IDENTIFICATION OF CANDIDATE BIODIVERSITY OFFSET SITES FOR THE ESTABLISHMENT OF A MUNICIPAL LANDFILL SITE AT CATO RIDGE, KWAZULU-NATAL BY THE ETHEKWINI MUNICIPALITY

April 2016

Draft Report

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1. BACKGROUND

Due to the growing requirement for waste disposal within the eThekwini Municipality, in 1996 Durban Solid Waste (DSW) initiated a process to secure suitable regional general waste landfill sites for to cater for future waste disposal requirements in the north, south and west zones of the municipality. A new regional landfill facility for the disposal of general solid waste has been proposed for development at a site in Cato Ridge, KwaZulu-Natal. Such waste disposal operations are subject to detailed environmental impact assessment (EIA) during the planning phase and an EIA was undertaken on behalf of DSW by WSP Parsons Brinckerhoff, Environment & Energy, Africa (WSP) with submission of the Final EIA Report to DEDTEA in 2010. Ezemvelo KZN Wildlife in response to review of the EIA, called for a biodiversity offset site to be identified before the development of the facility can proceed. An addendum to the EIA process is being prepared by WSP in response to a request for further information by DEDTEA. WSP has appointed Jeffares and Green (Pty) Ltd to identify and assess candidate offset sites and to submit preferred options for consideration by the proponent – DSW, Ezemvelo KZN Wildlife, and the Department of Economic Development, Tourism and Environmental Affairs (DEDTEA).

During the course of this project, the difficulties of undertaking conservation-related offsets for a development were found to be challenging. Most of the problems were related to finding suitable offset sites for the project rather than for lack of understanding of what was required. A further layer of complexity was added by the very long time horizon of the project which could still be some 60 years or more in the future and so could be subject to substantial change over that period. If such change were to happen, or even in the extreme event that the project was to be abandoned altogether, then the offsetting measures taken would be rendered invalid. Because of this the focus of the study was changed from actually pinpointing sites to simply determining what offsets might be required under different development scenarios at the landfill site. Despite the change, all of the various activities undertaken during the course of this study are documented here in order that any future investigations may be informed on what had been done and what decisions were made.

Finally, a series of proposals on both the manner in which the impacts of the project may be reduced, and a mechanism for moving the project forward, are included. It is recognised that the responsibility for the actions will lie primarily with both DSW and Environmental Planning and Climate Protection Department (EPCPD) although both Ezemvelo KZN Wildlife and the DEDTEA should be kept well informed as they have responsibility for final authorisation of the development.

2. OFFSETTING FOR IMPACTS ON BIODIVERSITY

It has long been recognised that most new developments, and especially those that take place on previously undeveloped land ("Greenfields developments") carry the probability of adverse impacts on the natural environment including the geosphere, hydrosphere,

atmosphere, and biosphere. Since the natural processes and functioning of these "spheres" is increasingly recognised to offer valuable "ecosystem services" which are necessary to maintenance of life on this planet including that of humankind, it has become apparent that uncontrolled development without some form of control, is unsustainable from a human perspective. This awareness is not new and for many years, environmental legislation has demanded that potential impacts from developments be reduced in some way. In the past the mechanism for such precaution was commonly that of mitigation for impacts. Initially such measures were simply remedies which were applied at the site of the development and were often no more than palliative since the nature of the development was such that *in situ* measures could never compensate for the changes or losses which were to take place. From there, the impact reduction process was expanded to allow for external, or off-site, mitigatory measures. Thus an impact at one place could be compensated for by measures at another. In theory the combination of both types of mitigation was a substantial improvement but the ever increasing pace of development soon made it apparent that mitigatory measures were, alone, not enough to counteract the impacts which were happening. This awareness, coupled with an increasing understanding of the environment as a finite entity, led to the concept of "offsets" for development impacts. Offsetting for impacts implies a number of expansive concepts which move on from merely repairing damage done. These include:

- The concept of no net environmental loss, or even of environmental gain, as a consequence of a development.
- The concept that impacts at one point can be compensated for at another point. This implies a holistic perspective of the environment and the interdependency of its components for effective functionality.
- The creation of a domain in which multiple compensatory mechanisms might be possible. Such mechanisms could include:
    - ✓ setting aside an area or areas, similar in character to the impact site, for future conservation and maintenance;
    - ✓ setting aside an area or areas, dissimilar in character to the impact site but of higher conservation and functional value, for future conservation and maintenance ("trading up");
    - ✓ monetary compensation where the developer contributes to a fund which is used to purchase land elsewhere for offset purposes; and
    - ✓ monetary compensation where the developer contributes to a fund which is used for some other biodiversity conservation purpose.

These concepts are embodied in the definition of biodiversity offsetting as set out by the Business and Biodiversity Offsets Programme (BBOP) (2009):

> *"Biodiversity offsets are measurable conservation outcomes resulting from actions designed to compensate for significant residual adverse biodiversity impacts arising from project development after appropriate prevention and mitigation measures have been taken. The goal of biodiversity offsets is to achieve no net loss and preferably a net gain of biodiversity on the ground with respect to species composition, HABITAT STRUCTURE, ECOSYSTEM FUNCTION and people's use and CULTURAL VALUEs associated with biodiversity."* (BBOP, 2009)

NOTE: The practice of biodiversity offsetting is relatively new in South Africa and is clearly still under development. It has commonly proved difficult to implement, primarily as a

consequence of not being able to find “receiver” sites which are suited for the purpose, or else through the reluctance of the owner of the site being unwilling or unable to undertake the necessary ongoing financial and management responsibilities. Despite this, an implicit assumption here is that the developer is seeking land parcels which would be set aside in a direct, like-for-like, offset for the impacts at the landfill site, and the study was based on that premise. However, in the face of future complexities in the offsetting process, it may be necessary to consider one or other of the remaining offset options. While this possibility is recognised it is further ignored in this document.

3. STUDY TERMS OF REFERENCE

The objective of the study which is reported on here was originally to identify a number of candidate sites which could be considered for offsetting the loss of Ngongoni Veld (SVs 4) at the site of the proposed future Cato Ridge landfill project. In order to meet this objective, the following tasks were identified:

- A report (Carbutt, 2006) on biodiversity in the area was to be considered in order to ensure that its conservation-related recommendations were to be followed;
- The extent of Ngongoni Veld in the province of KwaZulu-Natal and, especially in the eThekwini Municipality was to be determined from the Ezemvelo KZN Wildlife vegetation mapping;
- The extent of untransformed Ngongoni Veld was to be determined by use of the Ezemvelo KZN Wildlife land transformation data;
- Through use of GIS mapping and Google Earth imagery areas of vegetation similar to that at the project site were to be identified. Priority would be given to sites within five kilometres of the project area but, if nothing suitable could be located there the area was to be progressively expanded. The search was, however, to be confined to the boundaries of the eThekwini Municipality.
- Once candidate areas had been identified they were to be ranked, in terms of their biophysical characteristics, against similarity to the project sites;
- The sites which most closely matched the project site were to be visited and a high level survey of their vegetation and suitability was to be undertaken; and,
- The findings of the study were to documented in a report and to be submitted to both WSP and Ezemvelo KZN Wildlife for their consideration and for inclusion into the addendum to the EIA report which is being prepared by WSP.

During the course of undertaking the above scope of work it became apparent at an early stage that suitable single sites for the required offsetting were not available in the eThekwini Municipality. At the same time, it was also found that the original vegetation mapping was inaccurate in terms of the vegetation type at the study site since the vegetation there is actually KwaZulu-Natal Sandstone Sourveld (SVs 5). Since this vegetation type has very high conservation priority the focus of the study was then shifted to finding means of minimising the potential impact of the project and of recommending a means through which the offsetting process could be conducted by the municipality in collaboration with Ezemvelo KZN Wildlife.

4. STUDY PROCEDURES

The study comprised of several components which are listed below. The activities were inter-related and were not undertaken sequentially.

