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Terrestrial Plant Species Specialist Assessment for Proposed Future Land Use for the Cato Ridge Development Company, Cato Ridge, KwaZulu-Natal

Performed for Zutari



23 April 2023

Specialist Assessment Report Details and Declaration of Independence

This is to certify that the following assessment and report has been prepared independently of any influence or prejudice and as per the requirements of:

Section 32 (3) of the NATIONAL ENVIRONMENTAL MANAGEMENT ACT, 1998 (Act No. 107 OF 1998) ENVIRONMENTAL IMPACT ASSESSMENT REGULATIONS 2014 as per Government Notice No. 38282 GOVERNMENT GAZETTE, 4 DECEMBER 2014 (as amended in 2017).

Document Title:	Terrestrial Plant Species Specialist Assessment for Proposed Future Land Use for the Cato Ridge Development Company, Cato Ridge, KwaZulu-Natal
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Client:	Zutari

Details of Specialist Team

The relevant experience of specialist team members involved in the compilation of this report are briefly summarized below. Curriculum vitae can be supplied on request.

Specialist	Role	Details
David Styles <i>Pr.Sci.Nat.</i> Botanist	Principal author	David Styles is a SACNASP registered professional natural scientist (reg. no. 120066) who has more than 16 years of experience conducting vegetation surveys in the summer-rainfall region of South Africa. During this time he has collected more than 6 000 herbarium specimens, authored or co-authored 43 popular and scientific botanical articles and papers, including a number of new species descriptions, and issued more than 200 reports on botanical subjects. Between 2003 and 2012 he edited the botanical journal <i>PlantLife</i> (http://plantlifesouthafrica.blogspot.com). His MSc in environmental science (UKZN) comprised a floristics study of the grasslands of Cato Ridge inland of Durban.
Douglas Macfarlane <i>Pr.Sci.Nat.</i> Ecologist	Co-author/ reviewer	Douglas Macfarlane is a SACNASP registered Professional Natural Scientist (reg. no. 400077/10) in the field of Ecological Science. He has 15 years of experience in consulting and is the Chief Scientist of Eco-Pulse Environmental Consulting Services. His experience is broad, ranging from field vegetation surveys through to wetland and biodiversity studies. He was responsible for helping to evaluate recovery potential and in developing a quality metric for KZNSS based on data collected for the vegetation type. This approach was also integrated into the biodiversity offset report for this study. He was then responsible for undertaking a review of this report and in providing recommendations for enhancement to align with national protocols for terrestrial plant species assessments.

Front cover

Above: *Chaetacanthus / Dyschoriste* sp. nov. This undescribed species appears to be endemic to KwaZulu-Natal Sandstone Sourveld in the outer part of the eThekweni Municipal Area.

Below: KwaZulu-Natal Sandstone Sourveld grassland north of the N3 in the vicinity of the old Cato Ridge airfield with *Eucalyptus* invasion behind. Large numbers of cattle are being grazed, which have degraded the grassland's species diversity.

Summary

The Natal Group sandstone plateau north of the N3 is well-suited to development, because of flat terrain and ease of access from, and proximity to existing roads and rail. Unfortunately, most of this is KwaZulu-Natal Sandstone Sourveld of varying quality, which is considered Endangered (Skowno et al. 2018) or Critically Endangered (Jewitt 2018). Numerous threatened species or species of conservation concern were found to occur on this plateau.

This grassland is most impacted by the development proposal, which is separated into three phases and envisage transformation of several hundred hectares of this grassland. The impacts of the proposed footprints are well presented in mapping and descriptions in this report. Other vegetation types include a large amount of Eastern Valley Bushveld, some of which is an excellent example of this vegetation type, below the plateau. The geology there is more complex and much comprises granite or Dwyka Group tillite. As the terrain is hilly or comprises steeper slopes, it is much less suited to development. However, the development proposal avoids Eastern Valley Bushveld.

This report draws on information from 307 plots surveyed over many years (2013-2014) and (2020-2022) in grasslands north and south of the N3, including 119 in the present study area. This is broken down as follows:

- In the spring to end summer of September 2012 to March 2013 and September 2013 to March 2014, 236 plots were surveyed in better quality grassland at Cato Ridge. Many of these were north of the N3, with 48 in the present study area. This was for an M.Sc. study. The survey methodology is described further below. In the years 2020-2021, a further 21 plots were surveyed north of the N3.
- In 2022 Eco-Pulse was contracted by the Cato Ridge Development Company to investigate the feasibility of offsets which may be required if KwaZulu-Natal Sandstone Sourveld was developed. I was in turn subcontracted by Eco-Pulse to survey a further 50 plots north of the N3.

The purpose of the 2022 surveying had two objectives:

- To improve coverage of plot-based surveying and improve quality and mapping resolution.
- Based on kind of disturbance and when disturbance occurred in grassland, assess the extent to which it is able to recover.

In addition, to address these two criteria, Eco-Pulse consulted with a grassland scientist and natural sciences statistician, Mr. Craig Morris of the University of KwaZulu-Natal, Pietermaritzburg to subject this plot-based data, as well as previous plot-based data, to more intensive analysis so that they could be allocated to more highly resolved and finely graduated quality gradients, which were differentiated to a greater number of species-richness categories.

Given that KwaZulu-Natal Sandstone Sourveld is an Endangered vegetation type, even very degraded instances are valuable, especially if there is prospect of recovery. It has been indicated in an initial meeting involving the eThekweni Municipality's Biodiversity Management Department (BMD, formerly the Environmental Planning and Climate Protection Department) and Ezemvelo KwaZulu-Natal Wildlife (EKZNW) that loss of such grassland is not supported. The developer should take note of this statement and the risk involved, in absence of such support.

The sandstone grasslands and wetlands on the plateau are threatened by illegal sand-mining, overgrazing and associated over-burning, and alien plant invasions (particularly the expansion of the trees *Acacia mearnsii* – Black Wattle, eucalypts and some localized infestations of *Populus x canescens*, the Grey Poplar). On the other hand, under-burning appears to be an issue in the Eastern Valley Bushveld vegetation and likely historically grassland within the concrete palisade fencing of Assmang.

The mitigation hierarchy such as indicated in the draft national offset policy should be navigated before offsets become an option and become applicable. High offset ratios are indicated. In a 2013 policy document EKZNW (2013b) considers KwaZulu-Natal Sandstone Sourveld Critically Endangered, and does not consider most threatened vegetation types suitable for offsetting. However, for Endangered vegetation types offset ratios of between 1:3 (i.e. transformation of 1 hectare requires 3 in offset) and 1: 5 were proposed. Much higher offsets have since been communicated in respect of KwaZulu-Natal Sandstone Sourveld by EKZNW. Note should be made of the 2018 National Spatial Diversity Assessment and incorporation into the Revised National List of Threatened Ecosystems that assesses KwaZulu-Natal Sandstone Sourveld as Endangered. Eco-Pulse has independently investigated the feasibility of offsetting and ratios which are scaled according to quality of the affected grassland and costs for implementing offset actions within and outside the eThekweni Municipal Area.

Development should be focussed on more degraded grassland and confer effective conservation management on the balance in order to prevent and reduce the current threats. My own view is that without such management being well resourced, with a full time management or security presence, the grassland still in primary condition will in the long term deteriorate further and prospects of recovery in remaining degraded instances will be limited. An extremely robust and sustainable management regime will need to emerge from any authorized development. A worst case scenario for these grasslands would be sizeable loss to development, without effective management, resulting in deterioration of what will be an even smaller instance.

If some grassland is developed and offsets are obligated, I also note that properties with important amounts of KZN Sandstone Sourveld and Dry Coast Hinterland Grassland have been acquired south of the N3 by the eThekweni Municipality for conservation purposes. There may still be possibilities for expansion and consolidation of these areas. The N3 divided what was once a large grassland area and there is for this reason a substantial species overlap, which includes the sharing of many species, as well as many of the same species of conservation concern, including localized endemics. However, insofar as available, these areas may well be insufficient to accommodate all offsetting required. Due to land values within the eThekweni Municipal Area, their acquisition may also be relatively high cost solution. However, ownership and the situation of grassland in a non-communal settings bring fewer long-term protection and management risks. The options for meeting offset obligations are investigated more thoroughly in the biodiversity offset report (Macfarlane, 2023).

In this regard, offsetting is problematic if development will impact on species of conservation concern which have localized or a main Durban escarpment presence. Several are not known from KwaZulu-Natal Sandstone Sourveld much further afield, or to the north. These occurrences should be protected or at minimum not impacted upon extensively. These species are identified and occurrences mapped in this report. It is also possible to establish populations of some species of conservation concern at Cato Ridge more extensively south of the N3, as well as in grassland north of the N3 which remains undeveloped, providing this grassland is then protected and managed.

List of acronyms

BMD – The eThekweni Municipality's Biodiversity Management Department

DCHG – Dry Coast Hinterland Grassland

DFFE – the national Department of Forestry, Fisheries and the Environment

DEFF – Department of Environment, Forestry and Fisheries, precursor of the DFFE

EDTEA – the provincial department of Economic Development, Tourism and Environmental Affairs

EKZNW – Ezemvelo KwaZulu-Natal Wildlife, the province's provincial conservation authority

EMA – eThekweni Municipal Area

EPCPD – The eThekweni Municipality's Environmental Planning and Climate Protection Department, former name of the BMD.

EVB – Eastern Valley Bushveld

KZNSS – KwaZulu-Natal Sandstone Sourveld

LAP – The Cato Ridge Local Area Plan, developed at the behest of the eThekweni Municipality

NV – Ngongoni Veld

SANBI – The South African National Biodiversity Institute

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Dear Patrick

**VEGETATION IM PACT ASSESSM ENT FOR PROPOSED FUTURE LAND USE BY THE CATO RIDGE
DEVELOPM ENT COM PANY AT CATO RIDGE, KWAZULU-NATAL**

1. Introduction

I have been asked by Zutari to provide a vegetation impact assessment on land owned by the Cato Ridge Development Company at Cato Ridge. Amongst requirements:

- The study should fulfil the needs for a biodiversity specialist study as part of an EIA process as per the Protocol for the Specialist Assessment and Minimum Report Content Requirements For environmental Impacts On Terrestrial Plant Species (GN.1150 of 30 October 2020).
- Include a baseline, GIS mapping and sensitivity ranking of vegetation communities. Including latest national Species Environmental Assessment Guideline (SANBI 2021).
- Assess disturbance on the site (e.g. sand mining, invasive alien vegetation) and current state and trends.
- Make recommendations concerning future development and land use.

Although wetland vegetation is described, I am not a wetland specialist and wetland delineation and associated assessments were therefore undertaken by a wetland specialist (Eco-Pulse, 2023a).

2. Study area and proposed development

The extent of the Cato Ridge Development Company landholdings and study area at Cato Ridge are shown in Figure 1. There are three proposed future land use phase sites as shown in Figure 2. The approach taken is to deal with common features of all, prior to moving on to assessment of each site. However, it has been found that based on the proposed land uses, and assessment of impacts on all sites, according to the methodology provided by Zutari, the results are similar for each site.

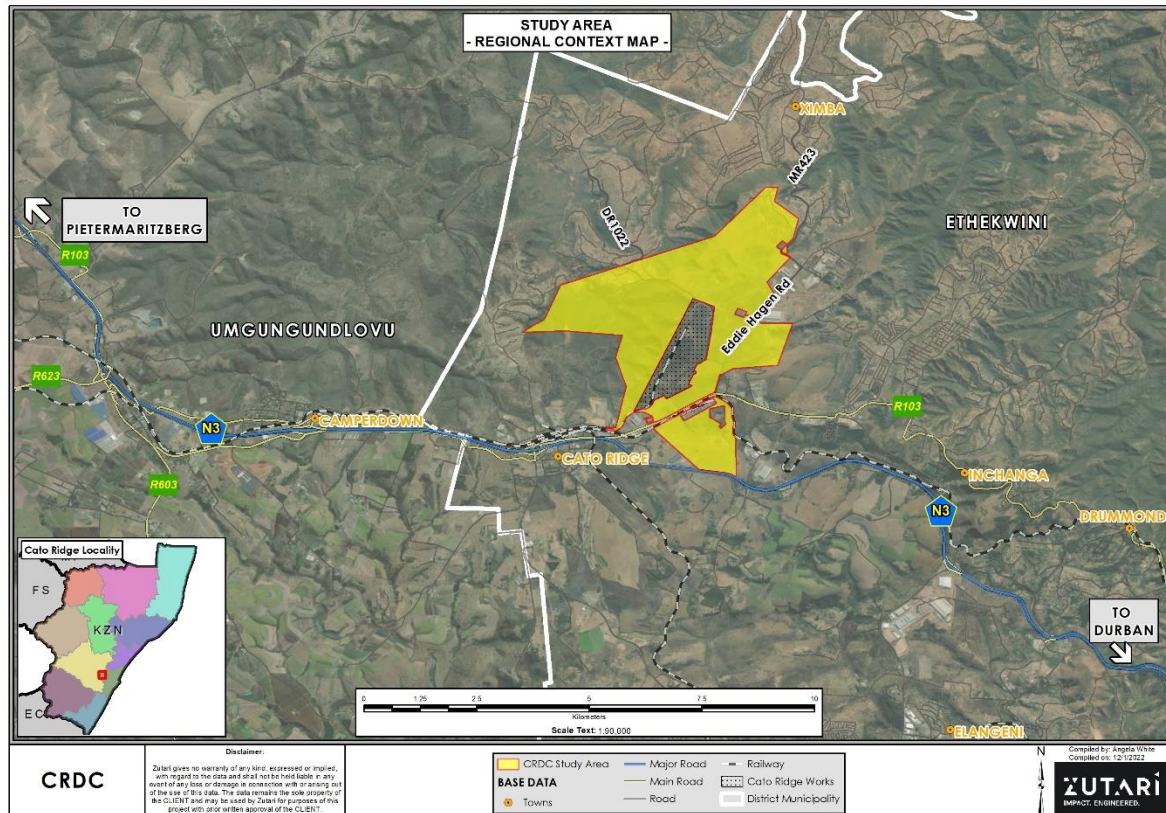


Figure 1. The Cato Ridge Development Company study area at Cato Ridge, north of the N3 national road.

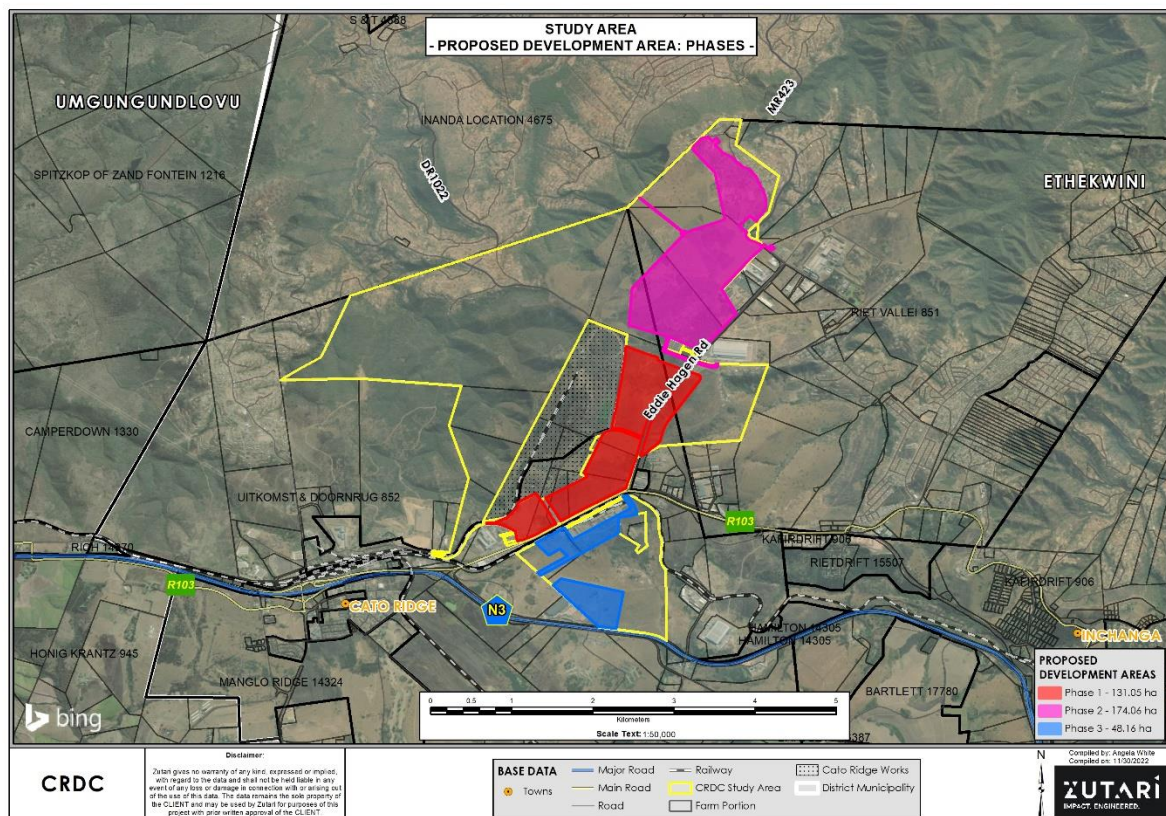


Figure 2. The proposed development area with phasing

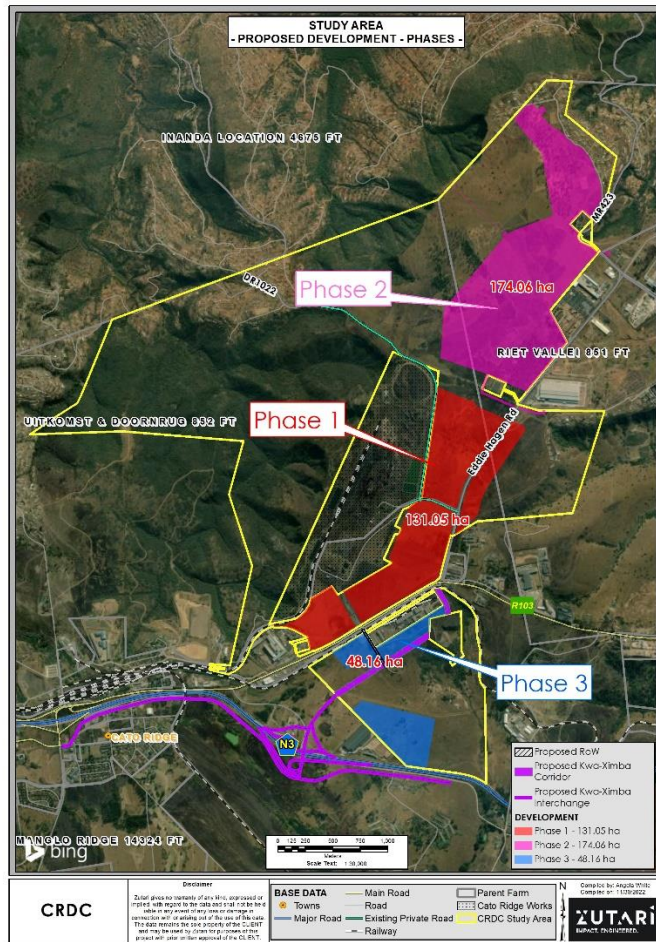
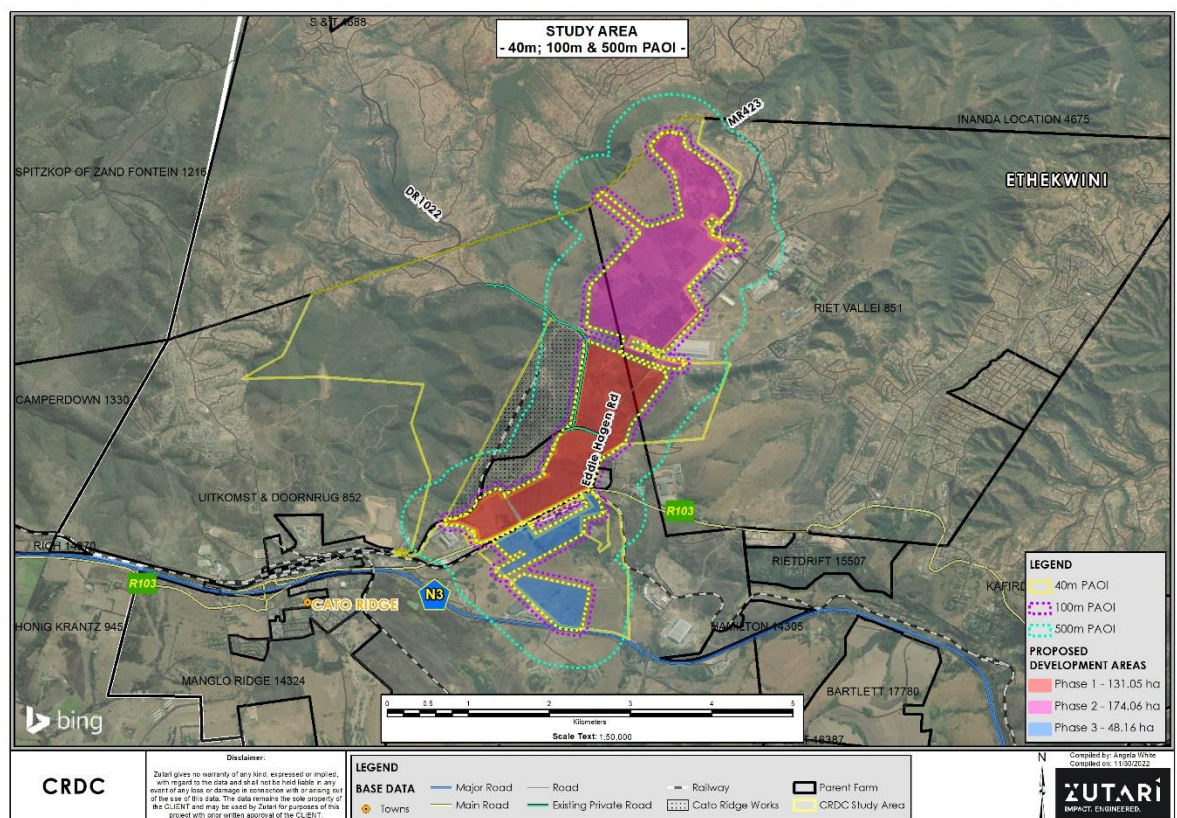


Figure 3 (left). Proposed phases of the development indicating size of each development area in hectares:

Phase 1: 131.05 ha
Phase 2: 174.06 ha
Phase 3: 48.16 ha

Figure 4 (below). Property boundary and location of three study areas, showing Project Areas of Influence at 40, 100 and 500 metres.



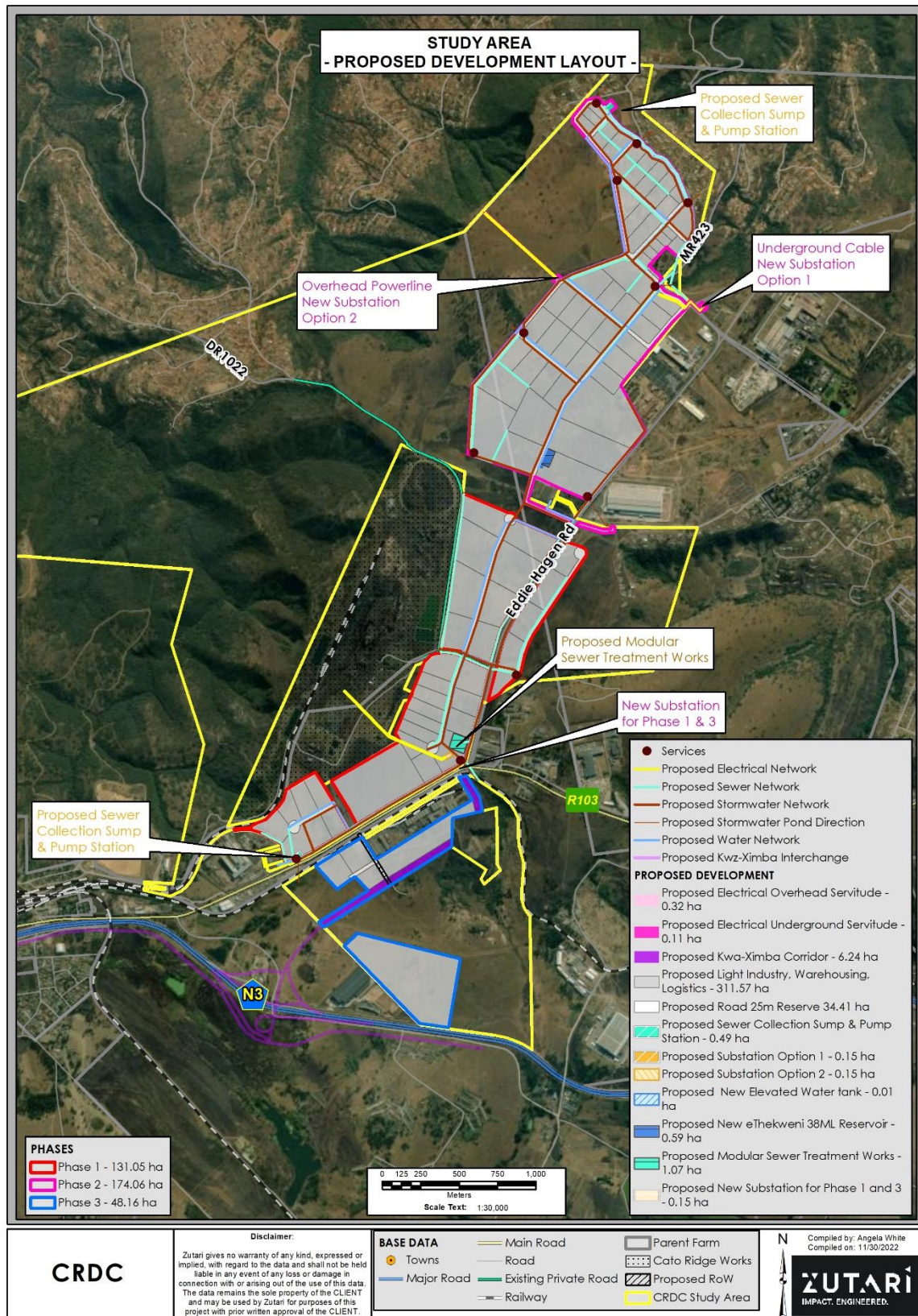


Figure 5. Proposed land uses in each development area – 28 November 2022.

3. Surrounding land uses

The current surrounding land use is summarized as follows.

- Untransformed land, comprising natural vegetation and open space. Much of the study site forms part of the Durban Metropolitan Open Space System (D'MOSS), which also extends extensively into the proposed development site. D'MOSS is intended to maintain open space and environmental functionality within the eThekweni Municipal Area by incorporating features which at first screening appear valuable.
- Some rural residential areas, including informal settlement.
- Industrial, warehousing and logistical developments north of the N3.

The open space at Cato Ridge and extending into the contiguous part of Hammarsdale includes significant landholdings south of the N3 national road which have been acquired by the eThekweni Municipality for conservation, which includes KwaZulu-Natal Sandstone Sourveld. Private smallholdings and farmland, much uncultivated, do not or no longer occur north of the N3, whereas this being so south of the N3, makes remaining instances of both KwaZulu-Natal Sandstone Sourveld and Dry Coast Hinterland Grassland more defensible due to fewer and more easily managed negative informal impacts. The eThekweni Municipality is, with just cause, interested in expanding and consolidating its existing conservation holdings south of the N3.

4. Methodology

In addition to review of relevant desktop resources, this report draws mainly on information from 307 plots surveyed over many years (2013-2014) and (2020-2022) in grasslands north and south of the N3, including 119 in the present study area. The plot-based methodology is described in more detail in Appendix 19. The sampling coverage is shown in Figure 6 and at larger size in Appendix 7, and as can be seen, is representative. As the surveying was focussed on grassland where development is proposed, the large area of Eastern Valley Bushveld to the west (shown in red), was more superficially visited, with the plot-based methodology used in grasslands not appropriate to this woody and thicket vegetation.

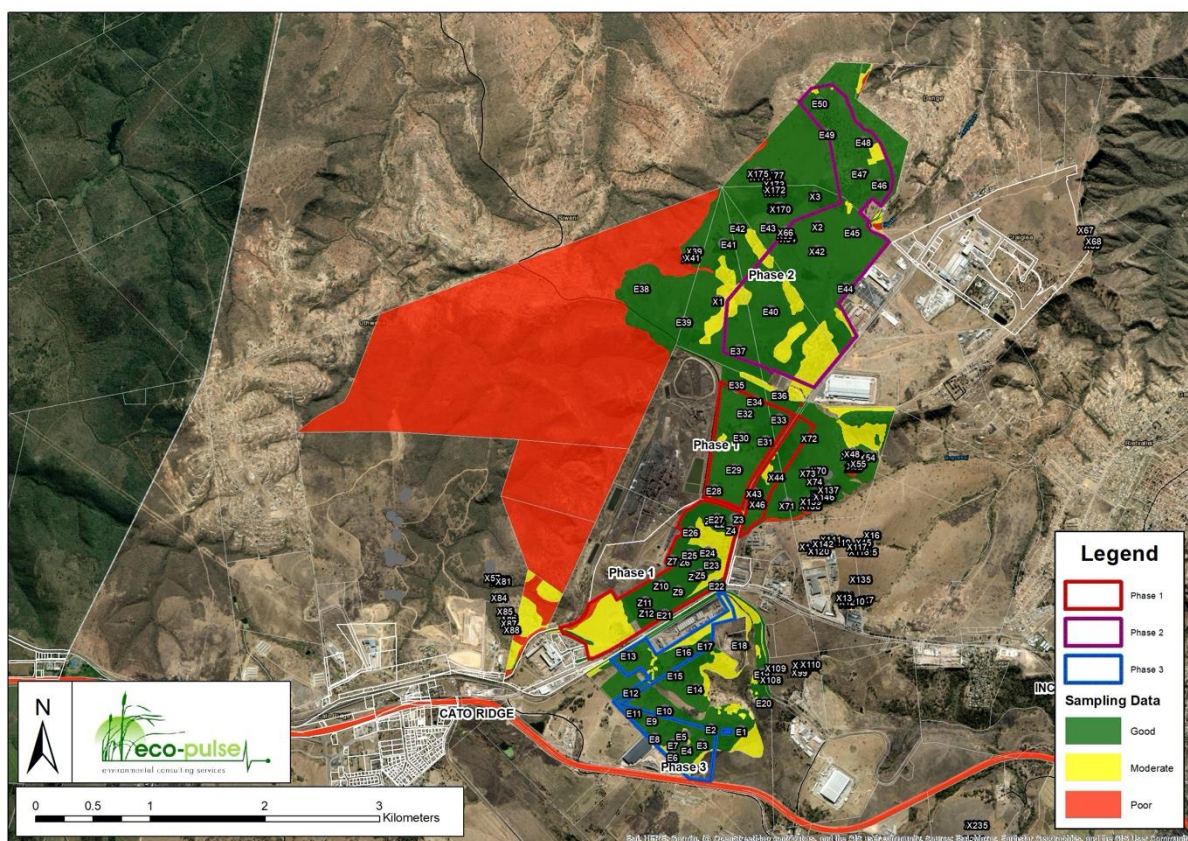


Figure 6. Survey intensity through the study area, with unaffected Eastern Valley Bushveld (shown in red), excluded.

The plot-based surveying is broken down as follows:

- In the spring to end summer of September 2012 to March 2013 and September 2013 to March 2014, 236 plots were surveyed in better quality grassland at Cato Ridge. Many of these were north of the N3, with 48 in the present study area. This was for an M.Sc. study. The survey methodology is described further below. All subsequent plots were surveyed according to this methodology to enable good comparisons. In Figure 6 and Appendix 7, these plots have the prefix “X”.
- 6 visits of varying duration in early 2020 (18-20 March and 12-13 April), north and south of the N3. These are not visible beneath proximate “X” plot positions.
- 3 visits of varying duration in early 2021 (25 February, 1 and 2 March), north and south of the N3. Nine plots were surveyed at some of the M.Sc. plot locations to determine if there had been changes, but it was found there was no large divergence. These plots are not shown in the coverage map as they correspond with previously surveyed plot positions.
- 6 visits of varying duration in later 2021 (16, 18-19, 24-25 November and 7 December). These were focussed on grassland north of the N3. 12 further plots were surveyed. These plots are shown with a “Z” prefix in Figure 6 and Appendix 7.

- In 2022 Eco-Pulse was contracted by the Cato Ridge Development Company to investigate the feasibility of offsets which may be required if KwaZulu-Natal Sandstone Sourveld was developed, particularly at the extent proposed and including some which was in Moderate or better condition. I was in turn subcontracted by Eco-Pulse to survey a further 50 plots north of the N3. This new plot-based data was gathered on 21, 23-24 and 26-27 April and is also now included in this report. These plots are shown with an “E” prefix in Figure 6.

The purpose of the 2022 surveying had two objectives, the latter novel and not a purpose of previous surveying:

- To improve coverage of plot-based surveying, and the quality and resolution of vegetation mapping.
- Based on kind of disturbance and when disturbance occurred in grassland, assess the extent to which it is able to recover.

In addition, to address these two criteria, Eco-Pulse consulted with a natural sciences statistician, Mr. Craig Morris of the University of KwaZulu-Natal, Pietermaritzburg to subject all plot-based data to more intensive analysis so that they could be allocated more highly resolved and graduated quality bands. This is explained in Appendix 1, at the end of this report.

Plot-based surveying, especially involving herbaceous plants, is not often carried out even during EIA processes, due to the amount of time this involves. While it is always possible to gather more data and map at ever finer scale, the amount of data which has been gathered for this process is extensive by usual EIA standards, even if presented concisely in maps.

As plots occupy a small part of a landscape, are indicative and do not encompass all species, especially those rare or uncommon in a study area, plot-based surveying was combined with a reconnaissance or walk- and drive-through approach, during which mapping was undertaken with a handheld GPS device, and notes and photographs taken.

5. Limitations

A small part of the grassland in the Phase 1 area had not been burned and was moribund in the period 2020 to 2022) and it was difficult to assess quality, and this includes species of conservation concern. The area is limited and is shown in Figure 7. Ideally, this grassland should be burned and more plots should be surveyed to enable better assessment. Some poor material in this moribund grassland may be *Senecio exuberans* (Endangered), which occurs on a scattered basis in other grassland at Cato Ridge, including the Phase 1 area. However, on large survey sites as were indicated for surveying, it is not always possible to ensure that all parts of grassland are burned off the winter or early spring before sampling is undertaken.



Figure 7. Very moribund grassland (shaded in red) in the Phase 1 area, which could not be accurately assessed or species composition fully determined.

A further significant limitation involves the issue of buffers. The recently issued Species Environmental Assessment Guideline (SANBI 2020) advises a standard 200 metre buffer between development and any species of conservation concern. This 200 metre buffer is advised for fauna (mammals, birds, reptiles, amphibians, insects etc., some of which are highly mobile) and plant species (which are not mobile).

I agree that larger buffers are better than smaller buffers. However, I know the issue of scaling of buffers is challenging, because of a lack of hard science when it comes to their width. I presume this is why the authors (SANBI 2020) entered into little or no discussion as to why a 200 metre buffer is necessary. In doing so, the authors simply avoided a thorny discussion involving differential scaling for organisms, habitats or development types. They appear have settled on some kind of maximum precautionary buffer instead, after which they placed the onus on specialists to disagree.

In my opinion, advising a 200 metre buffer for all species and all kinds of developments, without *any* rationale or scientific explanation, is a large lacuna in these guidelines, and if this is followed it has profound implications for environmental impact assessment and development in South Africa, including what is proposed at Cato Ridge. Such a buffer here and elsewhere would in fact sterilize much land for development. This would also tend to include within buffers much degraded and even transformed land, only because they are 200 metres from what may at times be fragments of natural vegetation in which such species persistence is found. Threat assessments are also often best guesses, which engage with available information, but may nonetheless be incomplete or partial for many species.

After reviewing literature, I have formed the opinion that buffers come down to common sense and professional judgement more than anything else. Based on observations at Cato Ridge, it appears around existing hard boundary-enclosed industrial/logistics/warehousing developments, there is some degree of impact in the form of disturbance, a skirt of ruderal or scrubby vegetation, or increase in alien invasive species at up to 40 metres. In addition there may, uncommonly, be some percolation of waste or refuse over boundary lines. To mitigate these effects it is important that all development sites in the proposed development are enclosed (fenced in), with access through only one or a few points.

On this basis, illustrative buffers beginning at 40 metres are provided for species of conservation concern in Appendix 16, and while open to larger recommendation, it is necessary to then record the inconsistency with Species Environmental Assessment Guideline's unexplained 200 metres advisory. If developments are proposed which produce large amounts of dust, generate significant amounts of waste that cannot be entirely detained, or are in storage areas that can rupture (for example tanks, under or above ground, or containment ponds or dams that can also rupture, especially during flood events), then larger buffers will be necessary, although even these may then be insufficient in the event of a major disaster.

I have therefore provided 40 metres as a *minimum* common sense distance for species of conservation concern assuming development impacts will be consistent with what is presently seen at Cato Ridge. I do not at all disagree with precautionary benefit of a larger distance, but am also of the view that the 200 metre advisory for species of conservation concern seems excessive and unjustified based on observation of actual disturbance around industrial/logistics sites at Cato Ridge. I also note the problem that development is currently proposed even *within* 40 metre illustrative buffers shown in Appendix 16, as the developer does not believe the development can occur without some transformation of better quality grassland.

6. Relevant laws and regulations

6.1. Environmental assessment practitioners (EAPs) and specialists

The following is extracted from the National Environmental Management Act, Act 108 of 1998 (NEMA). The relevant sections are section 12 & 13 and are included below for ease of reference:

Appointment of (EAPs) and specialists

12.

- (1) A proponent or applicant must appoint an EAP at own cost to manage the application.
- (2) In addition to the appointment of an EAP, a specialist may be appointed, at the cost of the proponent or applicant, if the level of assessment is of a nature requiring the appointment of a specialist.
- (3) The proponent or applicant must -
 - (a) take all reasonable steps to verify whether the EAP and specialist complies with regulation 13(1)(a) and (b); and

- (b) provide the EAP and specialist with access to all information at the disposal of the proponent or applicant regarding the application, whether or not such information is favourable to the application.

General requirements for EAPs and specialists

13.

- (1) An EAP and a specialist, appointed in terms of regulation 12(1) or 12(2), must-
 - (a) be independent;
 - (b) have expertise in conducting environmental impact assessments or undertaking specialist work as required, including knowledge of the Act, these Regulations and any guidelines that have relevance to the proposed activity;
 - (c) ensure compliance with these Regulations;
 - (d) perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the application;
 - (e) take into account, to the extent possible, the matters referred to in regulation 18 when preparing the application and any report, plan or document relating to the application; and
 - (f) disclose to the proponent or applicant, registered interested and affected parties and the competent authority all material information in the possession of the EAP and, where applicable, the specialist, that reasonably has or may have the potential of influencing -
 - (i) any decision to be taken with respect to the application by the competent authority in terms of these Regulations; or
 - (ii) the objectivity of any report, plan or document to be prepared by the EAP or specialist, in terms of these Regulations for submission to the competent authority; unless access to that information is protected by law, in which case it must be indicated that such protected information exists and is only provided to the competent authority.
- (2) In the event where the EAP or specialist does not comply with sub regulation (1)(a), the proponent or applicant must, prior to conducting public participation as contemplated in chapter 5 of these Regulations, appoint another EAP or specialist to externally review all work undertaken by the EAP or specialist, at the applicant's cost.
- (3) An EAP or specialist appointed to externally review the work of an EAP or specialist as contemplated in sub regulation (2), must comply with sub regulation (1).

6.2. National Environmental Management Act, Act No. 107 of 1998 (NEMA)

NEMA requires, inter alia, that:

“Development must be socially, environmentally, and economically sustainable.”

“Disturbance of ecosystems and loss of biological diversity are avoided, or, where they cannot be altogether avoided, are minimized and remedied.”

“A risk-averse and cautious approach is applied, which takes into account the limits of current knowledge about the consequences of decisions and actions.”

NEMA also states that:

“The environment is held in public trust for the people, the beneficial use of environmental resources must serve the public interest and the environment must be protected as the people’s common heritage.”

6.3. National Environmental Management: Biodiversity Act (Act No. 10 of 2004)

In terms of the Biodiversity Act, developers and land managers have a responsibility to limit further loss of biodiversity and conserve endangered ecosystems. Insofar as vegetation aspects are concerned, EIA regulations (2014, as amended) state that an environmental assessment process must be followed in terms of:

- Listed Activity 27 of Listing Notice 1 of EIA Regulations (2014, as amended) – The clearance of an area of 1 hectares or more, but less than 20 hectares of indigenous vegetation.
- Listed Activity 12 of Listing Notice 3 of EIA Regulations (2014, as amended) – The clearance of an area of 300 m² or more of indigenous vegetation –
 - (iv) Within any critically endangered or endangered ecosystem listed in terms of section 52 of the NEMBA or prior to the publication of such a list, within an area that has been identified as critically endangered in the National Spatial Biodiversity Assessment 2004;
 - (v) Within a Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans.

A national list of threatened terrestrial ecosystems for South Africa was gazetted on 9 December 2011 (National Environmental Management: Biodiversity Act: National list of ecosystems that are threatened and in need of protection, (GN 1002, 9 December 2012).

Threatened or protected ecosystems are listed according to 4 categories: critically endangered (CR), endangered (EN), vulnerable (VU) or protected. The purpose is stated to be reduction of the rate of “ecosystem and species extinction” and to preserve sites of high conservation value. This is achieved primarily by the requirement that environmental impact assessments be followed when more than 300 m² of indigenous vegetation in critically endangered or endangered ecosystems may be transformed by development (Activity 12 of 985). The definition of indigenous vegetation in the regulations is extremely broad – it is defined as “vegetation consisting of indigenous plant species occurring naturally in an area, regardless of the level of alien infestation and where the topsoil has not been lawfully disturbed during the preceding 10 years.”

This is also accomplished by the requirement that threatened ecosystems be appropriately considered and treated by organs of government (such as municipalities) in the drafting of spatial plans.

In the mapping which accompanies the 2012 national list, grassland at Cato Ridge was shown as Ngongoni Veld, a Vulnerable type. However, the eThekweni Municipality has improved vegetation

mapping within its municipal area and this should supercede the coarser national mapping. In addition, I also assess the grassland on the Natal Group Sandstone plateau north of the N3 as KwaZulu-Natal Sandstone Sourveld. The 2012 national list identifies KwaZulu-Natal Sandstone Sourveld as an Endangered ecosystem.

KwaZulu-Natal Sandstone Sourveld is currently assessed as Endangered (Skowno et al. 2018) or Critically Endangered (Jewitt 2018). While EKZNW's Concise Guideline: Biodiversity Offsets assesses the dry form of Ngongoni Veld as Endangered, this "dry" form, called Dry Coastal Hinterland Grassland was subsequently assessed as Vulnerable (Jewitt 2018; Skowno et al 2018).

A revised National Spatial Biodiversity Assessment (NSBA) also occurred in 2018. This 2018 NSBA made threatened and other ecosystems synonymous with vegetation types and the threat status of these vegetation types. This was then reflected in the Revised National List of Threatened Terrestrial Ecosystems in Government Gazette 47526 (Notice No. 2747), published in terms of the National Environmental Management: Biodiversity Act (NEMBA, Act No. 10 of 2004).

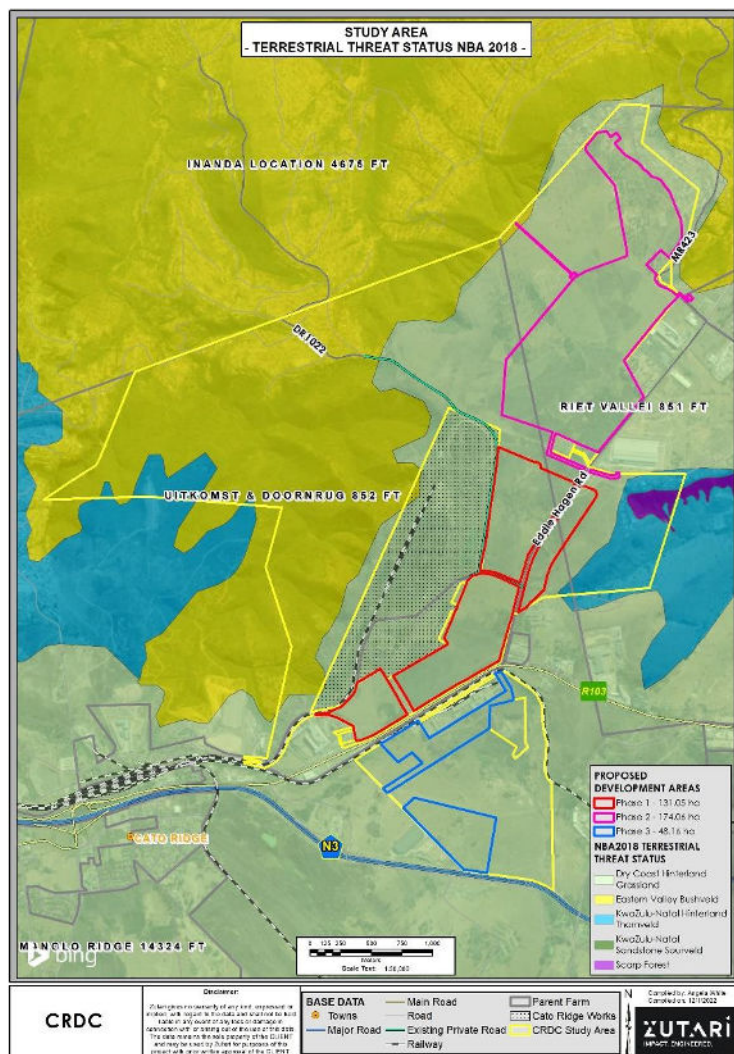


Figure 8. View of proposed development site overlain with the 2018 NSBA-based assessment of vegetation types in this area.

These are translated to ecosystems in the 2022 Revised National List of Threatened Terrestrial Ecosystems.

The only non-Least Concern ecosystem is the green-shaded area shown as Ngongoni Veld/Dry Coast Hinterland Grassland, a type which is recognized as Vulnerable. However, as presented further below, this ecosystem is not accurately mapped in the study area and nearly all grassland is instead KwaZulu-Natal Sandstone Sourveld (an Endangered ecosystem).

The 2018 NSBA assessment is presented in Figure 8 above. It is based on national vegetation mapping (SANBI 2018), also revised in this year, which depicts grassland in the study area as Dry Coast

Hinterland Grassland, but this is incorrect and inaccurate for grassland type in the study area, as discussed further below. Dry Coast Hinterland Grassland is shown in a higher risk category of Vulnerable and so included in the Revised National List of Threatened Terrestrial Ecosystems. Although not accurately mapped at Cato Ridge, the Revised National List of Threatened Terrestrial Ecosystems records KwaZulu-Natal Sandstone Sourveld, which is in fact the affected type, as Endangered.

All other vegetation types, namely Eastern Valley Bushveld, KwaZulu-Natal Hinterland Thornveld and Scarp Forest are in the 2018 NSBA Least Concern category and so not included the Revised National List of Threatened Terrestrial Ecosystems. However, it must be emphasized that just because a vegetation or ecosystem is Least Concern, this does not mean it is not species-rich, valuable, or lacking in species of conservation concern.

6.4. Aquatic and Terrestrial Biodiversity Protocols and associated Species Environmental Assessment Guideline

Specialist reporting during EIA processes has become increasingly regulated and prescribed for EIA processes, as set out in these protocols and in these voluminous guidelines, such as the “Species Environmental Assessment Guideline” SANBI (2020). In particular, the guidelines require that “Project Areas of Influence” and “Site Ecological Importance” be assessed.

6.4.1. Project Areas of Influence (PAOI)

A proposed development footprint has been provided and a PAOI should be defined by the Environmental Assessment Practitioner (p. 20). However, “Specialists should [also] aim to distinguish between potential direct and indirect influences. In the case of the specialist vegetation assessment, the proposed footprint is taken to be a direct influence, with direct or indirect influences (during construction or operation) extending another 20 to 40 metres.

This is based on observation of impacts on vegetation around other, existing logistics and commercial/industrial developments on the same plateau. These are customarily contained behind sturdy fences or walls, which limit disturbance beyond such fences or walls and to the extent evident, and mainly consists of increased alien invasive plant species in a skirt around the boundaries. It is imperative that any future development be similarly well fenced or walled, and the alien plant presence can quite feasibly be addressed if the developments concerned controlled alien plants their premises, *including* in a band around their perimeters.

It is perhaps possible there could be some minor influence at a distance of 40 to 100 metres of the footprint. This would likely consist of increased, though lesser presence of alien invasive plants than in the close bounds of the perimeters. Moreover, if alien plant presence around perimeters is not controlled, this can contribute to seeding of invasive species into grassland and other vegetation at further distances. On this basis, a PAOI for flora in which there is more certain disturbance within 20 metres of the footprint, possible disturbance within 40 metres of the footprint, and perhaps some minor or inconsistent impact at 100 metres. The 500 metres POAI is a maximum but it is difficult to foresee how impacts could be this expansive. This is illustrated in Figure 4, above. Note however that areas owned by the applicant within this 500m buffer were specifically assessed as part of this study

to better understand the contribution that such areas could make towards conservation of terrestrial plant species.

6.4.2. Site Ecological Importance

Site Ecological Importance is defined through a formula as follows (p. 27):

- $SEI = BI \text{ (Biodiversity Importance)} + RR \text{ (Receptor Resilience)}$.
- $BI \text{ is in turn} = (\text{equal to}) CI \text{ (Conservation Importance)} + FI \text{ (Functional Integrity)}$.

Conservation Importance is defined (p. 27) as:

The importance of a site for supporting biodiversity features of conservation concern present, e.g. populations of IUCN threatened and Near Threatened species (CR, EN, VU and NT). Rare species, range restricted species, globally significant populations of congregatory species, and areas of threatened ecosystem types, through predominantly natural processes.

Range restricted species are considered to have a global population of 10 000 km² or less.

Functional integrity is defined (also p. 27) as:

A measure of the ecological condition of the impact receptor as determined by its remaining intact and functional area, its connectivity with other natural areas and degree of current ecological impacts.

Ratings of Conservation Importance are provided (p.28), from Very High, High, Medium, Low and Very Low, together with threshold (fulfilling) criteria. It is noted that any area of a Critically Endangered ecosystem, or any area comprising >0.1 % of an Endangered ecosystem are scored as Very High.

Ratings of Functional Integrity from Very High to Very Low are also provided (p. 29), with threshold (fulfilling) criteria.

Ratings of Functional Integrity from Very High to Very Low are also provided (p. 30, with threshold (fulfilling) criteria.

Receptor Resilience is “The intrinsic capacity of the receptor to resist major damage from disturbance and/or to recover to its original state with limited or no human intervention.” (p. 29). In this regard, it is mentioned that plot-based surveying has shown only limited recovery in areas disturbed as long ago as 1937, and so RR is considered low where such disturbance has occurred (principally formerly transformed areas, former areas of agricultural activity, significant alien plant invasion or sand-mining).

Fulfilling criteria for the formula components $SEI = BI \text{ (with } BI = CI + FI) + RR$ are assessed and presented in a map in Appendix 12.

The guidelines also record that SEI should be interpreted as follows:

- “Very High – Avoidance mitigation – no destructive development activities should be considered. Offset mitigations not acceptable/ not possible.
- High – Avoidance mitigation wherever possible. Minimisation mitigation.” This involves changes to development design to limit the amount of impact, with offsets required for high impact activities.
- “Medium – Minimisation and restoration mitigation.
- Low – Minimisation and restoration mitigation.” However restoration activities may not be required.

6.5. National Forests Act (Act No. 84 of 1998)

According to the Act:

Communities of indigenous trees where the crowns are contiguous are considered forest in terms of the act and are similarly protected, although licenses may ultimately not be required for vegetation that is not tall or closed enough to constitute forest (such a thicket vegetation). “No person may cut, damage, disturb, destroy or remove any protected tree, or collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree, except under a license granted by the Minister.”

Disturbance, removal, pruning or transplanting of such a protected tree species requires a license from the administrators of the National Forests Act, in this case the Department of Environment, Forestry and Fisheries (DEFF) based in Pietermaritzburg.

