to stabilise the 45m tall powerlines. Each stay (or guyrope) requires a hole approximately 4m wide and 4m deep, but in reality these have much larger disturbance footprints, as the loose sand does not allow for vertical walls, and the excavated sand also has to be placed to one side. This loose sand then blows away and will impact on surrounding natural vegetation, perhaps smothering some of the plants. For every pylon there are four such holes, and heavy vehicles (offroad concrete mixers, steel carrying trucks, offroad cranes, etc.) have to drive between all the points, effectively creating a 1ha node of disturbance around every pylon.

The only real botanical impact at the operational stage is servicing of the lines, where vehicles drive on the existing access tracks, and impacts are thus minimal at this stage. This analysis thus covers both stages, but is concerned primarily with the construction stage, as this is when 80% of the impact occurs.

b) Scale: The scale of the direct impact is at the local level (access tracks and pylon footings and stays). However, it is important to point out that over 70% of the plant species that will be impacted do not occur outside Namaqualand, and that any impact to them within the study areas thus also has a national and global indirect impact in terms of their national and global populations and status.

c) Duration: Impacts associated with loss of vegetation around and within the concrete pylon and stay footing areas can be regarded as permanent, whilst loss of vegetation and habitat quality associated with the access tracks is long term, but can usually be reversed over time.

d) Intensity: The intensity of the impacts ranges from Medium (tracks) to High (footings).

e) Probability: The probability of the impacts occurring will be Definite.

f) Significance before mitigation: The significance of the impacts is likely to be **Medium negative.**

g) Significance with mitigation: The significance of the impacts is likely to be **Low to Medium negative.**

h) Confidence: High. Information about the exact placement of the pylons is not yet available, and this flexibility in fact constitutes part of the mitigation, as small sensitive areas along the route (eg. quartz ridges) can be avoided during walk-down stage.

Table 2: Overall Impacts on vegetation along route – Alternatives D, E, and G

	Source of impact	Nature of impact	Scale	Duration	Intensity	Probability	Confidence	Significance	
								Without mitigation	With mitigation
Construction	Clearance of vegetation for construction of pylon footings and stays	Loss of vegetation, which may include rare or endemic species, especially in the sensitive areas identified in the maps	Local	Permanent	High	Definite	High	Medium -ve	Low to Medium -ve
	Construction of new access tracks on >70% of route	Loss of vegetation, which may include rare or endemic species, especially in the sensitive areas identified in the maps	Local	Long term	Medium	Definite	High	Medium -ve	Low to Medium –ve
Operation	Vehicular damage to plants within access tracks	Loss of vegetation, which may include rare or endemic species, especially in the sensitive areas identified in the maps	Local	Long term	Medium	Definite	High	Low to Medium -ve	Low to Medium –ve
	Long term erosion along tracks	Development of gulleys and washaways, with possible loss of vegetation	Site	Long term	Low	Probable	High	Low – Medium -ve	Low -ve

5.2.1 Specific Mitigation Recommendations for routes B, D, E and G

- Reduction: If possible all construction should be done during the dry season (Oct – April), as this will minimise damage to the many rare or localised bulbs and annuals which grow and/or are above ground only during the autumn – spring period. This refers particularly to the driving of vehicles over natural veld, and is especially important in this highly seasonal area. However, given the length of this route the construction period is expected to extend over a long period, and thus the above recommendation should become mandatory for at least the High Sensitivity areas identified in the maps.
- Avoidance: Detailed pylon and access track placement must be undertaken in conjunction with the botanist at the walk-down stage for all High Sensitivity areas identified in this report. This will help ensure that impacts in the most sensitive areas are minimised. This walk down should ideally be undertaken during the period May – September in order to facilitate the identification of especially sensitive areas.

- Avoidance: The Eskom planners should ensure that all rocky outcrops, quartz patches, gravel patches, and wetlands (including pans) are avoided when doing preliminary pylon placements, as this will save a lot of time later on. If they are indicated on the maps as falling within such areas they will have to be moved during the walk-down process, and it would be best to pre-empt this time consuming task by doing the job responsibly at the desktop stage.
- Avoidance: Serious consideration should be given to modifying Alternative E in its southernmost portion, to avoid impacting on the Jaagleegte quartz patches near the Namakwa Sands MSP. It is proposed that from southwest of Nuwerus the southern portion of E actually continues on the original route of Alternative A in this area, rather than deviating west as it does in Alternative E at this stage (see Figure 7).

6. GENERIC MITIGATION

- No vehicles should be driven through seasonal or permanent wetlands.
- All rocky outcrops, gravel patches, and quartz patches must be regarded as Very High Sensitivity areas and must not be disturbed by vehicles, unless authorised by the botanical specialist during the walk-down study.
- There should be no construction or pylon placement in any sort of wetland area (seasonal or permanent).
- Existing access tracks should be used where possible in order to minimise the creation of new tracks.
- At the walkdown stage the botanist should look at all sensitive areas and identify and locate the footprints with the least impact. This walkdown should be conducted in the period May – September.
- Cables should be laid out on existing tracks or disturbed areas.
- Mixing of concrete should be undertaken in the contractors camps or laydown areas (or other low sensitivity areas), and may not be undertaken in areas of natural vegetation that will not be disturbed. In other words, if concrete is mixed on site, it should be done only in footing areas that will be disturbed anyway later on, and not in adjacent natural areas. No concrete residue should be left in any areas of natural vegetation.
- Contractors and Eskom personnel may not make any open fires in the Namaqualand Sand Fynbos areas northeast of Koingnaas, or in the dunes east of Hondeklipbaai, or elsewhere in Sand Fynbos areas. These areas contain sufficient fuel to burn, and will recover only very slowly, as they are not a fire driven ecosystem.