3.1 Background Data Collection

A desktop study of the area was undertaken in order to gather general and historic information of relevance to the biodiversity at the site and at candidate offset sites. Of key importance in this regard was a report on the biodiversity in the Harrison Flats / Cato Ridge area (Carbutt, 2006). The Ezemvelo KZN Wildlife conservation databases and Provincial C Plan were interrogated and reference was also made to the SANBI Threatened Ecosystems Database and to red data lists and atlases for key taxonomic groups.

3.2 Liaison with the Client (WSP) and Others

Meetings were held with the Client and with representatives from EPCPD and Ezemvelo KZN Wildlife. The purpose of these meetings was to gain an understanding of the requirements of the developer and the provincial conservation agency so as to both obtain their support, and to ensure that the information necessary to meet those requirements could be efficiently collected. At the same time the EPCPD offered to provide a list of possible alternative offset sites.

3.3 Site Visits

The site of the proposed landfill development was visited so as to gain an understanding of its characteristics. As a result of these visits it was possible to identify candidate sites from a combination of vegetation maps and remote sensing images. Some such sites were retained as being possibly suitable while others could be immediately eliminated.

5. DESCRIPTION OF THE PROPOSED LANDFILL SITE

The site for the proposed landfill operation is located on the property Farm Riet River 851 Portions 25 and 26 and is presently owned by Assmang (Pty) Ltd which operates the nearby manganese smelter. See Figure 1. The surrounding area is zoned for industrial purposes and is undergoing a rapid development phase as a result of the activities of a wide variety of commercial and industrial activities.

The proposed landfill site is located on a ridge which protrudes northwards from Harrison Flats towards the Umgeni River Valley. The flat crest is at an altitude of approximately 805 m above sea level. It is characterised by a flat gradient and the underlying geology consists of Natal Group sandstones over Mapumulo Suite granites and gneisses. The soils are typically thin fine-grained silty sands which show the pink colour of the parent sandstone material.

The area proposed for the landfill site occupies most of the north-western part of the ridge with the actual footprint of the development being approximately 240ha in extent. To the west and north, the ridge drops off steeply into the valley below while on the eastern and southern sides lies flatter terrain which has been used for development purposes.

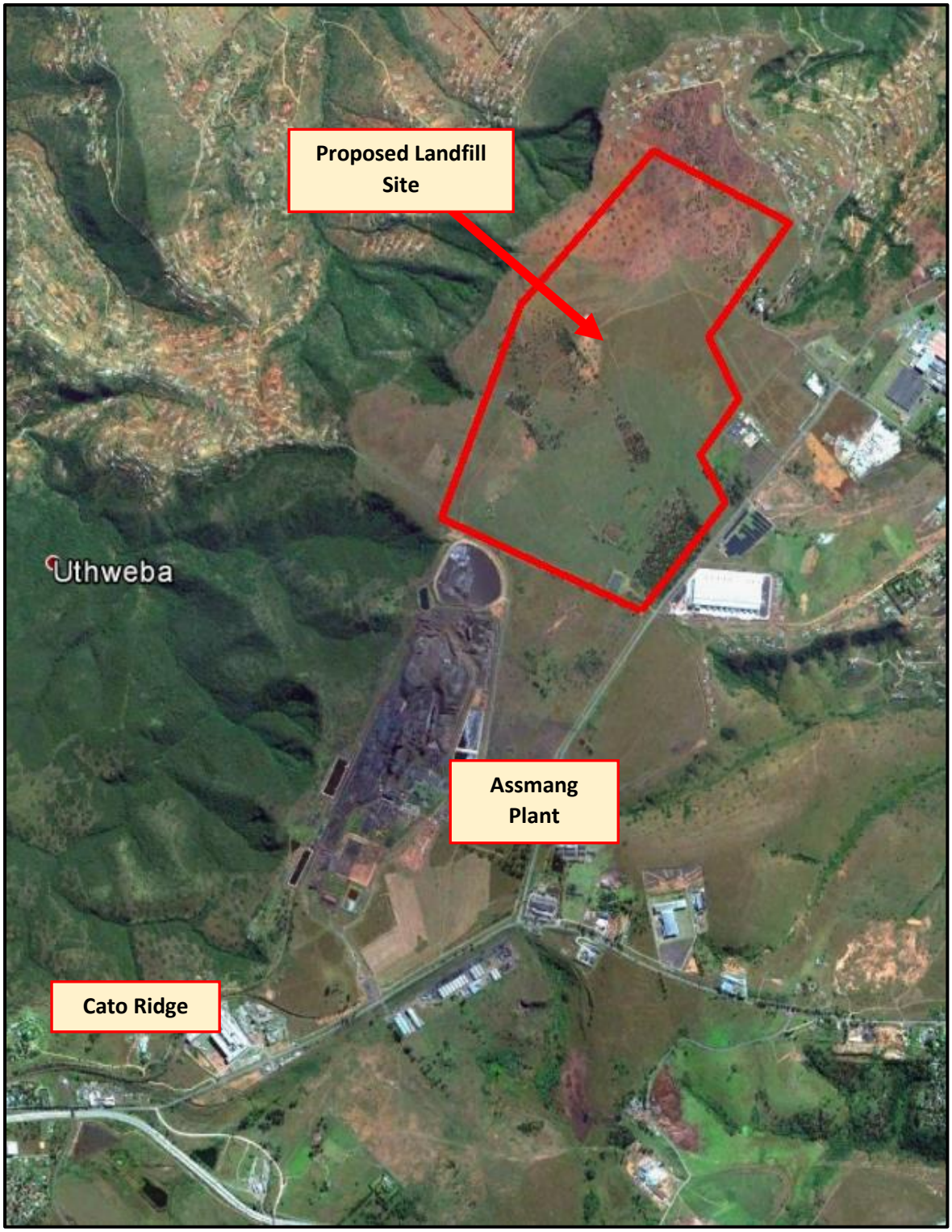

Figure 1. Locality of the proposed landfill site in relation to Cato Ridge and the Assmang Plant.

6. Site Baseline Description

5.1 Climate

The climate is temperate to sub-tropical with the greater part of the mean annual rainfall of 809 mm falling in the summer months. Much of this rainfall comes from violent convective storms and runoff after such events is severe. January average temperatures range from 27.6°C to 17.3 °C and July average temperatures range from 22.1 °C to 3.9 °C.

5.2 Terrestrial Vegetation

The natural vegetation type at the site is variously classed as Dry Coast Hinterland Grassland Gs 19 (Scott-Shaw *et al*, 2011) or as Ngongoni Veld SVs4 (Mucina and Rutherford 2006). Since the landfill site is almost entirely devoid of indigenous woody vegetation, the use of the grassland type is given preference although it remains recognised that the woody element may simply be missing as a consequence of human activities. Ezemvelo KZN Wildlife describe the vegetation (Gs 19) as undulating plains and hilly landscape mainly associated with drier coast hinterland valleys in the rain-shadow of the rain-bearing frontal weather systems from the east coast. Sour sparse wiry grassland dominated by unpalatable Ngongoni grass (*Aristida junciformis*) with this monodominance associated with low species diversity. In good condition dominated by *Themeda triandra* and *Tristachya leucothrix*. Carbutt, (2006) recognised that the vegetation at the site is of a type which is under threat and is considered to be "Endangered" or "Vulnerable". Protected plant species which are known to occur at the site include *Aloe parviflora, Habenaria chlorotica,* and *Crinum macowanii*. However, despite the forgoing classifications, the site is now considered by both Ezemvelo KZN Wildlife and EPCPD staff to be in KwaZulu-Natal Sandstone Sourveld (SVs 5) after Mucina and Rutherford (2006). This vegetation type is classified as "Critically Endangered".

Styles (2015) provides a detailed description of the vegetation at the proposed landfill site. See Appendix I.

5.3 Fauna

The fauna of the area is not well documented but Table 1 lists the species of concern which are either known to be present in the area or else are indicated by Ezemvelo KZN Wildlife computer models to be present.

Table 1. Red data listed fauna of the study area.