A seam of Scarp Forest (Mucina & Rutherford 2006) and one smaller patch is mapped on Cato Ridge Development Company land as shown in Appendix 4. This includes at least one, unusual occurrence of *Prunus africana* (African-almond or Red Stinkwood), a species also protected by the Act. Some of the more mesic Eastern Valley Bushveld on steep south- and east-facing slopes is transitional with dry Scarp Forest. Much of this Eastern Valley Bushveld also qualifies as forest in terms of the Act’s broad structural definition, even if better described and recognized in national vegetation mapping as a form of thicket vegetation. Due to terrain and issues of road access, these forest and valley bush parts of the Cato Ridge Development Company’s Cato Ridge landholdings do not appear well-suited for development and are not included in the proposed development footprint for this study. The area in which development is proposed does not create National Forests Act issues.

6.6. Provincial conservation ordinance

The KwaZulu-Natal provincial conservation ordinance provides special protection to a range of other indigenous plant species, including other tree species and smaller herbs. The list is decades old and in need of revision (such as to taking note of threat assessments in the national red list).

It is noted that the approach taken in the ordinance is to blanket protect groups and families, as a result it includes many species are included which are not threatened. These plants may not be disturbed, damaged, destroyed or relocated without permit authorization from provincial conservation authority Ezemvelo KwaZulu-Natal Wildlife (EKZNW).

Large numbers of smaller protected herbaceous species occur in all better quality natural vegetation on the Cato Ridge Development Company Cato Ridge's landholdings as described for each site further below. There is far less to no presence in or near proposed footprint areas which intersect with grassland that has Low to Very Low forb diversity scores but an increase where there is intersection with Medium to High forb diversity scores (as illustrated in Appendix 9).

My own view is that to the extent that relocation is required, this should be focused on species of conservation concern (most of which are not protected), or protected species which are rare or unusual. Although a permit will need to be obtained, relocation is less easy to justify in the case of common protected species and the intention of a permit application process is not to automatically require relocation of these.

6.7. Alien and Invasive Species Regulations

Alien and Invasive Species Regulations have been published under the National Environmental Management: Biodiversity Act of 2004 (Government Gazette No. 43735, 25 September 2020, 16 February 2018). The following is advised:

Category 1a species must be "combatted or eradicated". A person in control of category 1a invasive species (presumptively landowners) must "immediately take steps to combat or eradicate" them. Category 1b species "must be controlled". Category 2 species must be controlled and treated as category 1b species unless there is a permit to grow or keep them, and they must not be allowed "to spread outside the land or area specified in the permit." Category 3 species may be subject to exemptions as well as prohibitions, but if in riparian areas such as along the drainage lines on the properties, must be treated in all cases as category 1b species.

Alien invasive species are pervasive in much of South Africa, particularly in the eastern portion and close to cities and towns. As a result, it is unsurprising to report that alien invasive species occur in all categories in and next to the study area. A list of alien invasive species found is provided in Appendix 18 and much of the more consolidated alien plant presence is mapped in Appendices 2.1 and 2.2. This includes extensive areas of *Acacia mearnsii* (Black Wattle) and *Eucalyptus* invasion, together with some *Populus x canescens* (Grey Poplar) proliferations and surrounding thickets of *Lantana camara*. These are slowly expanding and replacing grassland. On a good practice basis these alien plant invasions should be destroyed.

6. National vegetation mapping

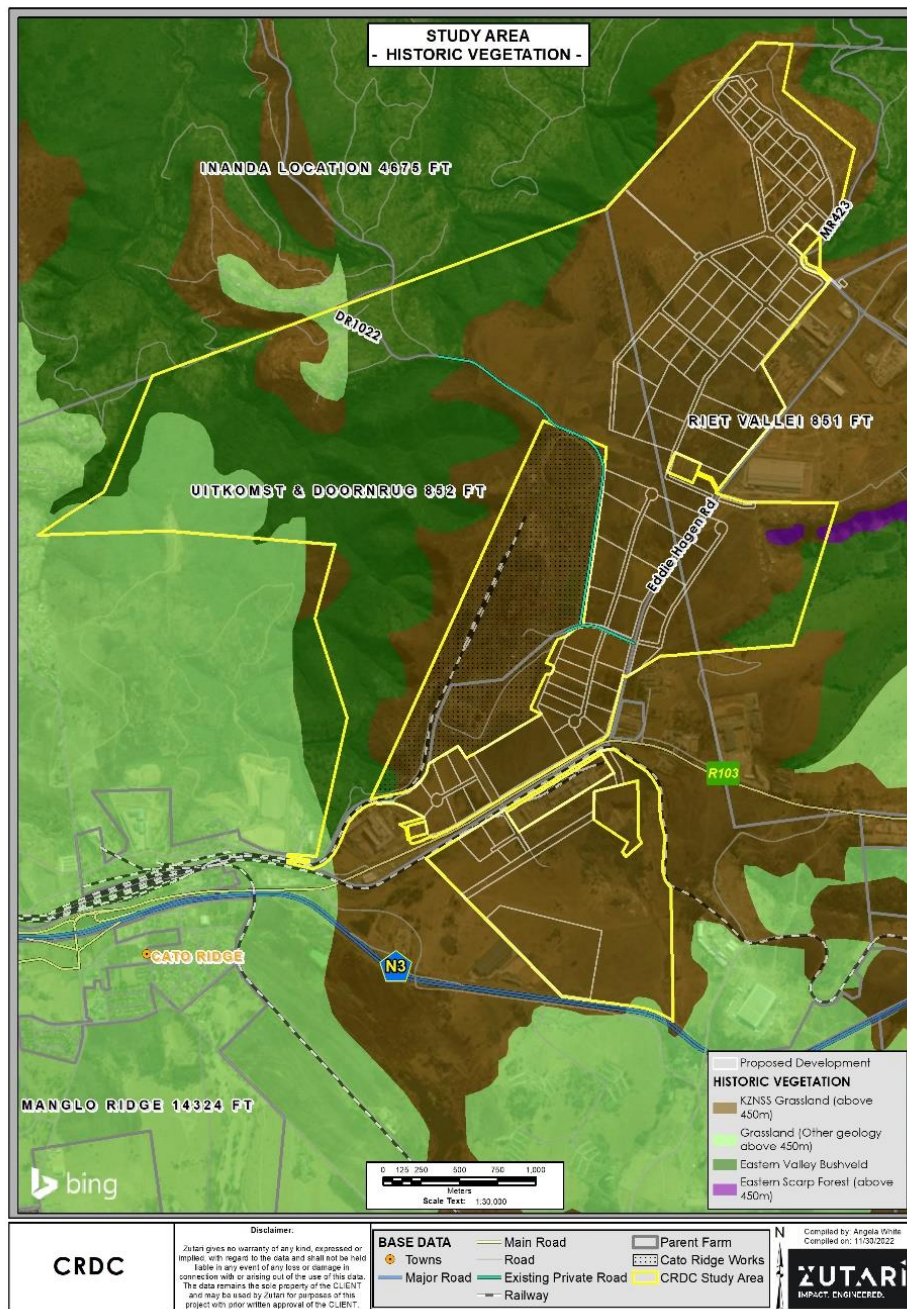


Figure 9. Mapping of vegetation types at Cato Ridge by the eThekweni Municipality's Biodiversity Management Department. Brown shading indicates KwaZulu-Natal Sandstone Sourveld.

According to national vegetation mapping (SANBI 2019) vegetation is as follows:

- Ngongoni Veld (which since 2011 has been separated out into dry and moist variants. The variant at Cato Ridge is now called Dry Coast Hinterland Grassland, although some in the area is not particularly dry);
- Coast Hinterland Thornveld; and
- Eastern Valley Bushveld.

7. Ezemvelo KwaZulu-Natal Wildlife Systematic Conservation Plan

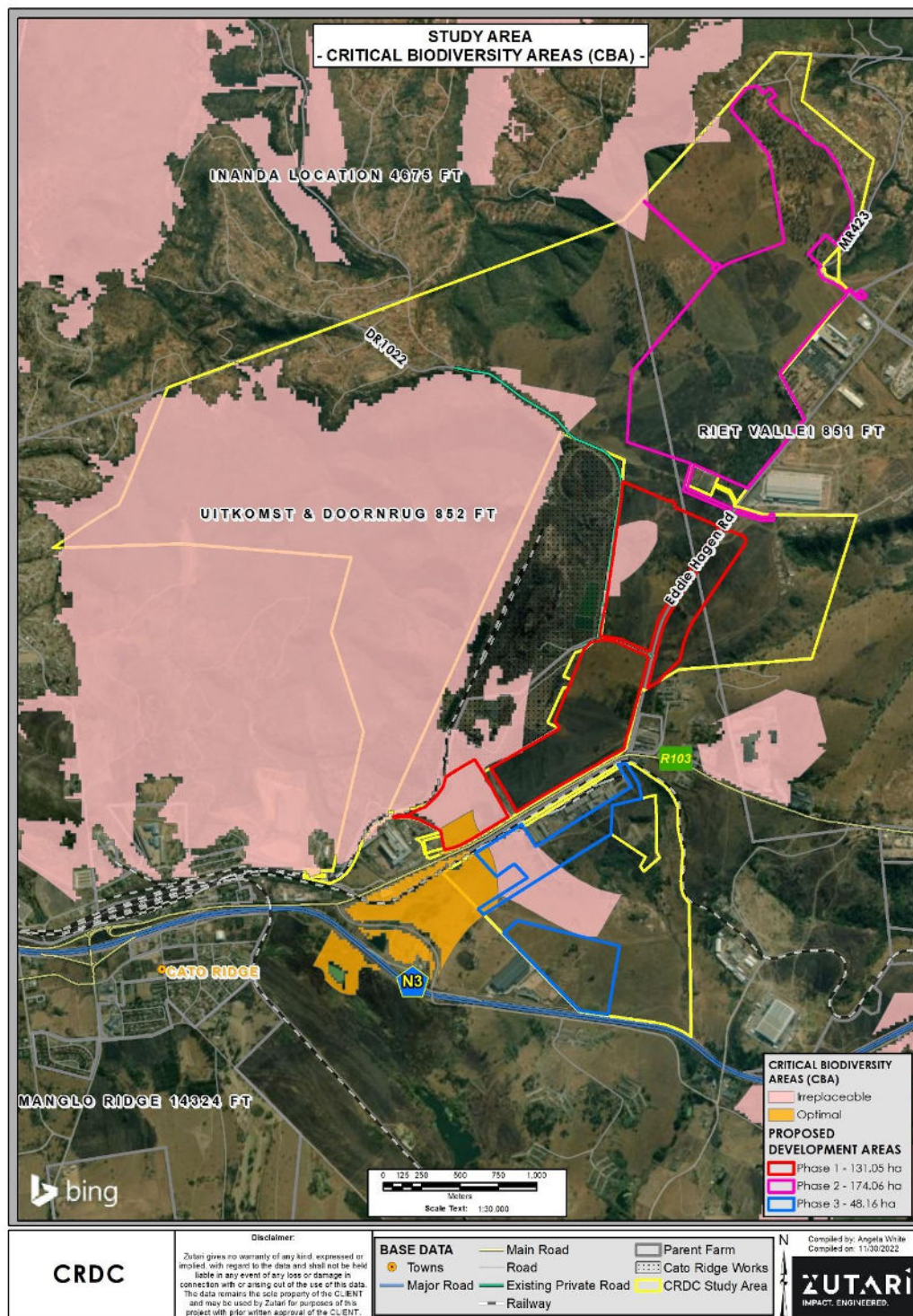


Figure 10. Critical biodiversity areas identified by EKZNW (2016).

EKZNW's Systematic Conservation Plan classifies areas (planning units) of the province in terms of their irreplaceability value for biodiversity (EKZNW 2010). Parts are given highest priority in this mapping. More focussed, but still extensive areas are shown as Irreplaceable in updated 2016 mapping. These areas correspond particularly with occurrences of Eastern Valley Bushveld and appear

based on actual or predicted occurrence of faunal species, including invertebrates, but not vegetation or plant species.

Little grassland is included. If it was appreciated that the grassland north of the N3 is mostly KwaZulu-Natal Sandstone Sourveld, it would undoubtedly have also been accorded highest irreplaceability status due this vegetation type being Endangered or Critically Endangered (Jewitt 2018; Skowno et al. 2018).

8. D'MOSS

The Durban Metropolitan Open Space System (D'MOSS) links open space areas important for conserving biodiversity and providing ecosystem services. D'MOSS does not necessarily prevent development, but these areas are provisionally identified as important and flagged for intensive scrutiny in the event of development proposals within it.

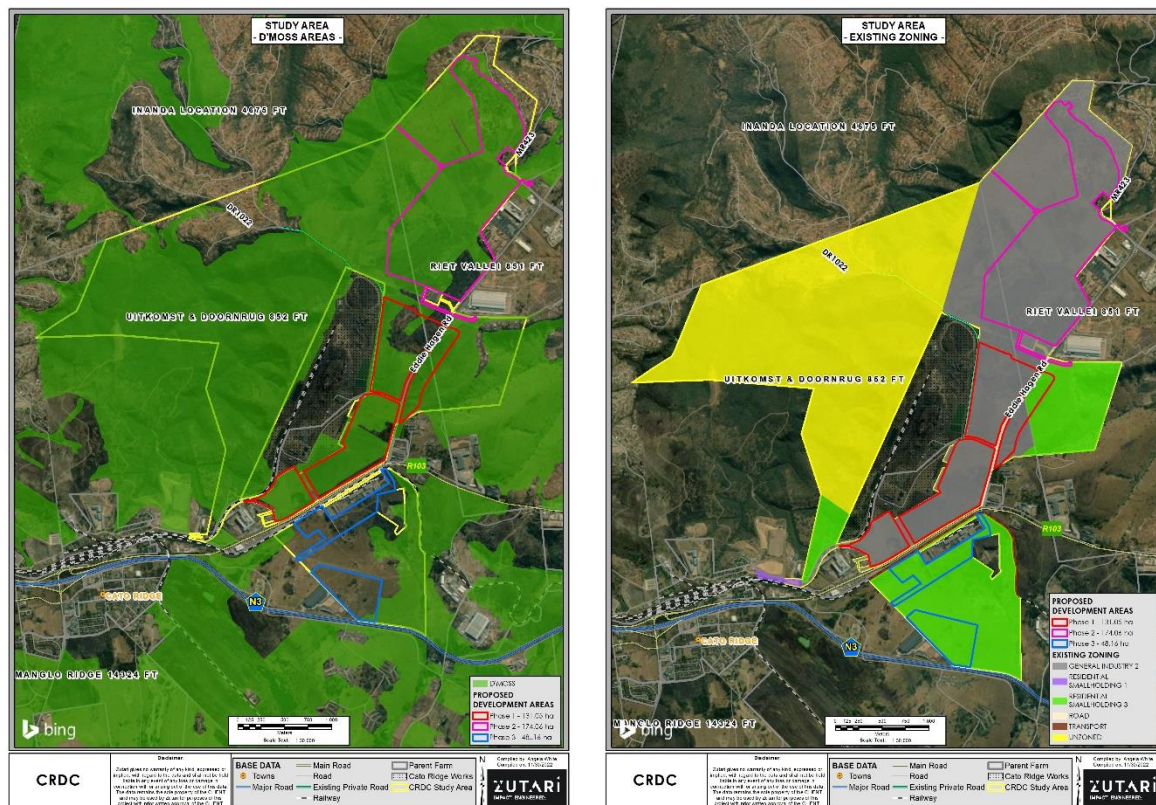


Figure 11. Extent of D'MOSS including and bounding the study site (on the left), together with existing zonings (to the right), with which there seems to be significant conflict.

9. Cato Ridge Local Area Plan

Note is taken of proposed land use in the Cato Ridge Local Area Plan as shown in Figure 6-2 of the plan below.

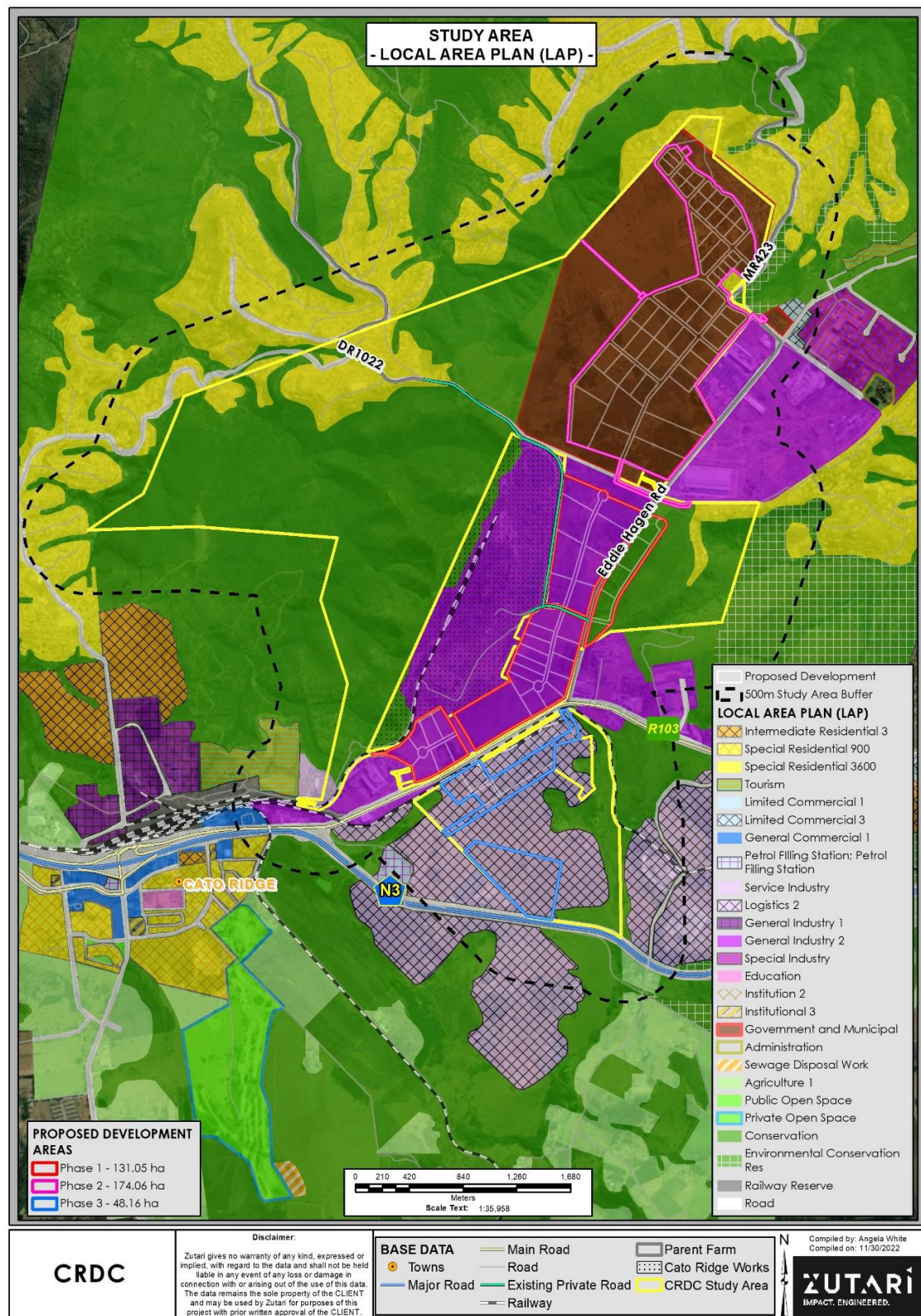


Figure 12. Figure 6-2 of the Cato Ridge LAP, with proposed land uses.

It is further noted that the LAP records the following (at p. 16):

Grasslands

“The study area includes the last remaining large contiguous grassland systems in the municipal area, and broader sub-region. These include the Critically Endangered KZN Sandstone Sourveld (KZNSS) and Vulnerable Ngongoni Veld (NV) grasslands.

Both of these grassland types are confined to KwaZulu-Natal, with the distribution of KZNSS falling predominately within and/or adjacent to the eThekweni Municipal Area; and both require protection in terms of the National Environmental Management: Biodiversity Act (2004). The remaining areas are well under the minimum conservation thresholds required and there are limited alternative conservation opportunities within the municipality and/or region to meet these thresholds.

As such, it is imperative that all remaining representative patches of primary KZNSS and NV are protected from irreversible transformation. The EPCPD identified a number of intermediate and good condition KZNSS and NV grasslands to the north and south of the N3. These are to be retained as environmental protection areas. These grasslands are closely linked to the key water catchment areas mentioned above and will also aid in water provision and purification.”

Reference is also made to Table 4-3 of the LAP:

“Grasslands (including Dry Ngongoni Veld, species rich KwaZulu-Natal Sandstone Sourveld, Coastal Grassland and Secondary Grasslands):

- All grassland types within the EMA are threatened as large areas of these ecosystems have already been lost. Further development in areas with these grassland types is not permitted.
- Any development must be set back at least 25m from the edge of the grassland.
- French Drains must not be located within 25 m of the edge of these grassland types.

Wetlands:

- Minimum 30 m development buffer must be maintained between development and wetlands. The size of the buffer required depends on the size and the functionality of the wetland, as well as the nature of the proposed development.
- The functionality and exact boundary of the wetland is established by wetland specialists during the development application process.”

It is noted that the LAP's proposed land uses, involve some significant conflicts with high value biodiversity resources as well as some of its own statements concerning these. It was likely also not helpful that National Vegetation Mapping for this area was at time of LAP compilation still inaccurate for the area, as it continues to be (including in the 2018 NSBA and 2022 Revised National List of Threatened Terrestrial Ecosystems (see further discussion below).

10. Grassland in the Cato Ridge Development Company study area

All vegetation is mapped for each of the phases. The broad categories of kind – grassland, wetland vegetation and hygrophilous grassland, extensive alien plant invasion, valley bushveld and forest - are easily grasped. Aided by plot-based surveying which brings in more objectivity than walk-throughs grassland is ranked according to the diversity for species in the plots. The categories are: Very High, High, Medium, Low and Very Low.

The vegetation most affected by potential development is grassland as it occurs on flat land adjacent to roads. However, it is necessary to comment on the issue of whether it is KwaZulu-Natal Sandstone Sourveld or Dry Coast Hinterland Grassland/Ngongoni Veld. Relatively little is known about the floristics of these vegetation types, including their endemics, biogeographically important and other important species.

10.1. Ngongoni Veld and variants

Acocks (1953) was the first to define Ngongoni Veld, as one of 70 “veld” types he recognized in South Africa based on estimation of agricultural potential (Van Wyk & Smith 2001). Ngongoni Veld was stated to occur from the lowermost part of the coastal escarpment, at about 450 m a.s.l. and extending inland to about 900 m a.s.l., where it is cooler than the coastal belt and annual rainfall is 750 to 1300 mm. Although noting woody vegetation as being present, he recognized grassland dominated by *Aristida junciformis* (Ngongoni grass) as its main feature. Acocks (1953) says little else about its species composition and assumed that under former natural conditions the vegetation comprised forest and woody vegetation.

The work of Low and Rebelo (1996) was the first to reclassify the vegetation of South Africa since Acocks (1953). The authors discerned two vegetation types within the area now mapped to Ngongoni Veld and KwaZulu-Natal Sandstone Sourveld: Coast-Hinterland Bushveld between 450 to 900 m a.s.l. comprised of “*Acacia karroo* savanna or scrub, with Ngongoni Bristlegrass *Aristida junciformis* almost entirely dominant” and Moist Upland Grassland – sour grassland between the wide altitude range of 600 to 1 400 m a.s.l. “on Karoo sequence sediments and dolerite.” Few typical species were provided. This representation is clearly highly simplistic.

Much of this became Ngongoni Veld in Mucina & Rutherford (2006). This Ngongoni Veld grassland is stated to be distributed on the coastal escarpment (400–900 m a.s.l.) between Libode in the Eastern Cape and Melmoth in KwaZulu-Natal on heavy soils including those derived from tillite and dolerite. It is described as: “Dense, tall grassland overwhelmingly dominated by unpalatable, wiry Ngongoni grass (*Aristida junciformis*) with this monodominance associated with low species diversity” (Mucina & Rutherford 2006). There are 18 species listed as important, but three are trees that are hardly typical of open grassland, one is a widespread weed and one is a herb not typical of open grassland. Most of the rest are species common and widespread in many grassland types in KwaZulu-Natal (pers. obs.). The list does not create much impression of floristic distinctness. No biogeographically important or endemic species are cited. As a result, the list is probably not very useful diagnostically, except perhaps for degraded instances. It does not correspond with the species composition of good quality “Ngongoni Veld” at Cato Ridge or elsewhere (pers. obs.).

This vegetation type is considered Vulnerable by Mucina & Rutherford (2006), with less than 1% statutorily conserved and about 39% transformed to cultivation, plantations and urban development. This has since been separated into dry (at Cato Ridge Dry Coast Hinterland Grassland) and moist variants (SANBI 2018). While the dry variant has been reported as containing less floristic diversity than the moist, this is unproven (Mucina & Rutherford 2006) and almost no information has been published on how the floristics of these variants differ. As mentioned, the Revised National List of Threatened Ecosystems holds this vegetation type/ecosystem as Vulnerable.

10.2. KwaZulu-Natal Sandstone Sourveld

KwaZulu-Natal Sandstone Sourveld made its debut as a vegetation type in Mucina & Rutherford (2006), where it is described as “short, species-rich grassland with scattered low shrubs and geoxyllic suffrutices.” KwaZulu-Natal Sandstone Sourveld is considered Endangered (Mucina & Rutherford 2006) and in the Revised National List of Threatened Ecosystems. Others hold it as Critically Endangered (EKZNW 2013; Jewitt 2018). Little is conserved, more than two-thirds is transformed and most of what remains has been degraded to some extent.

It is described as occurring on “elevated coastal inland [Natal Group] sandstone plateaux from Mapumulo near Kranskop to St. Faiths near Port Shepstone in the south”. The Natal Group sandstone geology gives rise to a landscape of “flat (or rolling) plateau tops and steep slopes commonly forming table mountains” (Mucina & Rutherford 2006). This is the landscape and geology of Cato Ridge north of the N3 freeway. This is the same landscape as Table Mountain east of Pietermaritzburg and Wartburg (not to be confused with the more familiar and iconic Table Mountain of Cape Town), which occurs only 7-8 km from the study site to the north.

Unlike Ngongoni Veld, Mucina & Rutherford (2006) present KwaZulu-Natal Sandstone Sourveld as “species-rich” and provide a much more extensive range of important species. Further unlike Ngongoni Veld, they record that it has 20 biogeographically important species and 12 endemic species. However, the floristic account of KwaZulu-Natal Sandstone Sourveld contains some problems as itemised below:

- It is stated that species in the genera *Faurea*, *Leucospermum* and *Protea* (Proteaceae) are locally common. However, *Faurea saligna* is a rather widespread if localised tree species, growing gregariously and forming woodlands (Boon 2010; pers. obs.). *Faurea saligna* is not an element of, or typical of grassland.
- *Leucospermum gerrardii*, the only member of the genus within the KwaZulu-Natal Sandstone Sourveld area, is very rare and known from only a few localities in KwaZulu-Natal (Boon 2010; Scott-Shaw 1999; Styles 2011), all north of Durban.
- *Protea* species (*P. caffra*, *P. roupelliae* and *P. simplex* with the exception of *P. welwitschii*) have a wide distribution in KwaZulu-Natal (Boon 2010; Rebelo 1995), often localized on steeper south- or east-facing slopes, and are also locally common in this situation in one large Dwyka Group tillite grassland south of the N3.

- Of the 31 important species listed, a few do not occur in grassland at all: *Senecio medley-woodii* occurs on rock faces (Hilliard 1977). *Helichrysum woodii* is a species of sheer rock faces; it does not occur in grassland (Hilliard 1979, 1983; pers. obs.); *Cynorkis compacta*, *Gladiolus cruentus* and *Hesperantha gracilis* are endemic or nearly endemic to Natal Group sandstone but are also species of wooded, usually sheer rock faces (Goldblatt 2003; Goldblatt & Manning 1998; Hilliard 1979, 1983, 1986; Linder & Kurzweil 1999; pers. obs.).
- *Brachystelma perditum* is a high-altitude Drakensberg endemic; *B. tenellum* is known only from the north of the Pondoland Centre. A few more are debatably typical of open grassland.
- *Bulbine inflata* is not a biogeographically important species as it was described from collections from as disparate localities as Mpumalanga Province and Swaziland. An apparently undescribed species related to and confused with *B. inflata* does occur within the eThekweni Municipal Area, however (pers. obs.).
- *Crassula multicava* subsp. *floribunda* occurs in forest and woodland (Toelken 1985).
- Of the 11 species listed as endemic, *Eriosema rossii* is not so, although with a southern KwaZulu-Natal distribution (Stirton 1986). Another five of these do not occur in grassland: *Crassula inandensis* is not a climber as stated, but a small herb entirely confined to the floor of damp forest (Toelken 1985; pers. obs.).

As already indicated, there is imperfect correlation between the distribution of Natal Group sandstone on the one hand (Marshall 1994), which is stated to be the underlying geology of KwaZulu-Natal Sandstone Sourveld, and the SANBI (2018) mapped occurrence of KwaZulu-Natal Sandstone Sourveld. The divergence with earlier vegetation mapping is presented in Styles (2017). However, since 2006, there have been a number of new inclusions in national vegetation mapping beyond the original extent. This process will likely continue, particularly in the eThekweni Municipal Area, where the EPCPD has mapped grassland at finer scale, resulting in better correlation.

Where grassland in good condition occurs on Dwyka Group tillite at Cato Ridge (and on tillite and dolerite elsewhere within the Ngongoni Veld distribution area), it is species-rich and does not correlate with the Mucina & Rutherford (2006) depiction. In fact, at Cato Ridge, species richness was found higher on tillite than on sandstone (Styles 2017). As a result, it seems likely that the Mucina & Rutherford (2006) depiction may only correspond with degraded or depauperate instances of this grassland type. Furthermore, while *Aristida junciformis* and other unpalatable species increase in response to forms of disturbance, especially overgrazing, herbaceous diversity declines as well and common and widespread species are those that then may persist. Degraded KwaZulu-Natal Sandstone Sourveld may then more closely floristically approach the Mucina & Rutherford (2006) “Ngongoni Veld” depiction.

It is possible nonetheless to make correlations based on the occurrence of species these authors cite as important, biogeographically important or endemic in KwaZulu-Natal Sandstone Sourveld and important in Ngongoni Veld. This leaves aside the issue of whether the species listed by these authors deserve a meritorious place in these categories. For the purposes of analysis, species cited as important, biogeographically important and endemic in KwaZulu-Natal Sandstone Sourveld by Mucina and Rutherford (2006) were reduced to a single category: important. A chi-square test was performed on the data from plots on Natal Group sandstone and those on Dwyka Group tillite (Styles 2017). Results showed that more of the Mucina & Rutherford (2006) “important” KwaZulu-Natal Sandstone

Sourveld species were found in Dwyka Group tillite plots (8%) than Natal Group sandstone plots (6%) but the difference was not statistically significant ($p=0.38$). Similarly, while results showed more “important” Ngongoni Veld species in Dwyka Group tillite plots (4%) compared to Natal Group sandstone plots (3%) the difference was not statistically significant either ($p=0.38$).

Styles (2017) nonetheless found that there are significant differences in species composition between better quality grassland on Natal Group sandstone and Dwyka Group tillite at Cato Ridge. This suggests they belong to different grassland types.

Table 1. Relative abundance of species (the 30 most abundant) in Natal Group sandstone versus Dwyka Group tillite plots.

Natal Group sandstone	%	Dwyka Group tillite (DGT) (excluding Thornridge Farm)	%	DGT (Thornridge Farm) *	%
<i>Tephrosia macropoda</i> var. <i>macropoda</i>	3.501	<i>Chaetacanthus burchellii</i>	4.237	<i>Ajuga ophrydis</i>	4.512
<i>Commelina africana</i>	3.170	<i>Agathisanthemum chlorophyllum</i> var. <i>chlorophyllum</i>	2.9	<i>Agathisanthemum chlorophyllum</i> var. <i>chlorophyllum</i>	4.44
<i>Justicia protracta</i> subsp. <i>protracta</i>	2.725	<i>Aster bakerianus</i>	2.881	<i>Chaetacanthus burchellii</i>	4.367
<i>Chaetacanthus burchellii</i>	2.593	<i>Gerbera kraussii</i>	2.853	<i>Corchorus asplenifolius</i>	3.712
<i>Zornia capensis</i> subsp. <i>capensis</i>	2.356	<i>Berkheya umbellata</i>	2.635	<i>Hypoxis hemerocallidea</i>	3.566
<i>Eriosema salignum</i>	2.243	<i>Tephrosia macropoda</i> subsp. <i>macropoda</i>	2.512	<i>Crabbea hirsuta</i>	3.493
<i>Cyanotis speciosa</i>	2.214	<i>Senecio glaberrimus</i> / <i>S. latifolius</i>	2.265	<i>Blepharis integrifolia</i>	3.057
<i>Agathisanthemum chlorophyllum</i> var. <i>chlorophyllum</i>	2.157	<i>Graderia scabra</i>	2.208	<i>Hibiscus aethiopicus</i> var. <i>ovatus</i>	2.984
<i>Tetraselago natalensis</i>	2.157	<i>Senecio bupleurioides</i>	2.199	<i>Senecio coronatus</i>	2.984
<i>Anthospermum rigidum</i> subsp. <i>pumilum</i>	1.987	<i>Hypoxis hemerocallidea</i>	2.047	<i>Orthosiphon suffrutescens</i>	2.838
<i>Chamaecrista plumosa</i> var. <i>plumosa</i>	1.921	<i>Hypericum aethiopicum</i> Thunb. subsp. <i>sonderi</i>	1.867	<i>Argyrolobium ascendens</i> / <i>A. humile</i>	2.547
<i>Indigofera rubroglandulosa</i> sensu lato	1.788	<i>Vernonia natalensis</i>	1.858	<i>Thunbergia atriplicifolia</i>	2.183
<i>Argyrolobium rotundifolium</i>	1.268	<i>Thunbergia atriplicifolia</i>	1.763	<i>Zornia capensis</i> subsp. <i>capensis</i>	2.111
<i>Acalypha glandulifolia</i>	1.192	<i>Indigofera</i> sp. nov. B (= DGA Styles 5091)	1.725	<i>Senecio glaberrimus</i> / <i>latifolius</i>	2.038
<i>Berkheya umbellata</i>	1.192	<i>Vernonia oligocephala</i>	1.649	<i>Gerbera kraussii</i>	1.892
<i>Helichrysum krebsianum</i>	1.126	<i>Indigofera rubroglandulosa</i> sensu lato	1.64	<i>Ruellia baurii</i>	1.892

Natal Group sandstone	%	Dwyka Group tillite (DGT) (excluding Thornridge Farm)	%	DGT (Thornridge Farm) *	%
<i>Chamaecrista plumosa</i> var. <i>erecta</i>	1.079	<i>Acalypha peduncularis</i>	1.564	<i>Wahlenbergia krebsii</i> subsp. <i>krebsii</i>	1.747
<i>Vigna unguiculata</i>	1.050	<i>Acalypha glandulifolia</i>	1.516	<i>Abrus laevigatus</i>	1.674
<i>Senecio glaberrimus</i> / <i>latifolius</i>	1.031	<i>Senecio umgeniensis</i>	1.469	<i>Commelina africana</i>	1.674
<i>Hypoxis argentea</i> var. <i>sericea</i>	1.022	<i>Helichrysum krebsianum</i>	1.431	<i>Helichrysum krebsianum</i>	1.601
<i>Delosperma lineare</i>	1.012	<i>Ocimum obovatum</i> subsp. <i>obovatum</i>	1.422	<i>Ocimum obovatum</i> subsp. <i>obovatum</i>	1.601
<i>Senecio albanopsis</i>	1.012	<i>Rhynchosia totta</i> var. <i>totta</i>	1.204	<i>Indigofera</i> sp. nov. B (= DGA Styles 5091)	1.601
<i>Indigofera williamsonii</i>	0.956	<i>Zornia capensis</i> subsp. <i>capensis</i>	1.194	<i>Centella asiatica</i>	1.528
<i>Senecio variabilis</i>	0.956	<i>Hypoxis argentea</i> var. <i>sericea</i>	1.166	<i>Sebaea sedoides</i>	1.528
<i>Crassula pellucida</i> subsp. <i>brachypetala</i>	0.937	<i>Lotononis corymbosa</i> / <i>pulchra</i>	1.147	<i>Aster bakerianus</i>	1.383
<i>Aeschynomene micrantha</i>	0.889	<i>Cyanotis speciosa</i>	1.128	<i>Cyanotis speciosa</i>	1.31
<i>Helichrysum griseum</i>	0.852	<i>Scabiosa columbaria</i>	1.033	<i>Polygala hottentota</i>	1.31
<i>Gerbera kraussii</i>	0.804	<i>Helichrysum pallidum</i>	1.014	<i>Stachys natalensis</i> var. <i>natalensis</i>	1.31
<i>Sphenostylis angustifolia</i>	0.804	<i>Adhatoda densiflora</i>	0.995	<i>Scabiosa columbaria</i>	1.164
<i>Helichrysum aureum</i> var. <i>monocephalum</i>	0.757	<i>Syncolostemon parviflorus</i> var. <i>parviflorus</i>	0.986	<i>Vernonia natalensis</i>	1.164

* By way of explanation, Thornridge Farm is a large area mainly comprising valley bushveld abutting the Cato Ridge Development Company study area north of the N3 national road. Much of the grassland occurs in a mosaic with valley bushveld vegetation and is infiltrated by these elements, giving it a different character to more open grassland on tillite at Cato Ridge.

Styles (2017) tried to find a better list of “endemic” species that occur in, or mainly, grassland in the area of distribution of KwaZulu-Natal Sandstone Sourveld and Ngongoni Veld (see Appendix 20), including a small number of species shared with the small Pondoland Centre of Plant Endemism to the south. This was done by comprehensive review of botanical and taxonomic literature and herbarium specimens held at the KwaZulu-Natal Herbarium (NH) and the Bews Herbarium at the University of KwaZulu-Natal, Pietermaritzburg (NU). Some of these species are still formally undescribed. Once identified, it was found that a number of these undescribed species occur in grassland on both sandstone and tillite at Cato Ridge. The wide occurrence of a few endemic species resulted a picture of occurrence which did not differ much statistically on a simple *any* presence or absence basis. However, when one looks at the *particular* species present or absent, the picture changes.

Twenty-six such species were recorded in Natal Group sandstone and Dwyka Group tillite plots. Twenty-three of the 26 occur in Natal Group sandstone plots but only 14 in Dwyka Group tillite plots. Nine of the endemic species were seen *only* on a Natal Group sandstone substrate and 3 are mainly

present in Natal Group sandstone plots and occur in only one or a few Dwyka Group tillite plots. Only one published endemic species was found on a Dwyka Group tillite substrate but not on a Natal Group sandstone substrate.

In summary, while there is a significant presence of endemics in both grassland on sandstone and tillite, more species either occur on Natal Group sandstone or are small in their occurrence on tillite. Some of these were only found on tillite close to areas of contact with Natal Group sandstone. Many of these endemics are also typical species in grassland mapped as KwaZulu-Natal Sandstone Sourveld by SANBI (2018) elsewhere in the eThekweni Municipal Area (pers. obs).

Table 2. Endemic / range-restricted species found in plots according to abundance (* = number of records; NGS = Natal Group sandstone; DGT = Dwyka Group tillite). Plots on megacrystic biotite granite excluded.

Species	Endemism	NGS *	NGS %	DGT *	DGT %
<i>Agathisanthemum chlorophyllum</i> var. <i>chlorophyllum</i>	ECE-E (KwaZulu-Natal south-central coastal escarpment and the Pondoland Centre of Plant Endemism (PCE)	228	2.16	367	3.08
<i>Sensitive Species 88</i>	NCE-E (KZN Coastal Escarpment north of the PCE).	16	0.15	5	0.04
<i>Argyrobium longifolium</i>	NCEFE (Mainly KZN Coastal Escarpment north of the PCE).	15	0.14	14	0.12
<i>Brachystelma pulchellum</i>	NCE-E	24	0.23		
<i>Chaetacanthus/Dyschoriste</i> sp. nov. = D.G.A. Styles 3822, 3919, 3950, 3972, 3973	LE (possibly a local endemic). Historically known from the Inanda area, where habitat is now transformed. Plants bearing some vegetative resemblance have been seen on Table Mountain 7-8 km to the north. However, the identity of the Table Mountain plants need to be confirmed.	68	0.64		
<i>Cineraria atriplicifolia</i>	NCE-FE	39	0.37		
<i>Crassula stylesii</i>	LE	1	0.01		
<i>Crotalaria dura</i> subsp. <i>dura</i>	NCE-FE	22	0.21	34	0.29
<i>Dierama pallidum</i>	NCE-FE	10	0.10	15	0.13
<i>Eriosema populifolium</i> subsp. <i>populifolium</i>	NCE-E			11	0.09
<i>Eriosema superpositum</i> C.H. Sirt. ined. (see Stirton 1986)	NCE-E			1	0.01
<i>Eriosemopsis subanisophylla</i>	ECE-E	27	0.26	4	0.03
<i>Helichrysum griseum</i>	ECE-E	90	0.85	24	0.20
<i>Helichrysum pannosum</i>	ECE-E	29	0.27	33	0.28
<i>Hermannia sandersonii</i>	NCE-FE (Mainly KZN Coastal Escarpment north of the PCE). Occurrence in north-western KZN	6	0.06		

Species	Endemism	NGS *	NGS %	DGT *	DGT %
	not confirmed by Gwynne-Evans (2015)				
<i>Indigofera inandensis</i> Baker f. ex Schrire ined. (= DGA Styles 5122, 5237)	NCE-E	5	0.05	2	0.02
<i>Indigofera</i> sp. nov. B (= DGA Styles 5091)	ECE-E	10	0.01	204	1.46
<i>Indigofera rubroglandulosa</i> sensu lato	ECE-E	189	1.79	174	1.724
<i>Pachycarpus coronarius</i>	ECE-E	2	0.02		
<i>Phymaspermum pinnatifidum</i>	NCE-E	40	0.38		
<i>Plectranthus hadiensis</i> var. nov.	Taxonomic status to be resolved. Possibly LE.	21	0.20		
<i>Schizoglossum peglerae</i>	ECE-E	1	0.01		
<i>Senecio albanopsis</i>	ECE-E	116	1.10	3	0.03
<i>Senecio exuberans</i>	NCE-FE	24	0.23	9	0.08
<i>Streptocarpus polyanthus</i> subsp. <i>polyanthus</i>	NCE-FE	9	0.09		
Totals		803	7.60	726	6.10
Totals for all species by geology		10568		11925	

Indigofera sp. nov. A (DGA Styles 3457, 3477 NH), is an eastern coastal escarpment endemic, but often difficult to distinguish from the closely related *I. rubroglandulosa*. *I.* sp. nov. It is also often confused with *I. hiliaris*, although earlier flowering and with growth form completely different. *I.* sp. nov. is one of the most typical species of KwaZulu-Natal Sandstone Sourveld elsewhere on the Durban escarpment and beyond. Due to the problems in making rapid distinction from *I. rubroglandulosa* when just growing out or when often only partial material was available, both were recorded in the plots surveyed as *I. rubroglandulosa* sensu lato. *Indigofera* sp. nov. A is therefore also omitted from the tables showing endemism abundance results. However, *I.* sp. nov. B (= DGA Styles 5091 NH) is an easily identifiable species even when partial material is available, and is for this reason included. Based on available information, these undescribed *Indigofera* species are not threatened. *Indigofera inandensis* (Baker) is a species not recognized by SANBI. However, Dr. Brian Schrire who worked extensively on African *Indigofera* while at the Royal Botanic Gardens, Kew, avers that it is indeed a good species (pers. comm), only known from the Durban escarpment. This species may be threatened, and while it occurs at Cato Ridge, it does not occur within the proposed development areas.

For all the reasons above, the following is contended in summary:

- The Mucina & Rutherford species accounts for KZN Sandstone Sourveld and Ngongoni Veld are not entirely accurate and are in need of improvement. The Ngongoni Veld depiction may only be applicable to degraded forms of Ngongoni Veld and its variants, which are also floristically similar to degraded KZN Sandstone Sourveld.

- The plateau north of the N3 freeway comprises Natal Group sandstone and the landform associated with KZN Sandstone Sourveld, not Ngongoni Veld (and its variants).

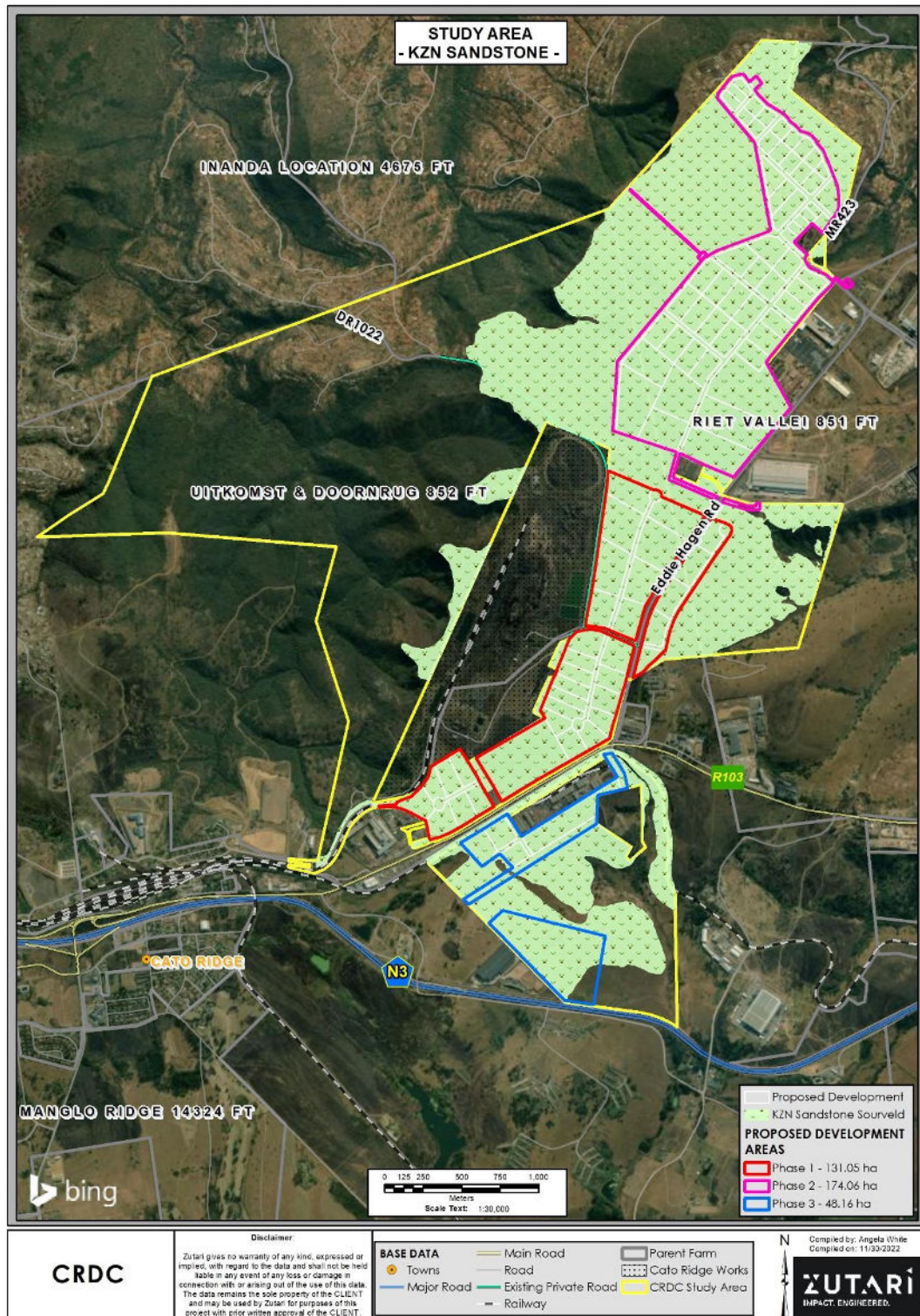


Figure 13. The extent of KwaZulu-Natal Sandstone Sourveld in the study area.

- The species composition of grassland on Natal Group sandstone and Dwyka Group tillite at Cato Ridge are different, at least where in better condition. In good condition, grassland on *both* sandstone and tillite is species-rich.
- Endemic species occur in both kinds of grassland, but more occur on Natal Group sandstone. Those that occur only or mainly on Natal Group sandstone are also species typical of, or indicators of KwaZulu-Natal Sandstone Sourveld, where this has been mapped as such by SANBI (2018) elsewhere and just to the east on the Durban escarpment.
- Grassland on the Natal Group sandstone plateau north of the N3 freeway is also KZN Sandstone Sourveld, as currently presented by the eThekweni Municipality's EPCPD.

11. Other vegetation types at Cato Ridge

11.1. KwaZulu-Natal Hinterland Thornveld

According to Mucina & Rutherford (2006) KwaZulu-Natal Hinterland Thornveld occurs in scattered patches above Eastern Valley Bushveld, in a relatively small area of south-central KwaZulu-Natal, between 450–900 m a.s.l. It is described as “open woodland dominated by *Acacia* species on undulating plains found on upper margins of river valleys.” The important species mentioned are widespread in other thicket and bushveld vegetation types in South Africa. One species is mentioned as endemic, namely *Aloe pruinosa*. It should be mentioned that this is however not endemic to KZN Hinterland Thornveld but also occurs in Eastern Valley Bushveld in south-central KwaZulu-Natal (pers. obs.).

It is considered by these authors as a Vulnerable vegetation type. None is statutorily conserved and about 22% is transformed by agriculture and urban development. Little of this vegetation type occurs within the eThekweni Municipal Area. Little occurs in the study area and this vegetation type is not impacted upon by the proposed development.

11.2. Eastern Valley Bushveld

This vegetation type occurs in lower, dry parts of major river valleys between the Tugela and the Kei, including the Umgeni. A number of important species are mentioned by Mucina & Rutherford (2006). The vegetation type is described as “semi-deciduous savannah woodlands in a mosaic with thickets, often succulent and dominated by species of *Euphorbia* and *Aloe*.”

I have more briefly visited edge parts of the Eastern Valley Bushveld which occurs below the proposed development. Due to terrain, these areas are not well suited to development. However, over years I have spent large amounts of time in the valley bushveld on the adjacent Thornridge Farm, which abuts the valley bush below the proposed development to the south and is only an extension thereof, as well as in the valley bushveld beneath the Craiglea escarpment less than 2 km to the north and east. As a result, I know the species composition of this vegetation well.

Although degraded and notably alien plant invaded on the eastern edge, beyond this most is in quite good condition, is species-diverse and is an excellent example of the type. Although it is not a threatened vegetation type, it is likely that threatened plant species and many protected species occur

within this vegetation (see below). In particular, *Adenia natalensis* (Critically Endangered) has been found to have a sparse presence in Eastern Valley Bushveld elsewhere in this area, together with *Sensitive Species 461* (Vulnerable) and is likely present Eastern Valley Bushveld below the study area. This vegetation is, however, threatened by an increase in alien plant invasion, while formerly parts were likely more open but have now become more closed, which may reduce species diversity. The reasons for this are not known, but fire is beneficial in maintaining patches of grassy growth between trees, which may not have occurred for many years. Furthermore, grazing and browsing by livestock occurs.

Due to the closed nature of the vegetation, some of it being taller and transitioning with dry Scarp Forest, any future development in this area will need to take cognisance of the National Forests Act. Even if Eastern Valley Bushveld, some of the vegetation meets the structural definition of forest contained in the Act. *Berchemia zeyheri* (Red Ivory) is likely present, seen just outside the area and *Sclerocarya birrea* subsp. *caffra* (Marula, seen within the area). These are both species protected by the National Forests Act, occur in this vegetation. *Scleroxylon inerme* (White Milkwood) is also likely present.

12. Threatened species

Red listing is a system developed by the International Union for the Conservation of Nature (IUCN) to evaluate the conservation status of species, and in particular for identifying species most in need of conservation attention (IUCN 2008). In this system, species are evaluated against a series of objective criteria (available from iucn.org). Based on the criteria, with some alterations, species in South Africa are placed in categories (shown below, available from <http://redlist.sanbi.org/redcat.php>). Species in threatened categories are referred to as red-listed or red data species.