7. ALTERNATIVES

It is important to note that no alternatives were presented for the section from Oranjemund to Gromis substations.

The primary long term impacts associated with such a project are direct loss of natural vegetation under the pylon bases and where the stays are grounded, and along the access tracks. Because the new powerline will be a lot bigger than the existing powerline (Oranjemund to Gromis substations) the design of the pylons will change, and the impacts are likely to be greater than they were for the initial line.

The tracks are technically not a permanent loss of vegetation, as without regular driving these tracks will rehabilitate in most areas, except in quartz patches, and in gravel lag areas (such as immediately south of Oranjemund substation). Both these impacts (stay emplacement and track construction) occur at construction stage. The only real botanical impact at the operational stage is servicing of the lines, where vehicles drive on the existing access tracks, and impacts are thus minimal at this stage.

A subjective basic impact assessment of the seven alternatives (south of Gromis) discussed in Sect. 4.3 is presented below.

Alternative	Overall Impact after mitigation
Alternative A	High –ve
Alternative B	Medium –ve
Alternative C	High –ve
Alternative D	Low to Medium -ve
Alternative E	Low to Medium -ve
Alternative F	High –ve
Alternative G	Low to Medium –ve

Table 3: Table showing overall regional botanical impacts associated with the 7 alternatives, after mitigation. **Note that this impact refers to only the greenfields section south of Gromis.**

8. CONCLUSIONS AND RECOMMENDATIONS

Three of the seven alternatives asssessed (Alternative A, C, and F) were identified as having potentially High negative botanical impacts that could not be effectively mitigated, which means that these are fatal flaws for these Alternatives.

At this point it is important to note that the section from Oranjemund to Gromis (no alternatives provided, and thus common to all routes) is likely to have a Medium - High to High negative impact (before mitigation), due primarily to the impacts associated with the first 15km of line. In my opinion the only way to reduce the impacts in this very sensitive area to an acceptable Medium negative level would be to undertake a significant biodiversity offset, whereby at least 100ha of the habitat is formally set aside as a conservation area, in addition to implementing all other mitigatory measures. Very thorough and detailed mitigation (including a large biodiversity offset), which must be clearly set out in an EMP and the ROD, could go some way to reducing impacts to a probable Medium negative, in which case it is possible to consider the remainder of the route, south of Gromis.

If any of the alternatives are authorised it is essential that all mitigation outlined in Sections 5.1.1, 5.2.1, and Section 6 be included in the ROD as Conditions of Approval.

The remaining four Alternatives have very similar overall botanical impacts, which were assessed as Medium negative before mitigation. Most of the impacts are direct impacts associated with construction of the powerline (pylon footings and stays) and associated new access tracks. These direct impacts (loss of natural vegetation, including potentially rare or localised species) are likely to be very limited in extent, but largely permanent in these specific areas of impact. The only significant indirect impact identified was possible erosion of access tracks, which can cause further loss of vegetation.

All High Sensitivity areas require special mitigation, including a detailed walk-down at the pylon placement stage; placing of pylons outside all rocky outcrops, quartz patches, gravel patches, and wetlands; location of construction camps and laydown (storage) areas outside sensitive areas; employment of an ECO to oversee all work in sensitive areas; Search and Rescue of all translocatable plant species within footprints in sensitive areas; construction outside the growing season in all High Sensitivity areas; and a minimum 100ha offset conservation area in the area immediately south of Oranjemund substation.

The remaining large portions of the route have either a Low or Medium botanical sensitivity and no special mitigation is required for these areas.

From a botanical point of view the preferred alternatives are Alternatives D, E, or G. However, it is suggested that a slight modification be made to Alternative E, where the southern portion from southwest of Nuwerus should instead follow the direct route of Alternative A all the way to Juno. In this case Alternative E would be preferred ahead of B, and the most direct of the viable options, and thus presumably the cheapest. Alternatives D and G avoid most sensitive areas, and are on a par with a modified Alternative E as preferred alternatives.

9. REFERENCES

Helme, N. and Desmet, P.G. 2006. A Description Of The Endemic Flora And Vegetation Of The Kamiesberg Uplands, Namaqualand, South Africa. Report for CEPF/SKEP.

Helme, N. and D. Raimondo. In Prep. Contributions to the new Red Data list of southern African plants.

Hilton Taylor, C. 1996. *Red Data list of southern African plants*. Strelitzia 4. National Botanical Institute, Pretoria.

Mucina, L. and M. Rutherford. (eds.). 2003. *Vegetation of South Africa, Lesotho, and Swaziland.* Beta version 2.0. National Botanical Institute, Kirstenbosch.

Rouget, M., Reyers, B., Jonas, Z., Desmet, P., Driver, A., Maze, K., Egoh, B. & Cowling, R.M. 2004. *South African National Spatial Biodiversity Assessment 2004: Technical Report. Volume 1: Terrestrial Component.* South African National Biodiversity Institute, Pretoria.

Ten Kate, K., Bishop, J., and R. Bayon. 2004. Biodiversity offsets: Views, experience, and the business case. IUCN, Gland, Switzerland and Cambridge, UK. Investment Insight, London.

Van Wyk, A.E. and G. F. Smith. 2001. Regions of Floristic Endemism in Southern Africa. Umdaus Press, Pretoria.