Scientific Name	Common Name	Status	Presence
Doratogonus cristulatus	Cristulate Black Millipede	Indeterminate	Modelled
Hemisus guttatus	Spotted Shovel-nosed Frog	Vulnerable	Present
Duranta amakosa flavida	Amakosa Rocksitter Butterfly	Indeterminate	Modelled
Coturnix nanus	Black-rumped Buttonquail	Endangered	Present
Circus ranivorus	African Marsh Harrier	Vulnerable	Present
Falco biarmicus	Lanner Falcon	Near-threatened	Present
Vanellus melanopterus	Black-winged Lapwing	Near-threatened	Present

Of the species known to be present, only the Spotted Shovel-nosed Frog would be unable to leave the area voluntarily in the face of development.

Carbutt, (2006) put forward seven recommendations for actions intended to ensure the long term survival of the valuable biodiversity in the Harrison Flats area which includes the proposed landfill development site. However, the rapid pace of industrial and commercial development has largely overtaken these recommendations and, while their content is sound, opportunities to implement them are now much reduced. Despite this, the recommended need for protection of the rare and sensitive vegetation at the study site has been noted and has, together with the recommendations of Styles (2015), been incorporated into the process put forward by this study.

7. DESIRABILITY OF USING THE OFFSET PROCESS TO MITIGATE FOR THE LOSS OF GRASSLAND AT THE DEVELOPMENT SITE

As far as possible the criteria recommended by Ezemvelo KZN Wildlife (2010) were followed. However, while the development of the landfill site was being subject to an EIA process, the consideration of offsets was being done at a time earlier than is usual so as to facilitate long-term planning. Therefore, at the time of the study reported on here, not all options for reduction of impacts have been considered and so the hierarchy of mitigation measures shown in Figure 2 is, to some extent, being bypassed.

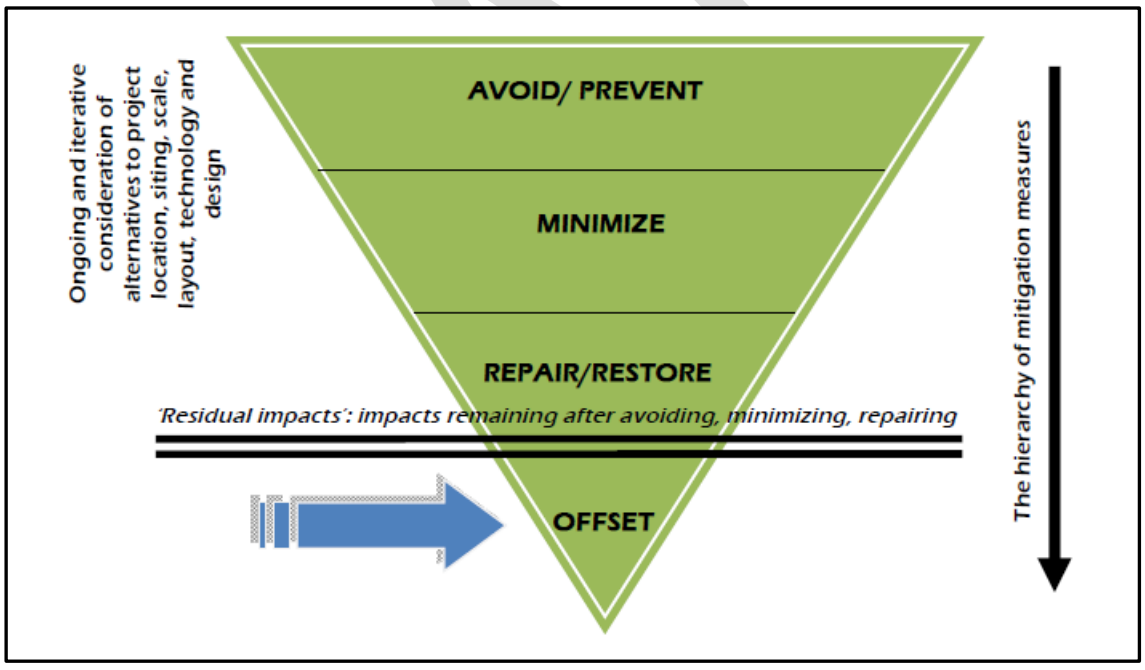

Figure 2. Hierarchy of possible mitigation measures which may be applied to reduce the impact of a planned development. Source: Ezemvelo KZN Wildlife (2010).

The lack of conformity with the usual EIA process (in terms of time scale) is seen as being proactive since it is possible, or even probable, that the scale of the development of the landfill operation would severely limit the effectiveness of any *in situ* mitigation measures. This approach is supported as the establishment of offsets is a time-consuming process and, if it is to be successful, is best instigated at an early stage.

At the same time, however, during a meeting held on 9 February 2016 with KZN Wildlife, DEDTEA, DSW and WSP it became apparent that the establishment of offset areas for the development would be extremely difficult and that undue reliance on the process should be avoided if at all possible. This realisation led to a change in the direction of this study and to the recommendation that a solution may be a combination of both *in situ* mitigation of impacts and *ex situ* offsets. The *in situ* mitigation proposed included an assessment of the "best fit" / revision of the landfill footprint within the landscape to avoid areas of high biodiversity. The purpose of the report is therefore two-fold:

- Identify the extent of Sandstone Sourveld that will be lost as a result of the planned landfill footprint; determine a suitable offset ratio; and identify potential offsite candidate offset sites; and
- Identification of "no-go areas" containing parcels of high biodiversity in order to inform a revision of the proposed landfill footprint to avoid impacts of biodiversity loss; as well as identification of opportunities for onsite offsets in a potential buffer area.

8. CRITERIA FOR SELECTION OF THE CANDIDATE OFFSET SITES

For administrative reasons it was not possible during the first phase of the project to undertake any meaningful biodiversity studies at the development site and so the background information from the literature and conservation databases was relied upon for the baseline description and for guidance in the steps that followed. The following offset site criteria were considered:

- **Nature and extent of the area to be offset against assumed 100% loss, and secondary impacts, in the long term**
  While the given study area consists of just the development area on the ridge top as described, it is considered that it is probable that the biodiversity impacts of the development will "overflow" that area to some extent. Because of the exposed (high elevation and isolated) nature of the site there will be inevitable blowing of materials including litter and dust as well as gases such as benzene and methane. Further impacts will arise out of the necessary quarrying/excavation of soil material to be used to cap the landfill site. However, these impacts were not considered as a part of this study and are not taken into consideration here.

- **Planning area**
  It is assumed that, since the proponent of the landfill development is the eThekwini Municipality, the offset site or sites must be within that municipal area.

- **Land ownership of the development site and candidate offset sites**
  At present the landfill site is owned by Assmang (Pty) Ltd and so transfer of ownership to the entity responsible for operation of the landfill site will be relatively straightforward. It is assumed that the finally selected offset site or sites will have to be transferred to either municipal or provincial ownership since it is improbable that private or communal ownership will be feasible because of the need for ongoing management input costs. Because of difficulties associated with transfer of communal land to some other owner, it is desirable that the offset sites are not on communal land.

- **Ownership of land surrounding the selected candidate offset sites**
  Since the finally selected offset site is to remain as open and near-natural as is possible, it is undesirable that it be vulnerable to risk of land invasion or even of some lower degree of informal resource utilisation. The risk of such events will be greater if the offset site is adjacent to communally owned land.

- **Biophysical characteristics of the candidate offset sites**
  In order for the offset process to be successful, the site or sites selected should ideally have certain conservation-related characteristics which include the following:
  - ✓ The site should contribute meaningfully to provincial and, if feasible, national conservation targets. This includes not just species or community benefits, but also if possible, contribution to corridors, buffer, and general landscape connectivity.
  - ✓ The area included for offset purposes must be large enough to achieve the desired goal. It should not, however, be compromised by setting of extravagant offset gearing ratios.
  - ✓ The sites should be in good condition with minimal invasion by alien weeds, soil erosion, or other such impacts.
  - ✓ The site should if possible provide enduring benefits for rural communities with the proviso that the utilisation does not compromise the integrity of the sites and its objectives.