Table 3. Description of the IUCN red list categories

Extinct	There is no reasonable doubt that the last individual of the species has died
Extinct in the Wild	The species no longer occurs in the wild, and is only found in cultivation or in captivity
Critically Endangered	The species is considered to be facing an extremely high risk of extinction in the wild, based on IUCN criteria
Endangered	The species is considered to be facing a very high risk of extinction in the wild, based on IUCN criteria
Vulnerable	The species is considered to be facing a high risk of extinction in the wild, based on IUCN criteria
Near Threatened	When evaluated against IUCN criteria, does not qualify for a Threatened category but is close to qualifying for or is likely to qualify in one of those categories in the near future
Least Concern	When evaluated against IUCN criteria, does not qualify for any category as Threatened or Near Threatened. Widespread and abundant species fall in this category
Data Deficient – Insufficient Information	There is inadequate information regarding the species' population size, distribution or threats for an assessment to be made

Data Deficient – Taxonomically Problematic	A species is DDT when taxonomic problems hinder the distribution range and habitat from being well defined, so that an accurate assessment of risk of extinction is not possible. This is often also because species are poorly known. On a precautionary basis, DDT species should also be regarded as being of conservation concern.
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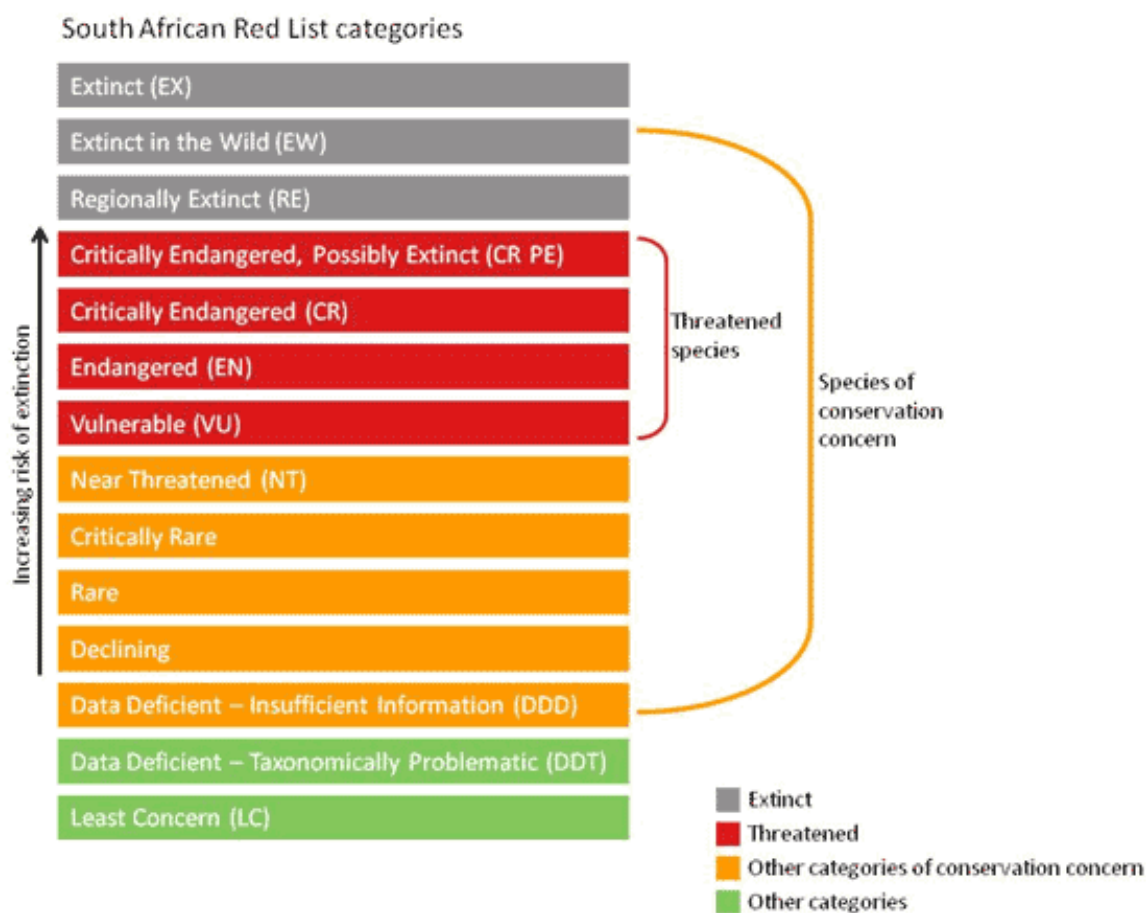


Figure 14. The IUCN red list category schema

Many threatened plant species occur within the study area, though not evenly distributed and confined to particular parts. They are mainly avoided by the proposed development. These are described on a phase-by-phase basis further into this report.

13. National Screening Tool: Species of conservation concern

The National Screening Tool predicts a number of species of conservation concern (corresponding with species in the National Red List (2018) red and orange categories. As these correspond with the National Red List species, they are also identified on a site-by-site basis below. It is a requirement that some species of conservation concern flagged as possibly present by the tool are referred to by numbers only, with the number allocation and database and management thereof curated by SANBI. This is to protect locality information of threatened species where in addition to other factors dictating threatened status, they are known to be targets of private, commercial or medicinal plant collectors.

For this reason, photographs of SCC species found in the study area have been uploaded to iNaturalist but not those which are masked with numbers in order to protect locality information from collectors. The link is: https://www.inaturalist.org/observations/davids_botanist

14. General observations and findings

Based on plot results and reconnaissance surveying, vegetation is mapped with forb diversity scores (which are a surrogate for grassland condition and species richness) in Appendix 8. A grassland quality classification is provided in Appendix 9, based in work described in Appendix 1.

Emerging from an Eco-Pulse study of orthorectified aerial imagery extending back to 1937 (Eco-Pulse 2022a), historically and currently disturbed areas impacts are shown in Appendix 5 and Appendix 2. However, bush encroachment is mostly not the result of direct but indirect anthropogenic impacts, although reduced frequency of fires probably contribute. An issue is that once woody vegetation increases, the ability of fires to move through vegetation also decreases, so there a compounding effect. In Appendix 6, the extent of alien plant invasion is also mapped – the main species present on the plateau are *Chromolaena odorata*, *Eucalyptus* sp. (Gums, often in stands), *Lantana camara* and *Populus x canescens* (Grey Poplar, also often in stands), and in in Eastern Valley Bush *Chromolaena odorata* and *Lantana camara*, although a much greater diversity of alien invasive species occurs.

14.1. Plot-based surveying

Sampling intensity is shown in Appendix 7. As can be seen, there is quite even coverage. The forb diversity scores through the grassland are shown in Appendix 8 and a classification provided in Appendix 9. These becomes surrogates for species richness and so grassland condition.

14.2. Current negative impacts affecting Cato Ridge Development Company grassland north of the N3

Parts of the study area have been occupied on an informal basis. At least some of this settlement appears to be unauthorized. It also includes some more recent settlement that is also unlawful in terms of NEMA regulations (i.e. clearing of vegetation in an Endangered or Critically Endangered ecosystem without following the prescribed process). This has resulted in the loss of some KwaZulu-Natal Sourveld and Eastern Valley Bushveld and also causes indirect impacts beyond.

One of the major negative impacts which has transformed grassland north of the N3 is sand-mining. This is unlawful and is not and was not authorized by Cato Ridge Development Company or the landowner. This affects only KwaZulu-Natal Sandstone Sourveld (i.e. parts north of the N3) as the Natal Group sandstone geology provides soils suitable for sand-mining. This continues to be a serious problem. In April 2022, on one day over a weekend, while surveying discreetly, I observed three different attempts to mine sand in the Phase 2 area, resulting in responses by Cato Ridge Development Company security and reported involvement of the South African Police Services. However, due to multiple attempts occurring in close succession, not all sand-miners could be apprehended. Although an effort has been made to deter access by laying out razor wire across common access points, this is not completely effective, and unless the Phase 2 area has a more continuous security presence, it is

clear that for an area prioritized by illegal sand-miners for abundance of saleable material, they will continue in their efforts, and some attempts will likely be successful.

This unauthorized mining appears to have occurred episodically over years, even prior to 2002. However, it has intensified in recent years. In order to assess the extent of the impact, areas sand-mined before 2017 and after 2017 were mapped. This mapping reveals the following:

- Prior to 2017, at least 12,01 ha were mined completely. There is also one additional large area of 71,83 ha in which severe soil disturbance and at least some sand-mining occurred on more incomplete basis. This occurred prior to 2002 and aerial imagery seen does not reveal what exactly occurred, or when.
- From 2017 to 2021, at least 18,61 ha of soil exposure is evident in aerial imagery and from the walk- and drive-throughs.
- In combination, over two or more decades, at least 30,62 ha of KwaZulu-Natal Sandstone Sourveld has been lost as a result of sand-mining, with more incomplete severe soil disturbance of uncertain origin but including at least some mining occurring in one area which is even larger.

Grazing and associated over-burning are issues that face grassland everywhere in the eThekweni Municipal Area. This has undoubtedly served to reduce the species diversity of grassland in the study area and reduce occurrence of conservation-important plant species. It has also transformed the grassland more uniformly to *Aristida junciformis* and other unpalatable grass species. The study area grasslands appear to sustain a significant number of cattle (see the front cover of this report for an example). Different herds graze different parts. If development occurs in some of the grassland, a necessary mitigation will be prevention of grazing in what remains, failing which concentration of animals into a smaller grazing area will have more severe impacts than now.

Alien plant invasion is also a significant problem in all the proposed development phases. These include aggregations and stands of *Populus x canescens* (Grey Poplar), *Eucalyptus*, *Lantana camara*, *Pinus* and *Rubus* invasion on Phase 1, *Eucalyptus* and *Lantana camara* invasion in the Phase 2 area, and *Populus x canescens* (Grey Poplar), *Eucalyptus* and *Lantana camara* invasion in the Phase 3.

15. Offsets

15.1. NEM A: Draft National Biodiversity Offset Policy

The Draft National Biodiversity Offset Policy was published in March 2017 in terms of the National Environmental Management Act (NEMA), 1998.

The policy acknowledges that traditional EIA approaches seek a 'best practicable' environmental option, invariably still resulting in some loss of biodiversity. The cumulative effects of such an approach continue to cause decline in biodiversity at a landscape and ecosystem scale.

Biodiversity offsets are an emerging tool to address this problem. It is defined as: "Setting aside land in the same or similar ecosystem elsewhere, at the cost of the applicant, to ensure no net loss of biodiversity." However, offsetting may also include enhanced management of degraded areas,

addressing causes of losses or restoring lost habitat assessed according to possibility indicated by best science.

The National Policy is intended to “ensure offsets are used in a controlled, consistent and predictable way” and to provide a policy where a Competent Authority does not have one. While provincially tailored policies are acknowledged as important, they must also be consistent with the National Policy.

15.2. Principles of offsetting

The Policy’s principles are summarized as follows:

- An ‘ecosystem system’ and big picture view must be taken, beyond site level and including cumulative impacts;
- Offsets are an option of last resort, where impacts cannot be avoided, minimized or the affected areas cannot be repaired or restored;
- Offsets may not be appropriate when impacts are low. They are applicable for medium or high impacts, but not when very high. Very high includes conservation status (e.g. CBA category areas), irreplaceability and level of threat to biodiversity, such as where losses cause risk of scientific conservation targets not being met.”
- Ecosystem protection and enhancement, particularly of priority ecosystems.
- No net loss. They should not enable activities that cause unacceptable loss of biodiversity, failure to meet conservation targets, or push any feature (including an ecosystem or species) beyond Endangered threat status.
- Biodiversity offsets “should be located in the landscape in such a way that they help secure priority areas for conservation, improve connectivity” or increase existing protected areas.
- Equivalence – they need to benefit “the same biodiversity components” as those negatively affected. Only in exceptional circumstances can an offset target “a relatively more threatened ecosystem or habitat.”
- Additionality – conservation gains beyond other required measures.
- Timing and duration – design of the offset and implementation plans must be approved by the provincial conservation agency (in KwaZulu-Natal this is EKZNW) and the competent authorizing authority before the activity starts. Implementation should also begin before the start of negative impacts.
- Defensibility – impact measurement and the offset “should be based on the best available information and science.”
- Precaution – “Designed in a risk-averse and cautious way to take into account uncertainties” about impacts, their management and success and timing of the offset.

15.3. Purpose

An authorization that allows an offset must not:

- “Result in the loss of Critical Biodiversity Areas (CBAs) or jeopardize the meeting of conservation targets;
- “Lead to ecosystems becoming more threatened than Endangered’, and/or
- Cause a decline in conservation status of species or ...special habitats.”

Furthermore:

- The sixth of the policy’s principles is emphasized insofar as offsets must be focused in priority biodiversity conservation areas or secure links between these areas.
- Ecosystem services provided by biodiversity must be safeguarded, especially where local or vulnerable communities are dependent on them.

15.4. Objectives

The policy requires that: “Offsets ...[must] be considered an integral part of the mitigation sequence during the planning of all” NEMA EIAs.

The policy assumes that it will be implemented “by officials in Competent Authorizing Authorities (CEAs) in reviewing EIAs and preparing authorisations, with the support and input of statutory commenting authorities, and by Environmental Impact Assessment Practitioners carrying out EIAs.

15.5. Scope of application

The policy is intended to encompass “all development and mining applications submitted to the CEA.”

It is noted that there are tight timelines for BAR and S&EIR processes. Thus, “it is desirable to evaluate the probable need for – and design of – offsets in the pre-application phase.” This also enables “an applicant and project funders a reliable indication of likely costs of offsets that should be taken into account in overall project budgets.”

Offsets need to be “discussed with the CEA and, if deemed appropriate, offset investigation, planning and design would best commence pre-authorization ...If an offset is required, the authorization should state the development should occur only after it is secured.”

The usual mitigation sequence should be followed in environmental impact assessment (i.e. Avoid/prevent; Minimize, Rehabilitate/Restore and only then offset).

15.6. Designing and locating an offset

The usual design process is set out in seven steps, paraphrased here, conceived of within the context of a NEMA EIA process:

1. Measuring the residual biodiversity loss, at minimum the area and condition of affected ecosystem / habitat (as done for vegetation in this report).
2. Determine the best type of offset;
3. Determine the size and optimal location;
4. Investigate candidate sites in the landscape that can meet requirements.
5. Decide on the best way to secure this, which must be acceptable to the CEA and statutory conservation authority (EKZNW);
6. Prepare an Offsets Report or dedicated section in EIA report (if at that stage);
7. Conclude agreements (including between the applicant and any implementing agent), and develop an Offset Management Programme.

15.7. Offset guidelines

Seven guidelines are summarized and paraphrased here:

1. Irreplaceable biodiversity impacts and Critically Endangered ecosystems have to be avoided except where there are no alternatives and there is overriding public importance. (Note that this criterion poses an applicability problem for KwaZulu-Natal Sandstone Sourveld, although I am not sure whether very degraded or secondary grassland deserves to be placed in the same category as that which is not).
2. Other important conservation areas should preferably be avoided, (including CBAs, protected areas, verified wetland and river feature FEPAs, areas marked for protected area expansion).
3. Endangered ecosystems can only be developed with very high offset ratios and Vulnerable ecosystems at lower ratios.
4. If Critically Endangered or very restricted range, local endemic species are present, such sites should be avoided. Even if an ecosystem is Least Threatened, if threatened or localised endemic species occur the offset should cater for these, and the basic offset ratio and number of sites may need to increase accordingly.
5. Even if Least Threatened, if there are affected special habitats, the offset area must include examples of the same. This may also serve to increase a basic offset ratio and number of offset sites.
6. Even for Least Threatened ecosystem sites it may be necessary to offset if they are important ecological corridors, in which case the offsets must include alternative corridors. If a threatened ecosystem, this may also serve to increase the basic offset ratio requirement.
7. Even if Least Threatened again, if sites provide high value ecological goods or services, or on which there is high community dependence, then an increase over the basic ratio and other compensation may be necessary.

It is recorded that: “Where significant wetland impacts are likely, specific guidance from DWS, including the Wetland Offset Best Practice Guidelines (SANBI/DWS 2016) should be used. “The functionality of both the affected ecosystem as well as that of the proposed offset area should be taken into account.

15.8. Offset location

Offsets must be located as follows:

- Same bioregion, vegetation type, ecosystem and preferably quinary.
- “Consolidate or buffer existing protected or priority conservation areas”.
- Maximize securing, protecting and/or linking biodiversity areas.
- Provide habitat for affected threatened species.
- Provide comparable ecosystem services specifically to those adversely affected.

15.9. Securing offsets

Offsets must preferably become a NEM PAA-declared protected area. Offsets option include:

- Land donation to a statutory conservation authority (i.e. EKZNW), or a public benefit organisation approved by the CEA (Competent Environmental Authority);
- Conservation servitudes (e.g. stewardship agreements, or the purchase and retirement of development rights).

Costs may include not only acquisition, but protection, rehabilitation and management.

15.10. Offsets within an EIA process

If within a NEMA EIA process, requirements for an Offset Report (submitted as a specialist report) or Offset Agreement are provided, together with those expected from a CEA. Offsets must be monitored and enforced, but monitoring may end if the offset is incorporated into a protected area.

15.11. Costing

A useful template for estimating financial costs of offsets is provided in Appendix 13 of the National Policy.

15.12. EKZNW’s offset policy document

EKZNW’s Provincial Comprehensive Guidelines for Biodiversity Offsets (2013) are entirely consistent with the National Policy and have informed the National Policy. Summarizing the EKZNW document is mostly superfluous as it recapitulates the National Policy. However, some aspects that amplify or explain the ethos of offsetting are:

Red lights for offsets include whether the following will be impacted:

- CBAs
- Protected Areas
- Threatened ecosystems, habitat containing threatened species, special habitats or ecological corridors
- Any other area identified by EKZNW as important or irreplaceable from a conservation perspective
- Areas important on providing valued ecosystem services to dependent communities or society

The EKZNW policy specifically recognizes that offset ratios are only a guideline and may be adjusted (upwards) by various case and context specific considerations (p. 7). Some of these can only be determined by further study as envisaged in the National Policy and not only on a desktop basis. Where wetlands are involved functional offsets are important.

It is specifically stated that offsets should be located in a: “CBA, priority area identified in the provincial systematic biodiversity or bioregional plan, municipal biodiversity plan or other area identified by EKZNW as being targeted for the expansion of protected areas, and/or irreplaceable for meeting conservation targets.”

Key factors in evaluating an offset proposal are:

- Would the ...offset “compensate fully for residual negative impacts,” be functionally viable and result in biodiversity benefits?
- “Would the offset have residual negative effects on local communities, or would they be adequately compensated? Would it be acceptable to main affected parties?”
- “Are there sufficient guarantees that the offset/s would be secured, managed, monitored and audited, as required, in the long term? Are there unacceptable risks associated with the offset?”

Page 49 of EKZNW (2013) provides a flow diagram that well communicates the sequence of steps that must be followed in the initiating and concluding an offset within an NEMA EIA process.

16. Results Of Fieldwork Based Mapping

The principal outputs of the vegetation surveying are maps which encompass the following:

- A map confirming the vegetation types, and particularly of KwaZulu-Natal Sandstone Sourveld in the study area.
- A map showing the quality through this grassland, particularly where development is currently proposed.
- The occurrences of species of conservation concern within the grassland and in or near proposed development areas.

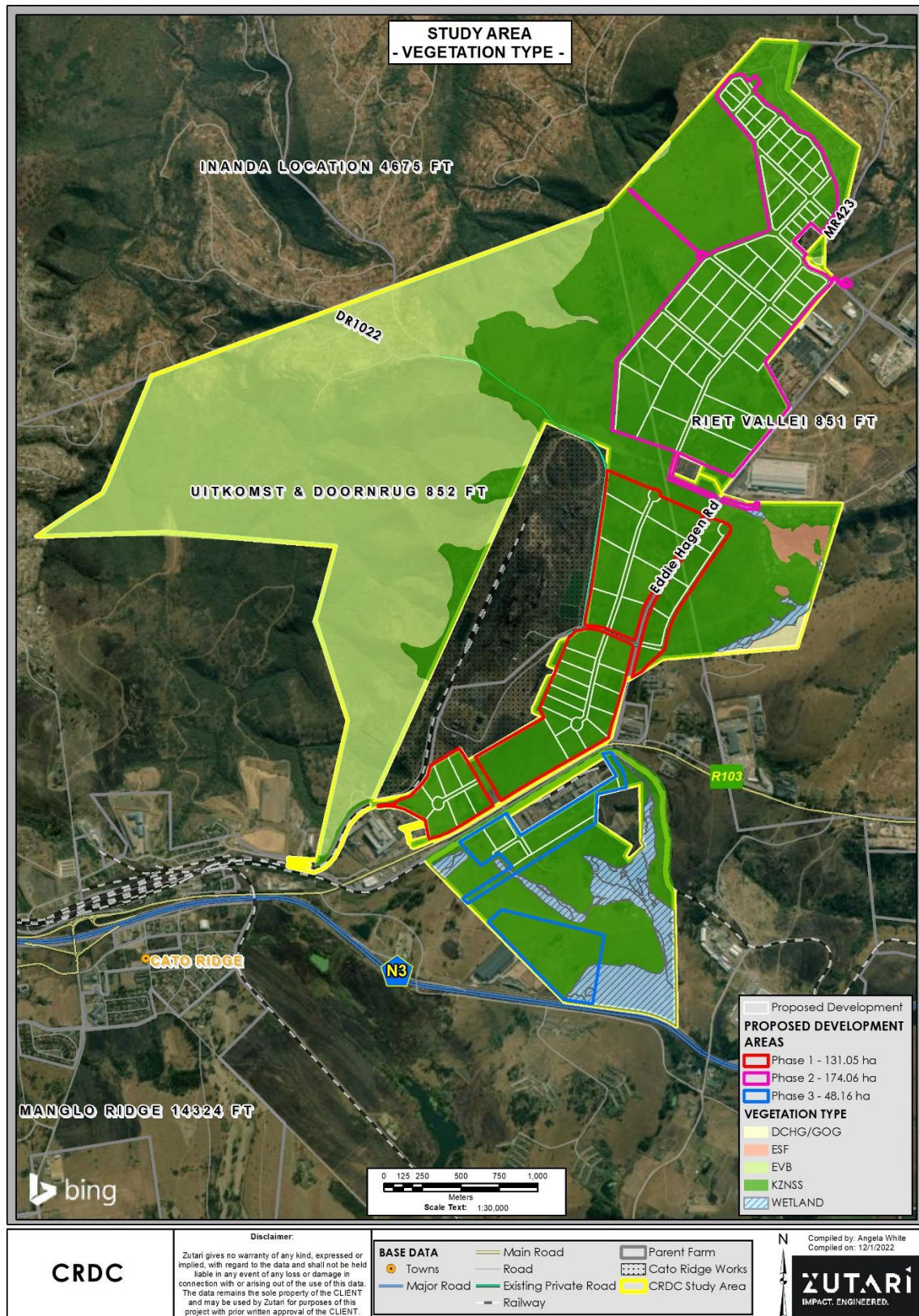


Figure 15. Vegetation types in the study area, as assessed during fieldwork. As can be seen, the development and its phases fall nearly entirely on KwaZulu-Natal Sandstone Sourveld Grassland.

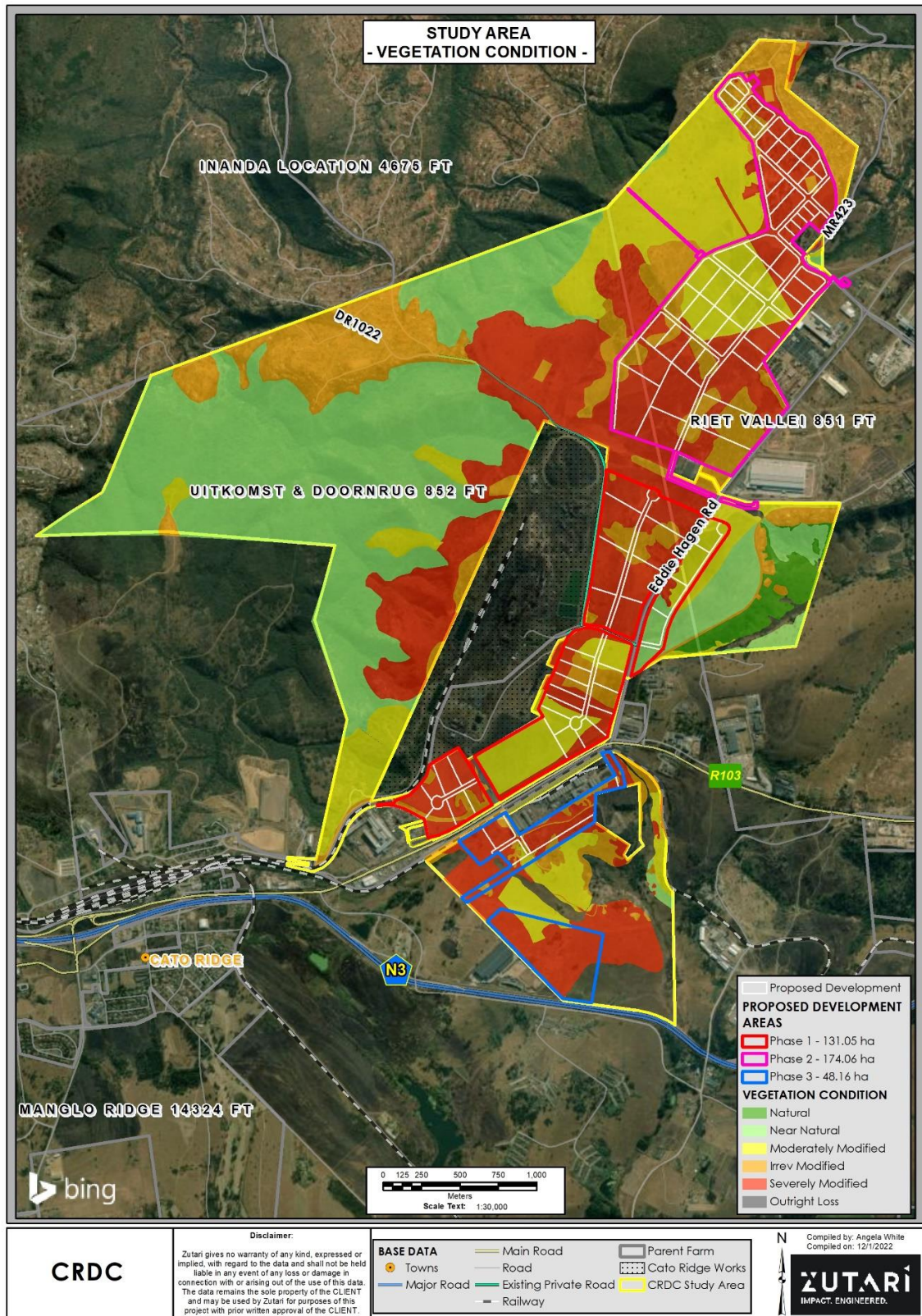


Figure 16. Vegetation condition through the study area.

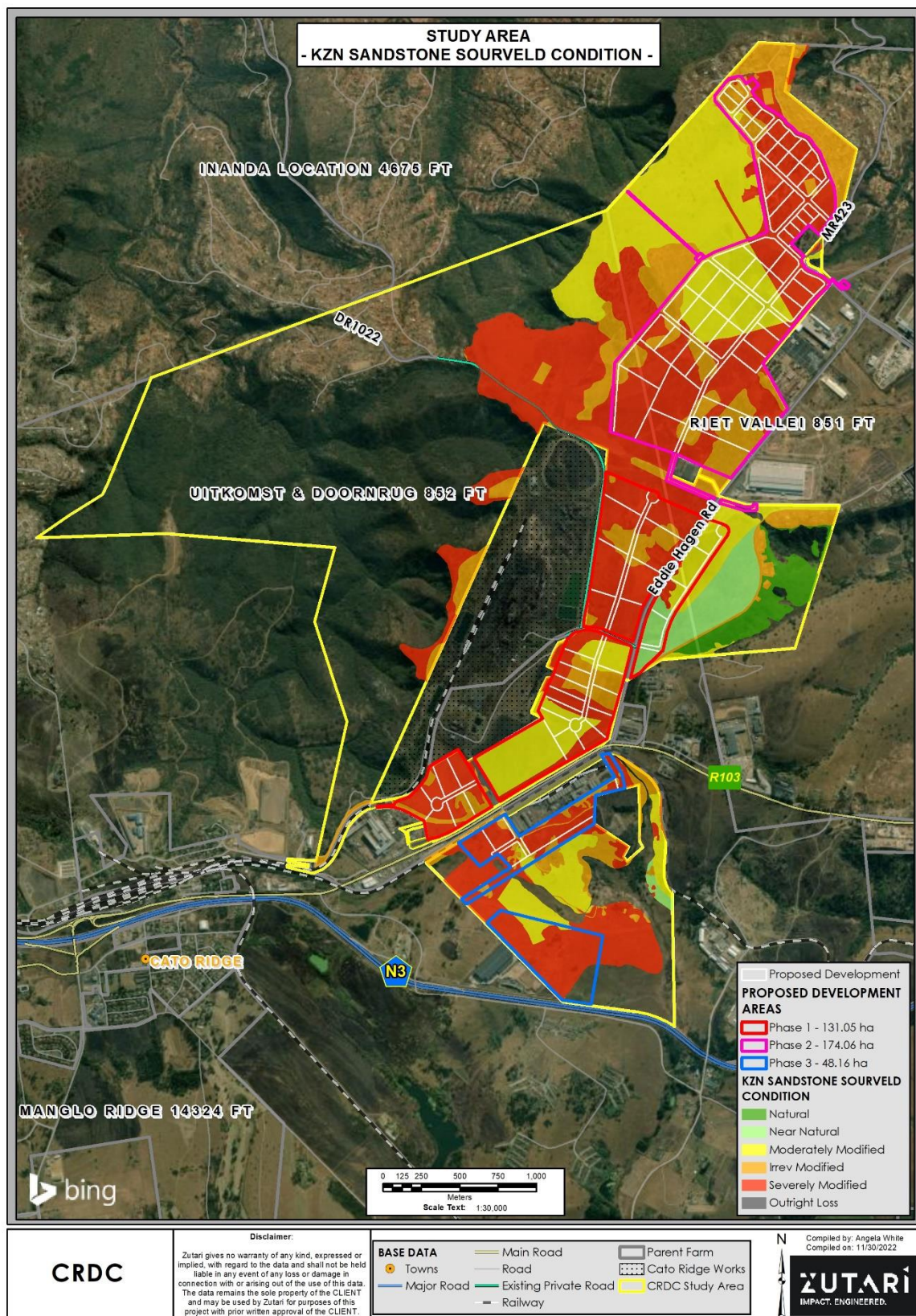


Figure 17. Vegetation condition through the study area, extracted and assessed only for KwaZulu-Natal Sandstone Sourveld.

17. Historical disturbance and “recoverability”

One of the aspects of this assessment is the degree of “recoverability” of degraded or formerly disturbed grassland. Historical impacts have been mapped through orthorectification and analysis of imagery for the sites to 1937, although resolution is lower in older imagery (Eco-Pulse 2022a).

It has been put to me by officials (Dominic Wieners of EKZNW and Greg Mullins of the EPCPD) that they wish to know not only whether grassland is degraded, but if so whether there are prospects for recovery. The concern therefore, is that having been degraded, whether it will remain so perpetually.

In my opinion, the sparse occurrence of alien plants does not always reflect persistence of grasses and indigenous herbs. If alien plants are removed, there may be fair prospects of recovery. Where I believe recoverability prospects are less optimistic is where impacts have been mapped as High but comprise the following:

- Sand-mining;
- Agriculture involving cultivation, especially if this was repetitive over several years. The caveat is that once-off plowing leaves rhizomes and seeds from which there can be some recovery, as seen on a property on adjacent to the Phase 1 area which is not owned by the Cato Ridge Development Company. However, I have no reason to believe that areas determined as cultivated on Sites 1 to 3, where vegetation is still assessed as being Poor, were not cultivated on a through-going basis;
- Areas transformed by settlement or hard development; and
- Dense alien plant infestations, especially if they are of long-standing.

Table 4. Classification of impacts (Eco-Pulse 2022).

Classification	Notes	Impact level
Alien plants	Areas are classified as alien plants where stands of woody vegetation exist that are not consistent with the indigenous vegetation type and where such stands exhibit linear characteristics such as row planting.	High
Alien plants sparse	As above, only density of trees is low.	High
Dams	Artificial water bodies.	High
Mixed - Settlement / Alien plants / Erosion	Areas where disturbance is a combination of impacts, not necessarily all three listed.	High
Roads / Breaks	Areas where small tracks or linear features have impacted the landscape.	High
Sand mining / Erosion	Areas where surface vegetation and soil has been removed.	High
Settlement	Areas where houses, buildings and other infrastructure has been constructed.	High
Undetermined	Areas where disturbance of the land has occurred, but the nature of the activity cannot be determined from the photo under review.	High
Agriculture - cultivation	Land has been tilled and crops cultivated. This has a significant impact on soil structure and hence on vegetation regrowth.	High

Classification	Notes	Impact level
Agriculture - grazing / baling	Land has been used for hay production with machinery used to harvest and bale hay. It is likely that this area is also used for grazing livestock.	Low
Agriculture - grazing camps	Land has been fenced into small areas to manage grazing livestock. This can result in heavy grazing pressure in these camps which can negatively affect natural vegetation.	Low
Agriculture - likely grazing camps	As above, only certainty of the land use is lower.	Low
Agriculture - undetermined	Areas classified as agriculture; however, the exact nature of the activity cannot be determined from the photograph under review.	Low
Agriculture (old)	This classification was only used in reviewing the 1937 photos. This was used to classify areas where evidence of agricultural activity exists, but that had occurred well before the photo was taken.	Low

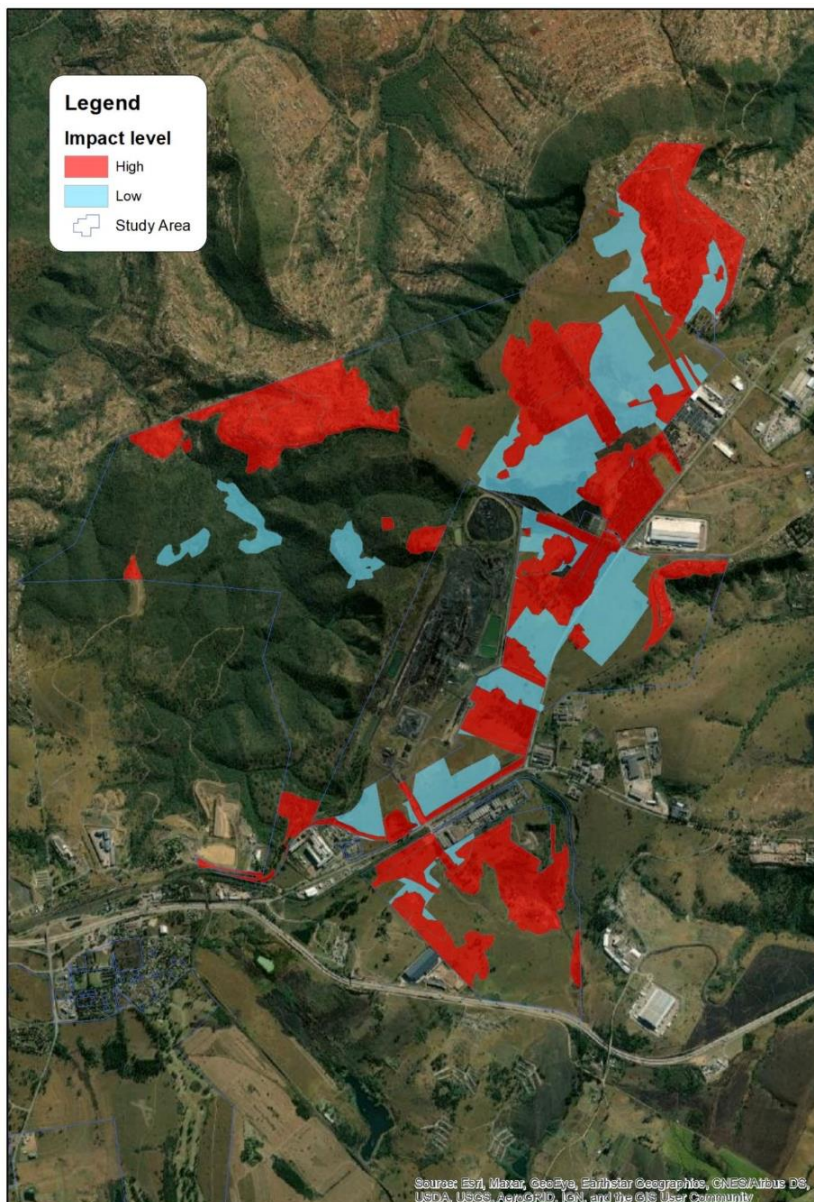


Figure 18. Assessment of historical impacts on vegetation at Cato Ridge (Eco-Pulse 2022b). Red = High; Blue = Low.

More information on the methodology followed in respect of assessing recoverability in grassland in disturbed parts of the study area, and results, is provided in Annexure 2. However, as set out in this Annexure, recoverability appears to be poor, and consequently receptor resilience as outlined as an assessment criterion by DFFE (2020) appears also to be poor. The limitation in this statement is only that while limited plot surveying shown no good recovery in high impact areas, these have likely also experienced little relief from heavy grazing, which continued more-or-less unabated in the years subsequently, as well as associated over-burning. Therefore, disturbed grassland may have shown some different plot results if post early disturbance events shown in Figure 18, negative impacts were thereafter prevented and the grassland was only managed well.

18. Comments on some species of conservation concern

18.1. *Chaetacanthus/ Dyschoriste* sp. nov.

Another species of conservation concern on all sites is *Chaetacanthus* sp. nov. This is a reportedly undescribed species which appears to be endemic to KwaZulu-Natal Sandstone Sourveld. It is distinguished from the more common and widespread *C. burchellii* by its usually larger flowers which are densely glandular (especially on the calyx), often decumbent to trailing habit and proportionally narrower leaves, and its ability to proliferate in the small areas in which it occurs, sometimes by stoloniferous offsets. It is extremely localized and confined to shallow or even skeletal sandy soils overlying or adjacent to rock outcrops. It is replaced by *C. burchellii*, the latter a common and widespread species, in grassland where soils become deeper. It is noted that the genus *Chaetacanthus* has been transferred to *Dyschoriste*, although the genus name *Chaetacanthus* is retained in use here.

The species is currently being studied by an expert on the family Acanthaceae, Prof. Kevin Balkwill of the University of the Witwatersrand, who has received multiple examples of pressed herbarium material from the study area. The collection has been made under the names and number D.G.A. Styles & A. Heiduk 5963 and will be incorporated into the C.E. Moss Herbarium at University of Witwaterstrand, although duplicates may also in due course be distributed from there to other herbaria. In addition, collections have been made from Sites 1 and 2 under numbers D. Styles 5940 and 5955 respectively, and lodged at the Bews Herbarium, University of KwaZulu-Natal, Pietermaritzburg.

The species appears to be only known with certainty from collections from two sites in the outer eThekweni Municipal Area, so closely adjacent these other occurrences are may best be referred to as subpopulations. These site are where there is or more pertinently was historical occurrence of KwaZulu-Natal Sandstone Sourveld. They are the environs of the Umzinyathi Falls at Inanda, where the has in recent decades been almost entirely transformed by settlement so that almost no grassland remains. The other is the nearby Matebetule Plateau, which has been substantially transformed by structures, settlements and encampments of adherents to the Nazareth Baptist Church (Shembe faith), which cover a large part of the Plateau, and furthermore by very extensive sand-mining which has destroyed as much as half of all other grassland at this site. Certainly if any plants remain still on the Matebetule Plateau, their persistence must be in doubt.

On the other hand, some hundreds of plants occur in very localized fashion in the Phase 1, 2 and 3 parts of the development. They are likely to be secure in the medium term, but perhaps less so in Phase 3, where development is situated in closer proximity. These plants were, prior to some fragmentation semi-continuous between the sites and comprised a single population, although localized in the rockiest parts or thin soils in all.

Together, these represent an important and possibly only significant remaining population of this species. There is a much smaller subpopulation at one place south of the N3, which was separated from the others by construction of this national road. It appears as if plants do not then extend through to what appears to be good habitat at Hammarsdale beyond. The reason for this is not known, but there is a crimping of Natal Group sandstone geology north the N3, where confined between Dwyka Group tillite. The absence of skeletal soils in the intervening area may also have prevented the population from expanding southwards. At a further distance, beyond these putative obstacles, there is suitable habitat in KZN-SS on land acquired by the eThekweni Municipality for conservation, into which this species could be introduced.

The occurrence of some vegetatively similar *Chaetacanthus/Dyschoriste* plants on Table Mountain, north-west of Pietermaritzburg and 7-8 km north of Phase 2, but whether they are in fact the same taxon as on the Cato Ridge sandstone plateau needs to be confirmed.

18.2. *Plectranthus* taxon

A note is also made about a *Plectranthus* taxon at Cato Ridge which is confined to KwaZulu-Natal Sandstone Sourveld, where there are skeletal soils surrounding Natal Group sandstone outcrops. This belongs to the *Plectranthus hadiensis* group, which is taxonomically problematic as it consists of three varieties (*P. var. hadiensis*, *P. var. tomentosus* and *P. var. woodii*, with the latter recognized at species level, namely *P. woodii*, by some authorities). Even with plants that can be discretely be referred to these varieties, there is much variation. Furthermore, the group extends northwards through Africa and the type collection of the typical variety of *P. hadiensis* derives from Yemen, which provides a reference point, but field studies necessary to resolve the group better are unlikely to either occur on a continent-wide basis or include the latter country given that it is a conflict zone. Recently, Paton (2019) solved the problem of resolving the *P. hadiensis* group by simply not recognizing any varieties of subspecies at all. He also transferred them to the genus *Coleus*.

All three of these three *P. hadiensis* varieties occur at Cato Ridge, but the plants at issue cannot be accommodated within any of these. The main subpopulation of this unresolved taxon occurs south of the N3, but a small population occurs in the Phase 2 area as shown in Appendix 10 and in at the edge of the map in Figure 20 below. As this taxon may be undescribed and be of more local occurrence, it is also of conservation concern. Both *Chaetacanthus* sp. nov. and the unresolved *Plectranthus hadiensis* group taxon are illustrated in photographs in Appendix 16.

18.3. *Senecio exuberans*

Senecio exuberans occurs on a scattered basis in the study area. It is currently assessed as Endangered (Raimondo et al. 2009). It is also only known from a small area between the upper Durban escarpment to Pietermaritzburg.

It can occur both primary and degraded grassland, although less common in the latter. *Senecio* species are toxic to and avoided by cattle. Furthermore, it is a fairly robust species that appears to be fast growing. It likely can grow up where grassland is both quite frequently burned (as able to flower and fruit in the same year) but can also persist in less frequently burned grassland. Finally, it is one of the few species of conservation concern at Cato Ridge with wind-distributed seeds and it appears that plants are able to re-establish in poor grassland, when others which are not wind-distributed cannot. I am therefore more amenable to relocation of *Senecio exuberans* than other species of conservation concern, especially where small numbers have established on a more isolated basis, in degraded grassland, away from main occurrences in better quality grassland. Another factor making relocation more feasible, is my belief that it persists even in grassland not in near-natural condition, if plantings occur into this, or if propagated and planted in grassland which varies in quality condition.

A different ranking system was therefore used for *Senecio exuberans* wherein grassland scores in which condition was adjusted upwards if threatened species occurred (integrated grassland scoring – see Appendix 1). If *Senecio exuberans* occurred, the integrated score was not adjusted beyond 60% if the grassland condition was less than this, but adjusted to 100% of the benchmark where other species of conservation concern occurred.

18.4. Comments on impacts

In terms of proposed future development boundaries, proposed new cadastral divisions are envisaged to which land uses are allocated. This is overwhelmingly for various forms of light to general industry, warehousing or logistics. Exactly what form these businesses will take is unclear, given that it is in fact intended that the properties will be sold to future owners, who will develop or occupy under general parameters.

Within the grassland areas, the other uses are also in places proposed, but these occupy a small part of the grassland proposed for development, such as:

- Rural Residential - Restricted Rural Residential
- Amenity - Conservation
- Servitude - Electrical Servitude

Given that specifics are not available, and while acknowledging that micropositioning (or alternate footprint placement is possible within the proposed cadastral divisions) I proceed according to the following precautionary gapstions.

Distribution of and density of proposed cadastral divisions with light industry, warehousing or logistics use will be transforming and have higher impact than many other development types. Even with

footprint reduction and optimal placement what remains within the proposed development phases will likely be quite fragmented and management so challenged. The vegetation impact assessment per site (Phase 1 through to Phase 3) therefore proceeds according to this assumption, that within the cadastral divisions there will be limited retention of grassland in the phases, they cannot be managed as larger grassland areas may be; it is likely they will not longer form a very functional part of the grassland remaining outside the divisions.

The area which will be developed (i.e. all three phases) amounts up to 352 hectares, minus some parts already transformed. The majority is KwaZulu-Natal Sandstone Sourveld. While a greater part of the developments are focussed on the Low and Very Low herbaceous plant diversity grasslands, not all is, and it will nonetheless result in loss or fragmentation of over half of this grassland type in the study area, and much of what remains on the plateau north of the N3.

Some examples of an Endangered species (*Senecio exuberans*) are also affected and development will be brought closer to other examples or populations of species of conservation concern. Against this though, and I discuss this further, the grasslands are currently not managed, particularly in respect of limiting grazing, ensuring burning occurs only at several year intervals and controlling alien plants, some of which have proliferated to form stands in these grasslands (principally eucalypts, some pines, and *Populus x canescens* in damper parts). Unless management occurs, these grasslands do not appear to be on any trajectory towards maintenance of current plant diversity, in other words the trend will be to degrade further.

In spite of this, and following the methodology prescribed by SANBI (2020) for determining Site Ecological Importance, the majority of the proposed development area has High to Very High Site Ecological Importance ratings, expressed through the formula $SEI = BI (CI + FI) + RR$, with BI (Biodiversity Importance), comprised of Conservation Importance and Functional Integrity) plus Receptor Resilience.

This is not a real mathematical formula, but involves judgement, and how the RR value is added and affects the outcome is not well set out. The following are the guideline qualifying criteria.

Conservation importance

Very high, if:

1. Confirmed or highly likely occurrence of CR, EN, VU or Extremely Rare or Critically Rare species that have a global EOO of $< 10 \text{ km}^2$. This does not apply to the species of conservation concern within or next to the phases that are assessed (Raimondo et al. 2009) but it is perhaps disingenuous to leave an undescribed, localized endemic outside of consideration, although these are avoided and only closely contiguous to some of the development area (mainly Phase 3).
2. Any area of natural habitat of a CR ecosystem type or large area ($> 0.1\%$ of the total ecosystem type extent) of natural habitat of EN ecosystem type. Note that the term “natural habitat” is open to interpretation. In my opinion “natural habitat” is likely intended to be understood as grassland which still contains some herbaceous plant diversity (i.e. is not secondary). In a context in which little KZN Sandstone Sourveld remains in good condition, it would be disingenuous to apply this criterion only to parts in good or “natural” condition. Instead, it

would be appropriate to only exclude parts confirmed as secondary (little of the KZN Sandstone Sourveld at Cato Ridge is truly secondary, even if it might be degraded).

In respect of KZN Sandstone Sourveld and following latest data (SANBI 2022), KZN Sandstone Sourveld has an original extent of 181 274 ha, of which 14% or only approximately 25 378 ha remains. Under category 2, and if the remaining extent is only as stated, it can be said that > 0.1% of remaining grassland of this type will be affected. Against this, and without suggesting that KZN Sandstone Sourveld is not an Endangered vegetation type, I record that the remaining extent is likely larger than that stipulated by SANBI due to mapping errors (for example that the national vegetation map omits the occurrence at Cato Ridge) and there are other errors in accounting elsewhere.

High, if:

1. High Confirmed or highly likely occurrence of CR, EN, VU species that have a global EOO of > 10 km². IUCN threatened species (CR, EN, VU) must be listed under any criterion other than A. If listed as threatened only under Criterion A, including if there are less than 10 locations or < 10 000 mature individuals remaining. Senecio exuberans is in this category, listed by Raimondo et al. (2009) under Criteria EN B1ab(ii,iii,iv), although most are avoided in the current development layout.
2. Small area (> 0.01% but < 0.1% of the total ecosystem type extent) of natural habitat of EN ecosystem type or large area (> 0.1%) of natural habitat of VU ecosystem type. Certainly the case.
3. Presence of Rare species. Yes, though most are avoided and development is only closely proximate.

Functional integrity

Very high, if:

1. Very large (> 100 ha) intact area for any conservation status of ecosystem type or > 5 ha for CR ecosystem types. Answer: Yes.
2. High habitat connectivity serving as functional ecological corridors, limited road network between intact habitat patches. Answer: This is more difficult to address, but some of the Phases (such as 1 and 2) are not divided within or from each other by extensive roads, and Phase 3 not within.
3. No or minimal current negative ecological impacts with no signs of major past disturbance (e.g. ploughing). Answer: Some of the grassland still contains Moderate herbaceous species diversity Whereas I believe the grasslands are suffering significant longer-term incremental impacts in terms of grazing and localized alien plant invasion, on a year-to-year basis there is probably no steep decline and plots surveyed in 2013/2014 and rechecked in 2020 showed similar results, although not focussed in the more degraded parts. Therefore, I believe while the trend is towards deterioration, this can probably only be measured within time frames of between 5 and 10 years.

High, if:

1. High Large (> 20 ha but < 100 ha) intact area for any conservation status of ecosystem type or > 10 ha for EN ecosystem types. Answer: Yes
2. Good habitat connectivity with potentially functional ecological corridors and a regularly used road network between intact habitat patches. Answer: Yes.
3. Only minor current negative ecological impacts (e.g. few livestock utilising area) with no signs of major past disturbance (e.g. ploughing) and good rehabilitation potential. Answer: Yes and no, yes to some of the area, but overgrazing in most.

Receptor resilience

Analysis of plot-based data by Ecopulse (2022) shows poor receptor resilience but this was where there were High negative impacts, rather than Low ones (see Appendix 2). Resilience requires attachment of time scales. Over a 5-year period, where the main impacts are lower impact – grazing and inappropriate burning regimes, the losses likely under long time frames, especially as plants become less able to complete their life cycles, or do so with less fecundity. This will reflect in consistent lower than natural herbaceous plant diversity, but may appear to be stable in under 10 year time frames, as where plots were resurveyed in 2020, after first being surveyed in 2013/2014, marked differences were not found, even if the diversity scores were not always good (i.e. good neither in 2013/2014 and 2020).

Site ecological importance

Given the criteria for Site Ecological Importance, particularly for Endangered ecosystems, but taking into account uncertainty and inconsistency in addition of the Receptor Resilience criterion, SEI for most of the development phases is either High or Very High and is estimated in Appendix 12. This also has implications for assessment of impacts (i.e. if areas with High or Very High SEI are transformed, then it makes sense that impacts should also be High or Very High, negatively if they either transform such areas, but positively if they confer protection and sustainability for whatever remains, although it is difficult to be confident about the implementation of the latter at a many decade horizon.

Whatever the case, in interpreting proposed development activities, where the SEI is Very High, it is recommended there be:

- Avoidance mitigation – no destructive development activities should be considered. Offset mitigation not acceptable/not possible (i.e. last remaining populations of species, last remaining good condition patches of ecosystems/unique species assemblages). Destructive impacts for species/ecosystems where persistence target remains.

Some of this commentary is not applicable to the development phases though, as even if Very High SEI under the threshold area transformation criterion, these mainly do not constitute last good condition patches or have particularly unique species assemblages (though these do occur in the study area outside).

Where SEI is High there should be:

- Avoidance mitigation wherever possible. Minimisation mitigation – changes to project infrastructure design to limit the amount of habitat impacted; limited development activities of low impact acceptable. Offset mitigation may be required for high impact activities.

As can be seen in Appendix 12, there is a mix of mainly Very High and High SEI areas within the phases, with approaches then directed according to both options above.

If the methodology provided by Zutari (set out in Appendix 3) is followed then impacts are assessed on an overall basis as follows. Scores for construction phases may not be less than post-construction/operation. Construction carries with it risk of disturbance outside designated work areas, while operation is a period of continuous activity, which in terms of logistics and warehousing, will involve continuous ingress and egress of people, vehicles, heavy vehicles and goods.

I do not believe there are dissimilar impacts, assuming that the construction and operational phases are well managed. It is hard to imagine a feasible decommissioning scenario in terms of which hundreds of hectares of warehouses, logistics centres or buildings and other infrastructure are levelled, debris removed and natural vegetation reinstated. The possibilities are highly uncertain but could, if operations end or abandoned by owners, result in occupation or use by others not committed to environmental management, or see the proliferation of alien species post-abandonment, with increased risk to the remaining natural area. It is possible there could be localized decommissioning (such as cessation of operation by a particular business), but within a framework of extensive, surrounding similar use by many active businesses, disuse or abandonment of a single site by a one or a few businesses is not likely to be permanent situation, but result in new use or redevelopment.

Insofar as mitigation measures are concerned, these are considered to substantially align across all the phases and be applicable to all. These are addressed after the assessment of the vegetation impact of Phase 1, 2 and 3.

19. Vegetation impact: Phase 1

19.1. Introductory comment

The grassland in Phase 1 is mapped in several ways as follows:

- Forb (herbaceous plant diversity scores) emerging from plot-based surveying (Appendix 8).
- A forb diversity classification in which this is differentiated to quality bands (Appendix 9).
- Occurrences of species of conservation concern (Appendix 10).
- An integrated grassland score in which the forb diversity classification is combined with occurrence of species of conservation concern – a higher score is allocated to grassland, even if less species rich than some other instances, where such species occur (Appendix 11).

19.2. Phase 1: Species of conservation concern

The eastern part of this comprises a Natal Group sandstone plateau with extensive outcropping. Many species of conservation concern occur, which are concentrated in the yellow-shaded area in Figure 19.

As also shown in Figure 19, an exception is some occurrence of *Senecio exuberans* (Endangered), enclosed within Assmang's security perimeter/concrete palisade fence, south of the main security control point, in mostly hygrophilous grassland.

The reason for damper conditions appears to be that this is an area comprised of shallow sandy soils with sandstone just beneath. As a result, at least seasonally, the soil can remain damp for some time. Some indicator species of this are *Gnidia nodiflora* and *Lotononis solitudinis*. Hundreds if not several thousands of *Lotononis* plants occur in the Moderate condition grassland. Although not red listed, it is described by Van Wyk (1991) as rare. This composition is shared with some of the western parts of Phase 2.

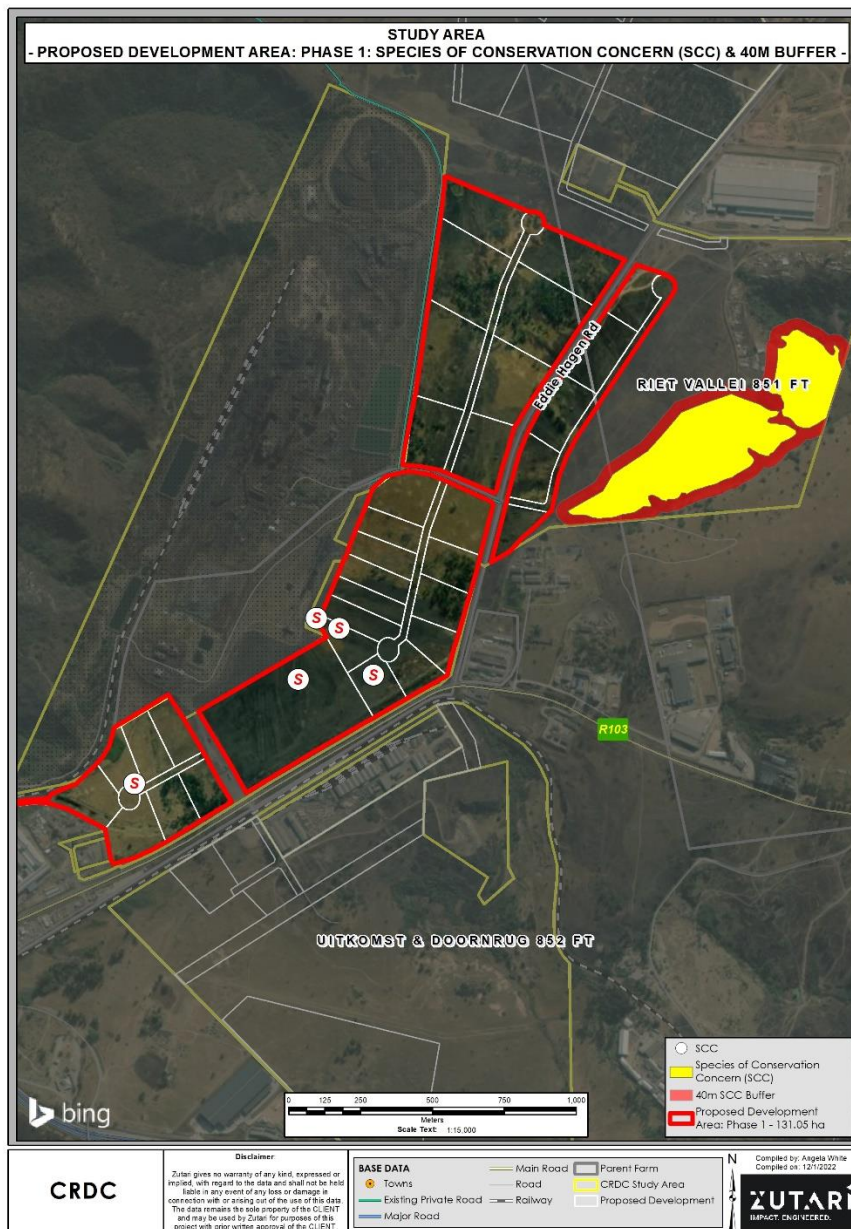


Figure 19. Phase 1: Occurrences of species of conservation concern (SCC).

The yellow-shaded area represents consolidated occurrence of all SCC species listed in Table 7, above.

At least 100 examples of *Chaetacanthus/ Dyschoriste* sp. nov. occur in the yellow-shaded area. The red-shaded area corresponds with occurrence of the majority of threatened species on this site.

S = occurrences of *Senecio exuberans* (Endangered) are an exception as some are shown outside of the yellow-shaded area. The western-most occurrence

Table 5. Threatened species mainly within the yellow area shown in Figure 19. Although some are of localized province, all have a limited distribution in KwaZulu-Natal or eastern South Africa.

Species	Red list status	Habitat	Comment
<i>Argyrolobium longifolium</i>	Vulnerable	Grassland, more often mesic than dry and more often on south- and east-facing slopes.	Yellow area shown in Figure 19.
Sensitive Species 88	Vulnerable	Grassland on Natal Group sandstone	As above, but some examples also just to the west.
<i>Cineraria atriplicifolia</i>	Vulnerable	Scrubby grassland, where rocky and on south- and east-facing aspects	Yellow area shown in Figure 19.
<i>Dierama pallidum</i>	Vulnerable	Grassland on Natal Group Sandstone and Dwyka Group tillite.	Yellow area shown in Figure 19.
<i>Eriosemopsis subanisophylla</i>	Vulnerable	Grassland on Natal Group sandstone, usually where it is rocky.	Yellow area shown in Figure 19, but some to the west.
<i>Helichrysum pannosum</i>	Endangered	Usually but not always in scrubby grassland, sometimes more open grassland.	Red-shaded area in Appendices 8 and 9, correlating with best grassland.
<i>Senecio exuberans</i>	Endangered	Grassland	Some presence in yellow-shaded area and on plateau to the west where indicated by the circled "S" in Figure 19. The westernmost occurrence needs further investigation as the grassland was moribund and material was in poor condition.
<i>Phymaspermum pinnatifidum</i>	Vulnerable	Rocky grassland, usually where soils are thin	Small presence in yellow-shaded area.

Chaetacathus/Dyschoriste sp. nov. is concentrated in the yellow-shaded area in Figure 19.

19.3. Phase 1: Protected species

A number of species protected by the KwaZulu-Natal provincial conservation ordinance occur on Phase 2, as follows. However, except for *Sensitive Species 649* (Vulnerable), *Dierama pallidum* (Vulnerable) and *Boophane disticha* (Least Concern but Declining due to medicinal exploitation), none of these species is threatened. *Sensitive Species 649* and *Dierama pallidum* occur in the yellow-shaded area of Figure 2 and are not affected by the proposed development.

Table 6. Protected species

Family	Species	Habitat
Agapanthaceae	<i>Agapanthus campanulatus</i>	Yellow area shown in Figure 19, correlating with best grassland.
Amoryllidaceae	<i>Boophane disticha</i>	All grassland, but sparse

Apocynaceae	<i>Sensitive Species 649</i>	Yellow area shown in Figure 19, correlating with best grassland.
Asphodelaceae	<i>Aloe maculata</i>	A common species
Asphodelaceae	<i>Sensitive Species 88</i>	Yellow area, correlating with best grassland, but a few just west of this.
Asphodelaceae	<i>Kniphofia laxiflora</i>	Yellow area, correlating with best grassland.
Asphodelaceae	<i>K. linearifolia</i>	Wetland vegetation below and on eastern edge of the yellow area.
Euphorbiaceae	<i>Euphorbia pulvinata</i>	Yellow area, correlating with best grassland.
Hyacinthaceae	<i>Albuca setosa</i>	Rocky grassland
Hyacinthaceae	<i>Ledebouria ovatifolia</i>	Widespread.
Hyacinthaceae	<i>Ledebouria cooperi</i>	Damp grassland on eastern edge of yellow area.
Hyacinthaceae	<i>Schizocarpus nervosus</i>	Mainly yellow area, correlating with best grassland.
Iridaceae	<i>Aristea abyssinica</i>	Grassland, widespread.
Iridaceae	<i>Aristea ecklonii</i>	Disturbed to damp grassland, not an indicator of grassland in good condition.
Iridaceae	<i>Aristea torulosa</i>	Grassland, widespread.
Iridaceae	<i>Dierama pallidum</i>	Yellow area, correlating with best grassland.
Iridaceae	<i>Freesia laxa</i> subsp. <i>laxa</i>	Yellow area, correlating with best grassland.
Iridaceae	<i>Gladiolus ecklonii</i>	Sparse but scattered.
Iridaceae	<i>Gladiolus sericeovillosus</i> subsp. <i>sericeovillosus</i>	Yellow area, correlating with best grassland.
Iridaceae	<i>Watsonia densiflora</i>	Yellow area, correlating with best grassland.
Orchidaceae	<i>Eulophia ensata</i>	Yellow area, correlating with best grassland.
Orchidaceae	<i>Eulophia hians</i> var. <i>hians</i>	Scattered but very sparse
Orchidaceae	<i>Eulophia parviflora</i>	Sterile plants seen may be this species. Scattered but very sparse.
Orchidaceae	<i>Eulophia tenella</i>	Sterile plants seen may be this species. Scattered but very sparse
Orchidaceae	<i>Satyrium longicauda</i>	Yellow area, correlating with best grassland.

19.4. Phase 1: Overall Vegetation Impact Assessment

Phase 1 contains KwaZulu-Natal Sandstone Sourveld in Good to Poor condition. On its western edge, where occurrences of *Senecio exuberans* are shown, soils appear seasonally damp and the species composition is different, including examples of *Gnidia nodiflora* and a great many of *Lotononis solitudinis*. Very large numbers of species of conservation concern, including *Chaetacanthus/Dyschoriste* sp. nov. occur in the yellow-shaded area of Figure 19, although avoided by the development.

While the proposed land-use avoids the great majority of species of conservation concern it still intrudes into some primary KwaZulu-Natal Sandstone Sourveld with Moderate to High herbaceous plant diversity. Furthermore, even the more degraded grassland is assessed as having High Site Ecological Importance, and that in better condition, Very High.

The assessment of the negative impacts are therefore High to Very High and within the impact assessment schema provided by Zutari (see Appendix 3). The negative impact is a Major impact. There is, as per the overall assessment, a similar Moderate positive impact if the balance of the grassland is

protected and managed well. A challenge in Phase 3 is that a column of unauthorized settlement has established part-way into the High to Very High herbaceous plant diversity grassland and next to the main area of occurrence of species of conservation concern. Any corridor of grassland maintained with the Phase 2 area may be at risk of being, not only an ecological corridor, but one for human movement from the settlement to Eddie Hagan Drive.

Ideally, development should avoid Moderate to High herbaceous species diversity grassland. If it cannot, offsets will be needed. For reasons given, particularly similar species assemblages occurrences of species of conservation concern, some species which are more localized endemics not present at more distant KZN Sandstone Sourveld sites, at least some of the offsetting should occur elsewhere in the Cato Ridge/Hammarsdale area (such as adding to the eThekweni Municipality's existing conservation holdings). The wider introduction of some species of conservation concern (including relocation) will need attention, particularly the possibility of doing so south of the N3. Exceptional protection and management of the remaining grassland should also occur.

20. Vegetation impact: Phase 2

20.1. Introductory comment

The grassland in Phase 2 is again mapped in several ways as follows:

- Forb (herbaceous plant diversity scores) emerging from plot-based surveying (Appendix 8).
- A forb diversity classification in which this is differentiated to quality bands (Appendix 9).
- Occurrences of species of conservation concern (Appendix 10).
- An integrated grassland score in which the forb diversity classification is combined with occurrence of species of conservation concern – a higher score is allocated to grassland, even if less species rich than some other instances, where such species occur (Appendix 11).

Phase 2 comprises a mix of KwaZulu-Natal Sandstone Sourveld in Very Low, Low and Moderate condition, insofar as herbaceous plant diversity is concerned. The proposed development area well avoids the area in which most species of conservation concern are concentrated (see Figure 20). Under criteria recommended by SANBI, because of the grassland and ecosystem type and amount proposed for transformation, the Phase 2 area nonetheless results in losses of areas with High to Very High site ecological importance.

Parts of the Phase 2 area and grassland to the west have been extensively damaged by sand-mining. The grassland is also being invaded by *Eucalyptus*, of which there are many hundreds and which occur particularly where soil has been disturbed by mining. Phase 2 appears to host a large number of cattle and be well grazed. Most of the grasses in the grassland, notwithstanding persistence of herbaceous diversity in parts, comprise unpalatable species, particularly *Aristida junciformis*. This is certainly the outcome of overgrazing.

Pachycarpus coronarius occurs as a few examples in the Phase 2 area and a little more in the excluded area. Although not assessed as as Least Concern (Raimondo et al. 2009), this assessment is likely not accurate as it is known from few (less than 10 locations), where mainly endemic to the Pondoland

Centre of Plant Endemism but extends through Highflats with the records at Cato Ridge the most northern, and the only locality known in the eThekwin Municipality Area.

Unfortunately, *Pachycarpus* species appear to be very susceptible to rapid reduction or extirpation where grazing occurs (pers. obs.), as on this plateau. It is recommended that this grassland herb be grown from seed and an attempt be made to plant a greater number in grassland which will be retained, where grazing has already reduced it to very low levels.

20.2. Phase 2: Species of conservation concern

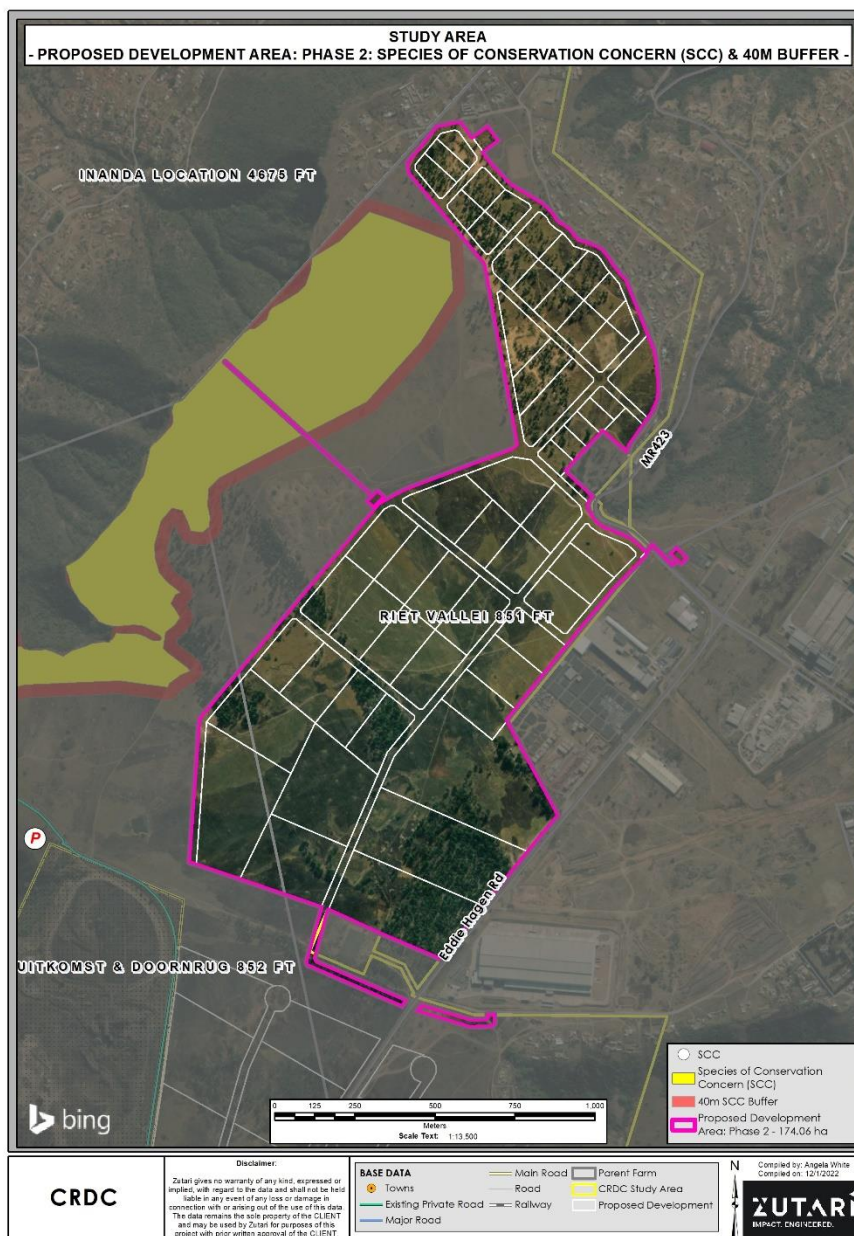


Figure 20. Distribution of species of conservation concern in Phase 2. A = *Sensitive Species 88* (Vulnerable); P = Unresolved taxon in the *Plectranthus* (*Coleus*) *hadiensis* group. Based on historical observation (2013-2015) There are also small occurrences of *Senecio exuberans* outside the red-shaded area, but they could not be relocated subsequently.

Table 7. Red listed species in and next to Phase 2. Localized endemics are indicated in **bold**.

Species	Red list status	Habitat	Comment
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<i>Sensitive Species 88</i>	<i>Vulnerable</i>	Grassland on Natal Group sandstone	Occasional, mainly in the yellow-shaded area in Figure 20.
<i>Brachystelma pulchellum</i>	Near Threatened	Grassland where soils are thin and there are Natal Group sandstone exposures.	Yellow-shaded area in Figure 20.
<i>Sensitive Species 649</i>	<i>Vulnerable</i>	Grassland on Natal Group sandstone.	Yellow-shaded area in Figure 20, where localized and in small number.
<i>Eriosemopsis subanisophylla</i>	<i>Vulnerable</i>	Grassland on Natal Group sandstone, usually where it is rocky.	Occasional in yellow-shaded area in Figure 20.
<i>Hermannia sandersonii</i>	<i>Vulnerable</i>	Grassland on Natal Group sandstone.	A few were seen in 2013 but at the time were not GPS position-recorded and they have not been relocated since. However, a small number may still occur.
<i>Senecio exuberans</i>	Endangered	Grassland on Natal Group sandstone, though also in Dwyka Group tillite grassland at Cato Ridge south of the N3.	Scattered occurrences, mainly in the yellow-shaded area but a few seen outside in years preceding the current surveying.

There are localized occurrences of *Chaetacanthus/Dyschoriste* sp. nov. in the yellow-shaded area (Figure 20), which according to known information on population sizes and distribution is assessed as a Critically Endangered under IUCN criteria, and a localized endemic. In my opinion, larger numbers should occur than are seen in the yellow-shaded area, but this grassland appears to have been exposed to overgrazing and associated over-burning impacts over a long period of time. The yellow-shaded area and all of the grassland unaffected by the Phase 2 development is also a good candidate for receiving more of these plants, if they can be cultivated and introduced in larger number.

20.3. Summary of protected species

A large number of species protected by the KwaZulu-Natal provincial conservation ordinance occur near or within Phase 2, as follows. Many are common species, or at least not threatened.

Table 8. Protected species. Those which are localized endemics are indicated in **bold**. Those only in the yellow area are avoided.

Family	Species	Habitat
Amaryllidaceae	<i>Boophone disticha</i>	All grassland, but sparse
Amaryllidaceae	<i>Cyrtanthus breviflorus</i>	Damp grassland, only seen in one place.
Apocynaceae	<i>Brachystelma pulchellum</i>	Grassland and rock outcrops yellow-shaded area (Figure 20). Avoided.
Apocynaceae	<i>Brachystelma rubellum</i>	Rocky grassland in yellow-shaded area. Avoided.
Apocynaceae	<i>Sensitive Species 649</i>	Yellow-shaded area, in small numbers (only a few seen). Avoided.

Asphodelaceae	<i>Aloe candelabrum</i>	Yellow-shaded area.
Asphodelaceae	<i>Aloe maculata</i>	Widespread but sparse
Asphodelaceae	<i>Sensitive Species 88</i>	Mainly in the yellow-shaded area, but a few may occur outside.
Hyacinthaceae	<i>Albuca setosa</i>	Grassland in yellow-shaded area. Avoided.
Hyacinthaceae	<i>Dipcadi</i> sp.	Scattered in all grassland
Hyacinthaceae	<i>Eucomis autumnalis</i>	Grassland in yellow-shaded area, possibly a few examples outside.
Hyacinthaceae	<i>Ledebouria apertiflora</i>	Grassland in yellow-shaded area.
Hyacinthaceae	<i>Ledebouria ovatifolia</i>	Widespread. Flat-growing habit and larger bulb mean it can persist even in disturbed and heavily grazed grassland.
Hyacinthaceae	<i>Ledebouria cooperi</i>	Damp grassland outside the yellow-shaded area (i.e. in the Phase 2 development area)
Hyacinthaceae	<i>Litanthus pusillus</i> (also called <i>Drimia uniflora</i>)	Rock exposures in grassland, yellow-shaded area.
Hyacinthaceae	<i>Merwillia plumbea</i>	Rocky grassland, yellow-shaded area.
Hyacinthaceae	<i>Schizocarpus nervosus</i>	Widespread but sparse, but mainly in the yellow-shaded area.
Iridaceae	<i>Aristea abyssinica</i>	Widespread
Iridaceae	<i>Aristea ecklonii</i>	Widespread, a ruderal species.
Iridaceae	<i>Aristea torulosa</i>	Mainly in the yellow-shaded area.
Iridaceae	<i>Freesia laxa</i> subsp. <i>laxa</i>	Widespread
Iridaceae	<i>Gladiolus inandensis</i>	Yellow-shaded area.
Iridaceae	<i>Gladiolus sericeovillosus</i> subsp. <i>sericeovillosus</i>	Damp grassland outside the yellow-shaded area (i.e. in the Phase 2 development area)
Iridaceae	<i>Moraea natalensis</i>	Yellow-shaded area.
Orchidaceae	<i>Eulophia clitellifera</i>	Widespread but sparse
Orchidaceae	<i>Eulophia tenella</i>	Widespread but sparse

20.4. Phase 2: Overall vegetation impact assessment

Phase 2 contains KwaZulu-Natal Sandstone Sourveld in Very Poor to Moderate condition. A large part of the Phase 2 area appears seasonally damp and the species composition is different, including again as in damp grassland in Phase 1, *Gnidia nodiflora* and a great many *Lotononis solitudinis*. Large numbers of species of conservation concern, including *Chaetacanthus* sp. nov., occur in the yellow-shaded area of Figure 20, where avoided by the development.

The proposed land use avoids the great majority of species of conservation concern but still intrudes into some primary KwaZulu-Natal Sandstone Sourveld with Moderate herbaceous plant diversity. Furthermore, given that the grassland is an Endangered ecosystem and type, and especially given that a large amount is proposed for development, even the more degraded instances are assessed as having High Site Ecological Importance, and that in better condition, Very High.

The assessment of the negative impacts is as for Phase 1 therefore High to Very High and within the impact assessment schema provided by Zutari (see Appendix 3), the negative impact is a Major

impact. There is, as per the overall assessment, a similar Moderate positive impact if the balance of the grassland is protected and managed well.

Ideally, development should avoid Moderate herbaceous species diversity grassland. If it cannot, as for Phase 1, offsets will be needed. For reasons given already, at least some of the offsetting should be elsewhere in the Cato Ridge/Hammarsdale area (such as adding to the eThekweni Municipality's existing conservation holdings). The wider or increased introduction of some species of conservation concern (including relocation) will need attention, including into yellow-shaded area of Figure 20 and the grassland west of that which will not be developed. Candidates are *Chaetacanthus/Dyschoriste* sp. nov., *Pachycarpus coronarius* and *Senecio exuberans*. The possibility of introductions into KZN Sandstone Sourveld Grassland south of the N3 should also be investigated and if possible achieved. Exceptional protection and management of the remaining grassland should also occur, including complete exclusion of livestock.

21. Vegetation impact assessment: Phase 3

21.1. Introductory comment

The grassland in Phase 3 is again mapped in several ways as follows:

- Forb (herbaceous plant diversity scores) emerging from plot-based surveying (Appendix 8).
- A forb diversity classification in which this is differentiated to quality bands (Appendix 9).
- Occurrences of species of conservation concern (Appendix 10).
- An integrated grassland score in which the forb diversity classification is combined with occurrence of species of conservation concern – a higher score is allocated to grassland, even if less species rich than some other instances, where such species occur (Appendix 11).

The vegetation in the Phase 3 development area comprises a mix of KwaZulu-Natal Sandstone Sourveld in mainly Low but a small amount Moderate condition, some of which is also damp. It also includes transformed areas.

This area has also been quite extensively damaged by unauthorized sand-mining and there does not appear to be a patrol presence to prevent this recurring, though an attempt has been made to block vehicular access. Parts are being invaded by alien species, including *Acacia mearnsii* (Black Wattle), *Eucalyptus*, and especially expanding groves of *Populus x canescens* in wetland areas or where soil is damp. A large diversity of other alien species occurs where soil has been disturbed by sand-mining, particularly in and around wetland areas. There is also some disturbance and establishment of alien invasive species along the boundaries of contiguous industrial developments, particularly *Lantana camara*.

Phase 3 hosts heavy grazing. I have on occasion seen over 100 animals in this grassland, and while this does not occur every day, it does quite regularly, as I have often seen a large number of animals in it when driving the N3 national road between Durban and Pietermaritzburg in recent years. It is also my opinion, that unless the amount of grazing is relieved, the grassland will deteriorate further, even if species of conservation concern are able to persist around rock outcrops.

There are a small number of occurrences of *Senecio exuberans* in the Phase 3 area, which may have established from larger numbers in better grassland beyond.

20.2. Phase 3: Wetland vegetation

Although avoided by Phase 3, but in close proximity, some of the wetland vegetation is still in good condition and the species presence and composition is unusual in the eThekweni Municipal Area, where most wetland and particularly the vegetation component have been degraded and either transformed or transformed from natural condition to a few robust, disturbance-tolerant species.

The following are typical species:

- *Phragmites australis* (Common Reed);
- Robust Cyperaceae (sedges), most notably *Cyperus latifolius*, also often forming stands or part of beds mixed with *Phragmites australis* and *Typha capensis*;
- Hygrophytic and damp-substrate grasses, particularly *Arundinella nepalensis*, *Imperata cylindrica* (wetland margins), *Miscanthus ecklonii* and *Setaria sphacelata* subsp. *sericea*;
- Many smaller Cyperaceae;
- Flanking wet or damp grassland and scrubland, the following wetland herbs occur:
 - *Crassocephalum picridifolium*
 - *Cyclosorus interruptus* (fern)
 - *Dissotis canescens*
 - *Dissotis princeps*
 - *Geranium flanaganii*
 - *Ludwigia octovalvis*
 - *Helichrysum natalitium*
 - *Helichrysum stenopterum*
 - *Ludwigia octovalvis*
 - *Monopsis stellarioides*
 - *Pycnostachys reticulata*
 - *Ranunculus multifidus*
 - *Senecio gregatus*
 - *Utricularia* sp.

The small herbs *Linderia nana* and *Rotala tenella* are not considered threatened (Raimondo et al. 2009) but are very uncommon, certainly in KwaZulu-Natal. Although not threatened at a national level, *Nesaea sagittifolia* var. *sagittifolia* is a very unusual species for the eThekweni Municipal Area and I have never seen it elsewhere except in the wetland area beneath Phase 3. *Gunnera perpensa* is a rather rare species in the eThekweni Municipal Area (and in the KwaZulu-Natal semi-coastal area), but large numbers occur. Large numbers of *Kniphofia linearifolia* also occur.

21.3. Phase 3: Species of conservation concern

Grassland close to Phase 3 hosts a number of species of conservation concern, however, these are avoided except for a few instances of *Senecio exuberans*.

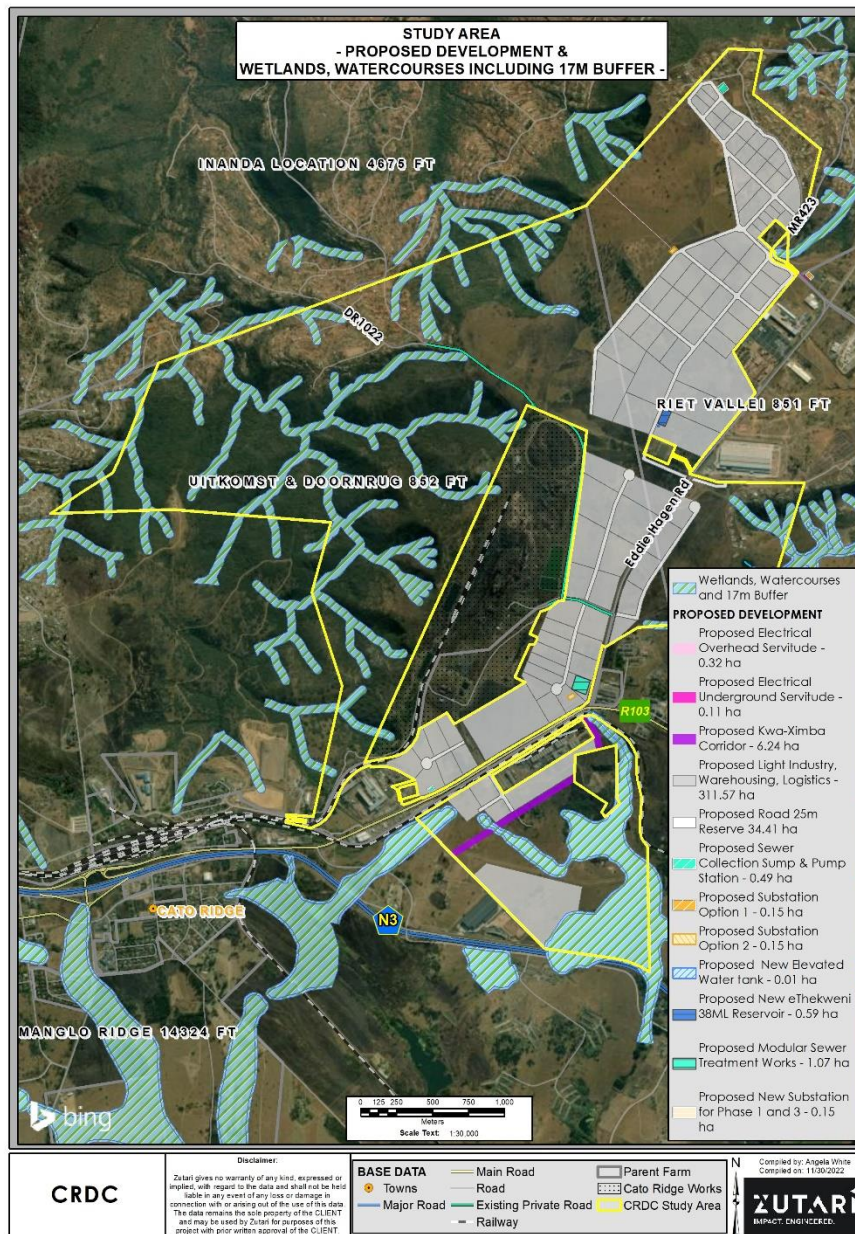


Figure 21. Although this map shows occurrence of wetland areas in all phases, it can be seen that the Phase 3 part of the development contains large wetland areas, with wetland vegetation comprising parts severely disturbed by sand-mining, in near-natural condition and damp to hygrophilous KwaZulu-Natal Sandstone Sourveld, with some modification in species composition where wetland conditions are strongly evident.

Table 9. Species of conservation concern in or close to Phase 3. These are however, with the exception of a few examples of *Senecio exuberans* and perhaps some examples of *Chaetacanthus/Dyschoriste* sp. nov. on the boundary, avoided.

Species	Red list status	Habitat	Comment
<i>Sensitive Species 88</i>	Vulnerable	Rocky grassland usually on Natal Group sandstone	There are likely more plants than the few seen as this is an extremely inconspicuous species when not in flower.

<i>Sensitive Species 649</i>	Vulnerable	Grassland on Natal Group sandstone. Away from Cato Ridge in sandy soils along the coastal littoral.	This species is usually encountered on the coastal littoral, but extends unusually inland on Natal Group sandstone soils to Cato Ridge. A few plants (c. 3 seen, but this is not a very conspicuous species and there are likely a few more).
<i>Eriosemopsis subanisophylla</i>	Vulnerable	Grassland on Natal Group sandstone, usually where it is rocky.	Widespread but sparse in all Moderate condition KwaZulu-Natal Sandstone Sourveld.
<i>Helichrysum pannosum</i>	Endangered	Usually but not always in scrubby grassland, sometimes more open grassland.	KwaZulu-Natal Sandstone Sourveld where scrubby. This species may be threatened but is not in my opinion Endangered as I see it quite frequently in both KwaZulu-Natal Sandstone Sourveld and in some Dry and Moist Coast Hinterland Grassland. It is most likely considered rare as it flowers in the early winter when few herbarium collections are likely to be made.
<i>Senecio exuberans</i>	Endangered	Widespread and scattered.	All Moderate condition grassland but has also (re-)established in some Poor Grassland. This species is fairly robust and prefers scrubbier grassland, fruits are wind dispersed and so able to percolate from better quality grassland to germinate and grow in more degraded grassland which has not been disturbed for some time.

Other species of conservation concern: Several hundred examples at least of *Chaetacanthus/Dyschoriste* sp. nov. occur. *Delosperma suttoniae* is a very poorly known species which is endemic to KwaZulu-Natal where known from few collections and has a DDT status in the national red list. However, it is my opinion a distinct species.

Like *Chaetacanthus/Dyschoriste* sp. nov., it occurs in thin to skeletal soils upon or next to Natal Group sandstone rock outcropping and so the species co-occur. It has bright pink flowers and a trailing habitat and co-occurs with *D. lineare* which also occurs on the site, but usually has white flowers (which may be slightly pink-tinged), and has more erect stems with narrower leaves.

These occurrences are avoided by the proposed development (Phase 3), however the populations will then be quite tightly enclosed by development.

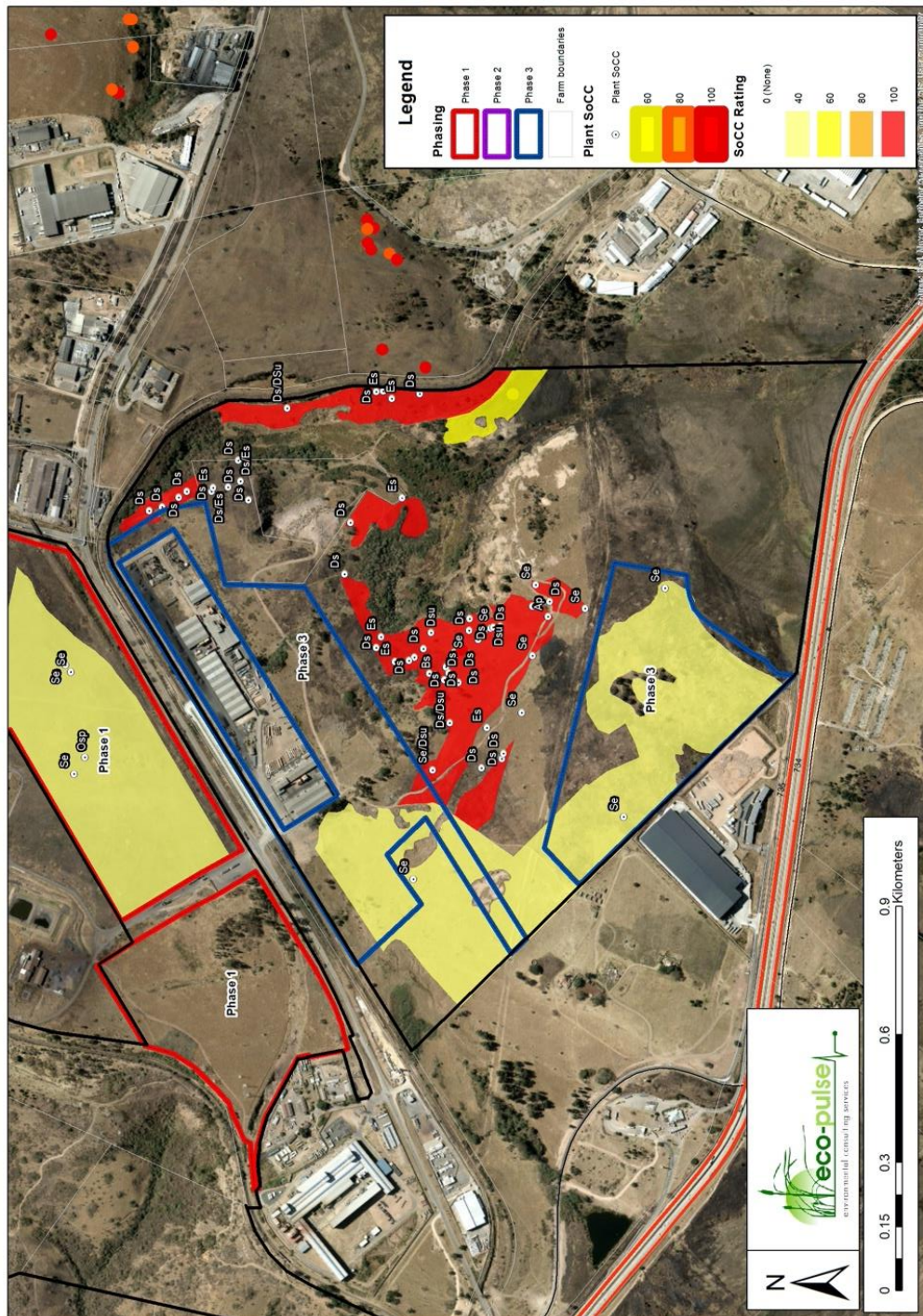


Figure 22. Red-shaded areas show closely contiguous occurrences of some hundreds of *Chaetacanthus/Dyschoriste* sp. nov., *Delosperma suttoniae* (DDT and a rare KwaZulu-Natal endemic) and *Eriosemopsis subanisophylla* (Vulnerable). Less common occurrences are: A = *Sensitive Species 88* (Vulnerable, which is very inconspicuous and of which there are certainly more than shown); B = several *Sensitive Species 649* (Vulnerable); S = *Senecio exuberans* (Endangered) occurs mainly in the yellow-shaded area, but there are a few scattered occurrences outside this area, in more degraded grassland. The portion within Phase 3 comprise only a few examples of *Senecio exuberans*, with occurrences of *Chaetacanthus/Dyschoriste* sp. nov. on the boundary or not buffered.

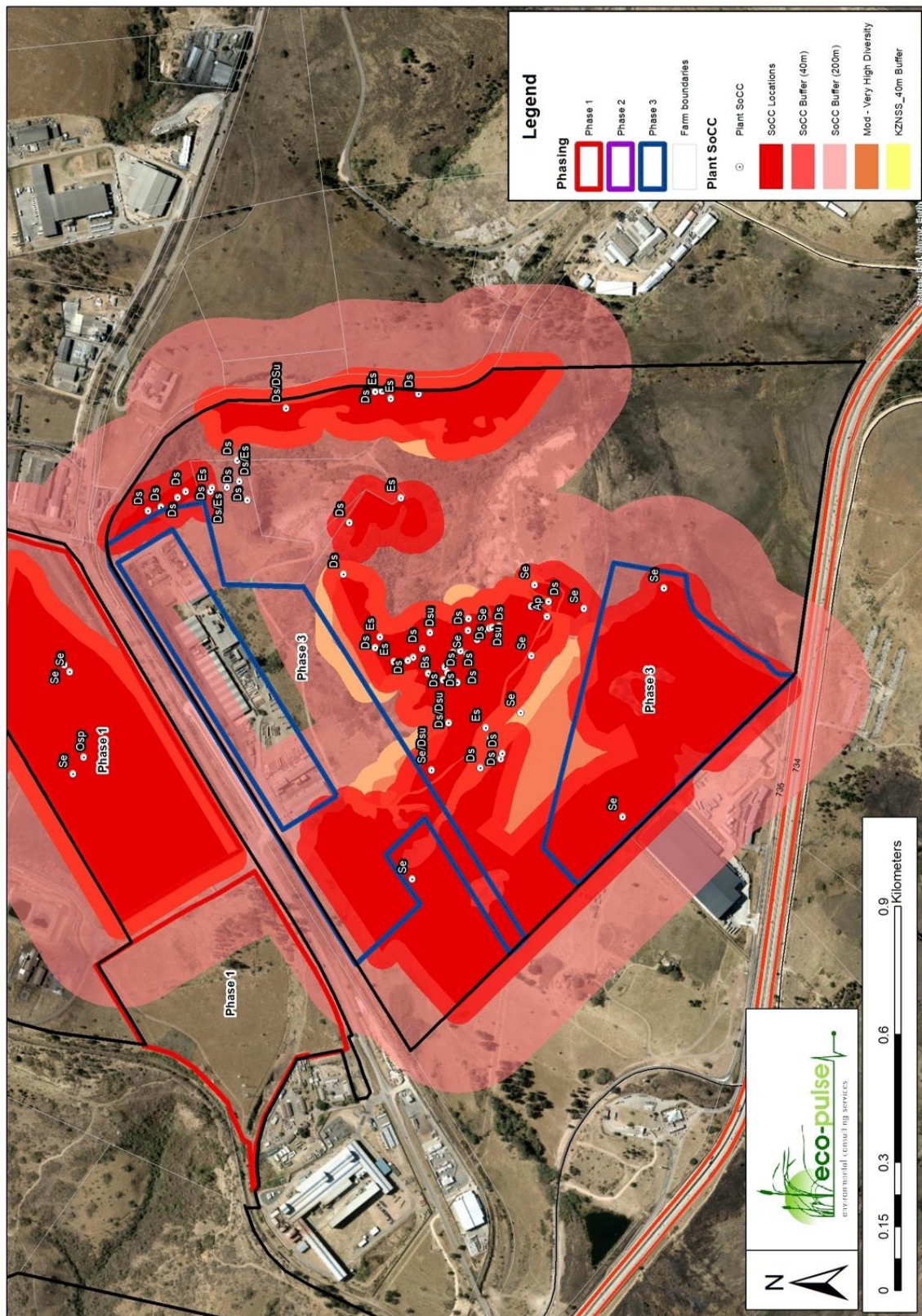


Figure 23. Illustrative buffers on species of conservation concern. Note that I have expressed the view, which I have explained, that relocation of more isolated examples of *Senecio exuberans* are more acceptable, particularly where they occur in more degraded grassland. However, the main occurrence of species of conservation concern is nonetheless well evident.

21.4. Phase 3: Protected species

A number of species protected by the KwaZulu-Natal provincial conservation ordinance occur near on Phase 3, as follows. However, except for *Sensitive Species 649* (Vulnerable) and *Boophone disticha* (Least Concern but Declining due to medicinal exploitation), none of these species is threatened.

Table 10. Protected species on or next to Phase 3.

Family	Species	Habitat
Amaryllidaceae	<i>Boophone disticha</i>	All grassland, but sparse
Amaryllidaceae	<i>Cyrtanthus breviflorus</i>	Damp grassland.
Apocynaceae	<i>Sensitive Species 649</i>	Rocky grassland. Avoided.
Asphodelaceae	<i>Aloe maculata</i>	A common species
Asphodelaceae	<i>Kniphofia linearifolia</i>	Wetland vegetation, avoided.
Euphorbiaceae	<i>Euphorbia pulvinata</i>	Rocky grassland, avoided.
Hyacinthaceae	<i>Albuca setosa</i>	Rocky grassland
Hyacinthaceae	<i>Ledebouria ovatifolia</i>	Grassland. Widespread.
Hyacinthaceae	<i>Ledebouria cooperi</i>	Widespread in damp grassland flanking wetlands. Some possibly affected.
Hyacinthaceae	<i>Schizocarpus nervosus</i>	Avoided.
Iridaceae	<i>Aristea abyssinica</i>	Grassland
Iridaceae	<i>Aristea ecklonii</i>	Disturbed to damp grassland
Iridaceae	<i>Aristea torulosa</i>	Grassland
Iridaceae	<i>Freesia laxa</i> subsp. <i>laxa</i>	Avoided
Iridaceae	<i>Gladiolus ecklonii</i>	Avoided
Iridaceae	<i>Gladiolus sericeovillosus</i> subsp. <i>sericeovillosus</i>	Avoided
Orchidaceae	<i>Disa brevicornis</i>	Avoided
Orchidaceae	<i>Eulophia ensata</i>	Avoided
Orchidaceae	<i>Eulophia hians</i> var. <i>hians</i>	Avoided
Orchidaceae	<i>Eulophia parviflora</i>	Avoided
Orchidaceae	<i>Eulophia tenella</i>	Avoided
Orchidaceae	<i>Habenaria dives</i>	Avoided
Orchidaceae	<i>Satyrium longicauda</i>	Avoided

21.5. Phase 3: Overall vegetation impact assessment

Phase 3 contains KwaZulu-Natal Sandstone Sourveld, with a large part of this damp, and transforming into what is shown as wetland in Figure 22, and where this is wetland, avoided.

The proposed development area occupies some grassland assessed as containing Moderate herbaceous plant diversity, though most is within Low herbaceous plant diversity parts which are degraded. The development area is not well buffered from Moderate diversity grassland. It also encroaches into the area, or at least is on the boundary of some examples of *Chaetacanthus/ Dyschoriste* sp. nov. and *Senecio exuberans*, but the main occurrence of *Chaetacanthus/ Dyschoriste* sp. nov. and other species of conservation concern are situated further away.

The main population (at least several hundred plants) of *Chaetacanthus/ Dyschoriste* sp. nov. will be quite tightly embraced by development. This species often co-occurs with *Delosperma suttoniae* and more scattered *Eriosemopsis subanisophylla* (Vulnerable), often where rock outcropping is more conspicuous and certainly where soils are shallow.

The proposed land-use does avoid the great majority of species of conservation concern, but not all, and brings development very close to these. Illustrative buffers are provided in Appendix 16 and if applied uniformly would subtract from a large part of the proposed development area.

As with the other phases, the assessment of the negative impacts is as for Phase 1 therefore High to Very High and within the impact assessment schema provided by Zutari (see Appendix 3), the negative impact is a Major impact. Insofar as a positive impact is concerned, this is Moderate if the balance of the grassland is protected and managed well. The Moderate positive impact could be rated as higher, with confidence that protection and management would be sustained over many decades. This is because the Phase 3 area and its surrounds appear to experience heavy grazing, sand-mining damage and expanding alien plant invasion. However, even if such a Moderate positive impact could occur, the overall negative impact remains Major, due to the loss of a large amount of the grassland.

Ideally, development should avoid Moderate herbaceous species diversity grassland and it would be better to apply buffers to the entire population of *Chaetacanthus/ Dyschoriste* sp. nov. If this cannot occur, then it becomes even more important as part of the mitigation, including any offsetting, to cultivate *Chaetacanthus/ Dyschoriste* sp. nov. and *Senecio exuberans* and plant these back in greater number, especially any remaining Low herbaceous diversity grassland from which likely eliminated through the negative impacts described.

While not deprecating the need to traverse the mitigation hierarchy set out in the draft national offset policy and the challenges the development faces overall in this regard, I see offsets as an important condition, if the Phase 3 development, as the other phases, is able to navigate through this. Again, at least some of the offsetting would, on a good practice basis, need to be elsewhere in the Cato Ridge/Hammarsdale area (such as adding to the eThekweni Municipality's existing conservation holdings).

22. Mitigations

Mitigations are considered to be similar across all phases, except insofar as specifically commented separately. Offsetting is an essential part of mitigation, unless a small amount of degraded grassland is affected, which is not the case.

Any loss of grassland should result from development that enables the overall conservation management of remaining grassland and wetland vegetation on an ongoing basis. In my view, given the amount of grassland proposed for transformation, the protection and management of what remains must be exceptional and sustained. For this to be achieved, the following actions will need to be integrated into the management of on-site conservation areas:

- Restrict access to management or bone fide conservation activities. This will likely need some fencing (which will need to be maintained) and placing of vehicular obstructions as needed.
- Prevent and deter the relentless assault on the grasslands by sand-miners, which I personally witnessed occur on a number of occasions, and by multiple actors in the course of only one day of surveying in the Phase 2 area, notwithstanding a security response which resulted in some arrests. A regular and even greater security and patrol presence is needed.
- The number of cattle in seen in the Phase 2 and 3 areas seems to be very large and the grasslands are overgrazed, indicated by often less than natural level of species diversity. I am not sympathetic to proposals involving allowance of limited or “sustainable” grazing. Current grazing assessment methods do not well address the issue of overall plant diversity maintenance, particularly the herbaceous component. In practice, there will always be efforts to press beyond what is allowed and consequently with enforcement. In my opinion, a policy of exclusion must be followed.
- A comprehensive system of firebreaks will need to be set in place, to prevent attempts to set fires at annual frequency. Burning should not occur more than once every two years, and it should also not be omitted for more than three years.
- Alien plant invasions must be eradicated, particularly by *Acacia mearnsii* (Black Wattle), eucalypts and pines, as well as what are sometimes quite significant *Populus x canescens* infestations in damp grassland, and *Lantana camara* thickets.
- Prevention of medicinal collection and digging out of plants.
- There is the possibility of some small scale percolation of waste or litter beyond development boundaries, and clean-ups must occur as necessary.

The mechanism by which this must be achieved requires convincing formulation. It must enable sufficient and permanent resourcing of all the measures above. In addition, for development areas there should be relocation of any affected species of conservation concern identified in this report. A vegetation specialist familiar with the species concerned will need to be involved throughout this process to ensure relocation to optimal areas. Relocation should also not cause more than minor disturbance in grassland in good condition, or disturb ground next to other species of conservation concern.

Plant rescue must occur. This is a requirement for an species of conservation concern within or as close to 20 metres from the footprints. Plants in this category must be relocated to other suitable habitat outside of the development footprints. There is a considerable amount of suitable habitat, particularly in the Phase 2 area.

A relocation plan must be formulated as a condition of development which should address all of the following, and there is no reason for the CRDC not to proceed with formulation this and planning for relocation post environmental authorization at this stage. The relocation plan should:

- Identify particular species involved;
- Numbers;
- Mapping to illustrate occurrences;
- Seasonal or other limitations;

- Relocation methodology;
- Relocation methodology to include maintenance (watering).
- Descriptions of specific species-related habitat requirements;
- Mapping to show the relocation areas in which this habitat occurs;
- Monitoring of plants, post-relocation.

Compilation of such a plan will require involvement of a knowledgeable botanist. Seasonality must also be taken into account. Relocation should preferably occur in the summer months, in order to aid maximum survival. Many species are only visible in the summer. For example, Sensitive Species 88 is hard to see until it flowers in the late summer. *Senecio exuberans* is also only conspicuous from about December when plants are growing up. Relocations (excavations), reseating, any growing on in a nursery and maintenance should be carried out by an experienced contractor (i.e. a person or agency who has in fact successfully relocated wild plants before), with due care and with capacity to do so at the scale identified. Capacity includes the maintenance aspects and may require use of a water-cart.