9. PRELIMNARY IDENTIFICATION OFFSITE OFFSET SITES

The search for sites was undertaken with the above criteria in mind. Use was made of GIS and the search process was done stepwise as follows:

- Mapping of the location of the proposed landfill site. The location of the site was provided by the Client.
- Mapping of the vegetation types at the landfill site.
- Mapping of threatened ecosystems which occur within the vegetation types which are present at the landfill site. The extent of the mapped area was that of the eThekwini Municipal Area. Note: On investigation, it was found that the available mapping of threatened ecosystems was based on KwaZulu-Natal Sandstone Sourveld (SVs 5) and so should not have been highlighted here as it was not the vegetation type found at the landfill site according to the Ezemvelo KZN Wildlife mapping. However, during the course of meetings and discussions held with the EPCPD and Ezemvelo KZN Wildlife, it was agreed by all that the vegetation at the site is actually KwaZulu-Natal Sandstone Sourveld and that all further planning should be done on this basis.
- Map the transformed areas within the vegetation types in the eThekwini Municipal Area.

On the basis of the above searches it was possible to determine areas within the municipal area which contained the same vegetation types as the landfill site and which were not already transformed by human occupation or other activities. Such areas could potentially be suitable for offset sites and were visually further searched, by means of Google Earth imagery, for sites which were unoccupied or which had some other characteristics which made them eligible for consideration.

8.1 Findings of Preliminary Site Identification

The findings of the preliminary searches for candidate offset sites which largely met the required criteria are shown in Figure 3. A total of nine sites were found and a summary of their characteristics is presented in Appendix II. It is to be noted that Site 6 consists of three separate parcels of land which are close to one another and are considered as a single unit.

Most of these are in rural community areas where formal development is largely restricted to the provision of some secondary roads although a few do have water and electricity reticulation as well. One (Site 9) is located in a peri-urban area and is adjacent to the Krantzkloof Nature Reserve. While some of these sites would appear to be ideal, unfortunately all of them have attached criteria which eliminate their use for the intended offsetting purpose. In the case of Sites 1 to 8 it is that all lie on land that is controlled by the Ingonyama Trust Board. This organisation is a corporate entity established to administer the land traditionally owned by the king for the benefit, material welfare and social well-being of the Zulu Nation. The area under its control comprises approximately one third of the province of KwaZulu-Natal, and, amongst other things it does not pay taxes to the municipality and it hold the mineral rights in its area. Gaining use of this land is difficult and, even if obtained, it might not be possible to hold it in perpetuity. Therefore the relevant candidate sites are effectively eliminated. Site 9, which is owned by the municipality, would appear to be ideal for the purpose but it has already been set aside for further housing development and, although very largely open, has already been excluded from the Durban Metropolitan Open Space System (DMOSS) and so it too is not available.

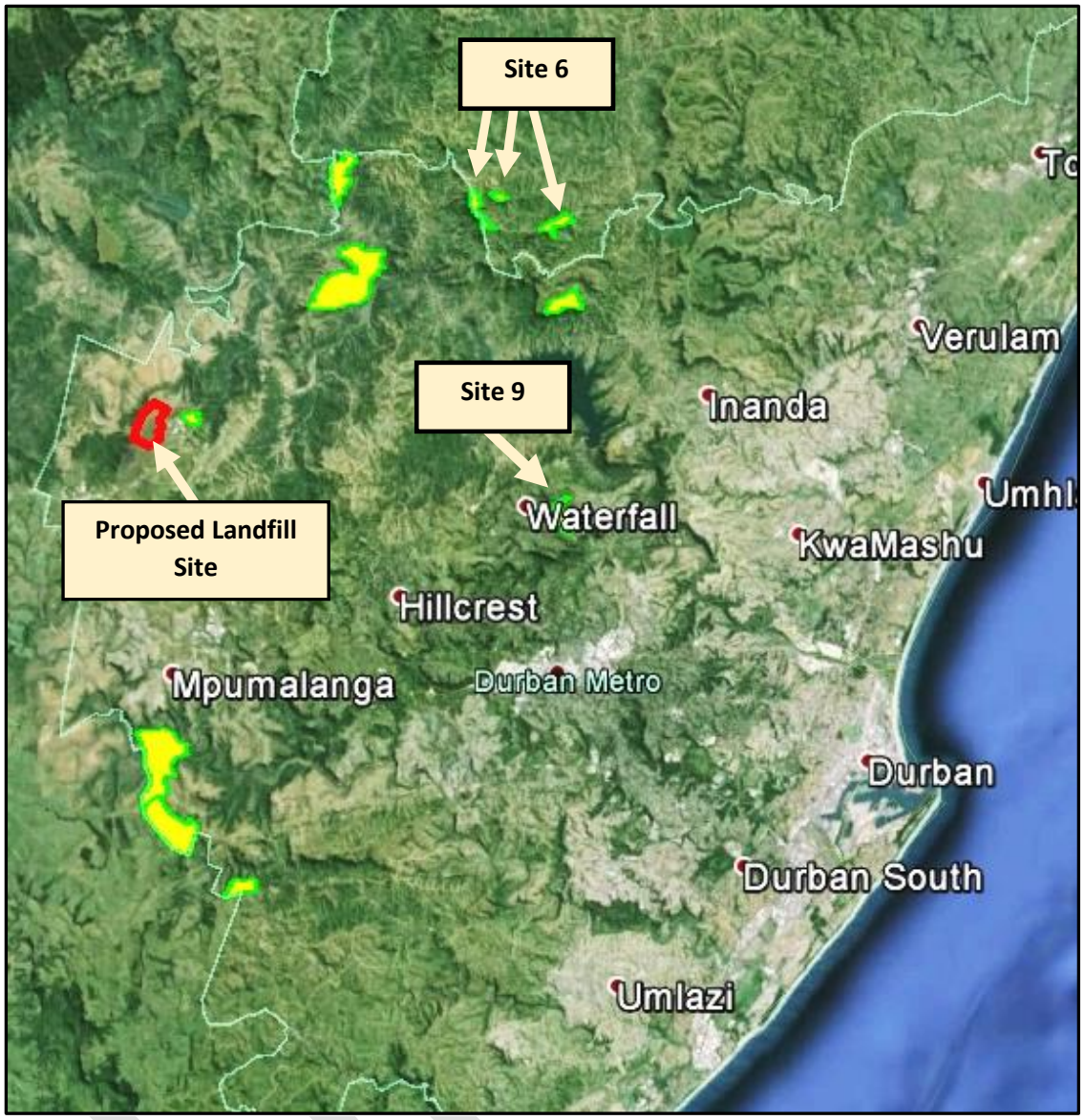

Figure 3. Distribution of the sites originally selected as candidates for offsetting the proposed landfill site but most of which have since been discarded. Site 9 at Waterfall is on municipal land.

10. FURTHER INVESTIGATORY SITE SEARCHES

Since all of the initially selected sites had been eliminated it was necessary to consider further means of locating possible offset sites and discussions to this effect were held with the EPCPD. It was determined that there are a moderate number of small patches of vegetation scattered throughout the municipality which would be suitable for offsetting losses at the proposed landfill site. However, demand for these sites, for either conservation or for development purposes, is high and that it is not presently possible to allocate any to the landfill site project. It was therefore agreed that a better course would be to reduce the areas required for offsetting by reducing the area of KwaZulu-Natal Sandstone Grassland which would be destroyed by the landfill development.

A further report (Styles, 2015) on the floral ecology was commissioned and indicates that the condition of the biodiversity in the development area was not uniform but that the area along the western edge of the site was the least affected by human activities. To the east of this,

the degree of various impacts increases and so there is a gradient of declining condition of the biodiversity. See Figure 4.

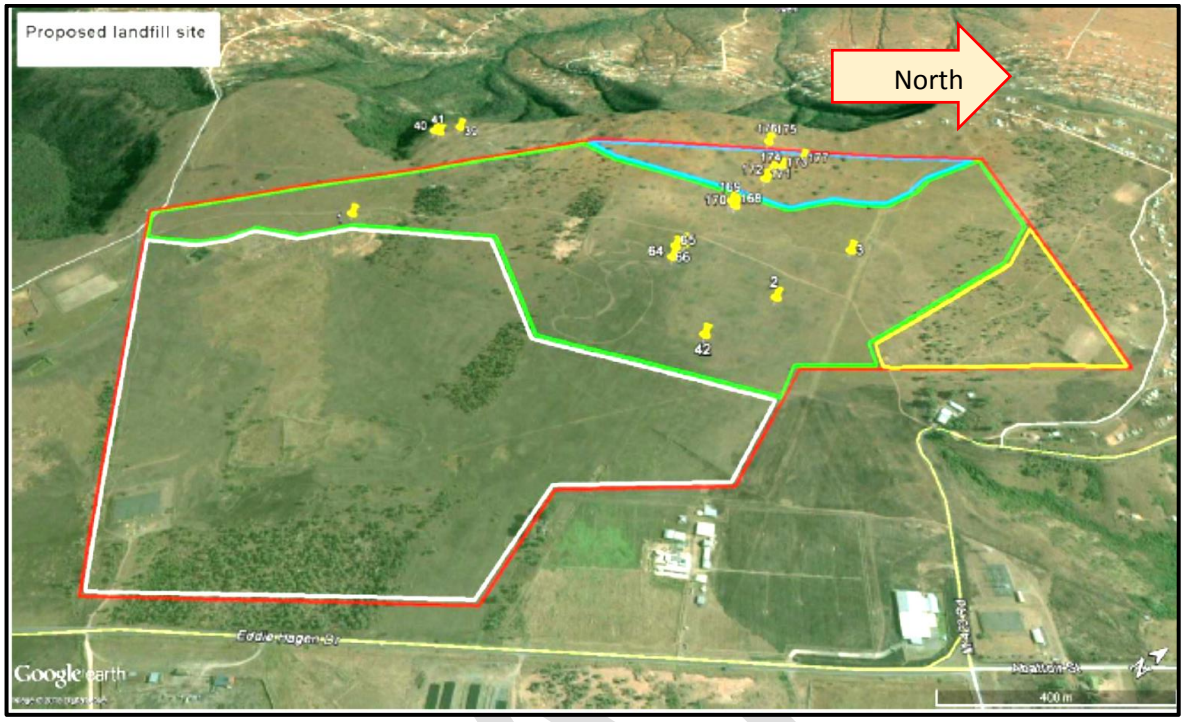

Figure 4. Zones of approximate uniform vegetation condition within the proposed development site. Source Styles (2016). Key: Blue Polygon = Rockier Grasssland, Good to Intermediate Condition. Green Polygon = Sandy Grassland, Intermediate Condition. Yellow Polygon = Degraded Grassland invaded by eucalypts, but retaining some herbaceous diversity in parts. White Polygon = Secondary Grassland.

Figure 4 shows the transition along an east-west axis in terms of the condition of the vegetation with the best preserved areas being in the west and especially the north-west. This zonation was tested during a further site visit and it was found that the Blue Polygon of KwaZulu-Natal Sandstone Sourveld should be extended a little further to the south as shown in Figure 5.

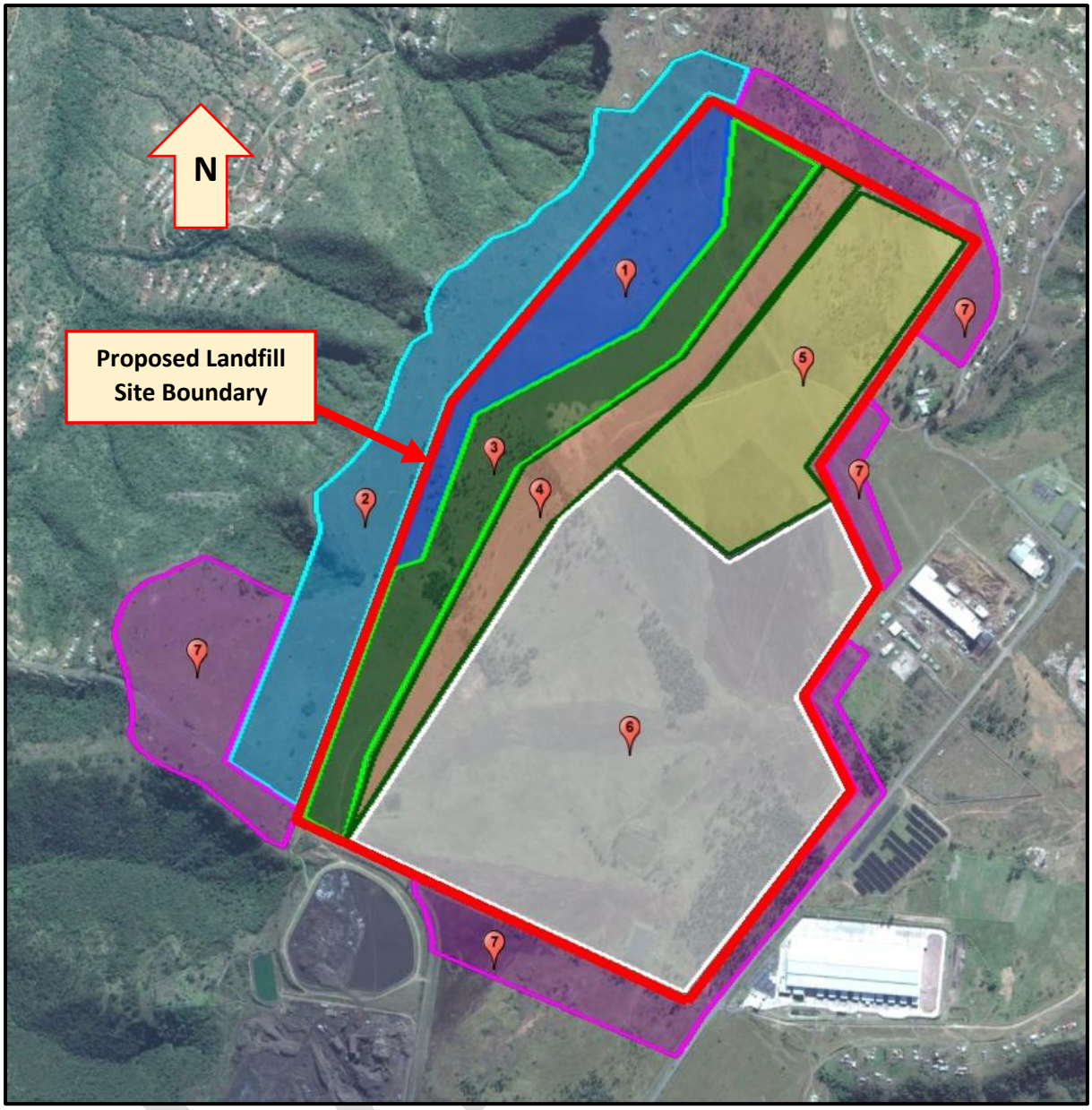

Figure 5. Zonation within and around the proposed landfill site. "1" = Mandatory Core Conservation Area. "2" = Mandatory Western Buffer. "3" = Internal Buffer Area. "4" = Internal Buffer Area (Expanded). "5" = North-eastern Landfill Area. "6" = South-eastern Landfill Area. "7" = Desirable Buffers (1,2,3,4).

It is therefore proposed to consider excluding the best preserved and most sensitive area of the landfill site and to set it aside as a permanent conservation area (Area "1"). Around this area would be a Buffer Zone which would be partly within the development site (Area "3") and partly along the outer edge on the western side (Area "2"). This combined buffer area would be mandatory. On the west the entire area along the landfill site boundary would be included. It would extend to the cliff edge where that exists and in a continued strip where there is no cliff. All of this area was found to include vegetation which is in good to very good condition and so is worthy of protection. The western buffer as illustrated, should be considered to be non-negotiable but it is to be noted that this, and all other buffers, are exempt from offsetting.

To the east and south of the conservation area, and within the proposed development site, a second buffer (Area "4") will be necessary as is indicated in Figure 5. The area shown may be regarded as being negotiable since it may involve trade-offs between the area of the development and environmental conservation in the form of offset requirements. The trade-off negotiations will have to be undertaken by the relevant departments within the Municipality but the outcomes will have to be accepted by Ezemvelo KZN Wildlife who will provide comment on the EIA addendum for review by DEDTEA. For this reason, the second buffer, as shown, is sized simply as a starting point for discussion purposes and it anticipated that the prime issues in the discussion will be the following:

- The Municipality will have a need to maximise the fill capacity to cater efficient for future waste disposal requirements.
- The shape of the landfill site should be as simple as possible to avoid management challenges. To this end it is suggested that a complex boundary which would outline "bays" or "peninsulas" should be avoided.
- The need to preserve a vegetation type which is of extremely high biodiversity conservation value. KwaZulu-Natal Sandstone Sourveld is currently listed as "Critically Endangered" and so no further loss may be contemplated.