At the same time it is unreasonable to expect many returns and iterative excavations and relocations. There should be an initial comprehensive sweep in the summer, This should involve searching of development areas by a botanist with field experience of the species involved and mapping and marking of the instances, which should then be relocated. If time allows this exercise should occur again in the later summer when some further species of conservation concern are more visible. If plants are only found at the end of the summer or are in poor condition (as they may then be dying back), they should be grown overwinter in a nursery to be planted out the next summer.

The issue of KwaZulu-Natal provincial conservation ordinance specially protected plants is addressed here. There is a legal requirement to obtain a permit for disturbance, destruction or relocation of such species. However, the current list of specially protected plants was formulated many decades ago and is very outdated. The approach appears to have been to protect entire families, groups or genera containing species which were at that time (and in fact still are) desirable to private, commercial or medicinal collectors.

However, such a blanket approach targets many common species, which are not in any way threatened. In my opinion, while a permit must be obtained for specially protected species, subject to permit conditions, relocating common species or those which are not unusual, rare or threatened may be considered desirable, but is not required. The relocation focus should be primarily on species of conservation concern that are identified in this report.

The following recommendation is also made, which can be considered a mitigation for destruction of some habitat and to secure future persistence. There are three species of conservation concern which can be cultivated and introduced into remaining grassland in greater numbers, including some of the more degraded remaining grassland. These include:

- *Chaetacanthus/Dyschoriste* sp. nov. Members of this family can usually be grown by cutting under proper nursery conditions. This may require use of heating beds and misting.
- The population of *Pachycarpus coronarius* on the plateau has been reduced to a small number of scattered plants, including the Phase 2 development area. Many members of this family

have deep but fragile underground organs that make it difficult to excavate them intact. If broken plants die. They are probably difficult to relocate. Introduction of more requires harvesting of seed and planting of grown-on plants, which in turn means that flowering plants will need to be identified, and that they cannot be grazed or grassland burned until follicles are ripe. They should then be easy to grow from seed but probably need to be planted early into deep bags of a well-drained medium or into grassland. They are also winter deciduous or partly deciduous, and cultivated plants likely rot easily in response to overwatering, particularly during the winter months when dormant. Specialist growing advice will be essential.

- *Senecio exuberans* should be easy to grow from seed, or at least there is a sufficiency of plants and flowering (and fruiting) material through the plateau grasslands to enable the growing of hundreds. Plants will likely do well and develop rapidly under nursery conditions, and will probably also do well after planting out.

If such a nursery operation is established or contracted to a specialist grower, it may also be possible to grow other species of conservation concern at Cato Ridge, so long as this involves only harvesting of a sustainable amount of seed. Some comments are made on establishment of these species south of the N3 national road.

- There is a very small population of *Chaetacanthus/Dyschoriste* sp. nov. just south of the N3. The population then seems to come to a stop. There appears to be a narrowing of the occurrence of Natal Group sandstone and may not have enough intervening shallow, sandy soil to enable expansion of the population beyond. Further south of the N3, the eThekweni Municipality has acquired property for conservation which appears to be ideal habitat. I believe it would be a very good idea to introduce what appears to be a highly threatened, likely KZN Sandstone Sourveld endemic, into this habitat though this will need to occur with the Municipality's involvement and consent.
- The population of *Pachycarpus coronarius* south of the N3 is also small, likely because of their susceptibility to grazing and being amongst the first species to reduce once livestock are introduced. It would be worthwhile also establishing a larger population of *Pachycarpus coronarius* south of the N3, if possible.
- Similarly, the population of *Senecio exuberans* can also be increased south of the N3. As this species appears to tolerate a modicum of disturbance, and are toxic to livestock, there are a number of potential receiving sites.

If this could occur, it would be possible to increase rather than decrease the populations of these plants at Cato Ridge, notwithstanding the amount of development proposed north of the N3. I also note that although not KZN Sandstone Sourveld, there is a large amount of Eastern Valley Bushveld in the study area, beyond the development phases. Some is in good condition and likely hosts the Critically Endangered climber *Adenia natalensis*. However, some is disturbed especially in the interface and near the boundaries of the Assmang Cato Ridge Works operation, and is quite invaded by alien plants (see Appendix 6). Alien plant control work would greatly benefit this part. There appears to be ongoing unauthorized encroachment into the Eastern Valley Bushveld by informal settlement, which reduces it and causes disturbance and greater alien plant establishment in the interface. This unauthorized settlement should be brought to an end.

23. Impact assessment – All Phases

The following Table provides a summary of the impacts described in Section 18.

Table 11: Impact Assessment summary. (N = Negative; P = Positive)

ACTIVITY	POTENTIAL ENVIRONMENTAL IMPACT	APPLICABLE AREA OF INFLUENCE	SIGNIFICANCE PRE-MITIGATION							SUMMARY OF MITIGATION MEASURES							SIGNIFICANCE POST-MITIGATION						
Description of proposed land use/ activity/ aspect	Summary description of the impact		Results of application of impact assessment							Mitigation measures							Results of application of impact assessment						
			INTENSITY	DURATION	EXTENT	PROBABILITY	TOTAL	STATUS	SIGNIFICANCE								INTENSITY	DURATION	EXTENT	PROBABILITY	TOTAL	STATUS	SIGNIFICANCE

Phase 1: Clearing vegetation and associated disturbance of vegetation related to the development of the footprint	Destruction or transformation of an Endangered vegetation type	Phase 1	7	7	3	7	119	Neg	Major-Negative	Improved protection and management of vegetation in undeveloped areas: •Fence the undeveloped areas and establish effective access controls. Police the sites, focussed on the undeveloped areas, to prevent illegal access impacts (grazing, sand mining, dumping, medicinal plant collection, etc) •Prevent cattle accessing the undeveloped areas/conservation areas. •Firebreaks and fire management. Grassland to burn every second year. •Eradicate all aliens, particularly by <i>Acacia mearnsii</i> (Black Wattle), eucalypts and pines, as well as what are sometimes quite significant <i>Populus x canescens</i> infestations in damp grassland, and <i>Lantana camara</i> thickets. •Relocate any species of conservation concern and other conservation important species out of development footprint/ disturbance areas into other suitable habitat, either in KwaZulu-Natal Sandstone Sourveld on CRDC land which will never be developed, or to other development-protected/ conservation-secure sites in the eThekwnini Municipal Area. Disturbance area are likely to be at least within 20 metres of footprint areas. A relocation plan must be formulated as a condition of development.	7	7	3	7	119	Neg	Major Negative *
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Phase 2: Clearing vegetation and associated disturbance of vegetation related to the development of the footprint	Destruction or transformation of an Endangered vegetation type	Phase 2	7	7	3	7	119	Neg	Major-Negative	• Fence the undeveloped areas and establish effective access controls. Police the sites, focussed on the undeveloped areas, to prevent illegal access impacts (grazing, sand mining, dumping, medicinal plant collection, etc) • Prevent cattle accessing the undeveloped areas/ conservation areas. • Firebreaks and fire management. Grassland to burn every second year. • Eradicate all aliens, particularly by <i>Acacia mearnsii</i> (Black Wattle), eucalypts and pines, as well as what are sometimes quite significant <i>Populus x canescens</i> infestations in damp grassland, and <i>Lantana camara</i> thickets. • Relocate any species of conservation concern and other conservation important species out of development footprint/ disturbance areas into other suitable habitat, either in KwaZulu-Natal Sandstone Sourveld on CRDC land which will never be developed, or to other development-protected/ conservation-secure sites in the eThekwnini Municipal Area. Disturbance area are likely to be at least within 20 metres of footprint areas. A relocation plan must be formulated as a condition of development.	7	7	3	7	119	Neg	Major-Negative
Phase 3: Clearing vegetation and associated disturbance of vegetation related to the development of the footprint	Destruction or transformation of an Endangered vegetation type	Phase 3	7	7	3	7	119	Neg	Major-Negative	• Fence the undeveloped areas and establish effective access controls. Police the sites, focussed on the undeveloped areas, to prevent illegal access impacts (grazing, sand mining, dumping, medicinal plant collection, etc) • Prevent cattle accessing the undeveloped areas/conservation areas. • Firebreaks and fire management. Grassland to burn every second year. • Eradicate all aliens, particularly by <i>Acacia mearnsii</i> (Black Wattle), eucalypts and pines, as well as what are sometimes quite significant <i>Populus x canescens</i> infestations in damp grassland, and <i>Lantana camara</i> thickets. • Relocate any species of conservation concern and other conservation important species out of development footprint/ disturbance areas into other suitable habitat, either in KwaZulu-Natal Sandstone Sourveld on CRDC land which will never be developed, or to other development-protected/ conservation-secure sites in the eThekwnini Municipal Area. Disturbance area are likely to be at least within 20 metres of footprint areas. A relocation plan must be formulated as a condition of development.	7	7	3	7	119	Neg	Major-Negative

I am asked also to express an opinion on the confidence of the assessment. In the case of direct negative impacts and the certainty that a large amount of grassland will be transformed, this is high: "Substantive supportive data or evidence exists to verify the assessment." For direct positive impacts, this is medium: "Determination is based on common sense and general knowledge. The assumptions made, whilst having a degree of uncertainty, are fairly robust."

24. Cumulative impacts – All Phases

There are also cumulative impacts, which in addition to all other impacts, including edge effects such as disturbance or increased alien plant presence along footprint edges, which are amplified if combined with increased grazing pressure as a result of similar numbers of animals concentrated in smaller grassland areas (when exclusion is instead the future management recommendation). Fragmentation and reduction of connectivity between remaining grassland patches may have some effects on the sustainability of plant biodiversity, although it must be mentioned that grasslands in and around the phases are already separated by substantial roads and corridors depicted are likely more valuable for faunal movement than dispersal of fruits or seeds between grasslands within or around the phases.

In order to reduce negative cumulative impacts, development must be encapsulated within effective boundaries, access provided only through built access points, with no percolation of waste or materials beyond footprints into grassland retained beyond, and clean-up if this occurs. There will be long-term positive cumulative impacts if sand-miners, unauthorized persons or cattle are prevented from accessing retained natural areas, alien plants are eradicated, and grassland is burned regularly but not annually. With regard to these more indirect and cumulative impacts, confidence is lower: "Judgement is based on intuition, and some major assumptions are used to assess the impact that may prove untrue."

Phase 3, dealt with further below, also includes an extensive wetland area with flanking hygrophilous grassland, and so the current hydrological conditions will need to be maintained in currently hygrophilous grassland or wetland vegetation which is excluded.

Table 12: Cumulative Impact Assessment summary (N = Negative; P = Positive)

ACTIVITY	POTENTIAL ENVIRONMENTAL IMPACT	APPLICABLE AREA OF INFLUENCE	SIGNIFICANCE PRE-MITIGATION							SUMMARY OF MITIGATION MEASURES	SIGNIFICANCE POST-MITIGATION						
Description of proposed land use/ activity/ aspect	Summary description of the impact	All phases	Results of application of impact assessment							Outline of recommended mitigation measures	Results of application of impact assessment						
			INTENSITY	DURATION	EXTENT	PROBABILITY	TOTAL	STATUS (POS/ NEG)	SIGNIFICANCE		INTENSITY	DURATION	EXTENT	PROBABILITY	TOTAL	STATUS (POS/ NEG)	SIGNIFICANCE
All Phases: Clearing vegetation and associated disturbance of vegetation related to the development of the footprint	Cumulative destruction or transformation of an Endangered vegetation type		7	7	3	7	119	N	Major-Negative	Exclusion of better instances of grassland. Buffering of these and species of conservation concern (the great majority that can be accommodated in this way). Encapsulation of developments. Prevention of further expansion of informal and unauthorized development/ settlement. Exclusion of grazing. Regular (2-3 years) but not over-frequent burning (1 to > 1 burn per year). Prevention of sand-mining. Control of alien invasive plants. Relocation of small number of affected species of conservation concern within footprints.	7	7	3	7	119	N	Major-Negative

25. Alternative layouts

No alternative layouts are currently being pursued by the proponent. However, the original layout was more extensive and has been reduced, while still consuming much grassland. While the original and larger layout could be considered an alternative, in my opinion it involved unacceptable levels of impact on vegetation, especially grassland. Insofar as the current layout is concerned, as presented in this report, although focused on consumption of more degraded parts, not all is so and the reduction of an Endangered vegetation type is considerable. There are various other layout permutations which could be made involving less consumption of this grassland, including one which avoids or more completely avoids and buffers all better instances (such as parts with Moderate or High scores in the Forb Diversity Classification Map in Appendix 9). Doing so would have a dramatic impact on the development, particularly in the Phase 2 area, then affecting the overall feasibility calculus on the part of the developer, but would also serve to reduce the significance of negative impacts and provide additional support to positive impacts.

26. No-Go Alternative

The No-Go Option, should the Cato Ridge Land Development and Release Project not proceed, would be that CRDC not pursue any development of the land and the land will remain under the ownership and management of CRDC/ Assmang and the status quo will be retained for the site.

For purposes of comparative assessment in terms of the EIA, a likely worst-case scenario approach for the no-go option is considered and compared with the impact assessment for the worst-case scenario preferred development alternative for consistency. Extrapolating the existing land use practices under a no-go development option, it is reasonable to assume that incursions onto the property for illegal sand mining, waste dumping, grazing (including associated over-burning) and informal development/settlement would continue. The landowner would continue to manage the areas together with law enforcement to the extent reasonable. However, given historical impacts and in the absence of additional income or resources to facilitate an intensified management approach to the land, it would be reasonable to assume that these impacts will not be entirely prevented and would both further degrade the grassland (mainly through reduction of species richness and abundance and overexpression of unpalatable or weedy species, as well as reduce in the amount of grassland). Impacts are assessed under a no-go scenario as having Moderate to Major negative significance.

Should the site eventually be transferred to “the community” it is unlikely the land would experience good management, unless incentivised, resourced and managed by an invested outside agency. The land would likely experience the “tragedy of the commons” scenario which in addition to uncontrolled grazing and burning, there would be no control of alien plant invasions, sand-mining will be unchecked and likely increase in informal settlement.

I also note there is a legal obligation on the landowner to control alien invasive plants within these landholdings and such control appears to be absent. The costs of doing so escalate as these alien, invasive species increase. I also acknowledge that most landowners are more invested in this if this is linked to a

development outcome or can be better resourced as a result of a development outcome. However, lack of alien plant control should be remedied under any scenario, particularly where the invasion is occurring into grassland. It is not known what may or may have been done to control grazing, but if this has occurred, it is currently ineffective. The No-Go Alternative would avoid loss and fragmentation of a large area of this grassland (assuming illegal activities and encroachment can be managed) and facilitate the retention of species richness and abundance, particularly in the short to medium term.

Table 12: No-Go Alternative

ACTIVITY	POTENTIAL ENVIRONMENTAL IMPACT	APPLICABLE AREA OF INFLUENCE	SIGNIFICANCE PRE-MITIGATION						
Description of proposed land use/ activity/ aspect	Summary description of the impact	All CDRD land north of the N2	Results of application of impact assessment						
			INTENSITY	DURATION	EXTENT	PROBABILITY	TOTAL	STATUS (POS/ NEG)	SIGNIFICANCE
No-Go Alternative: Status Quo including current level of management*	Further slow deterioration with some loss of an Endangered vegetation type, also impacting on populations of species of conservation concern, through ongoing unauthorized activity and illegal use of the site.	All phases	3	6	3	6	72	N	Moderate Negative

In accordance with the duty of care principle (and other legal obligations) the following recommendations are made in the event of the No-Go Alternative as the way forward:

1. Prevention of further expansion of informal and unauthorized development/settlement.
2. Prevention of sand-mining.
3. Exclusion or decrease in grazing.
4. Regular (2-3 years) but not over-frequent burning (the latter 1 to > 1 burn per year).
5. Control of alien invasive plants.
6. The applicant should consider selling/leasing the the land as a conservation banking purposes for offset purposes to government entity / private landowners. Under this scenario, offset funds could be used to finance the management of the site and address illegal activities that are otherwise likely to impact the site and degrade the KwaZulu-Natal Sandstone Sourveld grassland.

27. Concluding comments

The principal issues from a vegetation perspective is that while the phases are mostly focused on more degraded, low species diversity grassland, not all of this is so, and nonetheless, also taking into account degraded instances, this would result in very large transformation of an Endangered vegetation type.

As shown in Figure 2 of Appendix 2, various negative impacts has already resulted in a wide “fragmentation” effect since 1937 in these grasslands, resulting in uneven species diversity and grassland quality. The study carried out by Eco-Pulse, identifying historical impacts to major and minor categories, and then my plot-surveying of these, indicates poor recoverability for grassland in the major disturbance impact category. However, recovery may have been greater but for the fact that there has likely been continuous pressure on much of the grassland on the plateau in the form of overgrazing and inappropriate fire regimes, except for exclusion of grazing from grassland enclosed by Assmang’s security and perimeter fence.

At the same time, given the scale of the challenges faced by these grasslands, within and outside the phases, in the form of sand-mining, alien plant invasion, overgrazing and inappropriate burning, as well as some expansion of unauthorized informal settlement, I believe that the overall trajectory for all the grassland on the plateau will be towards diminished species diversity, without a change in course. It does not need to be pointed out that preventing illegal and unauthorized sand-mining and controlling alien plants should in any event be carried out by landowners. However, given the abundance of sand on the plateau, it is likely that efforts to mine it will continue, notwithstanding existing security patrols and attempts to make access more difficult (which have extended to stringing of coils of razor wire over long distances through the grassland, specifically to prevent vehicular access).

The amount of alien plant invasion, particularly *Eucalyptus* within or near the sand-mined areas, which appear to be increasing, and localized proliferations *Populus x canescens* in damp grassland and wetland areas, will require a considerable amount of work, although these are by no means the only alien invasive species present.

Finally, fencing and a permanent and a frequent security patrol presence, will need to occur in order to prevent the grasslands being used as pastures by cattle-owning non-land owners. There will also be a need to maintain fencing, should it suffer theft, cutting or dismembering, and keep purposely placed vehicular obstructions in place. Firebreaks will also need to be maintained through much of the grassland to prevent annual burning, as has often been the case beyond the perimeter of the concrete palisade fence perimeter that surrounds the Assmang facility.

From the perspective of a vegetation specialist, development of an Endangered grassland type is problematic, where not secondary, and should at least be held out of parts which contain Moderate species diversity. At the same time, some development can be justified as necessary, providing it will better resource protection and management of that which remains.

Given that some Moderate species diversity grassland is proposed for development, and the amount of grassland being proposed for development, whatever its condition, I believe this can only be

supported if accompanied by offsetting. It is likely that it is difficult for degraded and certainly secondary grassland at Cato Ridge to recover well or at all, so I am sympathetic to offset ratios being adjusted to take this into account. I do not believe in a one size fits all.

At the same time, any offsets need to take note of the following. First, grassland included in offsetting should ideally be in the same area and have similar species assemblages, particularly as some species of conservation concern at Cato Ridge do not have wide provenance, that is, they do not occur throughout the extent of KZN Sandstone Sourveld. However, very likely there will be insufficiency of grassland available or obtainable for this in the Cato Ridge/Hammarsdale or Durban escarpment areas, and so much or most may need to be sought outside. It may also not be possible to complete the entire offset contemporaneously, but rather over a period of time.

Grassland to be obtained or managed for conservation elsewhere, that is outside the proposed developments, should also be assessed for species diversity and condition – ideally better quality grassland should be included, rather than that which is very degraded or secondary.

There should also be capacity to protect and manage this grassland. While community partnership arrangements may result in seemingly cost effective forms of protection and management, in communal settings where high value is placed on livestock, it may be very difficult to control and limit grazing and associated over-burning which put grasslands on a path to impoverishment.

A suite of mitigation measures has been set out above, and is not reiterated here.

The following mitigations are needed to reduce the impacts:

- Whether or not the proposed developments can navigate the mitigation hierarchy identified in the draft national offset policy, offsets are a mitigation method for loss of KwaZulu-Natal Sandstone Sourveld in any condition.
- The proposed cadastral divisions should be focussed on the worst grassland, so that grassland with Moderate species diversity grassland or better is spared, or at least the loss minimized.
- Development should not alter the hydrological regime in remaining dryland grassland, hygrophilous grassland or wetland vegetation areas, which is probably most applicable to Phase 3.

28. Recommendation

As a vegetation specialist, I do not recommend transformation of threatened vegetation types, especially when Endangered (KwaZulu-Natal Sandstone Sourveld). This is particularly so where there is in Good to Moderate species diversity, correlating with similar condition.

However, limited development of some degraded or low species diversity grassland, can be supported on a trade-off basis. This would require formal, definite and sustained protection and conservation management of non-targeted KwaZulu-Natal Sandstone Sourveld north of the N3. This trade-off is based on my perception that unless grazing impacts are relieved, together with associated over-burning north of the N3, and sand-mining, unauthorized settlement and alien plant invasion is

prevented and controlled, it is likely that more of the plant species diversity will be lost than under a complete no-development scenario.

However, extensive losses of grassland as proposed, which includes transformation of some instances that are not very degraded, would result in significant residual impacts, and would need to be compensated through additional offset actions beyond earmarked on-site conservation areas. High offset ratios have been suggested for KZN Sandstone Sourveld by EKZNW and the eThekweni Municipality's BMD. However, I believe that a single high offset ratio for grassland irrespective of condition is not easily defensible and support the approach of adjusted offset ratios based on forb diversity and occurrence of species of conservation concern.

Offset actions would preferably include Dry Coast Hinterland Grassland south of the N3 that is already owned by the applicant, and further acquisition of KwaZulu-Natal Sandstone Sourveld or as an adjunct, Ngongoni Veld/Dry Coast Hinterland Grassland for conservation purposes south of the N3 (See Appendix 21 for a preliminary assessment of potential sites). Such actions would add to existing conservation areas which would also be more defensible from the kind of impacts seen in the grasslands north of the N3. These areas at Cato Ridge/Hammarsdale south of the N2 are particularly recommended due to species overlap and occurrence of many of the same, more localized endemics. However, it is very likely that offsets at the required scale cannot be achieved within the eThekweni Municipal Area, alone and will need to be sought for additionally, outside.

To summarize then, it is clear that the proposed Cato Ridge Land Release and Development Project will have a major negative impact on vegetation, in particular an Endangered grassland type, which at Cato Ridge hosts numerous species of conservation concern. This raises many reservations. However, given my perception these grasslands are also under great pressure from informal, unauthorized and illegal actors (including grazing, sand-miners and settlement), development without or with modification should be only be authorised if agreement can be reached regarding biodiversity offsets (the extent, location and other details to be agreed with the relevant authorities (not only the competent authority, but also with Ezemvelo KwaZulu-Natal Wildlife and the eThekweni Municipality's Biodiversity Management Department). This should preferably also result in further consolidation of grassland conservation resources at Cato Ridge or Hammarsdale south of the N3. These offsets must be secured before the commencement of each phase.

In addition, ironclad, permanently resourced, good management must result for the remainder of KZNSS on the earmarked landholdings. An effective, legally binding and enforceable mechanism or mechanisms must be agreed with the authorities to achieve this. This should combat disturbance, degradation and reduction of remaining grassland, currently expressed through overgrazing, over- or under-burning, alien plant invasion, sand-mining, and informal settlement and other unauthorized development, and so support its recovery. A most desirable management outcome from a conservation perspective may be formal protection and improved management of earmarked landholdings as part of a conservation bank.

The acceptability of the project is therefore conditional on agreement with authorities on biodiversity offsets, particularly targeting the protection and improved management of KwaZulu-Natal Sandstone

Sourveld, and ability to agree and establish effective, enforceable and permanent management of the grassland and natural vegetation which remains.

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Appendix 1. Developing an approach to classify the condition of grasslands based on indigenous forb species

(Note that this is a verbatim reproduction of the contents of Eco-Pulse (2023b), which accurately describes the approach to classifying grasslands at Cato Ridge, both in terms of descriptions and maps)

A. Introduction

Whilst methods have been developed to assess grasslands based on grass species sensitivity and abundance, little attention has been given to the forb component, which arguably the most important element from a floristic perspective. Assessing forb composition is challenging however, largely due to the high diversity of forb species occurring in grasslands and the limited special occurrence of many species. The development of simplified protocols to collect basic information on forb diversity to obtain an indication of conservation value and to inform decision making is therefore desirable.

David Styles has been working in the eThekweni Metro for many years, with a particularly strong focus on sampling KZN Sandstone Sourveld. This includes a total of 292 plots that cover a range of geologies including Dwyka Group Tillite (87 plots), Granite (9 Plots) and Natal Group Sandstone (196 plots). This provided an ideal opportunity to summarize the data and to assess to what extent it may be possible to apply a structured classification system to plots that could be used for monitoring and reporting purposes.

B. Data analysis

In each plot, a total of ten sub-plots of 1m² each were sampled within a single 10x10m quadrat. This data was then captured in a database that included a list of all species encountered in each quadrat and the frequency these were encountered across the ten sub-plots. Additional information such as the geology type and soil moisture conditions were also captured for each plot. In the case of grasslands occurring in the study area, a preliminary classification had been applied based on field observations.

The data was extracted and consolidated into a single spreadsheet where the data was cleaned to ensure that consistent names were applied for all species. All tree and grass species were then removed from the database to allow an analysis of the forb component. Forbs were then classified into alien, ruderal and non-ruderal species. Species of conservation concern were then identified and assigned a conservation status based on the latest red listing assessments.

Pivot tables were then used to run a range of queries and to explore the relationship between different variables. Not surprisingly, there was a strong relationship between forb diversity and the summed occurrence of forbs in each plot. The initial analysis was used to compare indigenous forb diversity with the preliminary classifications assigned to each site (Figure 1). This clearly showed that sites in good condition were easily distinguishable from sites in poor or very poor condition but that it was more challenging to assign a condition rating to sites at the lower end of the condition spectrum.

In order to improve the classification system, a suggestion was made to allocate plots into diversity bands based on forb diversity in each plot. This culminated in the preparation of preliminary disturbance bands that were based on both forb diversity and summed forb occurrence. The importance of also accounting for species of conservation concern in any importance metric was also discussed and a preliminary rating system developed. A meeting was then held with Dr Craig Morris (University of KwaZulu-Natal) to discuss the concept and the intention to use such a classification to

assign a value to grasslands in the CRDC study area. The approach was well supported, with some suggestions on how the bands could be tweaked and the two indicators could be combined in a composite conservation value metric.

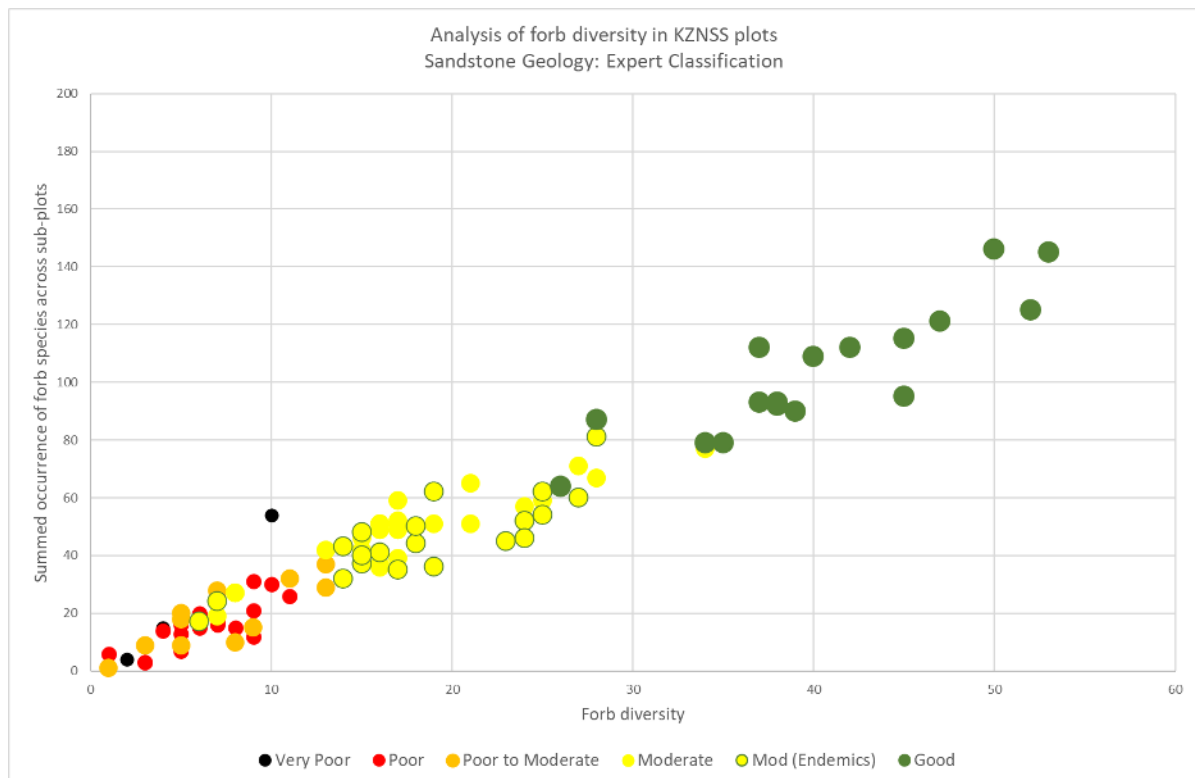


Figure 1. Preliminary comparison of expert condition ratings with the occurrence of indigenous forb species in sampled plots.

The classes used to rate the relative importance of sampled plots is presented in Table 1, below and is illustrated graphically in Figure 2. For the purposes of the assessment, a benchmark of 35 forb species was selected as representative of grasslands in “good” condition or “high” forb diversity. This is conservative as illustrated by the high number of plots with more than 35 species per plot. This does however make allowance for natural variability in forb diversity in response to aspect, wetness and geology that can all affect species occurrence.

Table 1. Classification system developed to refine the importance ratings of grassland plots based on indigenous forb diversity.

	Forb Diversity Classes				
Criteria	Very Low	Low	Moderate	High	Very High
Forb Diversity / plot	<=5	6-15	16-25	24-35	>35
Class mid-point	2.5	10	20	30	35
Forb Diversity Score	7%	29%	57%	86%	100%

A set of logical class intervals were then developed that aligned well with preliminary ratings (Table 1). A diversity score was then calculated by dividing the forb diversity of the plot with the reference score of 35 species. In this way, each plot could be allocated a diversity score that reflected a percentage relative to the benchmark.

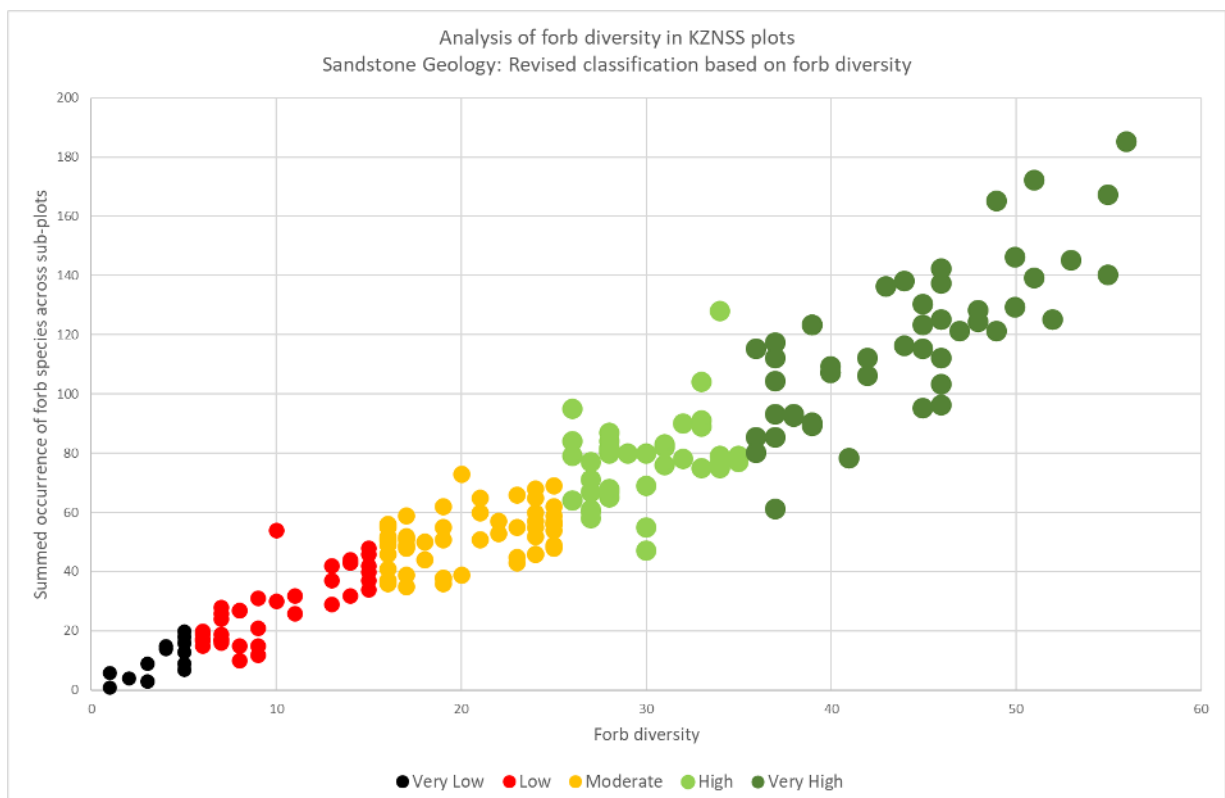
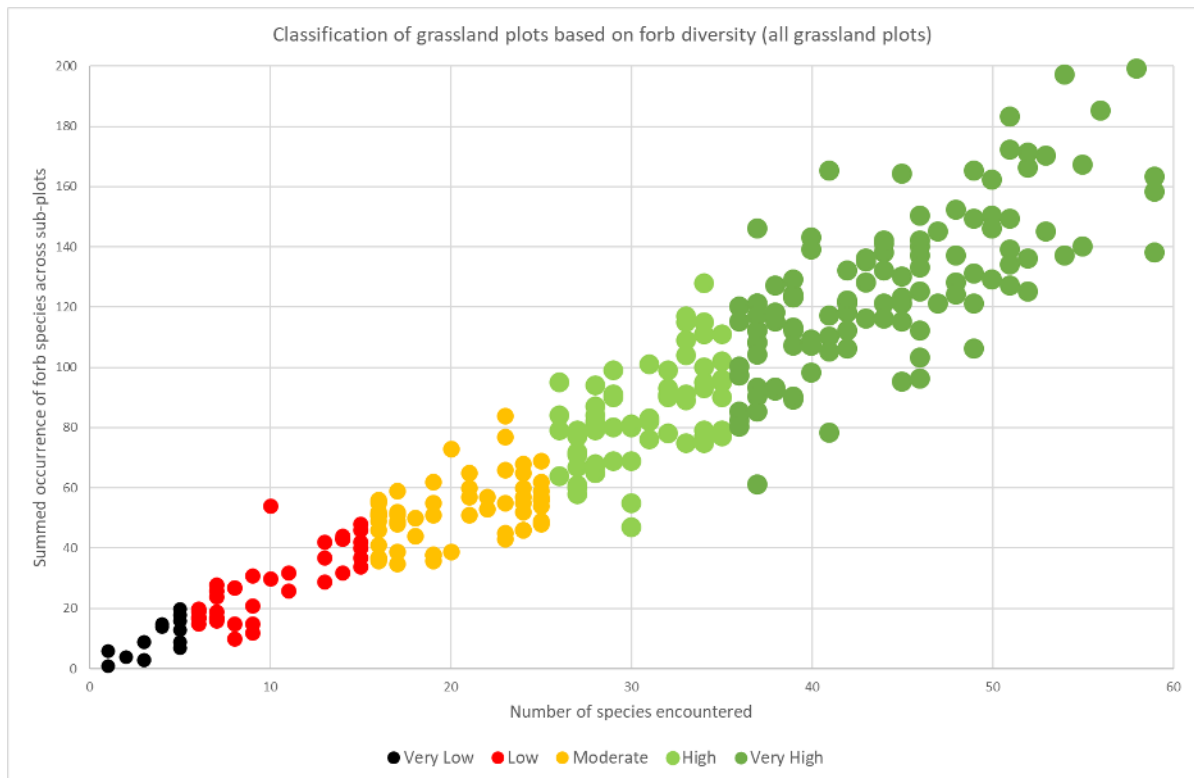


Figure 2. Classification of grassland plots based on forb diversity bands. The lower graphic presents data for grasslands on Sandstone geology that is most relevant to the CRDC site.

A second qualitative criterion was added in order to ensure that grasslands supporting important species of conservation concern were not undervalued in terms of their importance. For the purposes of this assessment, a minimum score of 60% was allocated to plots containing any species recognized

as important for conservation. The ratings applied together with species included in each class are indicated in Table 2.

Table 2. Qualitative rating of forb species of conservation concern.

Threat description	Class	Score	Forb species
Undescribed local endemic	Very High	100%	<i>Chaetacanthus sp. nov.</i>
Endangered			<i>Senecio exuberans</i>
Vulnerable	High	80%	<i>Argyrobium longifolium</i> <i>Sensitive Species 649</i> <i>Oneraria atriplicifolia</i> <i>Dierama pallidum</i> <i>Eriosemopsis subanisophylla</i> <i>Hermannia sandersonii</i> <i>Phymaspermum pinnatifidum</i>
Not RL, but very rare in KZN			<i>Pachycarpus coronarius</i> <i>Plectranthus hadiensis var. nov.</i> <i>Delosperma suttoniae</i>
DDT - KZN endemic with few records			<i>Delosperma suttoniae</i>
Near Threatened	Moderate	60%	<i>Brachystelma pulchellum</i> <i>Crotalaria dura subsp. dura</i>
Not RL but local endemic			<i>Indigofera inandensis</i>
Not RL, distinct KZN form			<i>Argyrobium baptisoides</i>

Once scores had been assigned to each species, the maximum score for species of conservation concern was applied to each plot. Thereafter, a final score for each plot was assigned based on the maximum score for these two criteria (Figure 3).

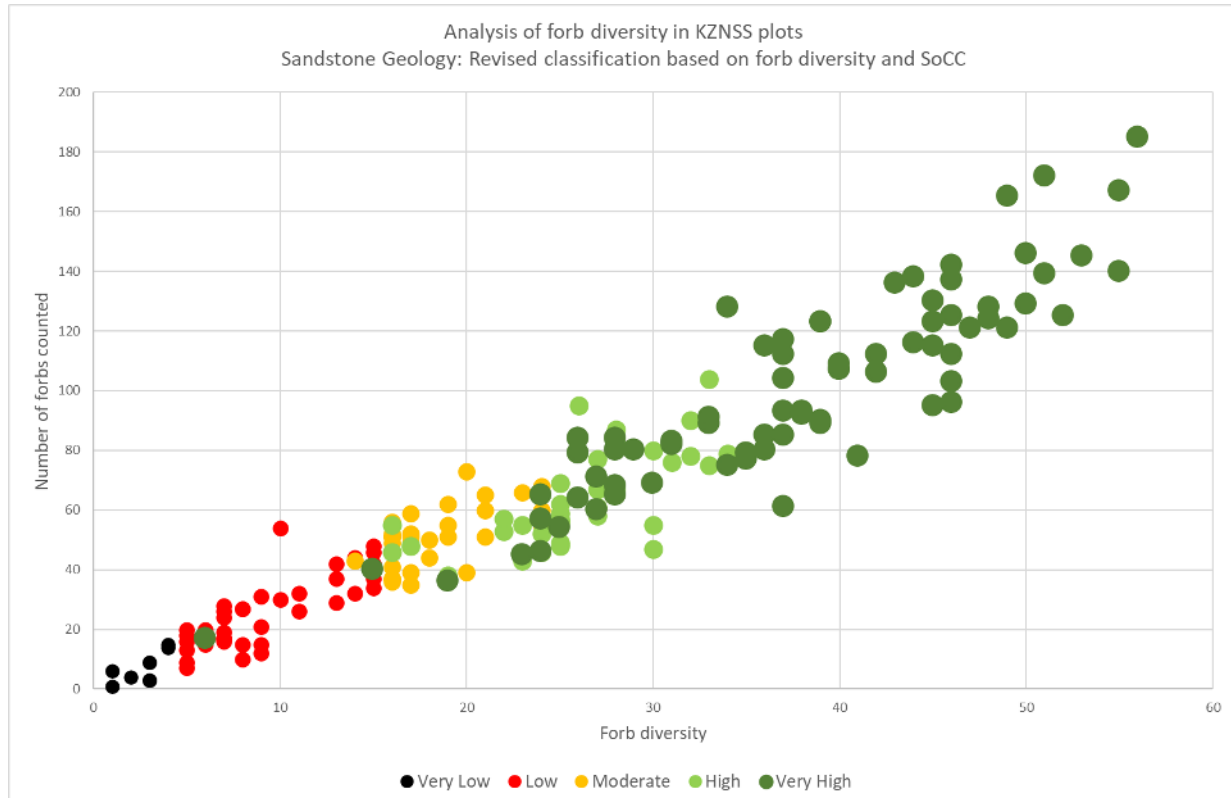


Figure 3. Final classification of KZNSS plots on sandstone geology when integrating scores for species of conservation concern.

C. Results

Once diversity scores had been calculated for each plot, these were shown relative to mapped habitat polygons. Scores were then manually assigned to each mapped feature based on the scores for individual plots (Figure 4). Where several plots were located within a polygon, an average score was calculated whereas in some instances, scores for a particular polygon had to be inferred based on comparable areas. Details of plots used to inform the allocation of scores to individual polygons is captured as part of the GISattribute table.

A similar approach was used to rate the occurrence of species of conservation concern although in this instance, additional points of occurrence had also been collected during the field inspections (Figure 5). Note that where isolated individuals of *Senecio exuberans* had been recorded, a lower score of 40% was allocated to the polygon based on the fact that the species does occur on some quite disturbed sites, and it is possible to translocate such plants.

The final results of the assessment are illustrated in Figure 6 and was generated based on the maximum scores for forb diversity and species of conservation concern. It is these scores that were then integrated into the calculation of offset targets on on-site conservation gains for the properties in question.

Figures appear below.

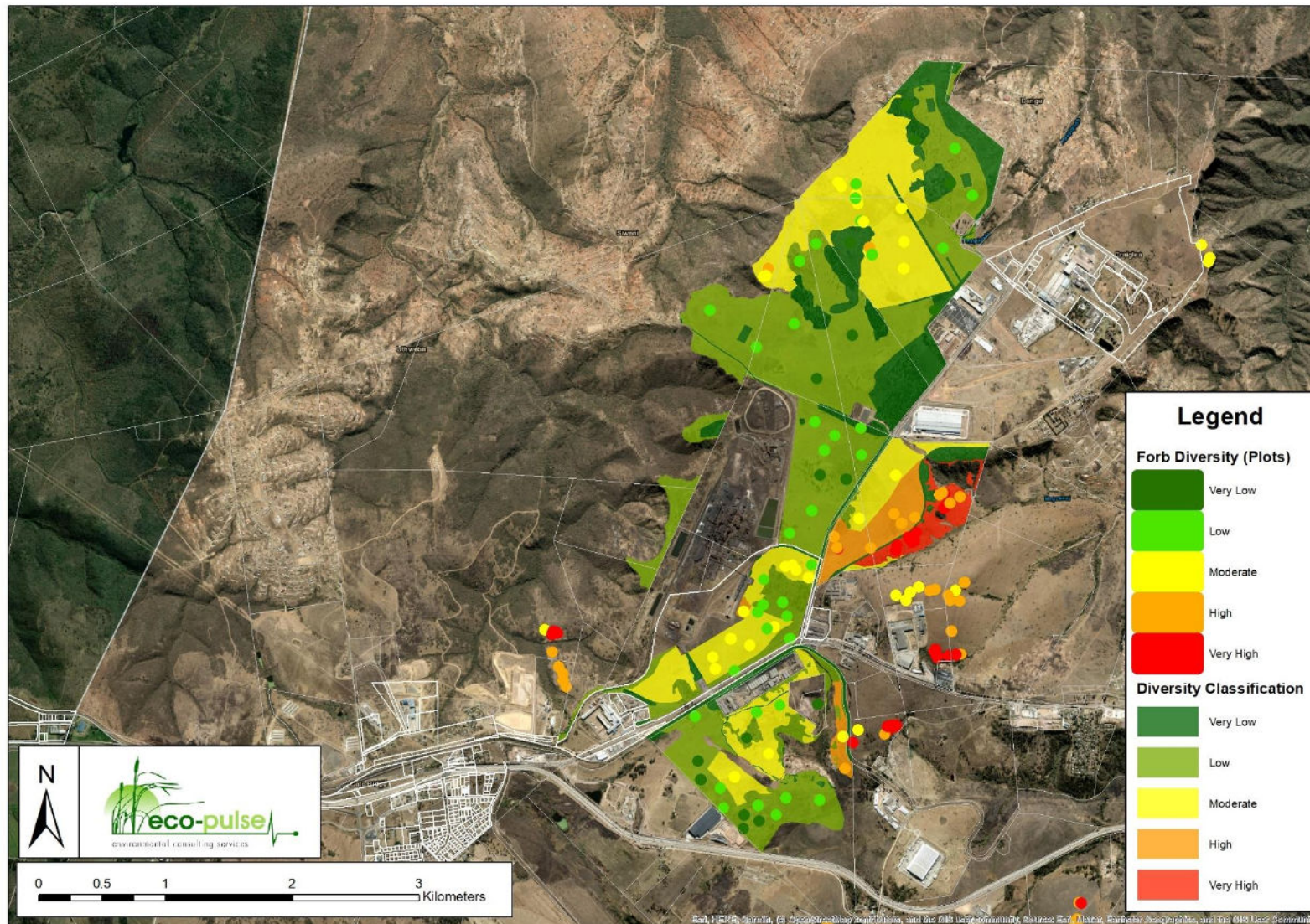


Figure 4. Initial classification of plots and historic KZNSS areas based on herb species diversity.



Figure 5. Quantitative rating of grassland patches containing plant species of conservation concern.

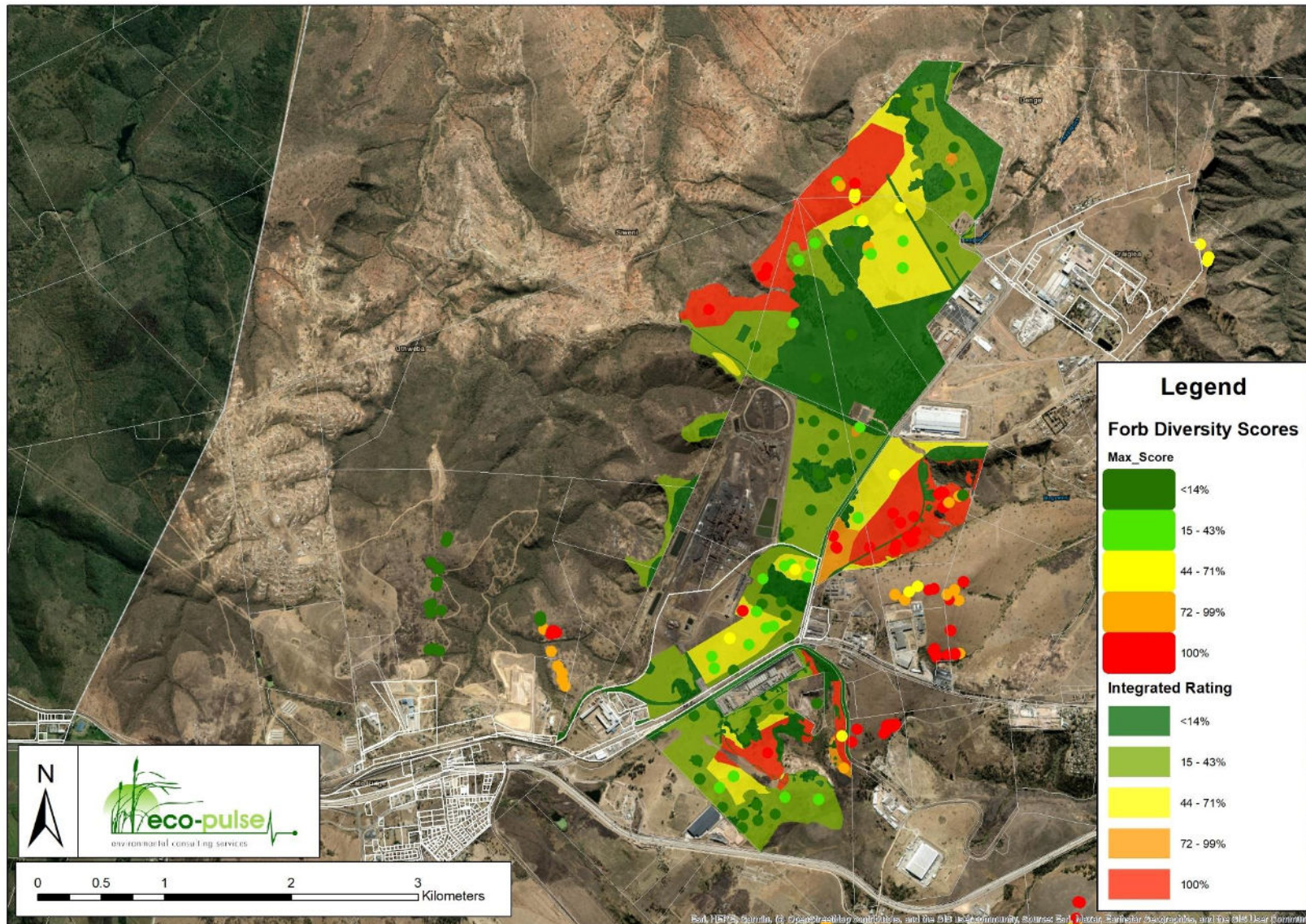


Figure 6. Integrated forb diversity scores assigned to the study area.

Appendix 2. Evaluation of recovery potential of KwaZulu-Natal Sandstone Sourveld

This information is derived from Eco-Pulse (2023b).

A. Introduction

Large portions of the target property have been subject to historic disturbance that has clearly affected the diversity of forb species in remaining areas of KZN Sandstone Sourveld habitat. Understanding the recovery potential of these areas is important to inform decisions regarding the future management of remnant patches of this vegetation type. If recovery potential is high, then sound management would lead to rapid recovery whilst if disturbance leads to more permanent change, there may be limited value in conserving degraded habitat. A targeted analysis of historic photography was therefore initiated to map out the disturbance history associated with the site. This was then followed by additional sampling of plant forb diversity to obtain an indication of the response of herbaceous species to disturbances.

B. Orthorectification of historical aerial photography and compilation of a date-stamped transformation layer

Mr Leo Quayle (Associate of Eco-Pulse) was appointed to undertake an analysis of historical aerial imagery for the site. This assessment was undertaken using available historical imagery to generate a land use time series of six fifteen-year (roughly) epochs going back to 1937. This time series allows the assessment of the level of disturbance of the grassland area.

The ArcGIS Georeferencing tool was used to geo-reference historical aerial photographs of the site from:

- 1937
- 1953
- 1968
- 1989
- 2004
- 2021

As a base / reference image, the South African 50cm colour imagery provided by the National Geospatial Infrastructure was used. Ground control points were located on the historical image and on the reference image and used to place the historical image in a corresponding position to that of the reference image (see the example of 1937 images in Figure 1).

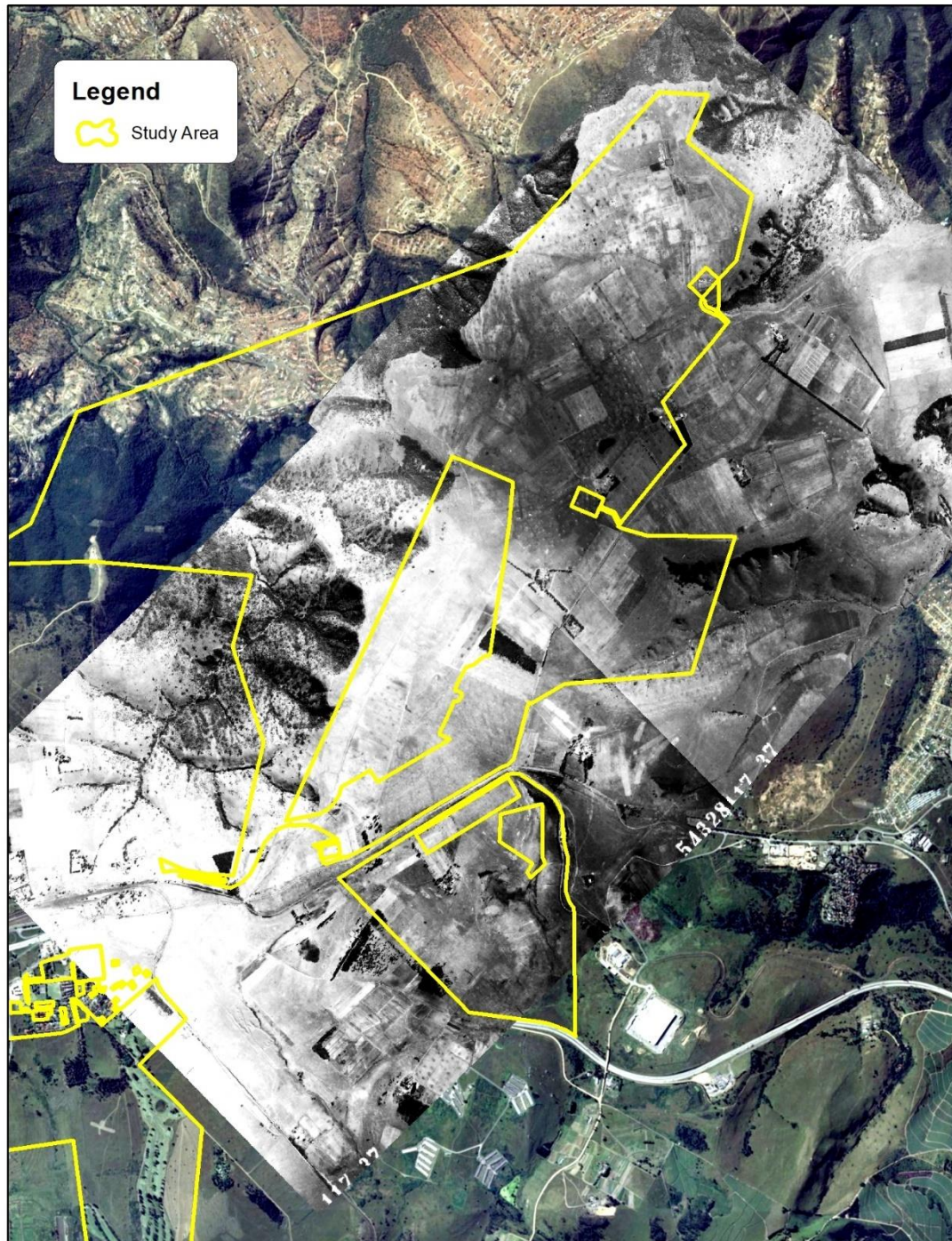


Figure 1: Historical aerial photographs from 1937 rectified against the NGI's 50cm colour imagery.

For the majority of images, a satisfactory result was achieved using a simple 1st order polynomial transformation (a geometric transformation that preserves lines and parallelism (but not necessarily distances and angles)). Where topography proved to be a problem in rectifying the image, a 2nd order polynomial transformation (allows additional image warping) was used to achieve a more accurate match to the reference image.

Once images were satisfactorily orthorectified, areas of disturbance were digitised and a classification assigned in the attribute table. Classification of impacts was done according to the 14 categories of activities listed in Table 1. In addition, all disturbances are classified as either having a high (those activities anticipated to have a transforming impact e.g. settlement, sand mining, cultivation etc.) or

low (activities which may impact veg species composition etc, but are not long term transformational activities (e.g. grazing and hay baling)) potential to transform the existing natural vegetation.

Table 1: Classes of disturbance used to evaluate historical activities in the Assmang site.

Classification	Notes	Impact level
Agriculture - cultivation	Land has been tilled and crops cultivated. This has a significant impact on soil structure and hence on vegetation regrowth.	High
Agriculture - grazing / baling	Land has been used for hay production with machinery used to harvest and bale hay. It is likely that this area is also used for grazing livestock.	Low
Agriculture - grazing camps	Land has been fenced into small areas to manage grazing livestock. This can result in heavy grazing pressure in these camps which can negatively affect natural vegetation.	Low
Agriculture - likely grazing camps	As above, only certainty of the land use is lower.	Low
Agriculture - undetermined	Areas classified as agriculture; however the exact nature of the activity cannot be determined from the photograph under review.	Low
Agriculture (old)	This classification was only used in reviewing the 1937 photos. This was used to classify areas where evidence of agricultural activity exists, but that had occurred well before the photo was taken.	Low
Alien plants	Areas are classified as alien plants where stands of woody vegetation exist that are not consistent with the indigenous vegetation type and where such stands exhibit linear characteristics such as row planting.	High
Alien plants sparse	As above, only density of trees is low.	Low
Dams	Artificial water bodies.	High
Mixed - Settlement / Alien plants / Erosion	Areas where disturbance is a combination of impacts, not necessarily all three listed.	High
Roads / Breaks	Areas where small tracks or linear features have impacted the landscape.	High
Sand mining / Erosion	Areas where surface vegetation and soil has been removed.	High
Settlement	Areas where houses, buildings and other infrastructure has been constructed.	High
Undetermined	Areas where disturbance of the land has occurred, but the nature of the activity cannot be determined from the photo under review.	High

C. Maps of historic disturbance

Three key outputs have been produced:

1. A series of orthorectified historical aerial photographs as .TIF files
2. A consolidated shapefile containing features representing all disturbances noted between 1937 and 2021. This file includes attribution of a disturbance description and the year in which it was noted. It also includes a classification of impact level (high or low potential to transform existing vegetation). This layer should be used in an interactive GIS environment to query the details associated with a particular disturbance area.
3. A simplified shapefile containing all disturbances noted, but overlapping boundaries are dissolved where impact level is the same. No attribution other than impact level is retained in this layer. This layer is shown in Figure 2.

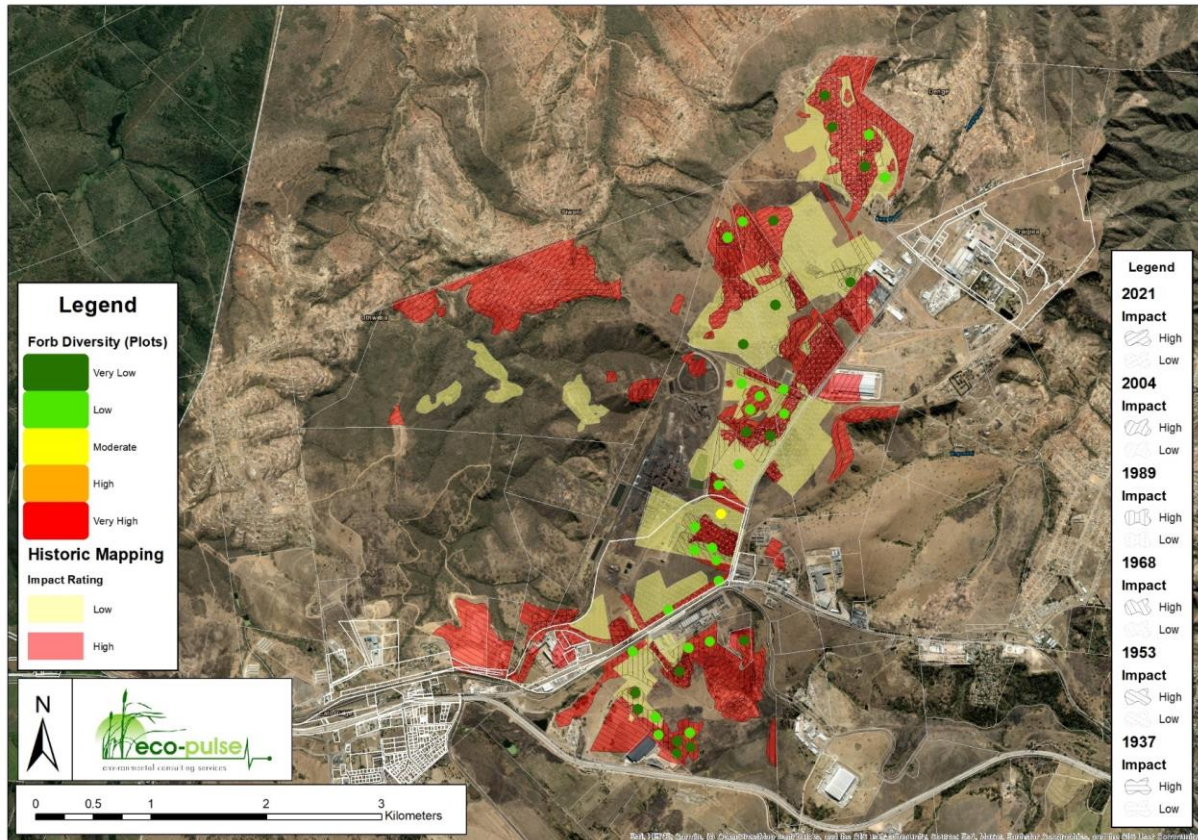


Figure 2: Areas in the Assmang study area impacted by human activity between 1937 and 2021

D. Analysis of recovery potential

An additional forty plots were sampled in addition to those undertaken in the initial survey in order to specifically assess recovery potential. In each case, species composition was recorded and used to allocate each plot to a forb diversity class. A map indicating the diversity classes assigned to each plot are included in Figure 2, whilst a summary of the results is illustrated in Table 2, below.

Table 2. Summary of diversity scores aggregated based on year of disturbance and disturbance type.

Year	Disturbance	Number of Plots	Alien Species	Ruderal Species	Indigenous Forb Species	Diversity Score
1937	Agriculture	4	4.4	3.0	5.3	1%
	IAP	2	1.5	2.0	6.0	3%
	Sub-Total	6	3.6	2.3	5.5	2%
1953	Agriculture	9	3.9	3.3	8.8	13%
	IAP	2	1.0	2.0	6.0	3%
	Sand-mining	1	8.0	0.0	3.0	0%
	Sub-Total	12	4.0	3.1	7.8	9%
1989/2004	Earthworks and Sandmining	2	6.5	2.5	6.5	5%
	IAP	2	9.0	1.5	8.0	10%
	Sand-mining	2	6.5	2.0	5.0	0%
	Sub-Total	6	7.3	2.0	6.5	5%
2021	Earthworks	1	7.0	0.0	3.0	0%
	IAP	6	3.0	2.0	9.0	13%

	Sand-mining	9	3.8	2.2	4.2	0%
	Sub-Total	16	3.7	2.1	5.9	3%
Grand Total		40	4.5	2.4	6.5	5%

This analysis clearly shows that the potential of KZNSS to recover following disturbance is very low, with disturbed plots typically supporting an average of between six and seven indigenous forb species relative to a benchmark of 35. Of these, there is a high proportion of ruderal indigenous species whilst disturbed sites also showed significant encroachment by alien invasive species. It is also important to point out that there is no increasing trend in diversity following time since disturbance. This is likely to be attributed to the encroachment by alien species, and apparent low rates of percolation of naturally occurring forb species.

E. Limitations

The mapping of disturbance over time should be interpreted in the light of the error associated with ortho-rectifying historical aerial photographs. The orthorectification of historical aerial photographs introduces a degree of error based on:

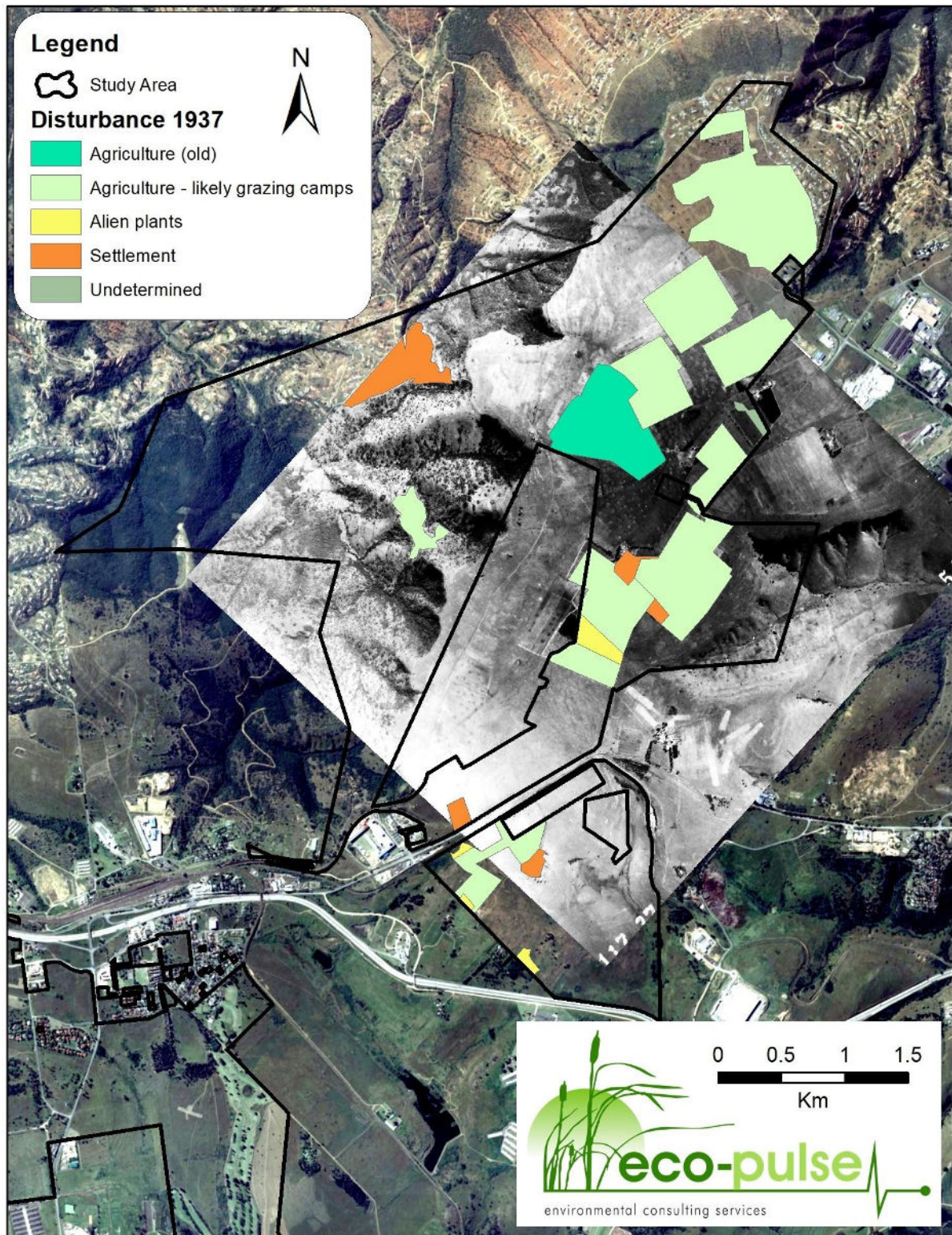
- The availability of common reference points in both the reference image and the image to be rectified. This can be particularly problematic in old images such as the 1937 aerial photographs used in this work where the landscape has changed to such a degree that landforms, buildings, trees and other static landmarks have changed or disappeared.
- The resolution of the images being rectified which can affect the ability to locate smaller reference points and the level of accuracy in placing reference points.
- The topography of the area in question and the position of the camera.
- Technical factors such as the settings employed on the historical image's camera and the transformation or projection used in the reference image.

Given these factors, the spatial products generated for this project should be interpreted as being indicative of the locations of disturbance rather than precise locations with an error of up to 50 metres. This value is generated as a root mean square error and is a product of the distances in the X and Y axes that the individual control points are away from their actual location.

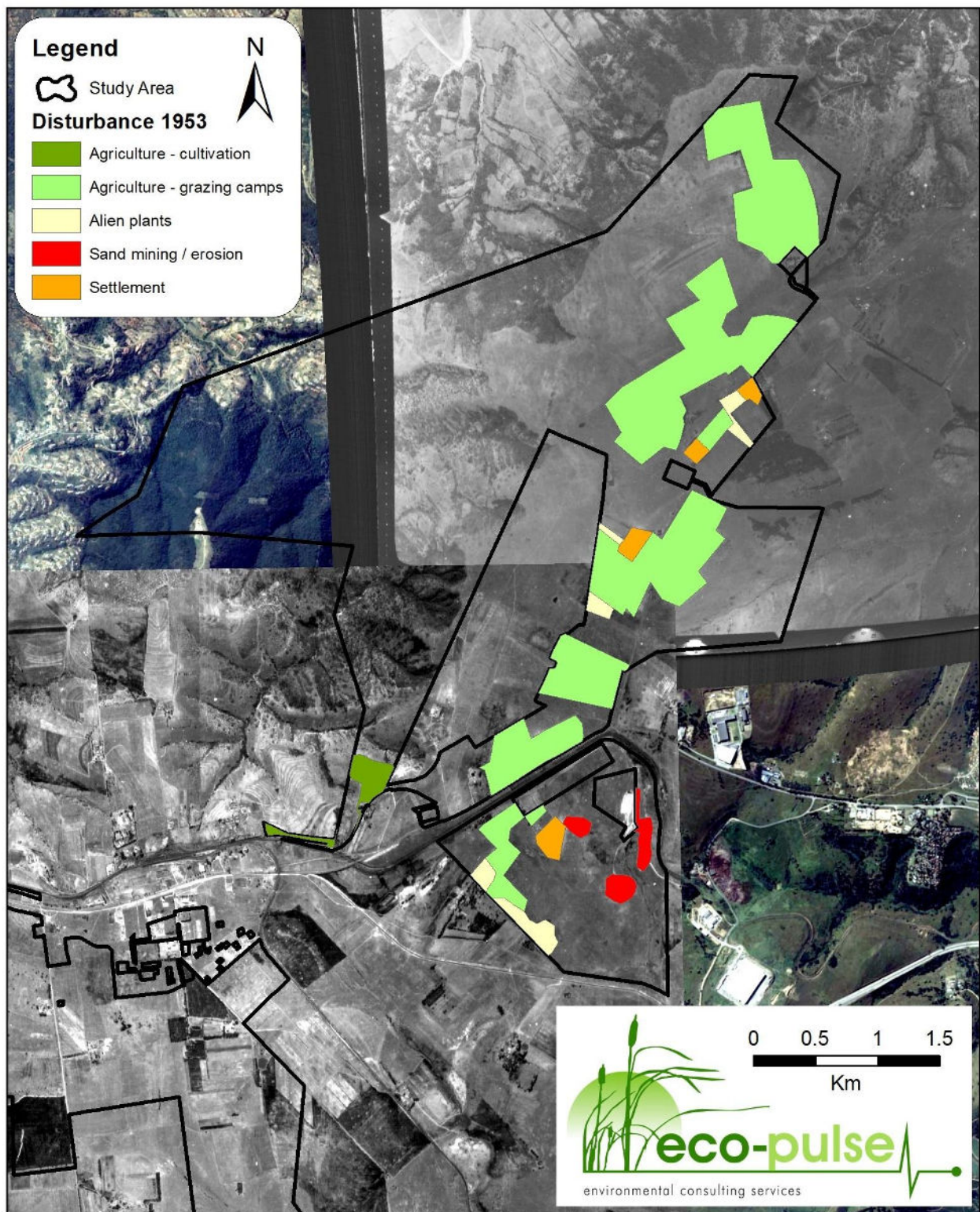
It is also important to note that whilst an attempt was made to try and select plots that represent specific types of disturbance, there is a risk that some sites have been disturbed more than once over time and as such, the comparison of responses to impacts over different time periods should be seen as indicative.

F. Appendices: Nature of disturbances in each epoch.

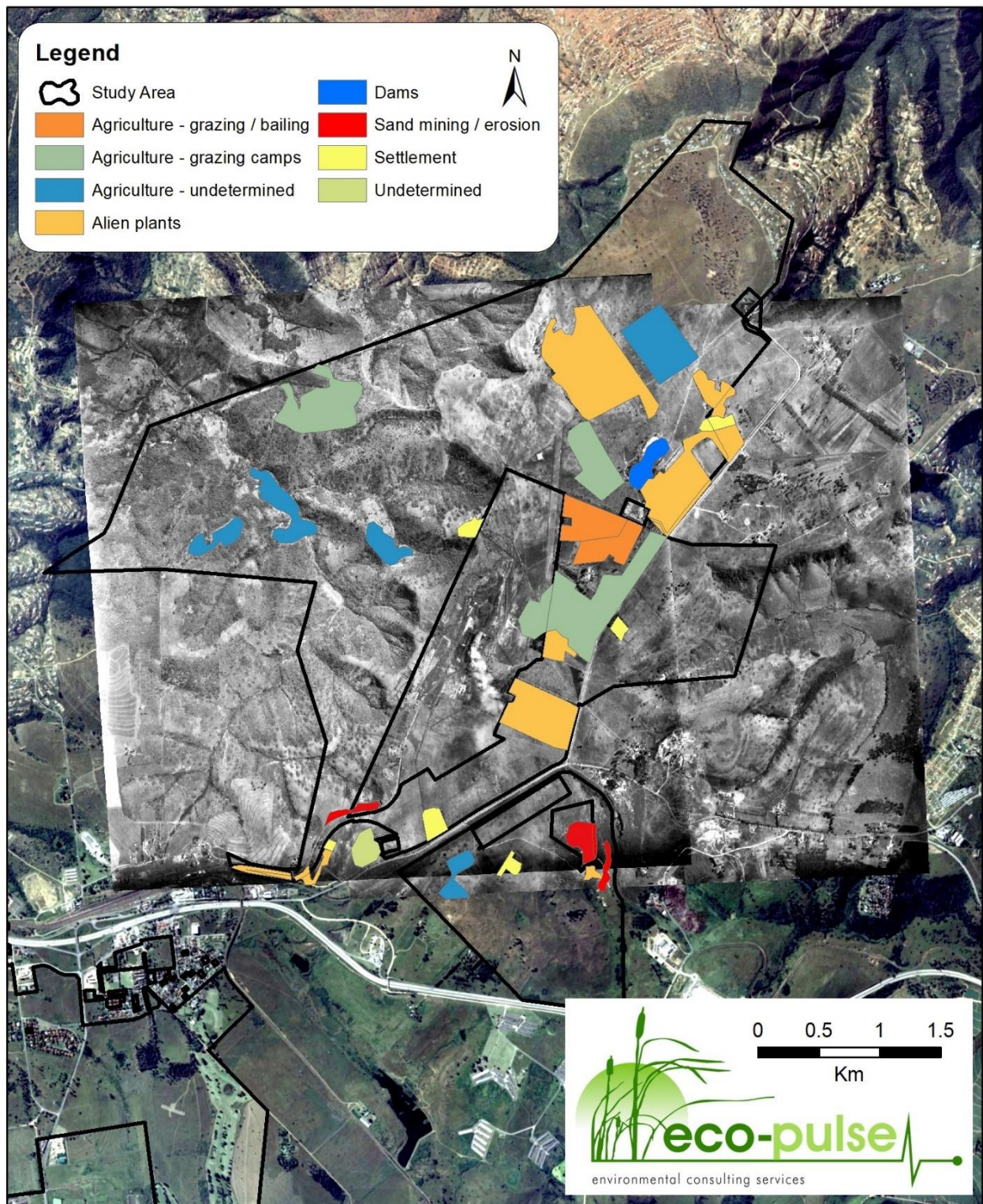
Disturbance 1937



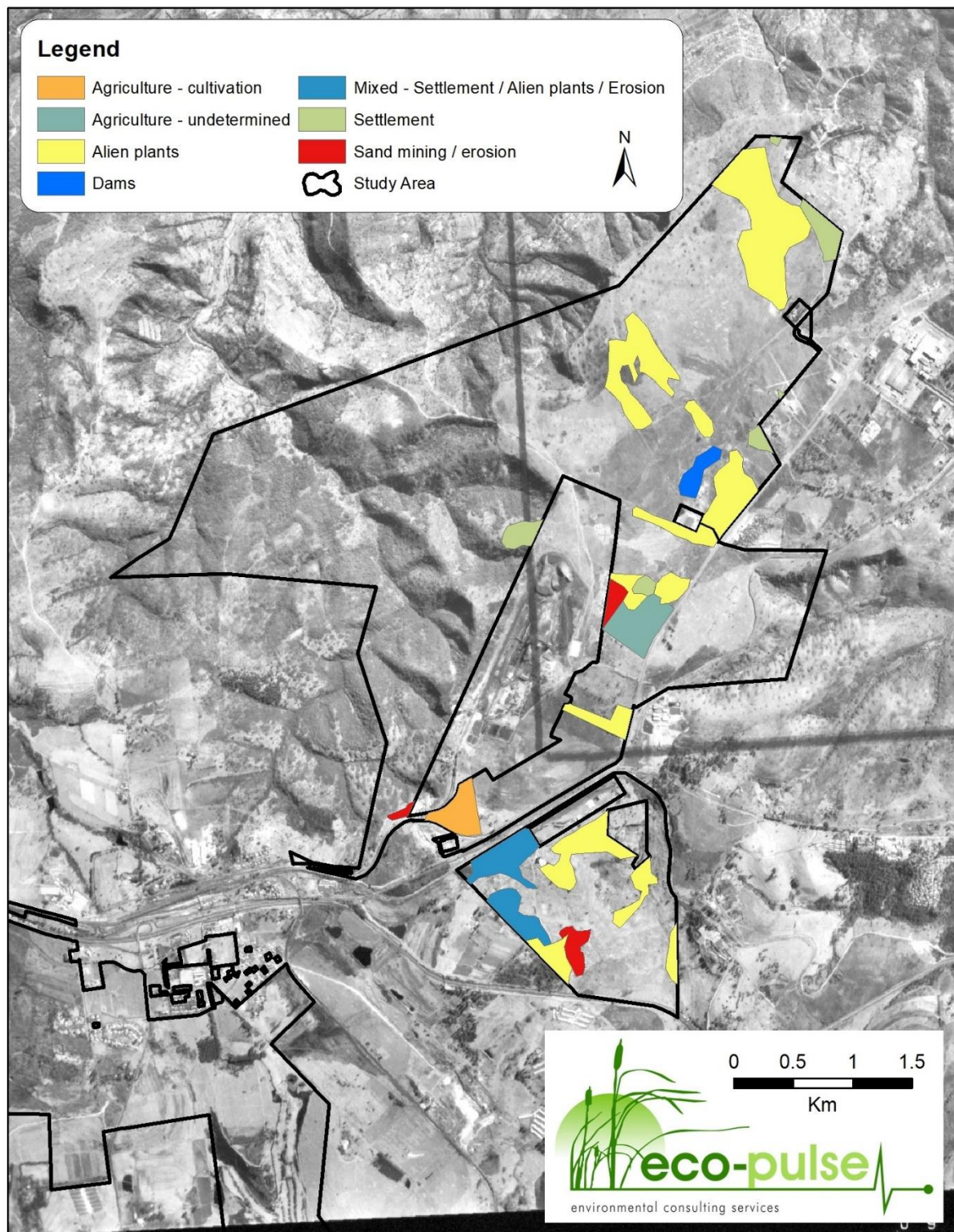
Disturbance 1953



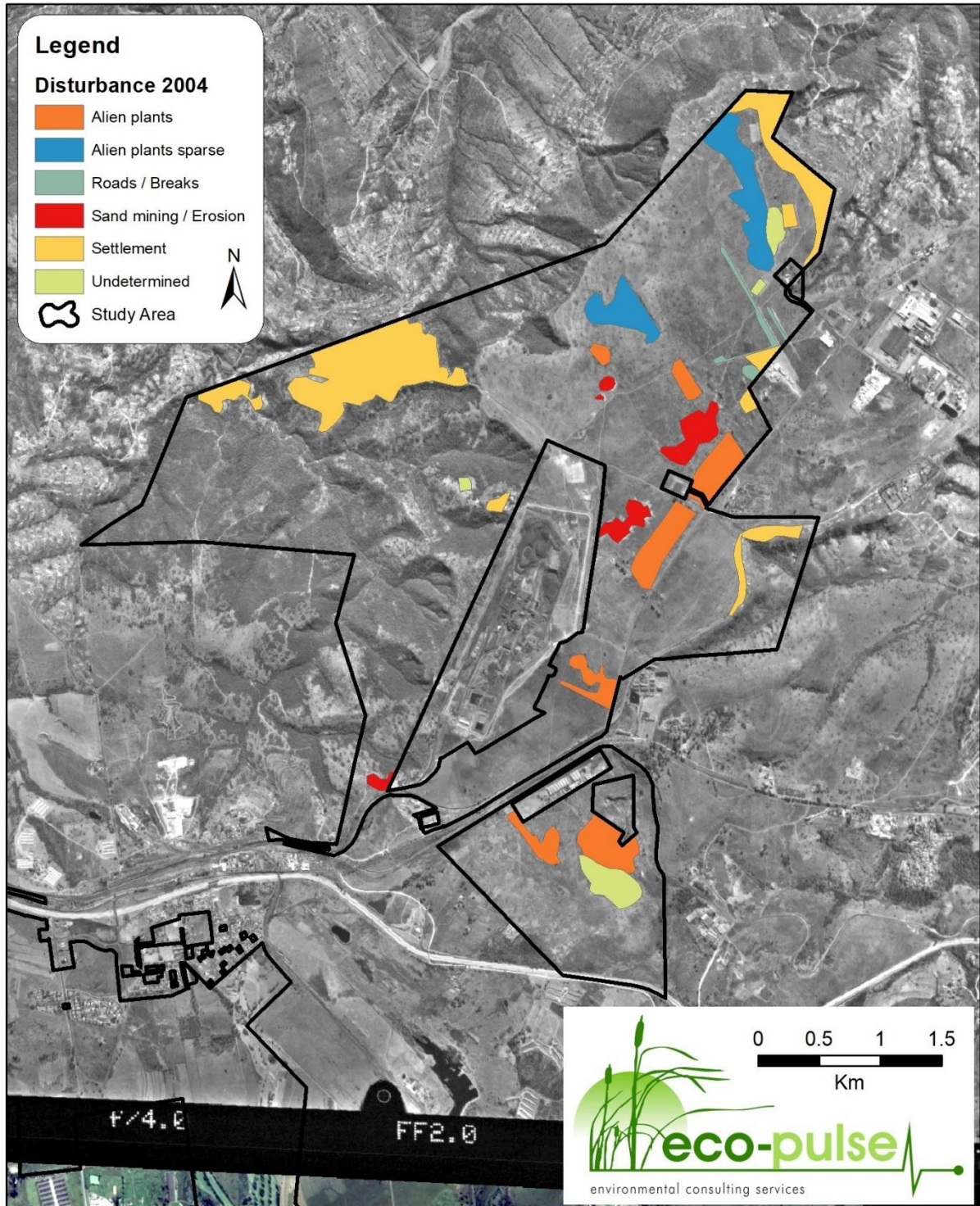
Disturbance 1968



Disturbance 1989



Disturbance 2004



Appendix 3. Impact Assessment Methodology

Supplied by Zutari, but results are not entirely consistent with the Site Environmental Importance approach advocated in SANBI (2020). All text below is as communicated by Zutari to me.

Impact Assessment Methodology

The following impact assessment methodology ensures that specialists address all relevant factors that contribute to significance (avoiding arbitrary assessment). The specialist report should outline the impact assessment methodology that provides the reader with a clear summary of how the specialist derived the significance.

For each predicted impact, criteria are applied to establish the significance of the impact based on likelihood and consequence, both without mitigation being applied (pre-mitigation) and with the implementation of the recommended mitigation measure(s) (post-mitigation).

“Significant impact” means an impact that may have a notable effect on one or more aspects of the environment or may result in non-compliance with accepted environmental quality standards, thresholds or targets and is determined through rating the positive and negative effects of an impact on the environment based on criteria such as duration, magnitude, intensity and probability of occurrence” (2014 EIA regulations, as amended).

The criteria that contribute to the consequence of the impact are:

- Intensity (the degree to which pre-development conditions are changed), which also includes the type of impact (being either a positive or negative impact); the duration (length of time that the impact will continue); and the extent (spatial scale) of the impact.
- The sensitivity of the receiving environment and/or sensitive receptors are incorporated into the consideration of consequence by appropriately adjusting the thresholds or scales of the intensity, duration and extent criteria based on expert knowledge.

For each impact, the specialist applies professional judgement to ascribe a numerical rating for each criterion according to the examples provided in Table 1, Table 2 and Table 3 below. The consequence is then established using the formula:

$$\text{Consequence} = \text{type} \times (\text{intensity} + \text{duration} + \text{extent})$$

Depending on the numerical result, the impact's consequence would be extremely, highly, moderately or slightly detrimental; or neutral; or slightly, moderately, highly or extremely beneficial. These categories are provided in Table 5.

To determine the significance of an impact, the probability (or likelihood) of that impact occurring is also considered. In assigning probability, the specialist considers the likelihood of occurrence and takes cognisance of uncertainty and detectability of the impact. The most suitable numerical rating for probability is selected from Table 4 below and applied with the consequence according to the following equation:

$$\text{Significance} = \text{consequence} \times \text{probability}$$

When assigning a probability to an impact, it is vitally important to distinguish this from the concepts of frequency and confidence, with which it is sometimes confused:

- Probability refers to the likelihood that an impact will occur.
- Frequency refers to the regularity with which an impact occurs. To illustrate the difference between frequency and probability, it must be considered that something that happens infrequently may still be a certainty (i.e. have a high probability). For instance, Halley's Comet only comes close to the sun every 75 to 76 years (i.e. it has a very low frequency), but it is still a certainty.
- Confidence refers to the degree of certainty of a prediction. Confidence may be related to impact assessment criteria (extent, intensity, duration or probability) and is not necessarily only related to probability. Confidence may be influenced by any factors that introduce uncertainty into a prediction. The specialists appointed to contribute to this impact assessment have empirical knowledge of their respective fields and can thus comment on their confidence in their findings based on the availability of data and the certainty of their findings. All specialists should include a short assessment and description of their confidence rating in their impact assessment report.

Depending on the numerical result of this calculation, the impact would fall into a significance category of negligible, minor, moderate or major, and the type would be either positive or negative. Examples of these categories are provided in Table 6.

Once the significance of an impact occurring without mitigation has been established, the specialist must apply their professional judgement to assign ratings for the same impact after the proposed mitigation has been implemented.

Lastly, two further points are important when applying these criteria to impacts:

- Specialists need to assess the impact, not the source or origin of the impact (i.e. the activity that causes the impact). For instance, although the activity that causes a specific impact may take place over a long period of time, this does not necessarily imply that the impact itself will persist for the same length of time. The assessment must focus on the impact (the change in the environment) rather than on the activity that causes an impact.
- Consider the direct impact of the proposed project design. If the design of a project avoids an area where a highly sensitive or irreplaceable resource occurs, it would be a mistake to assume that this resource would experience an impact simply because the resource occurs within the boundaries of the study area. For example, if a wetland or archaeological site occurs on portion A, but the project is located on portion B, the wetland or archaeological site may not be directly affected.

Status of Impact is classified as:

- Positive: + (A benefit to the receiving environment)
- Negative: - (A cost to the receiving environment)
- Neutral: N (No cost or benefit to the receiving environment)

The significance of an impact indicates the level of mitigation measures required to minimise negative impacts and reduce environmental damage during the various project phases. Suitable and appropriate mitigation measures should be identified for each potential impact based on specialist recommendations and expertise.

Table 1 Definition of Intensity ratings Rating		Criteria
Negative impacts (Type of impact = – 1)		Positive impacts (Type of impact = +1)
7	Complete destruction (irreversible and irreplaceable loss) of natural or social systems, resources (e.g. species) and human health. No chance of these processes or resources ever being restored to their pre-impact condition.	Noticeable, sustainable benefits that improve the quality and extent of natural or social systems or resources, including formal protection.
6	Very high degree of damage to natural or social systems or resources. These processes or resources may restore to their pre-project condition over very long periods of time (more than a typical human lifetime).	Great improvement to ecosystem or social processes and services or resources.
5	Serious damage to components of natural or social systems or resources and the contravention of legislated standards.	Ongoing and widespread benefits to natural or social systems or resources.
4	High degree damage to natural or social system components, species or resources.	Average to intense positive benefits for natural or social systems or resources.
3	Moderate damage to natural or social system components, species or resources.	Average, ongoing positive benefits for natural or social systems or resources.
2	Minor damage to natural or social system components, species or resources. Likely to recover over time. Ecosystems and valuable social processes are not affected.	Low positive impacts on natural or social systems or resources.
1	Negligible damage to individual components of natural or social systems or resources, such that it is hardly noticeable.	Limited low-level benefits to natural or social systems or resources.

Table 2 Definition of Duration ratings Rating	Criteria
7	Permanent: The impact will remain indefinitely.
6	Beyond project life: The impact will remain for some time after the life of the project.
5	Project life: The impact will cease after the operational life span of the project.
4	Long-term: The impact will continue for 6-15 years.
3	Medium-term: The impact will continue for 2-5 years.
2	Short-term: The impact will continue for between 1 month and 2 years.
1	Immediate: The impact will continue for less than 1 month.

Table 3 Definition of Extent ratings Rating	Criteria
7	International: The effect will occur across international borders.
6	National: The impact will affect the entire country.
5	Province/ Region: The impact will affect the entire province or region.
4	Municipal Area: The impact will affect the whole municipal area.
3	Local: The impact will extend across the study area and the LAP area.
2	Limited: The impact will be limited to the study area.
1	Very limited: The impact will be limited to the footprint of the development and will not extend to the boundaries of the study area.

Table 4 Definition of Probability ratings Rating	Criteria
7	Certain/ Definite: There are sound scientific reasons to expect that the impact will definitely occur.
6	Almost certain/ Highly probable: It is most likely that the impact will occur.
5	Likely: This impact has occurred numerous times here or elsewhere in a similar environment and with a similar type of development and could very conceivably occur.
4	Probable: This impact has occurred here or elsewhere in a similar environment and with a similar type of development and could conceivably occur.
3	Unlikely: This impact has not happened yet but could happen.
2	Rare/ improbable: The impact is conceivable, but only in extreme circumstances. The possibility of the impact manifesting is very low due to the design, experience or implementation of adequate mitigation measures.
1	Highly unlikely/ None: The impact is expected never to happen or has a very low chance of occurring.

Table 5 Application of Consequence ratings range		Significance rating
-21	-18	Extremely detrimental
-17	-14	Highly detrimental
-13	-10	Moderately detrimental
-9	-6	Slightly detrimental
-5	5	Negligible
6	9	Slightly beneficial
10	13	Moderately beneficial
14	17	Highly beneficial
18	21	Extremely beneficial

Table 6 Application of significance ratings Range	Significance rating	
-147	-109	Major - negative
-108	-73	Moderate - negative
-72	-36	Minor - negative
-35	-1	Negligible - negative
0	0	Neutral
1	35	Negligible - positive
36	72	Minor - positive
73	108	Moderate - positive
109	147	Major - positive

Table 7 Definition of Confidence ratings Rating	Criteria
Low	Judgement is based on intuition, and some major assumptions are used to assess the impact that may prove untrue.
Medium	Determination is based on common sense and general knowledge. The assumptions made, whilst having a degree of uncertainty, are fairly robust.
High	Substantive supportive data or evidence exists to verify the assessment.

Cumulative impacts

A "cumulative impact" is defined in the EIA regulations, 2014 as *"past, current and reasonably foreseeable future impact of an activity, considered together with the impact of activities associated with that activity, that in itself may not be significant, but may become significant when added to the existing and reasonably foreseeable impacts eventuating from similar or diverse activities"*.

Examples of cumulative impacts include those resulting where several hydroelectric projects are constructed or planned on the same river or within the same watershed, multiple oil and gas projects or mines are developed in close proximity, or several wind farms are constructed or planned within the same flyway or region. In other cases, cumulative impacts occur from the combined effects over a given resource of a mix of different types of projects, for example, the development of a mining site, access roads, transmission lines, and other adjacent land uses.

The assessment of the cumulative impacts should consider the cumulative impact of proposed land uses and developments in the broader Cato Ridge Local Area Plan (LAP) area.

The International Finance Corporation (2013) defines cumulative impacts as *'those that result from the successive, incremental, and/or combined effects of an action, project, or activity (collectively referred to ... as "developments") when added to other existing, planned, and/or reasonably anticipated future ones'* and further states that *'For practical reasons, the identification and management of cumulative impacts are limited to those effects generally recognised as important on the basis of scientific concerns and/or concerns of affected communities.'*

Valued Ecosystem Components (VECs) are considered key to understanding cumulative impacts because the sources of these impacts are diffuse and distributed over long periods of time. VECs may be:

- Physical features, habitats, wildlife populations, e.g. biodiversity).
- Ecosystem services.
- Natural processes, e.g. water and nutrient cycles, microclimate.
- Social conditions, e.g. health, economics; and
- Cultural aspects, e.g. traditional spiritual ceremonies.

While VECs may be directly or indirectly affected by a specific development, they often are also affected by the cumulative effects of several developments. VECs are the ultimate recipient of impacts because they tend to be at the ends of ecological pathways. The acronym VECs refers to sensitive or valued receptors of impact whose desired future condition determines the assessment endpoints used in the cumulative impact assessment (CIA) process (Figure 3).

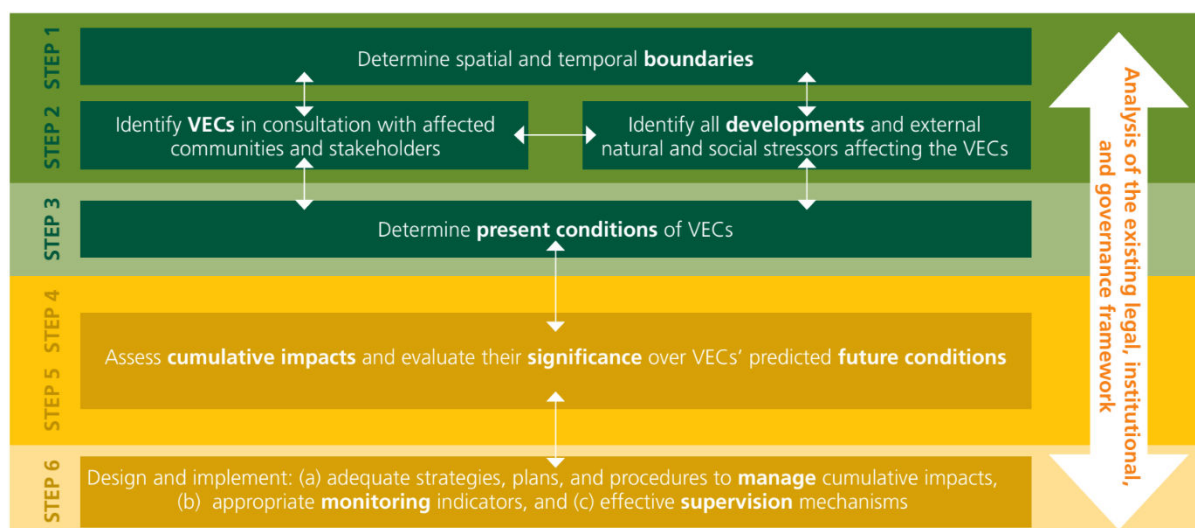


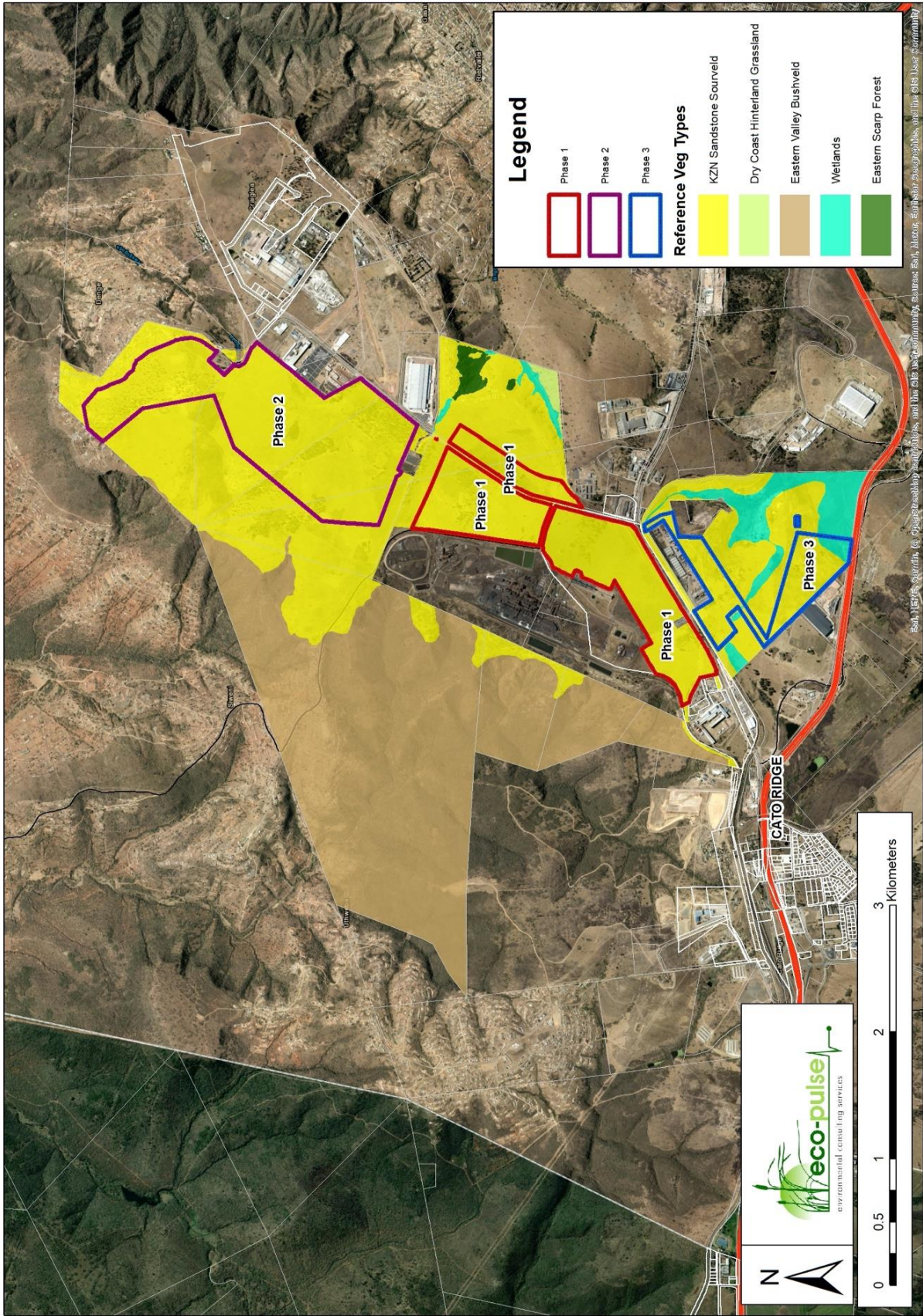
Figure 3: Cumulative impact assessment methodology

The IFC's Good Practice Handbook for CIA proposes *rapid cumulative impact assessment* (RCIA) as a useful preliminary approach for developers in emerging markets. The steps for RCIA are outlined in Table 9 below.

Table 9: Rapid cumulative impact assessment methodology – Steps	Description	Method
1	Determine VECs, spatial and temporal boundaries	a. The area that will be directly affected by the proposed project (study area) will be defined. b. VECs within the study area will be identified. This may include resources such as KZN Sandstone Sourveld, visual resources such as the cliffs on the edge of the plateau and heritage resources such as grave sites. c. It will be determined whether these VECs occupy a wider area beyond the study area or broader Cato Ridge LAP area. d. The distance that an effect can travel and other potential impacts on the VECs will be considered. As a starting point, at least the boundaries of the Cato Ridge study area considered in the Cato Ridge Local Area Plan (LAP) will be considered – see Figure 2. Since the project's proposed life span is 20 to 25 years, it is proposed that cumulative impacts should be assessed over the same time horizon.
2	Determine other activities and environmental drivers	Identify other past, existing, or planned activities within the analytical boundaries will be identified from municipal and environmental development applications through liaison with these respective authorities. Such activities or drivers may include past developments whose impacts persist, existing developments, and foreseeable future developments, other relevant external social and/or environmental drivers (e.g. climate change, human migration, population growth, grazing pressure, sand mining, and new settlements).

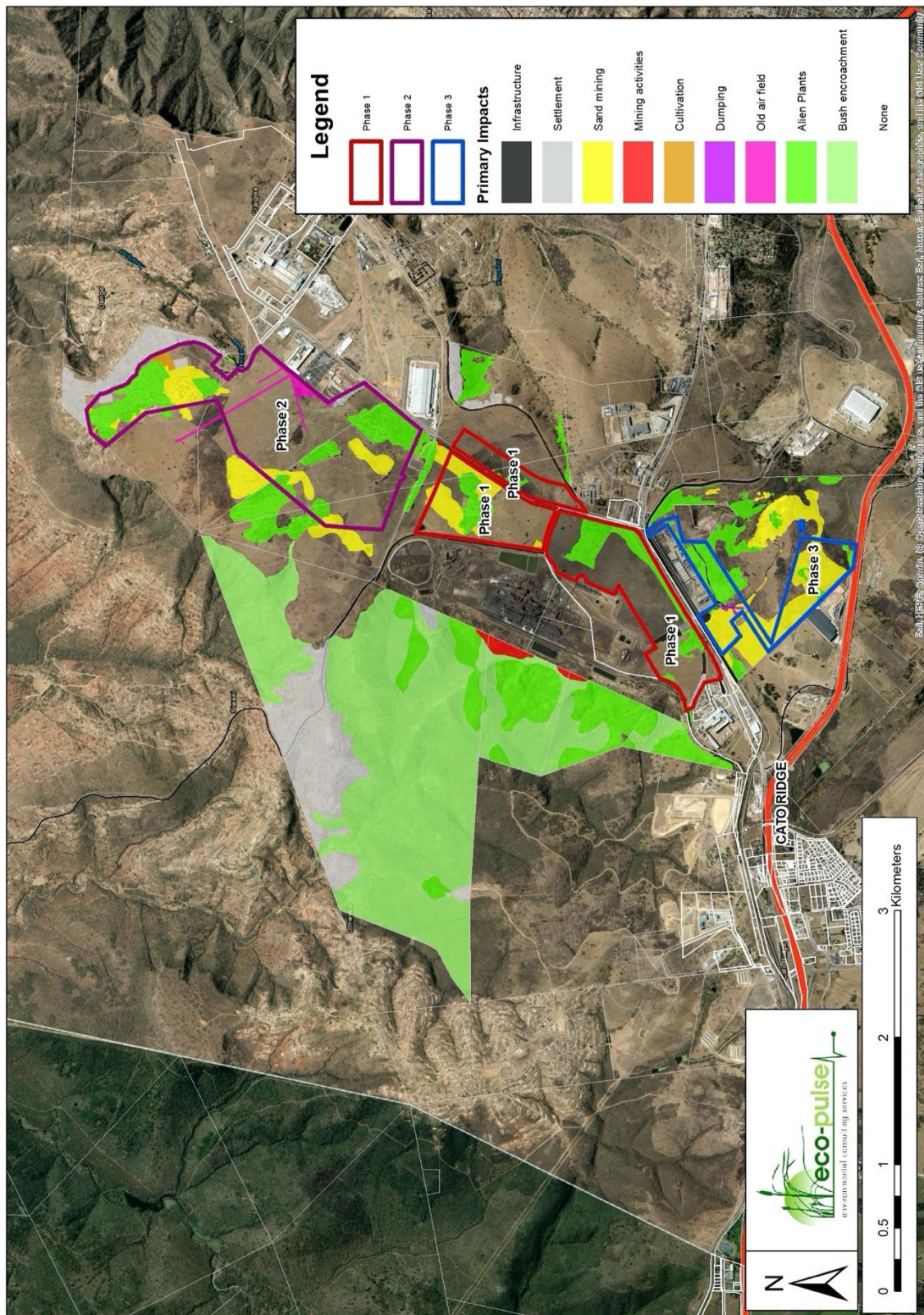
3	VEC baseline status determination	This step entails defining the existing condition of VECs. This will be done by reviewing baseline studies that have been done for the area for the pre-feasibility study and other studies completed within the past two years. The purpose of this step is to understand the reactions of the VECs to stresses, their resilience, and recovery time and to assess trends. Gaps in knowledge, assumptions and limitations should be acknowledged.
4	Assess the development's contribution to predicted cumulative impacts	Potential environmental and social impacts and risks that can arise from a combination of the project and other activities and drivers are assessed. These impacts will be expressed in terms of the potential change in the condition of the VEC in terms of their viability and sustainability). In doing this, the assessment team will consider additive, countervailing, masking, and/or synergistic effects. It is important to note that cumulative impacts will be measured not in terms of the intensity of the stress added by a given development but in terms of the VEC's response and change in condition. This is because a weak stress may lead to a change in VEC conditions, and vice versa, depending on the nature of the stress and the VEC. The methods used for analysis are specific to the characteristics of the VEC (e.g., different methods are appropriate for analysis of impacts on physical, environmental, biotic, and social VECs, and their
5	Evaluate the significance of predicted cumulative impacts to the viability or sustainability of the affected VECs	Appropriate "thresholds" and indicators will be identified for impacts based on the same impact criteria () used for impact assessment as discussed above. The significance of a cumulative impact will be evaluated not in terms of the amount of change but in terms of the potential resulting impact to the vulnerability and/or risk to the sustainability of the VECs assessed. This means evaluating cumulative impacts in the context of ecological thresholds beyond which their continued viability cannot be guaranteed. This is determined in the context of past, present, and future actions. When considered thresholds, a precautionary approach will be followed to take into account uncertainty in ecological and sociological relationships. Lastly, trade-offs or compromises that lead to desirable outcomes at the expense of some undesirable outcomes will be identified.
6	Determine mitigation, monitoring, and supervision measures	Mitigation, monitoring and supervision measures to manage the development's contribution to the cumulative impacts and risks will be defined. Mitigation measures may focus on the applicant's project, as well as on actions by other role players that may influence cumulative impacts and may extend beyond the project boundaries. In defining mitigation, the mitigation hierarchy (avoid – minimise – rectify – reduce – offset) will be applied, with avoidance of impacts being the preferred option. Propose mitigation and monitoring programs will be proposed, based on the recommendations of suitable specialists familiar with the conditions of the VECs. Monitoring measures to measure the actual impacts will also be defined.