In the north-eastern portion of the development site is an area (Area "5") which may be used but for which a very low offset ratio may be used. Styles (2015) indicated that it is invaded by alien species but that it still has some herbaceous diversity. The remaining area (Area "6") is secondary grassland which is of low conservation value and will require no offsetting.

The remaining areas (Area "7") shown in Figure 5 are external buffers. These are intended to not only protect the environment around the landfill site but also to prevent intrusions of any sort into the site. Such intrusions could include people wanting to get into the area for the purpose of scavenging or for other undesirable activities. As with the other buffer areas they have no offset requirements.

Behind all of the above will be the issue of offset ratios. Any areas of loss will have to be offset since the original area, although somewhat degraded, is still of a very high value.

11. CONSIDERATION OF OFFSET RATIOS

Implicit within the offsetting process is the determination of the gearing, or ratio, at which the loss of a site of conservation value would be replaced elsewhere. The greater the value of the site, and therefore the greater the impact of its loss, the greater the offset ratio will be. Because KwaZulu-Natal Sandstone Sourveld is listed as being "Critically Endangered" it is considered that no further loss may be allowed to occur and so, in theory, consideration of offsets is pointless. However, Ezemvelo KZN Wildlife have conceded that, because the site is already partially degraded, some loss may be considered but that acceptable offset ratios must be high. For this reason, attention was given to the ratio required for a similar vegetation type and Dry Ngongoni Veld which is classed as "Endangered" was used as a surrogate. The given ratio for this type is 21:1(Ezemvelo KZN Wildlife, 2010). This is a particularly high value but is based on an initial value of 11:1 which was then adjusted to allow for possible inaccuracies in the data and for the need to maintain a viable example of the type.

The high ratio would not apply right across all of the development site but would decrease in an easterly direction. Were the core conservation area to be considered the ratio might be as high as 30:1 whereas a ratio of 1.5:1 will be acceptable elsewhere. Therefore the

recommended offset ratios for the areas indicated in Figure 5 are as shown in Table 2 below.

Table 2. Recommended offset ratios for the zones indicated in Figure 5.

Zone	Area	Offset Ratio / Comment
Mandatory Core Conservation Area	1	No offset possible
Mandatory Western Buffer	2	No offset possible
Internal Buffer Area	3	21:1 (Area Negotiable)
Internal Buffer Area (Expanded)	4	10:1 (Area Negotiable)
North-eastern Landfill Area	5	1.5:1 (Area Negotiable)
South-eastern Landfill Area	6	No offset called for
Desirable Buffers (1,2,3,4)	7	May be used as offset areas for the North-eastern Landfill Area

Table 2 indicates that the areas of the Internal Buffer Area, the Internal Buffer Area (Expanded), and the North-eastern Landfill Area are negotiable. Of these three areas the first is the most important in terms of conservation and so it must be regarded as being the least negotiable in terms of its area or offset ratio. With the approval of Ezemvelo KZN Wildlife and the DEDTEA the offset rate may be adjusted slightly. In regard to the other two areas, which are of lower value, both the areas and the ratio may be negotiated more freely.

Table 2 also makes reference to four “Desirable” Buffers which are scattered around much of the periphery of the landfill site. The purpose of these buffers is to soften the edge of the site and, although they are not classified as “Mandatory” it would be highly advantageous to establish them. It is to be noted that their space may be used as total or partial mitigation or offset for the designated North-Eastern Landfill Area. This matter may only be resolved in the negotiation process between the DSW and the EPCPD.

12. CONCLUSIONS

The development of a future municipal landfill site for refuse disposal is always a difficult process as a result of the bio-physical environmental, social, and economic conditions associated with such facilities and experience from other sites has commonly been a drawn out process. In the case of this study, in which the focus has been on biodiversity conservation, the situation has been particularly complex since the natural vegetation is KwaZulu-Natal Sandstone Sourveld which type is endemic to the province of KwaZulu-Natal. It has been severely reduced in area as the consequence of human activities such as sugar cane and timber agriculture, and formal and informal residential and commercial development. As a result of the losses the type is classified as “Critically Endangered” by Ezemvelo KZN Wildlife in their Provincial Conservation Plan and, as a result, the standing policy is that no further losses may take place. That the study site and its immediate surrounds are of high value is not to be doubted since it includes a number of extremely rare plant species, some of which are new to science and are yet to be formally described (Styles, 2015). There are also a number of threatened faunal species on the site but their status is not as high as those of the plants. The use of offsets for the proposed development of the landfill was called for at a time when the vegetation at the site had not been surveyed in detail and was classified as Ngongoni Veld which has a lower status. Had its true character been known at that time then the site would have been precluded from the outset.

The initial terms of reference for the study called for the identification of suitable offset areas for the site and such a study was undertaken. It was found however that, for reasons of land tenure and the extensive degree of land transformation within the eThekwini Municipal Area, suitably large stand-alone areas are not available for offset purposes. The thrust of the project was then changed to a combination of finding means of reducing the impacts at the site, and then determining suitable conservation measures. It was realised that this process will require considerable negotiation between the environmental and waste management departments of the municipality and that the process will be protracted. Therefore, rather than try to find new areas and undertake the necessary studies at this stage, it was decided that this study should seek to find means to both reduce the initial impact on the site and then to establish a means through which refinements could be made in the future. Such a path has been set out although its success will depend on future discussions and negotiations. However, it must be recalled that there are a number different means through which offsetting may be done and Ezemvelo KZN Wildlife (2010) lists three alternatives as follows:

- Like for Like. This offset mechanism is based on land with biodiversity which is similar to that of a site which will be lost to development being set aside to compensate for the loss. It is the most commonly used form of offsetting and is the one which is the basis of this document.
- Trading Up. This offset mechanism is based on setting aside land which has a higher biodiversity value than land which will be lost to a development. Commonly a low offset ratio is used since the land to be protected has a higher value. A variation on this form of offsetting consists of supporting activities which will help biodiversity conservation at a site which is threatened by external influences. The example given refers to development of woodlots to stop depletion of natural forest by wood harvesting.
- Monetary compensation. This offset mechanism is based on contribution of money to a fund which will be used to acquire land for conservation purposes. Thus a number of small projects can “pool” their offsets to achieve a goal greater than any one of them could do on its own. However, this mechanism has very substantial administrative requirements and care is needed to ensure that the desired goal is reached.

Irrespective of which of the above options is finally selected, it will be necessary for cooperation between all involved. The key players will be staff of the municipality but it will also be essential to include the various conservation authorities. It is strongly recommended that they be kept informed at all stages of the process since their understanding of the issues will then be improved and they will be able to respond more readily when called upon to do so.

Finally, it is the view of Jeffares and Green that the municipality is to be commended for its decision to instigate planning procedures decades ahead of time and to be willing to address the complexities of unforeseeable issues which will undoubtedly arise. However, it is critical that definite steps such as the identification and fixing of suitable land parcels for offset purposes be done in the near future since options are being lost on almost a daily basis.

13. REFERENCES

BBOP. 2009. (Business and Biodiversity Offsets Programme). The Relationship between Biodiversity Offsets and Impact Assessment: A BBOP Resource Paper. BBOP, Washington, D.C.

CARBUTT, C. 2006. Harrison Flats / Cato Ridge Biodiversity Assessment. Prepared for the eThekwini Municipal Council. Ezemvelo KZN Wildlife. P. O. Box 13053, Cascades, Pietermaritzburg, 3202.

EZEMVELO KZN WILDLIFE. 2010. Norms and Standards for Biodiversity Offsets: KwaZulu-Natal Province, South Africa. Final Draft. Ezemvelo KZN Wildlife. P. O. Box 13053, Cascades, Pietermaritzburg, 3202.

SCOTT-SHAW, C.R and Escott, B.J. (Eds) 2011. KwaZulu-Natal Provincial Pre-Transformation Vegetation Type Map – 2011. Unpublished GIS Coverage [kznveg05v2_1_11_wll.zip], Biodiversity Conservation Planning Division, Ezemvelo KZN Wildlife, P. O. Box 13053, Cascades, Pietermaritzburg. 3202.

STYLES, D. 2015. Report on vegetation on a proposed landfill site at Cato Ridge. *Pers Comm* to WSP | Parsons Brinckerhoff, Environmental and energy, Africa.

WSP, 2010. Proposed Cato Ridge Regional General Landfill Site (EIA/0728). WSP Environmental (Pty) Ltd. Jan Hofmeyr Road, Westville. 3629. www.wspgroup.co.za

APPENDIX I

Description of the vegetation at the landfill study site - Extracted from Styles (2015)

1. Description of area

The site forms part of a flat-topped Natal Group sandstone derived plateau that occupies much of Cato Ridge north of the N2 freeway. The vegetation on the plateau is nearly entirely comprised of grassland. Beneath the plateau the geology transitions to Dwyka Group tillite and granite and the vegetation is more diverse, comprising both thicket and grassland. The grassland is, however, not like that on the plateau in that it has a different species composition and is more degraded. Vegetation on the plateau has become fragmented by industrial and to some extent residential development. As a result of these and associated impacts, much of this grassland is also transformed, degraded and in poor condition. However, there are also areas in which there is grassland in fair to good condition that indicate the composition of grassland as it once occurred more widely on the plateau.
The eastern part of the proposed landfill site comprises sandy soil with little or no conspicuous rock exposure. Much of this is also seasonally damp. Sandstone outcrops begin to appear travelling west, with the western edge the escarpment very rocky.

2. Provisos

The site was visited during drought conditions. Grass had been burned the winter before and combined with grazing, little replacement was evident. As a result, the grass was short and often sparse. There was poor expression and flowering of herbaceous and geophytic plants, with much of the presence inconspicuous or considered not evident at all.
However, this report draws on information from an MSc study comprising surveying of grasslands at Cato Ridge during which fieldwork continuing until March 2014. During this survey, 234 plots were surveyed at Cato Ridge with 20 on next to the site. The site and the position of lots is shown in Appendix 1. During the surveying of plots, a different picture was apparent, including moderate species diversity on parts of the site together with occurrence of rare and red listed species. The focus of the MSc was primarily plot-based, and although this was combined with reconnaissance and walk-through of grassland that included this site, it did not have as its objective the mapping of individual occurrences of rare and red listed plant species. As a result, while it is possible to report on rare and red listed species that occur on the site, together with approximate area of occurrence, it is not possible to provide a map showing actual occurrences.

3. Vegetation type

The grassland at Cato Ridge is mapped as Ngongoni Veld in the National Vegetation Map, where recorded as a Vulnerable vegetation type (Mucina & Rutherford 2006). However, the grassland

is considered to be, and is mapped by the Ethekwini Municipality's Environmental Planning and Climate Protection Department as KwaZulu-Natal Sandstone Sourveld, an Endangered type.
Mucina & Rutherford report that KwaZulu-Natal Sandstone Sourveld occurs on a Natal Group sandstone substrate, whereas Ngongoni Veld occurs on other geologies, including Dwyka Group tillite. These authors provide a list of species that are important, biogeographically important or endemic in KwaZulu-Natal Sandstone Sourveld and a much smaller list of important for Ngongoni Veld. Based on results from 234 plots surveyed in grassland at Cato Ridge, it was found that grassland on sandstone had a different composition to that on other geologies in the area (mainly tillite).
The list of species provided in Mucina & Rutherford list (2006) was studied and it was apparent that some of these species are included in error, as they are either not species that occur in grassland or in the area of distribution of KwaZulu-Natal Sandstone Sourveld. Once these errors were removed comparisons were made. It is important to note that a number of the endemic species cited for Kwazulu-Natal Sandstone Sourveld have very small and localized distributions and so even within the mapped area of this grassland type only some may be present on a particular site, or may not be so at all. The results show that grassland on a Natal Group sandstone substrate at Cato Ridge has the closest correlation with KwaZulu-Natal Sandstone Sourveld as follows.

Table 1. Grassland on a Natal Group sandstone substrate at Cato Ridge: Correlation with species cited as important, biogeographically important and endemic in Mucina & Rutherford (2006).

Important (25 species)	17 (68 %)
Biogeographically important (17 species)	9 (52.9 %)
Endemic (7 species)	2 (28.6 %)

It is therefore held that grassland on a Natal Group sandstone substrate at Cato Ridge is KwaZulu-Natal Sandstone Sourveld, even though it is not mapped to this type in the National Vegetation Map (Mucina & Rutherford 2006).

4. The proposed landfill site

Grassland on the site can be differentiated to two kinds. The eastern part of the site comprises sandy soils that are in many places seasonally damp (not evident at the moment due to drought conditions). The species composition differs from that on the western part of the site where drier and sandstone outcrops begin to appear. The 30 most abundant herbaceous species in grassland in the eastern versus the western part of the site are presented in Appendix 2. Basic information concerning species is as below.

Table 2. Species diversity in 10 m^2 plots on and next to the site.

	Eastern area (10 plots)	Western area (10 plots)
	Number of herbaceous species	Number of herbaceous species
Maximum	28	27
Minimum	10	14
Average	18	21

Although species diversity in the different parts of the site is well evident in Appendix 2, the following species are noteworthy.

Table 3. Noteworthy species on and immediately adjacent to the site. Red list status follows Raimondo et al (2009). Many of these species are shown in photographs attached in Appendix 3, most taken on or next to the site.

Species	**Endemism status**	**Red list status**	**Population information**
Agathisanthemum chlorophyllum (Hochst.) Bremek. var. chlorophyllum	Endemic to broad KwaZulu-Natal coastal escarpment		Common in grassland on the site
Aloe parviflora Baker	Nearly endemic to the Durban escarpment		Scattered plants, mainly but not only in the western, rocky part
Brachystelma pulchellum (Harv.) Schltr.	Mainly endemic to the Durban escarpment	Near Threatened	Large population probably comprising several hundred individuals in the western part but with some plants in deeper, sandy soil
Chaetacanthus sp. nov. = D.G.A. Styles 3822, 3919, 3950, 3972, 3973 (NH)	An apparent local endemic, treated further below		Probably several hundred individuals, mainly but not only in the western, rocky part
Delosperma suttoniae Lavis	A KwaZulu-Natal endemic	DDT	A rare species known from few collections. A

			pink-flowered species not to be confused with the white-flowered D. lineare L.Bolus that is far more common on the site
Eriosemopsis subanisophylla Robyns	Cited as a Pondoland Centre endemic, with Cato Ridge the northern known distributional limit.	Vulnerable	Scattered but widespread on the western part of the site, once sandstone outcropping begins to occur
Lotononis solitudinis Duemmer			
Pachycarpus coronarius E.Mey	Manly known from the Pondoland Cente, with Cato Ridge apparently the only locality from which known either to the north, or in the Ethekwini Muncipal Area		Scattered plants, mainly but not only in the western, rocky part
Senecio albanopsis Hilliard	Endemic to the Pondoland Centre and Natal Group sandstone grassland to the north, but south of the Tugela River		Only in the rocky, western part
Senecio exuberans R.A.Dyer	Endemic to the area between the Durban escarpment and Pietermaritzburg east.	Endangered	Scattered plants in both eastern and western parts

Noteworthy species on the eastern part of the site are Agathisanthemum chlorophyllum (Hochst.) Bremek. var. chlorophyllum with Lotononis solitudinis Duemmer locally common where the soil is damp. This latter species is species described as rare (Van Wyk 1991). The number of noteworthy species is larger in the western part, once Natal Group sandstone outcrops begin to occur. Brachystelma pulchellum (Harv.) Schltr., endemic to rocky KwaZulu-Natal Sandstone Sourveld and red listed as Near Threatened. Of biogeographical interest is Helichrysum asperum (Thunb.) Hilliard & Burtt var. comosum (Sch.Bip.), which is usually found on coastal sand dunes but extends inland to a few sites where there are sandy soils. Two red listed species are widely scattered and occur in both the eastern and western parts of the site. These are Senecio exuberans R.A.Dyer, which is Endangered, and Boophone disticha (L.f.) Herb. (Declining).