Appendix 4. Assessment of current and historical base vegetation types

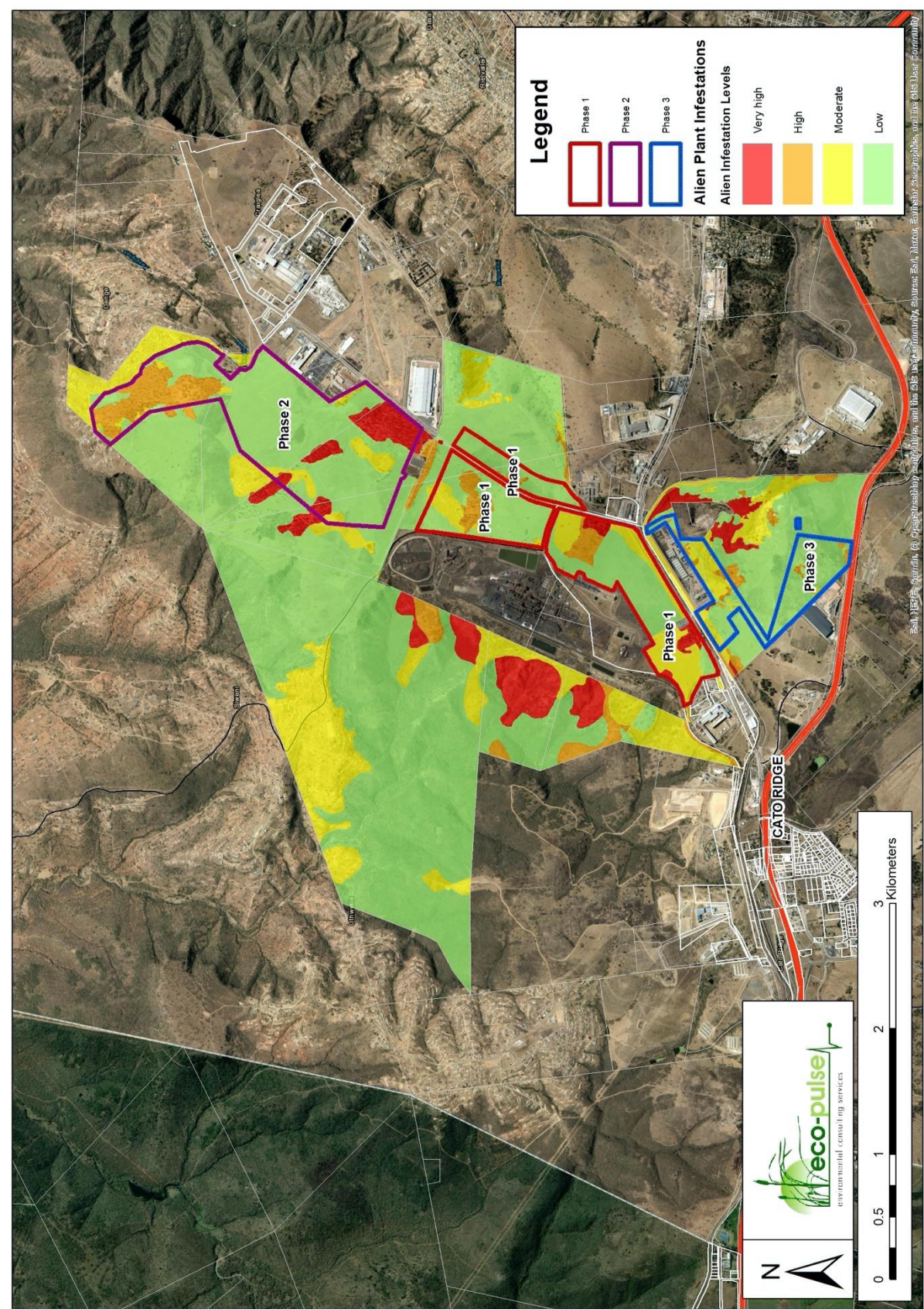


Appendix 5. Composite of anthropogenic impacts

(Note that bush encroachment may be very indirect impact. Woody vegetation has in a century increased at the expense of grassland and grassy growth throughout the midland and lowland parts of KwaZulu-Natal and climate change and increased atmospheric carbon may play a role, in addition to anthropogenic fragmentation of landscapes).



Appendix 6. Extent of alien plant invasion

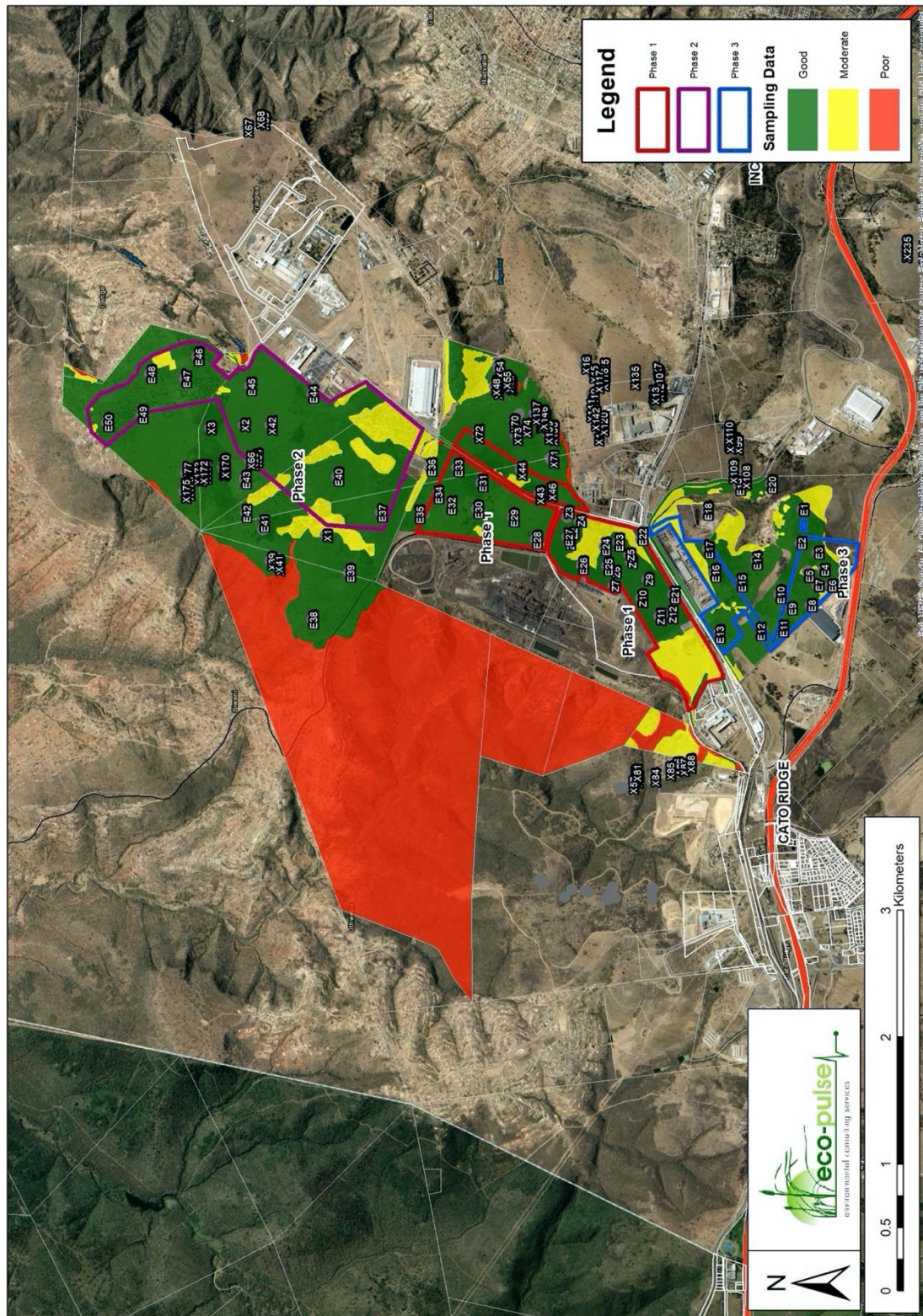


Appendix 7. Plot sample coverage

X Prefix = Plots surveyed 2013/2014. Some of these plots were resurveyed in 2020.

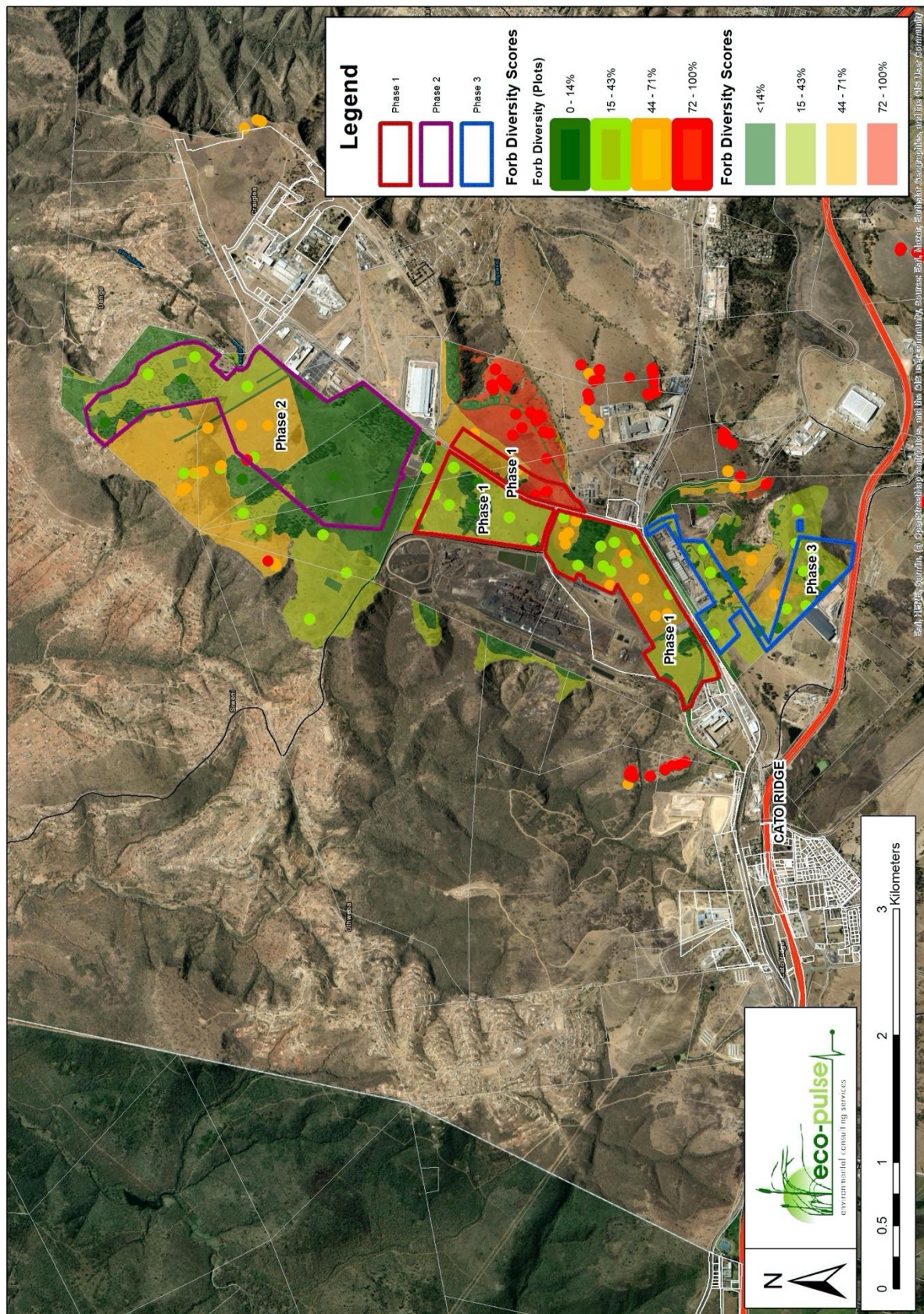
E Prefix = Plots surveyed in 2021

E -Prefix = Plots surveyed in 2022

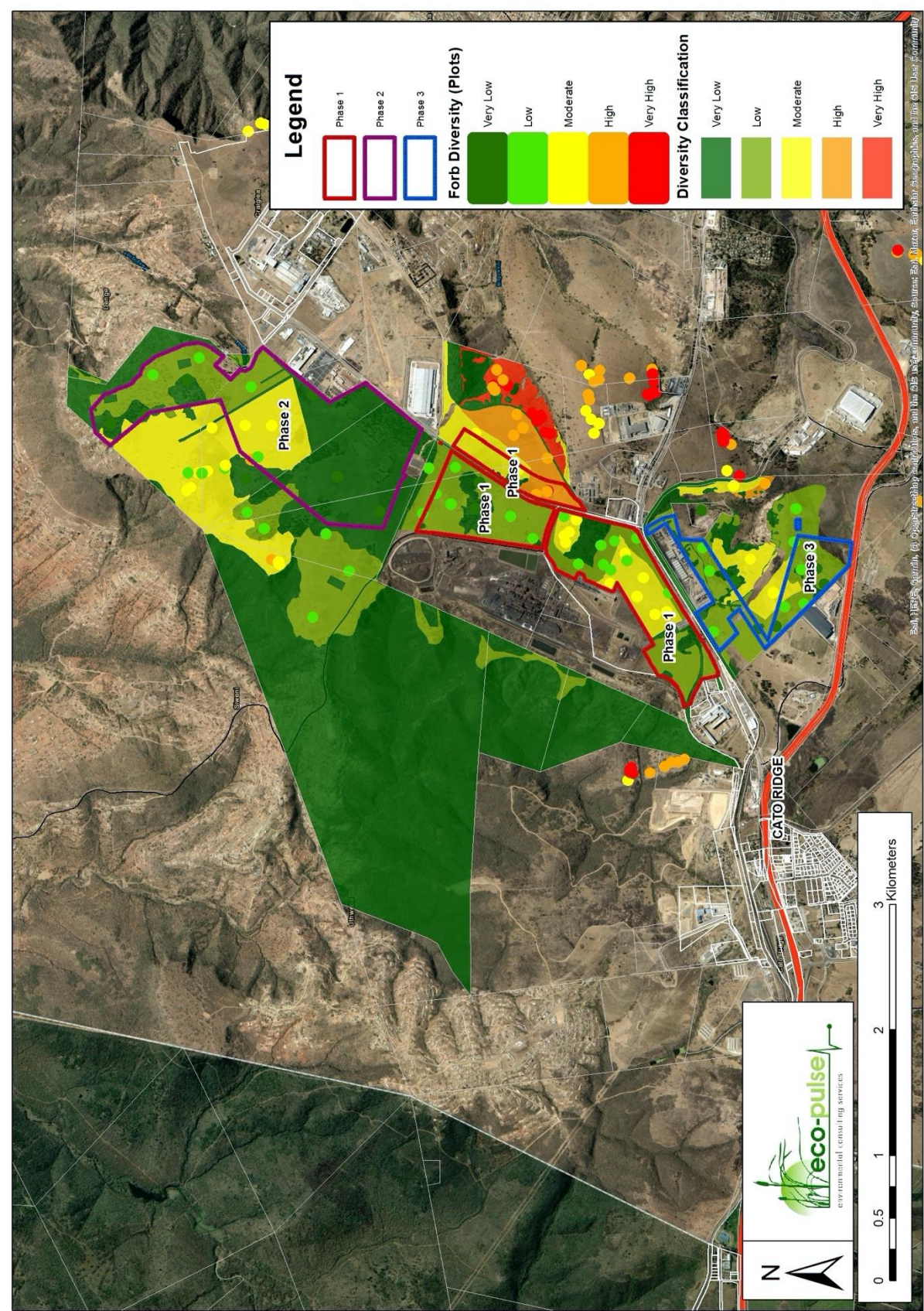


Appendix 8. Forb diversity scores

(Forbs are the non-graminoid/ non-grass or sedge, constituents of grassland and included in this category are herbaceous plants)

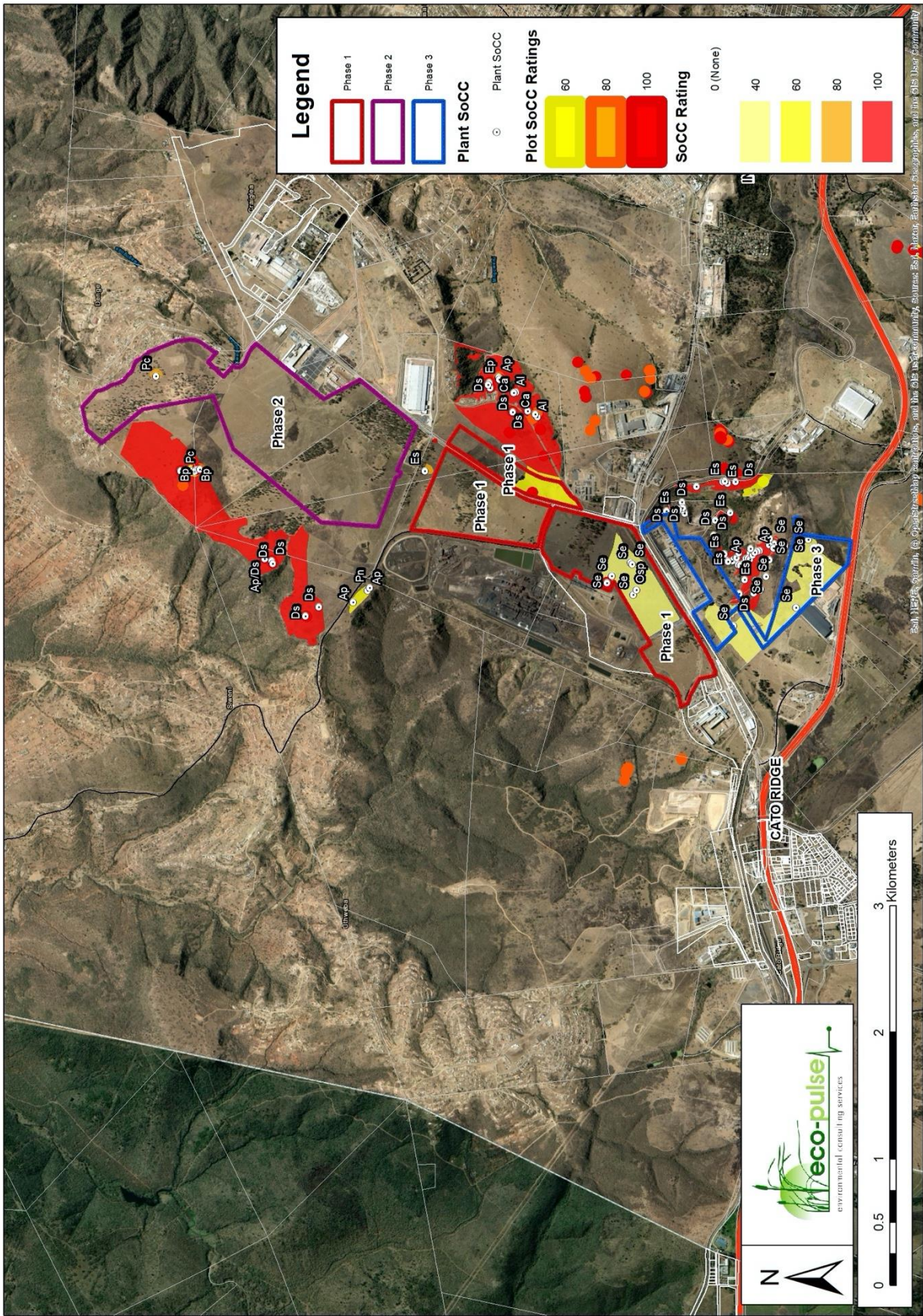


Appendix 9. Forb diversity classification



Appendix 10. Species of conservation concern

A key to species is provided below.



KEY

Ap = *Sensitive Species 88*

Bp = *Brachystelma pulchellum* (Near Threatened, KZN-SS and Durban escarpment endemic).

Ca = *Gineraria atriplicifolia* (Vulnerable). This is not a species of open grassland, but scrubby grassland typically on forest or bush clump margins.

Ds = *Dyschoriste* (*Chaetacanthus* sp. nov.) (National Red List does not assess undescribed species, but according to knowledge available would qualify under IUCN red list criteria as Endangered/ Critically Endangered. Appears to be a KZN-SS endemic).

Es = *Eriosempsis subanisophylla* (Vulnerable) is mainly known from the Pondoland Centre of Plant Endemism and occurs at the northern limit of its range at Cato Ridge.

Pc = *Pachycarpus coronarius* (not in red or orange categories but known from few populations; Cato Ridge is the only locality from which known in the eThekweni Municipal Area).

Pn = *Plectranthus* (*Coleus*) *hadiensis*, distinct form or variety not attributable to *P. hadiensis* var. *hadiensis*, var. *tomentosus* or var. *woodii*, all of which occur at Cato Ridge. This may be a localized endemic.

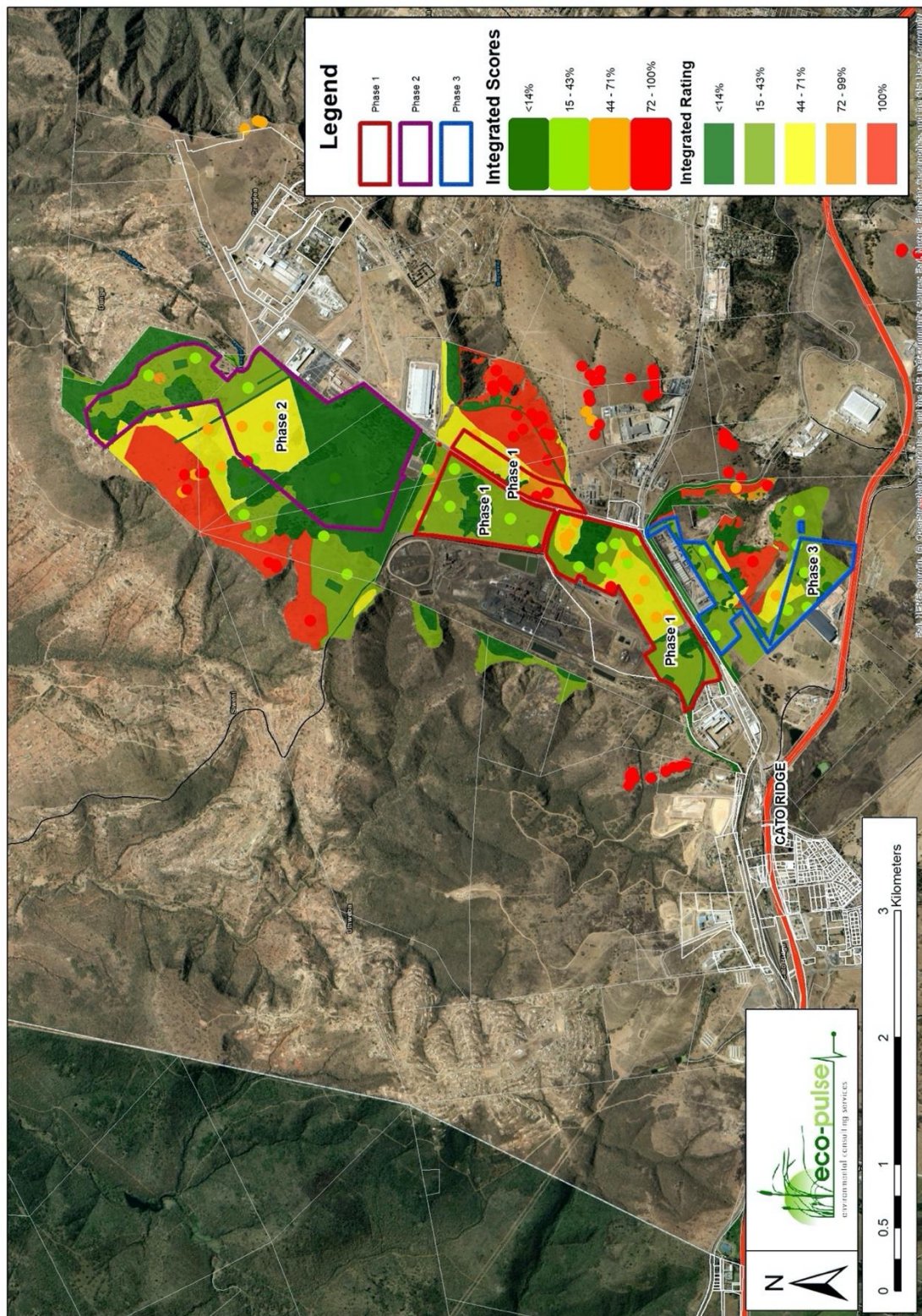
Se = *Senecio exuberans* (Endangered). This is only known from an area between the high Durban escarpment and Pietermaritzburg. It is, however, the only threatened species found (apart from *Gineraria atriplicifolia* which is not a species of open grassland), which has wind distributed fruits. As it tolerates and even flourishes in slightly disturbed, scrubby grassland, a few plants are able to re-establish away from more grassland with High forb diversity grassland (i.e. good quality grassland) into that with Low forb biodiversity scores (i.e. poor quality grassland). Therefore, occurrence does not exactly correspond with good quality grassland.

Other notes

- *Delosperma suttoniae* is not Ds (*Chaetacanthus*/ *Dyschoriste* sp.) but is tightly clustered with this in and adjacent to the development areas. *D. suttoniae* is DDT in the National Red List meaning it is insufficiently known and should on a precautionary basis be treated as a species of conservation concern. It is a KwaZulu-Natal endemic known from few locations.
- *Osp* = *Ornithogalum* sp. This is recorded on a precautionary basis. It is likely not threatened but was one of the few species which could not be identified during fieldwork and as all members of the family are protected by the KwaZulu-Natal provincial conservation ordinance. It should be relocated, and identified to species accordingly, if its habitat is destroyed.
- *Prunus africana* (African Cherry, Vulnerable). A single specimen was found in the smaller of two areas of Scarp Forest shown in Appendix 1 in 2014 but could not be relocated. It is possible there are more in the larger area of Scarp Forest. This species has a wide distribution in eastern South Africa and is locally common in some forests, but is rare in the semi-coastal area and severely threatened by medicinal harvesting.

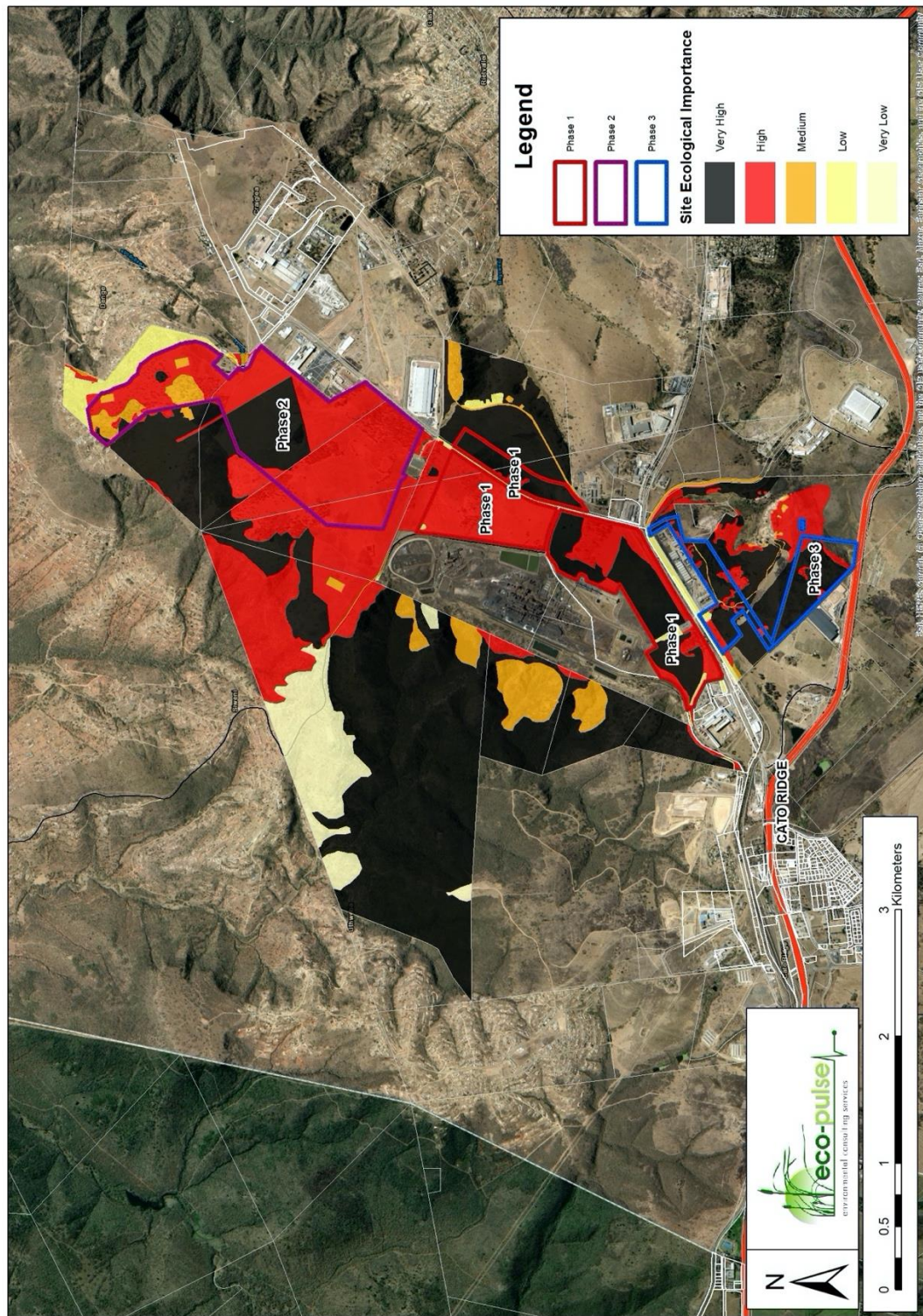
Appendix 11. Integrated grassland score

(This is composite of diversity and occurrence of threatened species/species of conservation concern)



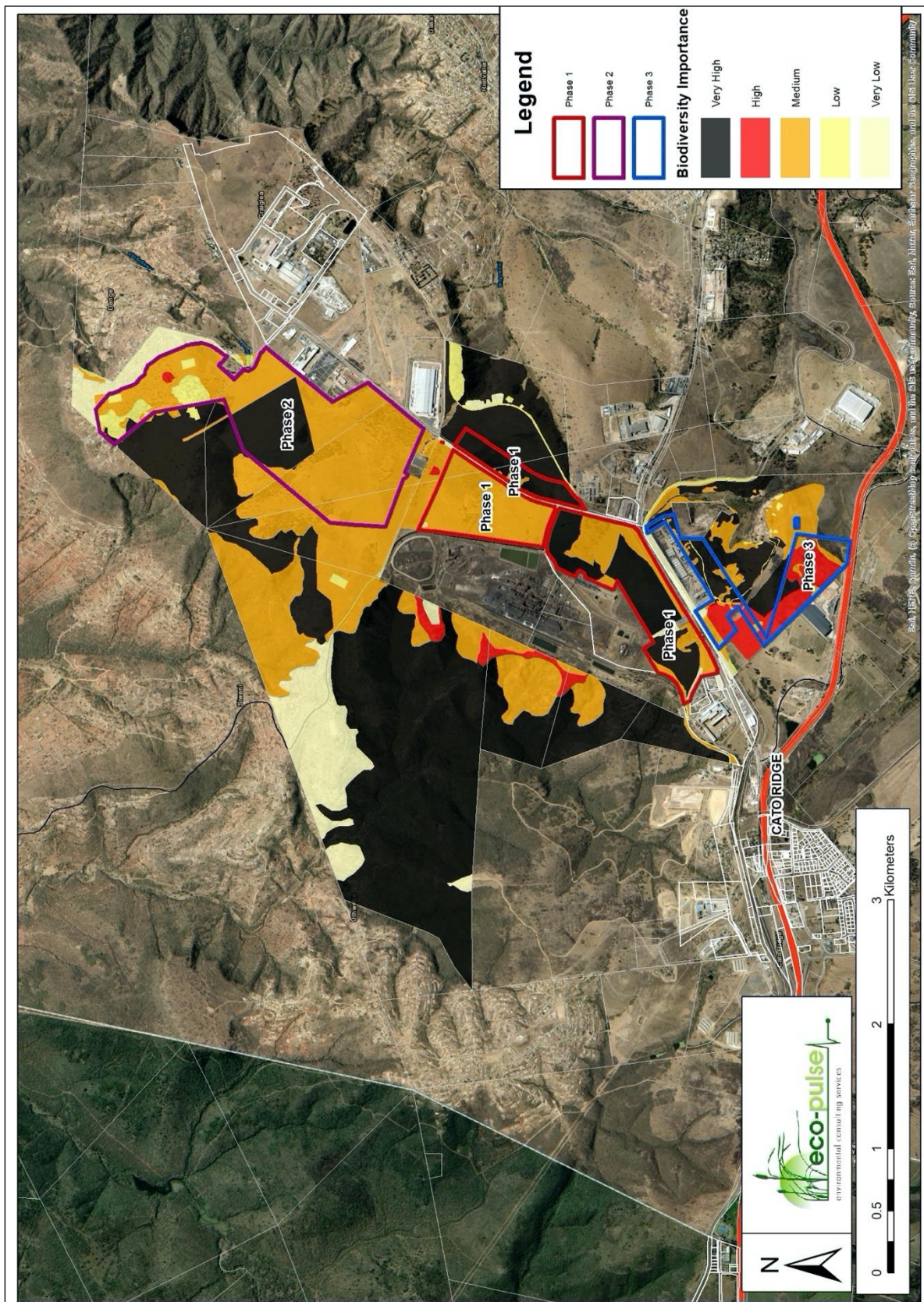
Appendix 12. Site ecological importance

Site Ecological Importance (SEI) is defined through a formula provided in SANBI (2020) as = (equal to) BI (Biodiversity Importance, mapped in Appendix 12) + RR (Receptor Resilience). Where BI is in turn = (equals) CI (Conservation Importance, mapped in Appendix 12) + FI (Functional Importance, mapped in Appendix 13).



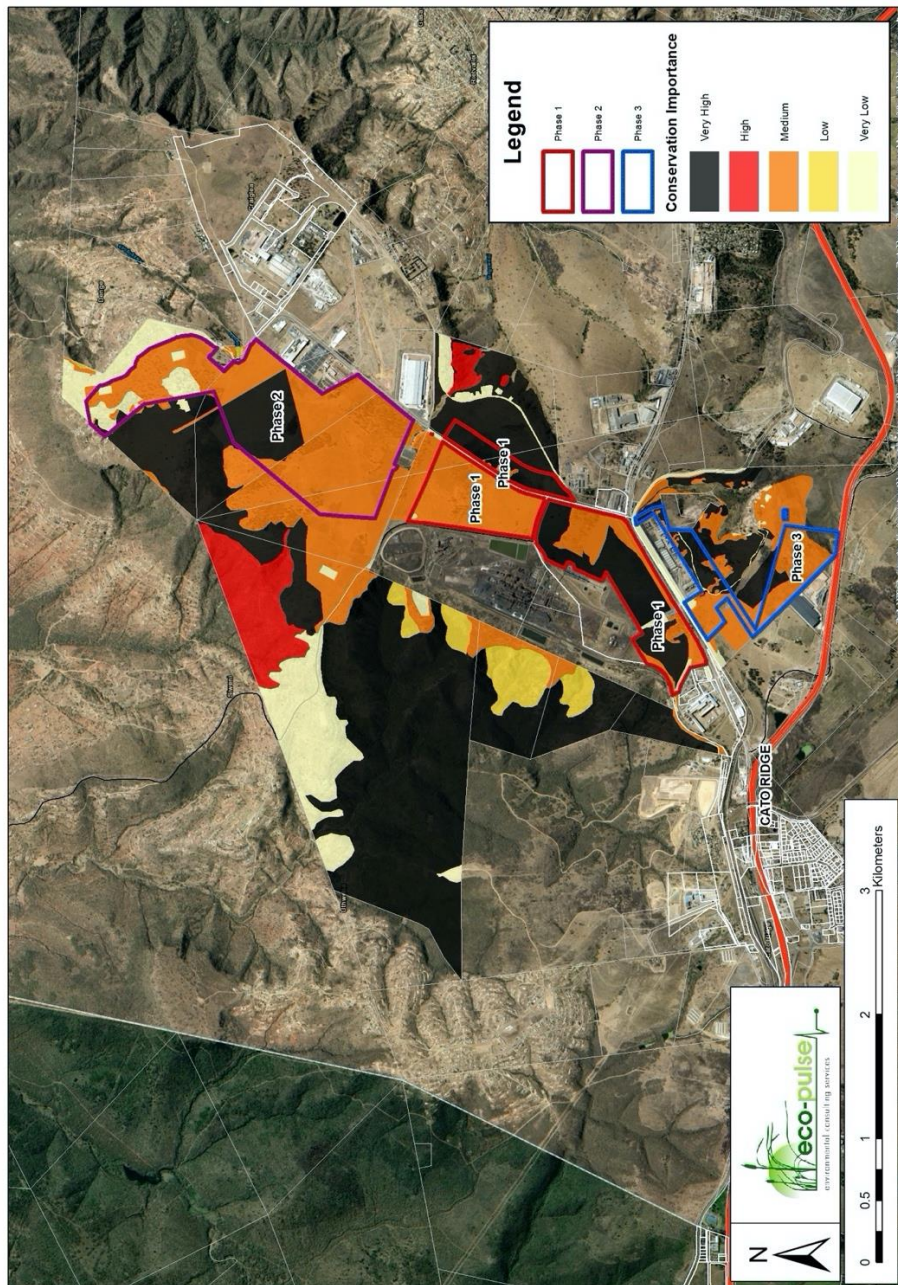
Appendix 13. Biodiversity importance

Biodiversity Importance is defined in SANBI (2020) as = (equal to) CI (Conservation Importance, shown in Appendix 10) + FI (Functional Integrity, shown in Appendix 11).



Appendix 14. Conservation importance

Conservation Importance is defined in SANBI (2020) as: “The importance of a site for supporting biodiversity features of conservation concern present, e.g. populations of IUCN threatened and Near Threatened species (CR, EN, VU and NT). Rare species, range restricted species, globally significant populations of congregatory species, and areas of threatened ecosystem types, through predominantly natural processes.” Range restricted species are considered to have a global population of 10 000 km² or less.

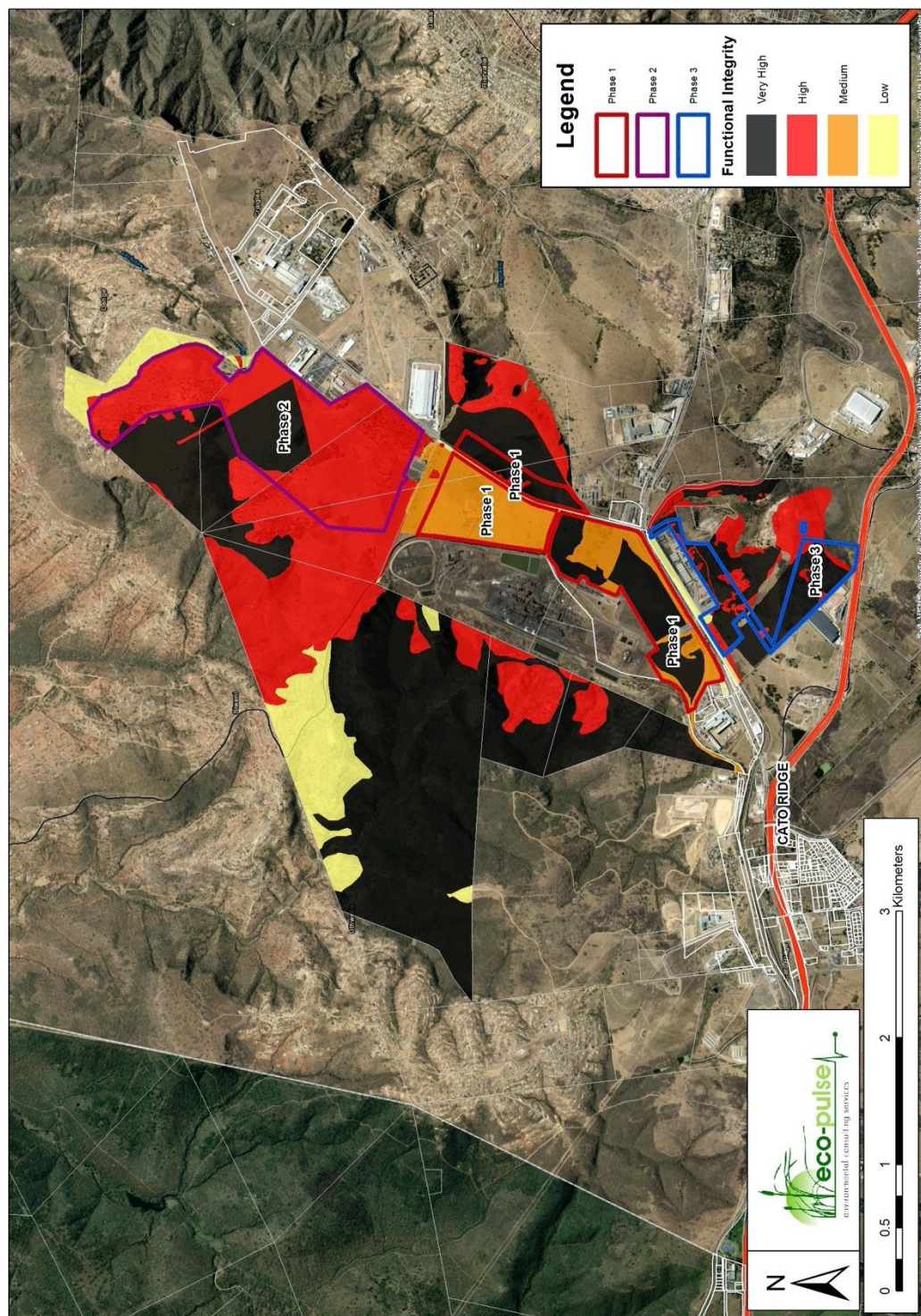


SANBI (2020) provides Ratings of Conservation Importance from Very High, High, Medium, Low and Very Low, together with threshold (fulfilling) criteria. It is noted that any area of a Critically Endangered ecosystem, or any area comprising >0.1 % of an Endangered ecosystem are scored as Very High.

In my opinion this percentage threshold should include degraded if not entirely secondary instances and that higher than Moderate conservation importance shown in this map, may be justified.

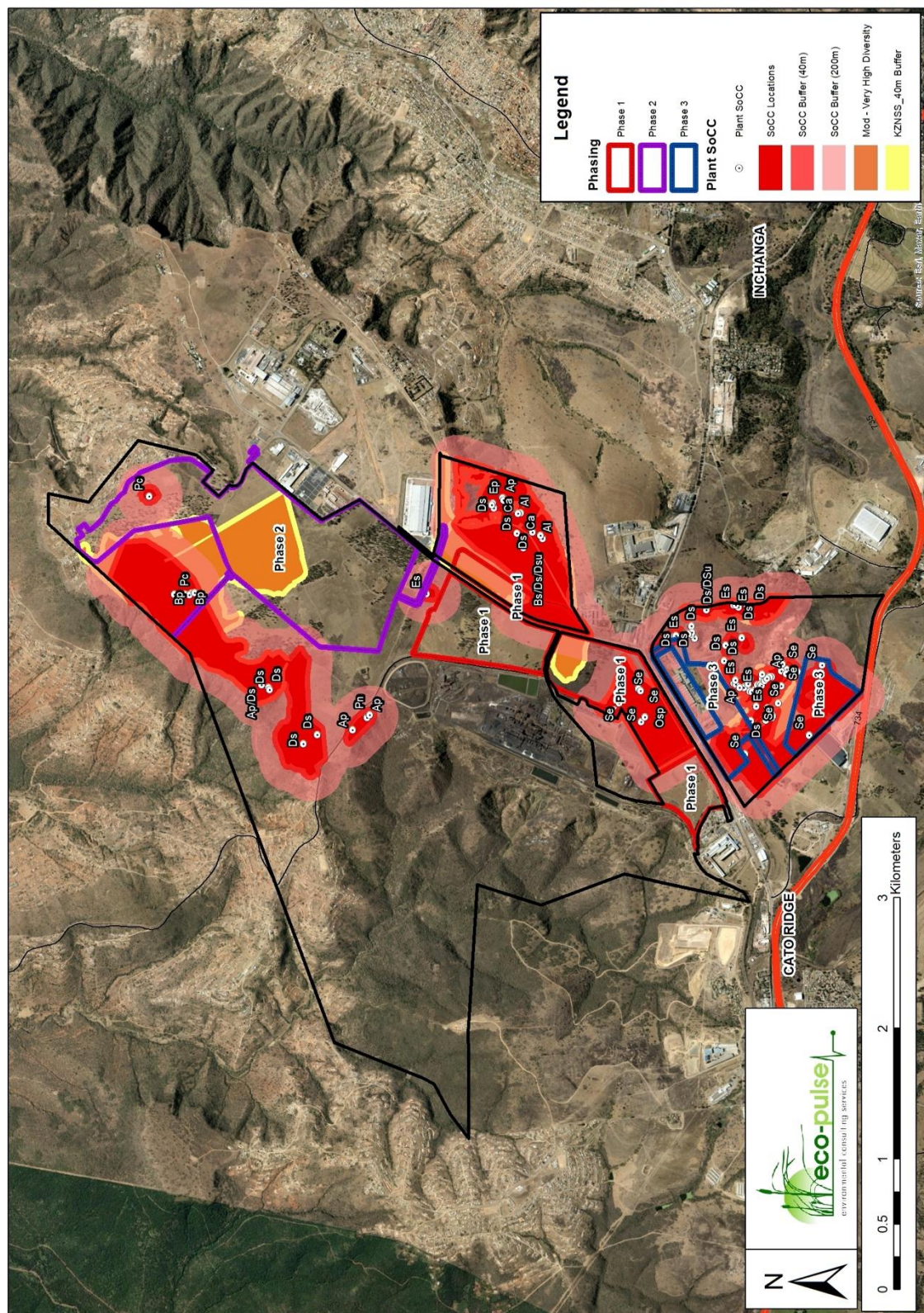
Appendix 15. Functional integrity

In terms of SANBI (2020): Functional Integrity (FI) of the receptor (e.g. the vegetation/fauna community or habitat type) is defined as the receptors' current ability to maintain the structure and functions that define it, compared to its known or predicted state under ideal conditions. Simply stated, FI is: a measure of the ecological condition of the impact receptor as determined by its remaining intact and functional area, its connectivity to other natural areas and the degree of current persistent ecological impacts.



Appendix 16. Buffers on areas of occurrence of species of conservation concern

This includes the illustrative buffers of 200 metres for all faunal and floral species indicated but not explained or justified in the Species Environmental Assessment guidelines. See comments in text of report.



Appendix 17. Photographs



Northern part of Phase 1, part comprising damp KwaZulu-Natal Sandstone Sourveld with which has suffered historical disturbance and displays mainly low herbaceous plant diversity.



Southern part of Phase 1, part comprising damp KwaZulu-Natal Sandstone Sourveld with moderate species diversity.



South-western part of Phase 1, close to Assmang facilities, a degraded patch in which alien *Pinus* trees have invaded the damp grassland.



Phase 1, eastern edge, comprising primary KwaZulu-Natal Sandstone Sourveld in good condition. The Natal Group sandstone outcrops are habitat for *Chaetacanthus* sp. nov. and other species of conservation concern.



Phase 2, rocky escarpment comprising KwaZulu-Natal Sandstone Sourveld. Herbaceous plant diversity varies from low to Moderate, but this area, especially towards the northern edge, hosts a large number of species of conservation concern.



Phase 2, damp KwaZulu-Natal Sandstone Sourveld in which species diversity is variable but mostly Low. An extensive line of invasion by eucalypts can be seen behind.



Phase 2, part which has been unlawfully sand-mined and invaded by eucalypts.



Phase 2, another part which has been repeatedly unlawfully sand-mined and invaded by eucalypts, with settlement behind.



Phase 3, part comprised of KwaZulu-Natal Sandstone Sourveld, well grazed by cattle.



Phase 3, well-grazed, secondary or nearly secondary KwaZulu-Natal Sandstone Sourveld.



Above: Rock outcrops have in some places deterred the worst effects of grazing, in which Moderate herbaceous plant diversity may still persist.



Low-growing species or those associated with exceptional outcropping or thin soils have also been somewhat protected, such as this proliferation of *Chaetacanthus/Dyschorise* sp. nov.



Phase 3. Historical sand-mining has caused localized, severe damage to some of the grassland and wetland vegetation.



Phase 3. Recent unlawful sand-mining with emergence of alien species in its wake (here mainly *Acacia mearnsii*, the Black Wattle).



Phase 3. Extensive wetlands and hygrophilous grassland occurs in parts, extending into and part pf habitat beyond the study area. This example of wetland vegetation shows many *Gunnera perperna*.



Argyrolobium longifolium, red listed as vulnerable. The tall, willowy appearance and narrow leaves make it distinctive in the later summer. However, in the spring and earlier summer, when plants are shorter and leaves may be broader, it can be confused with *A. baptisoides*

Argyrolobium baptisoides. Edwards (1994) suggests that plants in southern KwaZulu-Natal may be a distinct subspecies.





Brachystelma pulchellum, red listed as Near Threatened. It is nearly endemic to the Durban hinterland. It mainly occurs in thin soils on or flanking Natal Group sandstone outcrops, but is here photographed in deeper, sandy soil on the western edge of the old Cato Ridge airfield, north of the N3 national road.



Senecio exuberans is an Endangered species without ray florets known only from a small area between the Durban escarpment and Pietermaritzburg. It is also inconspicuous until it flowers in December and January. It is scattered throughout the Cato Ridge grasslands including Dry Coast Hinterland Grassland on Dwyka Group tillite south of the N3, but is more frequent on Natal Group sandstone, with these KZN Sandstone Sourveld grasslands prevalent north of the N2.



Chaetacanthus/Dyschoriste sp. nov., which occurs in skeletal to thin soils associated with extensive Natal Group sandstone outcropping. Early in the season they may be confused with *C. burchellii* Nees, but can readily be distinguished by glandular flowers, especially calyces, longer, stoloniferous stems and larger flowers.



Chaetacanthus/Dyschoriste sp. nov. appears to be endemic or nearly endemic to KwaZulu-Natal Sandstone Sourveld in the outer parts of the eThekweni Municipal Area, with other sites from which historically known at Inanda now entirely or substantially transformed.





Dierama pallidum. Red listed as vulnerable, this species is only known from the Durban escarpment to Pietermaritzburg. At Cato Ridge, it was found in grassland on Dwyka Group tillite and Natal Group sandstone.



Delosperma suttoniae. This is a poorly known species endemic to KwaZulu-Natal where known from few collections. Plants were found on and flanking Natal Group sandstone pavements and outcrops, much designated for transforming land use. In this habitat, it may grow with *D. lineare*, the latter a far more common species with white flowers.



Eriosemopsis subanisophylla, cited as a Pondoland Centre endemic (Van Wyk & Smith 2001) and red listed as vulnerable.

The species occurs in the Pondoland Centre and northwards along the KwaZulu-Natal coastal escarpment to inland of Durban. At Cato Ridge, it is nearly entirely confined to grasslands on Natal Group sandstone.





Helichrysum asperum var. *comosum* Hilliard is endemic to KwaZulu-Natal. It is usually found along beaches but is known from a few inland localities up to 900 m a.s.l. "always on sandy soils" (Hilliard 1983). At Cato Ridge, it is found in sparse grassland on Phase 2.

The occurrence at Cato Ridge, of *Sensitive Species* 649 Oliv. (N.E.Br.), another species mainly associated with the coastal littoral, may reflect the same phenomenon, namely sandy soils associated with Natal Group sandstone providing an edaphically similar substrate that enabled migration further inland.



Helichrysum griseum has a limited distribution in eastern South Africa. Inflorescences are at first pink to deep pink (below), but this complexion fades as they grow out (left).





Helichrysum pannosum DC. (above) is red listed as endangered. Here plants are still growing out, but become taller and develop inflorescences with lemon-yellow flower bracts in the early winter.



Hermannia sandersonii Harv. (left) is red listed as vulnerable and is mainly known from the high parts of the Durban escarpment. This is one of the earliest flowering grassland species, with flowers often appearing in the late winter and early spring before rains arrive or the leaves are well developed. It was only found in grassland on Natal Group sandstone.



Indigofera rubroglandulosa is part of a complex that includes *I. hiliaris* Eckl. & Zeyh., *I. sp. nov. A* and *I. sp. nov. B*, all of which are found at Cato Ridge.

Indigofera rubroglandulosa was found to be one of the 30 most common non-graminoid species in grassland on Natal Group sandstone at Cato Ridge.



Indigofera sp. nov. B (below and next page), is closely related to *I. hiliaris*, has leaflets that “are very narrow and sharply pointed and many times longer than wide, the leaves often ascending and hugging the stems” (Dr. Brian Schrire, pers. comm.).



Above: *Indigofera sp. nov. B*



Above: *Indigofera* sp. nov. B

Below: *Pachycarpus coronarius* E.Mey. Cato Ridge is the only locality from which known in the eThekwin Municipality Area, and also the most northern.





Phymaspermum pinnatifidum is cited as a KwaZulu-Natal Sandstone Sourveld endemic in Mucina & Rutherford (2006).

According to Hilliard (1977) it is known: "only from Umzinto to the Durban "between 600 and 900 m a.s.l." where it forms colonies in grassland over sandstone.



At Cato Ridge, it was only found in grassland on Natal Group sandstone, usually on south-facing aspects.

Although some difficulty was experienced in relating the varietal descriptions of Codd (1985) back to material of *Plectrathus (Coleus) hadiensis* found at Cato Ridge, plants illustrated below were referred to *P. hadiensis* var. *hadiensis*.





Plants referred to as *Plectranthus hadiensis* var. nov. These plants are only found in skeletal soils upon and on the edges of Natal Group sandstone pavements and outcrops. They differ from *P. hadiensis* var. *hadiensis* (which may occur in rocky grassland in deeper soils nearby) in smaller, more glaucous leaves and grown-out stems that have a longer decumbent habit. The inflorescences may become more elongate and the flowers are more richly coloured purple.



APPENDIX 18. Plant species list

8.1. Main alien invasive species

Name	Common Name
<i>Acacia mearnsii</i>	Black Wattle
<i>Achyranthes aspera</i>	Burweed
<i>Ageratum conyzoides</i>	Blue Weed
<i>Ageratum houstonianum</i>	Blue Weed
<i>Bidens bipinnata</i>	Blackjack
<i>Chenopodium album</i>	White Goosefoot
<i>Chromolaena odorata</i>	Chromolaena
<i>Cirsium vulgare</i>	Spear Thistle
<i>Conyza</i> spp.	Fleabanes
<i>Datura stramonium</i>	Thorn-apple
<i>Eucalyptus</i> spp.	Gum
<i>Flaveria bidentis</i>	Smelter's Bush
<i>Lantana camara</i>	Lantana
<i>Melia azedarach</i>	Syringa
<i>Nicandra physalodes</i>	Apple-of-Peru
<i>Opuntia ficus-indica</i>	Sweet Prickly Pear
<i>Physalis viscosa</i>	-
<i>Plantago lanceolata</i>	-
<i>Populus x canescens</i>	Grey Poplar
<i>Ricinus communis</i>	Castor-oil Bush
<i>Schinus terebinthifolius</i>	Brazilian Pepper Tree
<i>Senecio madagascariensis</i>	-
<i>Senna didymobotrya</i>	Peanut Butter Cassia
<i>Senna pendula</i> var. <i>glabrata</i>	-
<i>Sesbania punicea</i>	Red Sesbania
<i>Solanum mauritianum</i>	Bugweed
<i>Tagetes minuta</i>	Khaki Weed
<i>Tecoma stans</i>	Yellow Bells
<i>Verbena aristigera</i>	-
<i>Verbena bonariensis</i>	-
<i>Verbena brasiliensis</i>	-
<i>Verbena officinalis</i>	-

8.2. List of non-graminoid species recorded in grassland on the three sites with collecting numbers, where applicable

ACANTHACEAE

Asystasia gangetica var. *micrantha*
Barleria meyeriana
Barleria ovata
Blepharis integrifolia
Chaetacanthus burchellii
Chaetacanthus sp. nov.
Crabbea hirsuta
Hypoestes forskalii
Justicia flava
Justicia protracta subsp. *protracta*
Ruellia cordata
Thunbergia atriplicifolia
Thunbergia venosa

AGAPANTHACEAE

Agapanthus campanulatus subsp. *campanulatus*

ALLIACEAE

Tulbaghia acutiloba
Tulbaghia ludwigiana

AMARANTHACEAE

Kyphocarpa trichinioides

AMARYLLIDACEAE

Boophone disticha
Cyrtanthus breviflorus
Cyrtanthus contractus

ANTHERICACEAE

Chlorophytum cooperi
Chlorophytum krookianum

APIACEAE

Afrosciadium cafferum
Afrosciadium natalense
Alepidea peduncularis
Centella asiatica
Centella coriacea
Centella glabrata var. *natalensis*
Pimpinella caffer

APOCYNACEAE

Asclepias albens

Asclepias flexuosa
Aspidoglossum gracile
Brachystelma pulchellum
Brachystelma pygmaeum subsp. *flavidum*
Brachystelma rubellum
Cryptolepis oblongifolia
Gomphocarpus physocarpus
Huernia hystrix var. *hystrix*
Pachycarpus asperifolius
Pachycarpus concolor subsp. *concolor*
Pachycarpus coronarius
Pachycarpus natalensis
Periglossum mackenii
Raphionacme galpinii
Raphionacme hirsuta
Taczazea apiculata (unusually growing in open grassland)
Xysmalobium involucreatum
Xysmalobium undulatum var. *undulatum*

ANACAMPSEROTACEAE

Talinum cafferum

ANACARDIACEAE

Searsia dentata
Searsia discolor
Searsia penteri
Searsia pyroides var. *integrifolia*
Searsia rehmanniana

ARACEAE

Stylochaeton natalensis

ARALIACEAE

Cussonia spicata

ASPARAGACEAE

Asparagus africanus
Asparagus racemosus

ASPHODELACEAE

Aloe candelabrum
Aloe maculata
Kniphofia burchananii
Kniphofia laxiflora
Kniphofia linearifolia
Kniphofia tysonii Baker subsp. *tysonii*

Trachyandra gerrardii
Trachyandra saltii var. *saltii*

ASTERACEAE (COMPOSITAE)

Artemisia afra
Aster bakerianus
Athrixia phyllicoides
Berkheya bipinnatifida subsp. *bipinnatifida*
Berkheya erysithales
Berkheya insignis
Berkheya rhapontica subsp. *rhapontica*
Berkheya setifera
Berkheya speciosa subsp. *speciosa*
Berkheya umbellata
Callilepis laureola
Cineraria atriplicifolia
Conyza obscura
Conyza pinnata
Conyza ulmifolia
Cotula nigellifolia var. *nigellifolia*
Crassocephalum picridifolium
Dicoma anomala subsp. *cirsiioides*
Euryops laxus
Felicia erigeroides
Gazania krebsiana
Gerbera kraussii
Gerbera natalensis
Gerbera piloselloides
Gnaphalium austroafricanum
Helichrysum acutatum
Helichrysum adenocarpum subsp. *adenocarpum*
Helichrysum allioides
Helichrysum appendiculatum
Helichrysum asperum var. *comosum*
Helichrysum aureonitens
Helichrysum aureum var. *monocephalum*
Helichrysum auriceps
Helichrysum caespititium
Helichrysum cephaloideum
Helichrysum griseum
Helichrysum herbaceum
Helichrysum krebsianum
Helichrysum longifolium
Helichrysum natalitium
Helichrysum nudifolium var. *nudifolium*
Helichrysum nudifolium var. *pilosellum*
Helichrysum pallidum
Helichrysum panduratum var. *panduratum*
Helichrysum pannosum
Helichrysum ruderales
Helichrysum rugulosum
Helichrysum stenopterum
Hypochaeris radicata
Lactuca indica
Lactuca sp.
Laggera crispata

Macledium zeyheri subsp. *argyrophyllum*
Melanthera scandens subsp. *dregei*
Microglossa mespilifolia
Nidorella auriculata
Phymaspermum acerosum
Phymaspermum pinnatifidum
Pseudognaphalium luteo-album
Schistostephium griseum
Schistostephium heptalobum
Schistostephium rotundifolium
Senecio albanopsis
Senecio bupleurioides
Senecio chrysocoma
Senecio coronatus
Senecio erubescens var. *dichotomus*
Senecio exuberans
Senecio glaberrimus
Senecio latifolius
Senecio oxyriifolius
Senecio polyanthemoides
Senecio umgeniensis
Senecio variabilis
Seriphium plumosum
Sonchus sp.
Tenryhnea phyllicifolia
Tolpis capensis
Vernonia capensis
Vernonia dregeana
Vernonia galpinii
Vernonia hirsuta
Vernonia natalensis
Vernonia oligocephala

BORAGINACEAE

Cynoglossum sp.
Ehretia rigida subsp. *rigida*

BRASSICACEAE

Cleome monophylla
Heliophila elongata
Heliophila rigidiuscula

CAM PANULACEAE

Wahlenbergia denticulata
Wahlenbergia grandiflora
Wahlenbergia krebsii subsp. *krebsii*
Wahlenbergia madagascariensis

CAROPHYLLACEAE

Dianthus zeyheri subsp. *natalensis*
Pollichia campestris
Polycarpaea corymbosa var. *corymbosa*
Slene burchellii subsp. *multiflora*

Slene undulata subsp. *polyantha*

CELASTRACEAE

Gymnosporia buxifolia

Gymnosporia glaucophylla

COLCHICACEAE

Littonia modesta

COMBRETACEAE

Combretum molle

COMMELINACEAE

Commelina africana var. *krebsiana*

Commelina africana var. *lancispatha*

Cyanotis robusta

Cyanotis speciosa

CONVOLVULACEAE

Convolvulus natalensis

Evolvulus alsinoides

Ipomoea crassipes

Ipomoea pellita

Ipomoea simplex

Xenostegia tridentata subsp. *angustifolia*

CRASSULACEAE

Crassula alba var. *alba*

Crassula capitella subsp. *meyeri*

Crassula lanceolata subsp. *transvaalensis*

Crassula obovata var. *obovata*

Crassula pellucida subsp. *brachypetala*

Crassula perfoliata var. *heterotricha*

Crassula vaginata subsp. *vaginata*

Kalanchoe rotundifolia

CURCUBITACEAE

Cucumis hirsutus

Cucumis zeyheri

Momordica foetida

DIPSACACEAE

Cephalaria oblongifolia

Scabiosa columbaria

EBENACEAE

Diospyros lycioides subsp. *sericea*

EUPHORBIACEAE

Acalypha depressinerva

Acalypha glandulifolia

Acalypha peduncularis

Acalypha punctata

Acalypha villicaulis

Clusia cordata

Clusia hirsuta

Euphorbia gueinzii

Euphorbia pulvinata

Euphorbia striata var. *striata*

Jatropha hirsuta var. *hirsuta*

Tragia meyeriana

FABACEAE

Abrus laevigatus

Acacia nilotica subsp. *kraussiana*

Aeschynomene micrantha

Allyscarpus rugosus subsp. *perennirufus*

Argyrolobium baptisioides

Argyrolobium longifolium

Argyrolobium rotundifolium

Argyrolobium stipulaceum

Aspalathus chortophila

Chamaecrista capensis var. *flavescens*

Chamaecrista mimosoides

Chamaecrista plumosa var. *erecta*

Chamaecrista plumosa var. *plumosa*

Crotalaria globifera

Crotalaria lanceolata subsp. *lanceolata*

Dalbergia obovata

Desmodium dregeanum

Desmodium gangeticum

Desmodium setigerum

Dichrostachys cinerea

Dolichos trilobus subsp. *transvaalicus*

Eriosema cordatum

Eriosema kraussianum

Eriosema parviflorum subsp. *parviflorum*

Eriosema preptum

Eriosema salignum

Indigostrum fastigiatum

Indigofera hiliaris var. *hiliaris*

Indigofera rubroglandulosa

Indigofera sp. nov. A – D.G.A. Styles 5122, 5237
4253, 5231 (NH)

Indigofera sp. nov. B – D.G.A. Styles 5091 (NH)

Indigofera tristis

Indigofera vicioides var. *rogersii*

Indigofera williamsonii

Lotononis calycina

Lotononis cf. *pulchra*

Lotononis corymbosa

Lotononis solitudinis

Lotus discolor subsp. *discolor*

Macrotyloma maranguense

Pseudarthria hookeri var. *hookeri*
Rhynchosia caribaea
Rhynchosia cooperi
Rhynchosia nervosa var. *nervosa*
Rhynchosia totta var. *totta*
Sphenostylis angustifolia
Tephrosia capensis
Tephrosia elongata var. *elongata*
Tephrosia macropoda var. *diffusa*
Tephrosia macropoda var. *macropoda*
Tephrosia polystachya var. *hirta*
Tephrosia semiglabra
Teramnus labialis subsp. *labialis*
Vigna unguiculata subsp. *protracta*
Vigna unguiculata subsp. *tenuis* var. *ovata*
Vigna unguiculata subsp. *tenuis*
Vigna vexillata var. *angustifolia*
Vigna vexillata var. *vexillata*
Zornia capensis subsp. *capensis*

GENTIANACEAE

Sebaea grandis
Sebaea sedoides

GERANIACEAE

Geranium flanaganii
Pelargonium alchemilloides
Pelargonium luridum
Pelargonium pulverulentum

GUNNERACEAE

Gunnera perpensa

HYACINTHACEAE

Albuca setosa
Dipcadi sp.
Eucomis autumnalis
Eucomis comosa
Ledebouria apertiflora
Ledebouria ovatifolia
Ledebouria cooperi
Litanthus pusillus
Merwillia plumbea
Schizocarpus nervosus

HYPERICACEAE

Hypericum aethiopicum subsp. *sonderi*
Hypericum lalandii

HYPOXIDACEAE

Hypoxis argentea var. *sericea*

Hypoxis colchicifolia
Hypoxis hemerocallidea
Hypoxis multiceps
Hypoxis rigidula

IRIDACEAE

Aristea abyssinica
Aristea ecklonii
Aristea torulosa
Dierama argyreum
Dierama pallidum
Freesia laxa subsp. *laxa*
Gladiolus dalenii subsp. *dalenii*
Gladiolus ecklonii
Gladiolus inandensis
Gladiolus sericeovillosus subsp. *sericeovillosus*
Tritonia lineata var. *lineata*
Watsonia densiflora

LAMIACEAE

Aeollanthus parvifolius
Ajuga ophrydis
Endostemon obtusifolius
Leonotis intermedia
Leonotis leonorus
Ocimum obovatum subsp. *obovatum*
Orthosiphon suffrutescens
Plectranthus hadiensis var. *tomentosus*
Plectranthus hadiensis var. *hadiensis*
Plectranthus hadiensis var. nov. D.G.A. Styles 5087 (NH)
Rabdosiella calycina
Rothea hirsuta
Syncolostemon parviflorus
Teucrium kraussii

LINACEAE

Linum thunbergii

LOBELIACEAE

Cyphia elata
Lobelia flaccida
Monopsis decipiens
Monopsis stellarioides subsp. *stellarioides*

LYTHRACEAE

Nesaea sagittifolia var. *sagittifolia*
Rotala tenella

MAESACEAE

Maesa lanceolata

MELASTOMATACEAE

Dissotis canescens
Dissotis princeps

MESEM BRYANTHEACEAE (AIZOACEAE)

Delosperma lineare
Delosperma suttoniae

MOLLUGINACEAE

Limeum viscosum subsp. *viscosum* var. *glomeratum*
Psammotropha cf. *myriantha*

MYRTACEAE

Eugenia albanensis

OCHNACEAE

Ochna serrulata

ORCHIDACEAE

Eulophia clitellifera
Eulophia ensata
Eulophia hians var. *hians*
Eulophia tenella
Habenaria dives
Satyrium longicauda

OROBANCHACEAE

Alectra sessiliflora var. *sessiliflora*
Buchnera simplex
Cynium tubulosum subsp. *tubulosum*
Striga bilabiata subsp. *bilabiata*

ONAGRACEAE

Ludwigia octovalvis

OXALIDACEAE

Oxalis smithiana
Oxalis sp.

PASSIFLORACEAE

Basananthe sandersonii

PEDALIACEAE

Ceratotheca triloba

PHYLLANTHACEAE

Phyllanthus glaucophyllus
Phyllanthus heterophyllus
Phyllanthus maderaspatensis

PLANTAGINACEAE

Plantago lanceolata

POLYGALACEAE

Polygala hottentota
Polygala transvaalensis var. *transvaalensis*

POLYGONACEAE

Oxygonum dregeanum subsp. *dregeanum*

PROTEACEAE

Protea caffra subsp. *caffra*
Protea roupelliae subsp. *roupelliae*

RANUNCULACEAE

Clematis brachiata
Ranunculus multifidus

RUBIACEAE

Agathisanthemum chlorophyllum var. *chlorophyllum*
Anthospermum herbaceum
Anthospermum rigidum subsp. *pumilum*
Coddia rudis
Conostomium natalense
Eriosemopsis subanisophylla
Galopina sp.
Jasminum multipartitum
Kohautia amatymbica
Kohautia virgata
Oldenlandia affinis subsp. *fugax*
Oldenlandia herbacea var. *herbacea*
Pachystigma venosum
Pentanisia angustifolia
Pentanisia prunelloides subsp. *prunelloides*
Pentanisia prunelloides subsp. *latifolia*
Rubia cordifolia subsp. *conotricha*
Spermacoce natalensis
Vangueria infausta subsp. *infausta*

RUSCACEAE

Eriospermum cooperi var. *natalense*
Eriospermum flagelliforme
Eriospermum mackenii subsp. *mackenii*

RUTACEAE

Agathosma ovata

SANTALACEAE

Thesium costatum

Thesium natalense

SCROPHULARIACEAE

Diclis reptans

Graderia scabra

Hebenstretia comosa

Limosella grandiflora

Lindernia nana

Lindernia parviflora

Manulea parviflora var. *parviflora*

Nemesia denticulata

Selago densiflora

Selago hyssopifolia

Selago tarachodes

Sutera floribunda

Tetraselago natalensis

Zaluzianskya elongata

SMILACACEAE

Smilax anceps

SOLANACEAE

Solanum panduriforme

THYMELAEACEAE

Gnidia calocephala

Gnidia kraussiana var. *kraussiana*

Gnidia nodiflora

TILIACEAE

Corchorus asplenifolius

Grewia occidentalis var. *occidentalis*

Hermannia grandistipula

Hermannia sandersonii

Hibiscus aethiopicus var. *ovatus*

Triumfetta pilosa

VERBENACEAE

Lantana rugosa

Lippia javanica

VITACEAE

Cyphostemma natalitium

Rhoicissus tridentata subsp. *cuneifolia*

APPENDIX 19. Plot survey methodology

Part 1: Monitoring protocol for forbs and geophytes

The following protocols is supplied by the late Rob Scott-Shaw of EKZNW. There are two methods that should be used in combination, one for the graminoid component and one for the non-graminoid component (forbs and geophytes).

Aim:

To compare or enumerate sample site plant species composition

Objectives:

To measure the difference or change over time in plant species composition

To use simple and rapid methods including indicator groups

To use measures and scales that can be added to in later studies and are compatible with current vegetation science techniques

A) The standard for this work is to record the abundance of all non-graminoid plants at the 100 m² scale using 1 m² sub-samples

In other words we are compiling a species list for the 100 m² that gives us species richness of the forbs and geophytes. However to calculate a diversity index we also need an estimate of the abundance of each species.

The presence of non-graminoid plants in a 1 m² circular sub-plot or quadrat is recorded. This is repeated 16 times, although in some circumstances this can be reduced to 10 times. The sub-plot is placed randomly across the 10 m x 10 m sample site. Species present in the remainder of the site and not recorded in the sub-plots are then recorded by searching the unsampled area.

Plant species abundance is indicated by frequency. In other words this frequency measure is a 1 to 16 (index of the importance of the species for the plot. If *Helichrysum pallidum* occurs in sub-plots 4, 7, 13 then its frequency is 3 out of 16 and its abundance estimate is also 3.

This gives a list of species and their abundance. Species richness (the total) is a useful measure. However incorporating the abundance (estimate) of each enables the application of diversity indices. Shannon-Wiener diversity scores are obtained for each plot using the species list with abundance.

B) Record the abundance of non-graminoid plants at the 100 m² scale recording only species present in the 16 sub-plots and not the remaining area.

This is a quicker version of method A because it saves half an hour in the plot and time to identify additional species. It excludes a low number of species which tend to be rare on the site and tend to be of low significance if you want to detect changes in species composition over time i.e. a monitoring project where for example grazing pressure may have been reduced. 16 subplots without considering what is within the rest of the plot will typically detect 80 to 95% of the species.

C) Record the abundance of non-graminoid plants at the 100 m² scale recording only species present in the 10 sub-plots and not the remaining area.

This is a quicker version of method A and B because it saves a further half an hour in the plot and time to ID additional species and several hours to do the extra six sub-plots. My experience is that the 10 subplots will “pick up” 65 to 85% of the species.

This is adequate in many cases when a first assessment is needed as implemented on these properties.

Part 2: Monitoring protocol for grasses

Grass species composition should be determined using the common “veld assessment” method where 200 points are placed across the plot which in this area should be 10 m x 20 m. This gives a sampling intensity of 1 point per m². The nearest plant to the point is recorded. The final list provides the number of points/ strikes per species and should total 200 or more. This is converted to a percentage species composition.

Note: No benchmark lists are needed and no grazing condition scores are relevant. Other attributes of the grass sward of the plot such as basal cover and biomass are also not important for this level of monitoring.

Plots should well-placed and widely spaced around the suggested survey site, but this depends on grassland being more recently burned. These protocols should be implemented every three to four years. This is premised on grassland moving through two burning and regrowth cycles, assuming burning of instances every second year. Assessments within shorter cycles may not conclusively show trends in the face of either negative impacts or good management.

Appendix 20. Endemism in grassland on the KwaZulu-Natal coastal escarpment north of the Pondoland Centre

(Encompassing the KwaZulu-Natal Sandstone Sourveld and Ngongoni Veld grassland in this province)

Acronyms

ECE-E = Plant species endemic or nearly endemic to the Pondoland Centre and the coastal escarpment to the north;

LE = Local endemics, species collected from Cato Ridge without apparent matches in provincial herbaria or candidates in botanical literature

NCE-E = Northern coastal escarpment endemics, entirely confined to this area;

NCE-FE = Northern coastal escarpment floristic elements (nearly confined to this area);

PC-FE = Pondoland Centre Floristic Elements (mainly distributed in the Pondoland Centre but extending as far north as the Ngoye Forest).

* Occurrence in the Cato Ridge grasslands

1.1 Grassland

Northern coastal escarpment endemics and floristic elements (several undescribed species excluded)

<i>Sensitive Species 88</i> Baker *	NCE-E	Van Wyk & Smith (2014); Klopper et al. (2020)
<i>Argyrolobium longifolium</i> Walp. *	NCE-FE	Edwards (1994)
<i>Barleria natalensis</i> Lindau	NCE-E	Scott-Shaw (1999)
<i>Brachystelma modestum</i> R.A.Dyer	NCE-E	Styles (2008)
<i>Brachystelma natalense</i> N.E.Br.	NCE-E	Scott-Shaw (1999)
<i>Brachystelma pulchellum</i> Schltr. *	NCE-E	Dyer (1978, 1980, 1983); Styles (2008)
<i>Ceropegia rudatisii</i> Schltr.	NCE-E	Dyer (1980, 1983)
<i>Chaetacanthus</i> sp. nov. = D.G.A. Styles 3822, 3919, 3950, 3972, 3973 (NH) *	LE	HC
<i>Cineraria atriplicifolia</i> DC. *	NCE-FE	Cron et al. (2006); Hilliard (1977)
<i>Crassula smithii</i> Van Jaarsveld, D.Styles & G.McDonald	NCE-E	Van Jaarsveld et al. (2008)
<i>Crotalaria dura</i> subsp. <i>dura</i> J.M.Wood & M.S.Evans *	NCE-E	Styles & Le Roux (2012)
<i>Dierama pallidum</i> Hilliard *	NCE-E	Hilliard & Burt (1991)
<i>Dierama pumilum</i> N.E.Br.	NCE-FE	Hilliard & Burt (1991)
<i>Eriosema populifolium</i> Benth. ex Harv. subsp. <i>populifolium</i> *	NCE-E	Stirton (1978)
<i>Gymnosporia woodii</i> Szyszyl.	NCE-E	Jordaan (2004)
<i>Hermannia sandersonii</i> Harv. *	NCE-E	Gwynne-Evans (2015)
<i>Indigofera inandensis</i> Baker f. ex Schrire ined. (= DGA Styles 5122, 5237 NH) *	NCE-E	Dr Brian Schrire, pers. comm.
<i>Indigofera setosa</i> N.E.Br.	NCE-E	Brown (1912); Dr Brian Schrire, pers. comm.
<i>Kniphofia pauciflora</i> Baker	NCE-E	Codd (1968)
<i>Lotononis dichiloides</i> Sond.	NCE-E	Van Wyk (1991)
<i>Macrotyloma coddii</i> Verdc.	NCE-E	Verdcourt (1982)
<i>Pachycarpus acidostelma</i> M.Glen & Nicholas *	NCE-E	Glen et al. (2011)

<i>Phymaspermum pinnatifidum</i> (Oliv.) Källersjö *	NCE-E	Hilliard (1977)
<i>Rhus rudatisii</i> Engl.	NCE-FE	Moffet (1993)
<i>Satyrium rhodanthum</i> Schltr.	NCE-FE	McDonald & Styles (2012)
<i>Sisyranthus anceps</i> Schltr.	NCE-E	Raimondo (2009)
<i>Syncolostemon latidens</i> (N.E.Br) Codd	NCE-FE	Codd (1985); Scott-Shaw (1999)
<i>Tephrosia inandensis</i> H.M.L.Forbes	NCE-E	Scott-Shaw (1999)
<i>Zaluzianskya pilosa</i> Hilliard & B.L.Burt	NCE-FE	Hilliard (1994); Scott-Shaw (1999)

The KwaZulu-Natal form of *Leucospermum gerrardii* appears to be endemic to grassland on Natal Group sandstone, where known from a few localities on the high coastal escarpment between the Umvoti and Tugela Rivers (Scott-Shaw 1999, pers. obs.). Due to the form's uncertain taxonomic status, it is not included in the list above. It does not occur as far south as Cato Ridge.

Pondoland centre endemics and floristic elements occurring as far north as Durban

<i>Asclepias praemorsa</i> Schltr.	PC-FE	Nicholas (1982, 1999)
<i>Eriosemopsis subanisophylla</i> Robyns *	PC-FE	Scott-Shaw (1999); Van Wyk & Smith (2001)
<i>Kniphofia coddiana</i> Cufod.	PC-FE	Codd (1968); occurrence north of the Pondoland Centre based on personal observation

Appendix 21. Offsetting at Cato Ridge

It is preferable, for reasons listed in this report, that at least some of the offset be achieved locally including well investigating the possibility of adding to existing grassland conservation resources at Cato Ridge/Hammarvale south of the N3, or elsewhere on the Durban escarpment. At the same time, it is fully acknowledged this increases cost and much or most of the offset may need to be achieved outside of the eThekweni Municipal Area.

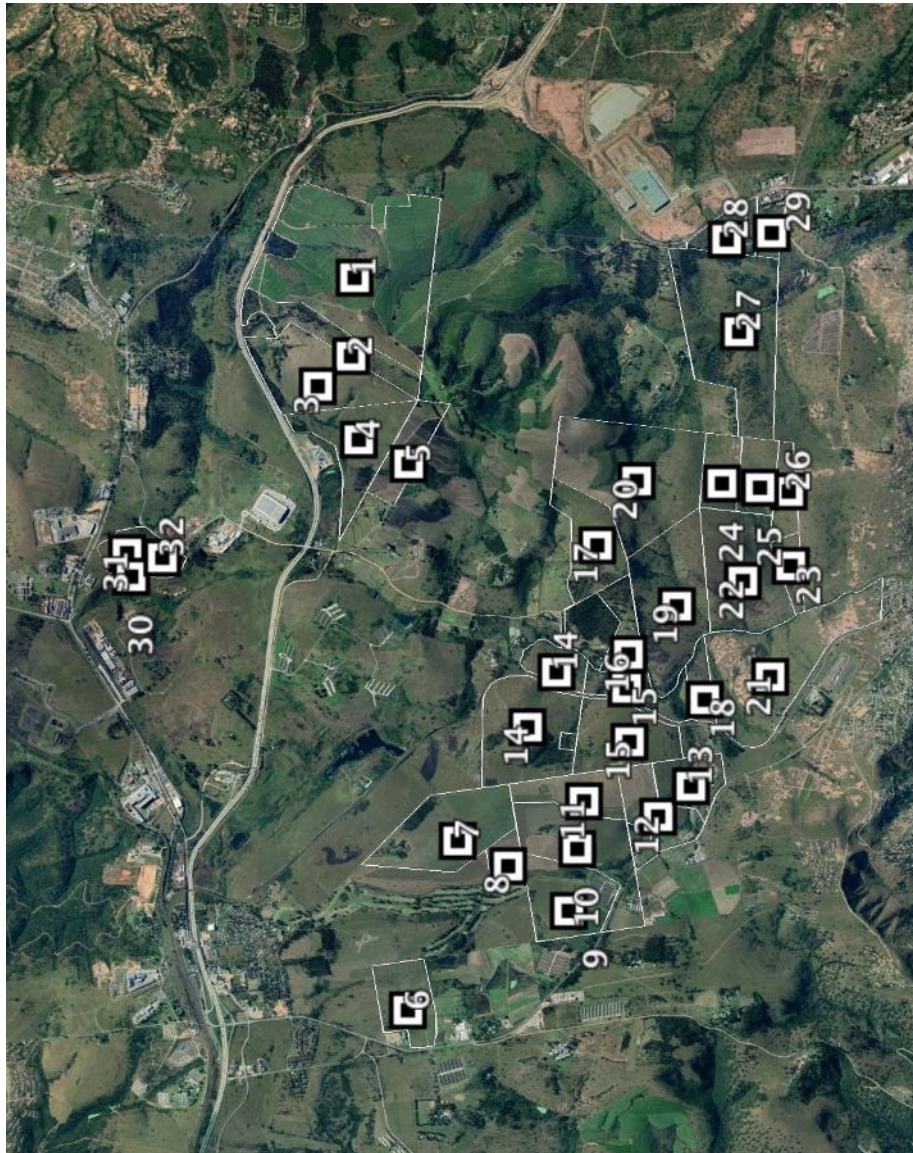


Figure 1. Potential offset areas identified for consideration in 2016.

11.1 Possible offset areas

Out of previous offset investigation work at Cato Ridge (in November 2016), unrelated to Assmang, I reviewed aerial photography for both Cato Ridge and nearby Hammarvale area in order to identify areas of grassland in better condition suitable for this purpose. Many of these areas were already familiar to me from prior surveying or walk-throughs.

11.2 Candidate sites

The position of the 2016 candidate sites is shown in Figure 1, together with a unique number to identify them in this report. Figure 1, above, shows all sites flagged for investigation during the desktop screening process, but a smaller number were found suitable after on-the-ground assessment. Only those that were found suitable are described below.

11.3. Natal Group sandstone (KwaZulu-Natal Sandstone Sourveld) properties

Sites that are adjacent to existing land purchased by the eThekweni Municipality for conservation (initiated by the EPCPD) were flagged as priority sites. This is because they can add to an existing conservation area which can then be managed as one unit, whereas more distant sites are then standalone and may present greater management challenges, which include deterring cattle and medicinal plant collection.

The Natal Group sandstone/KwaZulu-Natal Sandstone Sourveld sites purchased by the eThekweni Municipality for conservation are shown as properties 4, 20 and 22 in Figure 1, above. Property 19 may be under acquisition but this could not be confirmed and so it is retained here as an offset candidate site. The EPCPD is involved in ongoing efforts to acquire more land and status needs to be confirmed including whether some of these properties have been used in other offsets. The properties are grouped in logical tables, based on proximity to one another and existing eThekweni conservation sites.

Properties that are most valuable from an offset perspective as they are join or are closest to properties acquired by the eThekweni Municipality for conservation are shown in Table 1, below. Map no. refers to numbers in the map supplied in Figure 1.

Table 1.

Property description	Map no.	Size (approx.)	Good grassland	Property owner	Comment
Portion 23 of Uitkomst & Doornrug No. 852	14	83 ha	24 ha +	Peregrine, Sandra Ruby	Fair to good condition. Red listed species: <i>Brachystelma pulchellum</i> , <i>Senecio exuberans</i> . Unusual species: <i>Pachycarpus coronarius</i> , <i>Plectranthus hadiensis</i> var. nov.
Portion 24 of Uitkomst & Doornrug No. 852	15	67 ha	23 ha	Reddy, Jeevambigai	Fair to Good condition. Unusual species; <i>Pachycarpus coronarius</i> . Property is cut in half by railway line.
Portion 69 of Uitkomst & Doornrug No. 852	17	40 ha	6 + ha	Assegay Coffee CC	Fair to Good condition. Red Listed species: <i>Argyrolobium longifolium</i> , <i>Helichrysum pannosum</i> . <i>Gneraria</i>

					<i>atriplicifolia</i> and <i>Dierama pallidum</i> possibly present.
Portion 185 of Uitkomst & Doornrug No. 852	19	75 ha	63 ha	No owner information available	Good condition. This property may, however, not be available as in the process of acquisition by EThekweni Municipality. Red listed species: <i>Argyrobium longifolium</i> , <i>Cineraria atriplicifolia</i> , <i>Helichrysum pannosum</i> , <i>Hermannia sandersonii</i> , <i>Senecio exuberans</i> , Unusual species: <i>Crassula</i> sp. nov., <i>Plectranthus hadiensis</i> var. nov., <i>Dierama pallidum</i> probably present.
Portion 194 of Uitkomst & Doornrug No. 852	24	20 ha	5 ha	Woldsbane Blooming CC	Fair to good condition. Based on what was seen in adjacent grassland red listed species present may be: <i>Cineraria atriplicifolia</i> , <i>Dierama pallidum</i> , <i>Helichrysum pannosum</i> , <i>Senecio exuberans</i>
Portion 193 of Uitkomst & Doornrug No. 852	25	20 ha	1 ha	Bartlett & Edwards Farms CC	Good condition. The following red listed species possibly present as seen just outside: <i>Brachystelma pulchellum</i> , <i>Cineraria atriplicifolia</i> .
Total offsettable grassland in this cluster:					121 ha +

Table 2 comprises properties that can be made contiguous with the cluster of properties identified in Table 1, if the westernmost properties in Table 6 are acquired or placed under conservation servitude.

Table 2.

Property description	Map no.	Size (approx.)	Good grassland	Property owner	Grassland description
Portion 174 of Uitkomst & Doornrug No. 852	11	23 ha	20 ha +	Owner information not available	Mainly fair condition. Red listed species: <i>Dierama pallidum</i> , <i>Senecio exuberans</i> . Unusual species: <i>Pachycarpus coronarius</i> .

Portion 20 of Uitkomst & Doornrug No. 852 (29 ha)	12	29 ha	6 ha	Erasmus, Abel Hendrik	6 ha of grassland in good condition. No red listed species noted, but grassland was partly moribund and showed poor flowering expression. Owner interested in selling or registering conservation servitude in good grassland portion.
Portion 274 of Uitkomst & Doornrug No. 852 (24 ha)	13	24 ha	5 ha	Sathenna-Naidoo Family Trust - Trustees	6 ha of grassland in good condition. No red listed species noted, but grassland was partly moribund and showed poor flowering expression.
Total offsettable grassland in this cluster:					31 ha +

The Table 3 cluster, below, is relatively isolated, it will probably only be worth acquiring or registering conservation servitudes here if this can be done severally. Some of Portion 98 was temporarily cultivated in the past with 4 ha or more still in fair condition. However, in addition to being close to the development site, these sites also have the advantage of containing large numbers of red listed species, and a large subpopulation of *Chaetacanthus/Dyschoriste* sp. nov., an apparent local endemic mainly absent south of the N3 freeway (definitely present on Portion 98 and less on Portion 29).

Table 3.

Property description	Map no.	Size (approx.)	Good grassland	Property owner	Grassland description
Portion 12 of Uitkomst & Doornrug No. 852 (2 ha)	30	2 ha	1 ha	Transnet (due to this being a state entity this will probably be difficult to acquire/register a conservation servitude over). However, the amount of good grassland is small.	Fair to good condition. Red listed species: <i>Senecio exuberans</i> . Possibly present as seen immediately adjacent: <i>Dierama pallidum</i> , <i>Eriosemopsis subanisophylla</i> . Unusual species (possibly present as seen immediately adjacent: <i>Sensitive Species 88</i> , <i>Chaetacanthus/Dyschoriste</i> sp. nov., <i>Delosperma suttoniae</i> .

Portion 98 Uitkomst & Doornrug No. 852	31	10 ha	4 ha +	Propvest Investments (Pty) Ltd	Fair condition. Some of the property was cultivated in the past. Red listed species: <i>Eriosemopsis subanisophylla</i> , <i>Senecio exuberans</i> . There is a large population of <i>Chaetacanthus/Dyschoriste</i> sp. nov. Other unusual species: <i>Sensitive Species 88</i> , <i>Delosperma suttoniae</i> . However, this landowner may have development intentions.
Portion 49 of Uitkomst & Doornrug No. 852	32	12 ha	7 ha	Satroy Timbers (Pty) Ltd	Fair to good condition. Many red listed species: <i>Argyrobium longifolium</i> , <i>Sensitive Species 649</i> , <i>Dierama pallidum</i> , <i>Eriosemopsis subanisophylla</i> , <i>Hermannia sandersonii</i> . Unusual species: <i>Sensitive Species 88</i> , <i>Chaetacanthus/Dyschoriste</i> sp. nov., <i>Delosperma suttoniae</i> .
Total offsettable grassland in this cluster:					12 ha +

11.2 Hammarsdale, eastern flank of Cato Ridge

While further away from others sites, this property (Table 4) is very valuable from a plant biodiversity point of view contains large numbers of some red listed species and includes both dryland grassland and wetland areas in fair to good condition. There would, however, be management concerns given that this is somewhat further away from existing conservation properties.

Table 4.

Property description	Map no.	Size (approx.)	Remaining good grassland	Property owner	Comment
Portion 450 of Sterkspruit No. 907 (12 ha)	1	37 ha	13 ha	Vinotex CC	Fair to good condition. Red listed species present: <i>Dierama pallidum</i> (large number), <i>Eriosemopsis subanisophylla</i> , <i>Eucomis autumnalis</i> , <i>Hermannia sandersonii</i> , <i>Senecio exuberans</i> (large number).

11.3 Dwyka Group tillite sites

The eThekweni Municipality has acquired the property numbered as 4 for conservation and most comprises Dwyka Group tillite although on its margins the tillite transforms to Natal Group sandstone. This property and the large hill on which it part contain exceptionally species-rich grassland, with up to 20 herbaceous species per m² on some south and east-facing slopes. Large numbers of red listed species occur.

Table 5. Properties containing good grassland adjacent to property 4.

Property description	Map no.	Size (approx.)	Remaining good grassland	Property owner	Comments
Portion 291 of The Drift	3	61 ha	38 ha	Y.G.M. Haffejee Family trust - Trustees	Good condition. Many red listed species present: <i>Argyrolobium longifolium</i> , <i>Crotalaria dura</i> subsp. <i>dura</i> , <i>Dierama pallidum</i> , <i>Eriosema populifolium</i> , <i>Schizoglossum peglerae</i> , <i>Senecio dregeanus</i> , <i>Senecio exuberans</i> . Parts of this grassland have amongst the highest species diversity of any grassland in the eThekweni Municipal Area.
Portion 272 of The Drift	2	32 ha	18 ha	Rowsell, Jeremy Peter	Mostly good condition. Although shown as Natal Group sandstone in the eThekweni Municipality's

					geological map, the geology was found to be nearly all Dwyka Group tillite. As the adjoining property above, many red listed species present: <i>Argyrolobium longifolium</i> , <i>Crotalaria dura</i> subsp. <i>dura</i> , <i>Dierama pallidum</i> , <i>Eriosema populifolium</i> , <i>Senecio dregeanus</i> , <i>Senecio exuberans</i> . Parts of this grassland have amongst the highest species diversity of any grassland in the EThekweni Municipal Area.
Portion 291 of The Drift	3	61 ha	38 ha	Y.G.M. Haffejee Family trust - Trustees	Good condition. Many red listed species present: <i>Argyrolobium longifolium</i> , <i>Crotalaria dura</i> subsp. <i>dura</i> , <i>Dierama pallidum</i> , <i>Eriosema populifolium</i> , <i>Schizoglossum peglerae</i> , <i>Senecio dregeanus</i> , <i>Senecio exuberans</i> . Parts of this grassland have amongst the highest species diversity of any grassland in the EThekweni Municipal Area.
Total offsettable grassland in this cluster:					65 ha +

Table 6. Dwyka Group tillite (Dry Coast Hinterland Grassland) away from EThekweni conservation site (Property 4). These may be considered if offsetting is not on an exactly like-for-like basis as this is not KwaZulu-Natal Sandstone Sourveld.

Property description	Map no.	Size (approx.)	Remaining good grassland	Property owner	Comments
Portion 18 of Uitkomst & Doornrug No. 852	9	44 ha	18 ha	Rainbow Farms (Pty) Ltd	Fair to good condition. Includes the following red listed species: <i>Dierama pallidum</i> , <i>Senecio exuberans</i> . This is a very important site for <i>Eriosema populifolium</i> (Endangered).

Portion 19 of Uitkomst & Doornrug No. 852	10	58 ha	36 ha	Newpark Farming Enterprises CC	Fair to good condition. More investigation is needed to establish presence of red listed species.
Total offsettable grassland in this cluster:					54 ha +

It should also be mentioned that the eThekweni Municipality and its EPCPD manage important grassland conservation areas south of the N3. Effective management requires a costly security and patrol presence to deter grazing, unauthorized burning, hunting and excavation of medicinal plants. Financial support for this management and security presence will probably be considered valuable if also offered as a mitigation/offset.

APPENDIX 22. Curriculum vitae

David Styles is a professional botanist and environmental scientist who has for 15 years supplied a diverse range of vegetation-related consulting services.

Professional qualifications

- M.Sc. in Environmental Science from the University of KwaZulu-Natal, which was obtained with a first class pass. My thesis was a floristics and plot-based study of grasslands at Cato Ridge, inland of Durban.
- SACNASP (South African Council for Natural Scientific Professions) registered Professional Natural Scientist (Pri.Sci.Nat.) - registration number 120066 (Environmental Science).
- I have worked extensively within the South African commercial forestry industry for a decade years, particularly for Mondi (Pty) Ltd, with which I have a current three-year contract. This involves surveying and advising management of natural areas within its landholdings throughout KwaZulu-Natal and Mpumalanga Province, including grasslands, woodlands and forests. I worked within the King Shaka International Airport-Dube Tradeport precinct for five years, managing and implementing alien invasive plant control and rehabilitating former cultivated lands to natural vegetation.
- I have supplied more than 200 specialist vegetation reports for environmental impact assessments, together with many others not linked to environmental assessment outcomes.
- Between 2003 and 2012, I edited the botanical journal *PlantLife*, during which time it was read around the world by botanists, horticulturalists, students, collectors and others interested in African botany. Further information can be accessed through the following link:
<http://plantlifesouthafrica.blogspot.com/p/a-short-history-of-plantlife.html>
- I am an active botanical explorer in eastern South Africa, having collected more than 6000 plant specimens from KwaZulu-Natal, the Eastern Cape and Mpumalanga Province, which are lodged at the KwaZulu-Natal Herbarium in Durban, the University of KwaZulu-Natal Herbarium in Pietermaritzburg and the National Herbarium in Pretoria.
- I am author or co-author of 43 botanical contributions or papers, apart from *PlantLife* published in: *Aloe*; *Asklepios*; *Bothalia*; *Bradleya*; *Haseltonia*; *Flowering Plants of Africa*; *Phytotaxa* and the *South African Journal of Botany* as listed below.
- Author or co-author of a number of plant species or taxa new to science, some of which are *Ceropegia heidukiae*, *Cotyledon nielsii*, *Crassula smithii*; *Drimia flagellaris*; *Emplectanthus dalzellii*; *Gasteria croucheri* subsp. *pondoensis*; *Pseudoprospero firmifolium* subsp. *natalensis*, *Stellarioides littoralis* and *Turraea tugelensis*.
- In recognition of my contribution to botany, five plant species have been named after me, from either KwaZulu-Natal or the Eastern Cape, including the grassland herb *Ceropegia stylesii* (Heiduk 2023), tree *Combretum stylesii* (Maurin et al. 2011), succulent *Crassula stylesii* (Smith & Crouch 2021), climber *Vincetoxicum stylesii* (Meve et al. 2020) and forest herb *Plectranthus stylesii* (Edwards 2005).

List of publications

I have authored or co-authored the following botanical publications:

1. Burns, S & Styles, D. 2007. *Thorncroftia*: a little-known genus in the Lamiaceae. *PlantLife* 36: 43-59.
2. Crouch, N.R. & Styles, D. 2002. A new locality for *Impatiens flanaganiae* (Balsaminaceae) in the Transkei. *PlantLife* 27: 10-11.
3. Crouch, N.R. & Styles, D.G.A. 2010. Rediscovery in South Africa of the neglected African vegetable *Plectranthus esculentus*. *Bothalia* 40(1): 65-67.

4. Crouch, N. & Styles, D. 2020. *Turraea tugelensis*, a new species of *Turraea* sect. *Nurmonia* (Meliaceae) from South Africa. *Phytotaxa* 460(2): 137-142.
5. Crouch, N.R., Smith, G.F. & Styles, D.G.A. 2011. *Gasteria croucheri* subsp. *pondoensis*, a new cremnophyte from Pondoland, South Africa. *Bothalia* 41(1): 183-185.
6. Crouch, N.R., Martínez-Azorín, M., Beaumont, A.J. & Styles, D. 2014. *Stellarioides littoralis* (Asparagaceae, Scilloideae), a distinct new species from eastern South Africa. *Phytotaxa* 177(5): 261-268.
7. Crouch, N.R., Smith, G.F., Figueiredo, E & Styles, D.G.A. 2017. Rediscovery of *Adenia natalensis* W.J.dE Wilde (Passifloraceae) after 150 years. *Haseltonia* 22: 72–77.
8. Crouch, N.R., Styles, D.G.A. & Walters, M. 2021. *Cotyledon nielsii* (Crassulaceae), a new cremnophyte from KwaZulu-Natal, South Africa. *Bradleya* 39: 131–137.
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10. Crouch, N.R., Smith, G.F. & Styles, D.G.A. 2021. *Crassula floribunda* (Friedrich ex Toelken) N.R.Crouch, Gideon F.Sm. & D.Styles (Crassulaceae), a new status for a species endemic to central KwaZulu-Natal province, South Africa. *Bradleya* 39: 153–162.
11. Edwards, T.J., Beaumont, A.J. & Styles, D. 2001. New records and distributional disjunctions from South Africa, Zimbabwe and Mozambique. *Bothalia* 31(2): 199-202.
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13. Glen, H. & Styles, D. A note on the discovery of *Orbea speciosa*. *PlantLife* 36: 60-62.
14. Heiduk, A., Crouch, N.R. & Styles, D.G.A. 2023. *Ceropegia gilboaensis* (Apocynaceae), a new species from the Midlands of KwaZulu-Natal, South Africa. *Phytotaxa* 591(2): 125-136.
<https://doi.org/10.11646/phytotaxa.591.2.4>.
15. Heiduk, A., Styles, D.G.A. & Meve, U. 2021. Long-lost *Ceropegia rudatisii* (Apocynaceae-Asclepiadoideae)—Rediscovered and redescribed after 100 years. *Phytotaxa* 498 (2): 123–130.
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22. Stone, R.D., Mona, G.M., Styles, D., Burrows, J. & Ramdhani, S. 2019. Taxonomic revision of South African *Memecylon* (Melastomataceae—Olisbeoideae) including three new species. *Phytotaxa* 418 (3): 237-257.
23. Styles, D. & Crouch, N.R. 2004. John Medley Wood: the father of KwaZulu-Natal botany. *PlantLife* 22-27.
24. Styles, D., Dalzell, C. & Hankey, H. 2006. An expedition to the Tsitsa, Tina and Mbashe River Gorges. *PlantLife* 32: 7-13.
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30. Styles, D. 2000. Surprises from the Krantzklouf Nature Reserve, Durban. *PlantLife* 23: 17- 19.
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DECLARATION OF INTEREST BY SPECIALIST



KWAZULU-NATAL PROVINCE
ECONOMIC DEVELOPMENT, TOURISM
AND ENVIRONMENTAL AFFAIRS
REPUBLIC OF SOUTH AFRICA

Provincial Reference Number:	(For official use only)
NEAS Reference Number:	KZN / EIA /
Waste Management Licence Number (if applicable):	
Date Received by Department:	

DETAILS OF SPECIALIST AND DECLARATION OF INTEREST

Submitted in terms of section 24(2) of the National Environmental Management Act, 1998 (Act No. 107 of 1998) or for a waste management licence in terms of section 20(b) of the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008).

KINDLY NOTE:

1. This form is current as of **May 2021**. It is the responsibility of the Applicant / Environmental Assessment Practitioner ("EAP") to ascertain whether subsequent versions of the form have been released by the Department.

PROJECT TITLE

Cato Ridge Land Release and Development Project (DM/0006/2023: KZN/EIA/000)

DISTRICT MUNICIPALITY

eThekweni Metropolitan Municipality

1. SPECIALIST INFORMATION

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Professional affiliation(s) (if any)	SACNASP (SOUTH AFRICAN COUNCIL FOR NATURAL SCIENTIFIC PROFESSIONS)		
	REGISTRATION NO: 120066 (PROFESSIONAL NATURAL SCIENTIST)		
Project Consultant / EAP:	Zutari (Pty) Ltd		
Department of Economic Development, Tourism & Environmental Affairs, KwaZulu-Natal	Details of the Specialist and Declaration of Interest		Oct 2022 V1

DECLARATION OF INTEREST BY SPECIALIST

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2. DECLARATION BY THE SPECIALIST

I, DAVID STYLES are that --

General declaration:

- I act as the independent specialist in this application;
- do not have and will not have any vested interest (either business, financial, personal or other) in the undertaking of the proposed activity, other than remuneration for work performed in terms of the Environmental Impact Assessment Regulations, 2014;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- all the particulars furnished by me in this form are true and correct; and
- I am aware that a person is guilty of an offence in terms of Regulation 48 (1) of the EIA Regulations, 2014, if that person provides incorrect or misleading information. A person who is convicted of an offence in terms of sub-regulation 48(1) (a)-(e) is liable to the penalties as contemplated in section 49B(1) of the National Environmental Management Act, 1998 (Act 107 of 1998).



Signature of the specialist:

Name of company: DAVID STYLES

Date: 25 APRIL 2023

Department of Economic Development, Tourism & Environmental Affairs, KwaZulu-Natal	Details of the Specialist and Declaration of Interest	Oct 2022 V1
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