5. Undescribed species

The site and close surrounds are perhaps more important for the occurrence of two undescribed species that may be local endemics, photographs of which appear in Appendix 3. Local endemics are particularly conservation important as impacts at a site level may then be global and existential, whereas this is not usually so for plants with wider distributional provenance.
Chaetacanthus sp. nov. has been well collected from the site and the close surrounds, with material lodged at the KwaZulu-Natal Herbarium. Prof. Kevin Balkwill, an expert on the genus based at the University of the Witwatersrand advises that he believes this is an undescribed, new species (pers. comm.). It distinct from all other species occurring in South Africa, including the widespread Chaetacanthus burchellii that also occurs in these grasslands. It differs in its much large flowers and stoloniferous habitat, with stems becoming prostrate once they have grown out. This species is associated with sandstone pavements or with sandy soil near extensive outcropping. It also occurs on a land slated for industrial development between 1 000 and 1 800 metres away from the site (as shown in Appendix 1.2; see also comments on cumulative impacts, below).

Chaetacanthus sp. nov. occurs nearly entirely at these sites, and in spite of intensive searching of other sandstone sites south of the N2, including at Hammarsdale, has only been found elsewhere on one sandstone outcrop, where the subpopulation is very small (c. 10 plants). Plants with this appearance also occur in small numbers on the Table Mountain, a flat-topped Natal Group sandstone feature about 8 km to the north. However, plants were in poor condition and proper confirmation is required. Herbaceous diversity on Table Mountain is severely threatened by overgrazing as persons in the adjoining community have converted the mountain top into a cattle pasture, which has been fenced off for this purpose.
 An undescribed Pachycarpus species with affinity to P. dealbatus occurs within 1 km of the site. It was collected twice during surveying, with material lodged at the KwaZulu-Natal Herbarium, but the small population appears to have been destroyed by grazing. However, a thorough search is needed to establish if more survive elsewhere in the environs. The collections are being studied by Dr Ashley Nicholas of the University of KwaZulu-Natal, Westville Campus, with a view to description. According to Dr Nicholas it has been collected once before from Cato Ridge and there are no other known collections. It may be a very rare local endemic.
The site has not been investigated exhaustively and more plots were surveyed in grassland a little further away, between 500 to 1 800 six to the south and south-east, where other red listed species were found. At least five other red listed species were found in these plots. Due to the similarity and proximity of this grassland, the occurrence of at least some of these species is considered likely on this site.

Table 4. Red listed species in grassland similar to and within 2 km of the site.

Argyrolobium longifolium (Meisn.) Walp.	Endemic or nearly-endemic to the KwaZulu-Natal escarpment between about the Mzimkulu and the Tugela Rivers	Vulnerable
Brachystelma sandersonii (Oliv.) N.E.Br	Endemic to coastal KwaZulu-Natal, where it usually occurs along the coastal littoral, but extending in places up the	Vulnerable

	coastal escarpment where there are sandy soils	
Crotalaria dura J.M.Wood & M.S.Evans subsp. dura	Endemic to the coastal escarpment between Highflats and the Tugela River	Near Threatened
Helichrysum pannosum DC.	Endemic to the broad coastal escarpment, from about East London to the Tugela River	Endangered
Hermannia sandersonii Harv.	Known only from the broad Durban escarpment and from near Newcastle	Vulnerable
Senecio umgeniensis Thell.	A KwaZulu-Natal endemic	Threatened

Argyrolobium longifolium and Helichrysum pannosum are less likely to be found on the site as they prefer mesic often slightly scrubby grassland on south- and east-facing slopes. However, there is a reasonable probability of at least some of the others occurring on the site.

6. Grassland quality

Although part of the grassland on the site is not secondary and contains a moderate degree of species diversity as evident in Appendix 2, it deteriorates as one travels eastwards, an eventually indeed becomes secondary. This nebulous line of transition is shown in Appendix 1.1.

7. Threats to grassland on the site

Grassland on the site is severely threatened by the following.

 Large numbers of cattle can be seen on and adjacent to the site. One herd seems to be permanently sequestered on the site. These animals have been acquired and are owned by individuals living in the community off the site to the south, who, even though they appear not to own or have access to other grassland, have done so on the basis that they can pasture them on this site. This is reducing plant species diversity and abundance and can in turn convert the grassland more uniformly into secondary state over time, although there will likely be some persistence around rock outcrops. I have visited this site over many years, and it seems that the decommissioning of the old Cato Ridge Airfield and a less active presence on the land resulted in a great increase in this phenomenon.

 Sand-mining is occurring on a large part of the site, which is clearly evident in aerial photography. Mining was also seen during fieldwork, with removal occurring on a nearly daily basis. This has destroyed a minority of the grassland and will destroy more if unchecked.

 Alien trees (Eucalyptus sp.) have been planted in and are also invading the grassland. There is also a small but likely expanding presence of the alien tree Populus x canescens (Grey Poplar). If these trees are not controlled, they will also reduce the amount of grassland over time.

8. Other observations

Due to drought conditions observations made before this time are included in case not noted by any faunal specialist. The site is important for the breeding of Black-winged Lapwing (Vanellus melanopterus), with at least three nests seen on the site in the past. These birds also breed and forage in the area of secondary grassland on the site. A photograph of a bird and nest on the site is provided in Appendix 3. One pair was seen on the site on 13 November 2015. This breeding is threatened by the cattle on the site.

9. Cumulative impacts

The landfill will have wider impacts than just on the site. It will increase the amount of activity in the close surrounds and isolate the remaining grassland to the west, which will occur as a narrow band along the escarpment edge. This will interrupt ecological processes including fire, important for maintaining grassland health, species diversity and abundance. The proposed development must also be seen in the context of other development proposed at Cato Ridge.

The Cato Ridge Local Area Plan (LAP) was developed by consultants appointed by the Ethekwini Municipality, styled as the Graham Muller Associates Consortium. The LAP provides the site with a landfill land use. The plan also allocates an industrial use to nearly all of the other grassland on this plateau that is still in fair to good condition. The conclusion must be reached that the consultants chose to disregard environmental specialist inputs concerning the quality of grassland north of the N2 and propose development in what remained regardless. Specialist biodiversity inputs were also inadequate during this process.

The biodiversity reporting for the Cato Ridge LAP occurred at a high level and involved only a few days of fieldwork instructed during the winter months. Both the time and season were unsuitable for this kind of surveying. While mapping was undertaken that identified where grassland occurred at Cato Ridge and gave it a quality ranking, it did not differentiate it to type (such as KwaZulu-Natal Sandstone Sourveld), nor could rapid surveying in winter conditions report on the composition of these plant communities or identify the location of priority species. This was a serious flaw.

As a result, it may have been believed that by developing nearly all flat land north of the N2, this was not such an unfavourable environmental outcome as it may appear now, because other open space and grassland occurs below the plateau. However, this is not KwaZulu-Natal Sandstone Sourveld, nor does it have the same species composition or many of the endemics (including the undescribed species mentioned) associated with this type, and it is also mostly more degraded.

Alternately, a decision may have been made to intensify development north of the N2, without paying much regard to conservation of this grassland, but then mostly retaining traditional agricultural use for grassland on the south side of the N2. However, there is little KwaZulu-Natal Sandstone Sourveld, at least in the Cato Ridge area south of the N2. It is also notable that the LAP allocates environmental or open space use nearly entirely or only to wetlands and closely flanking areas that are more unsuitable for development.

10. Recommendations

If the landfill is implemented, it is strongly recommended that the Ethekwini Municipality undertake the following:

 A review the Cato Ridge Local Area Plan with a view excluding industrial land use in the other fair to good quality KwaZulu-Natal Sandstone Sourveld north of the N2 freeway, particularly where indicated in Appendix 1.2, so that at least some of this grassland survives and remains as habitat for priority species mentioned above, including any local endemics that may be existentially threatened by wholesale intensification of industrial and development in this part of Cato Ridge.

 The Ethekwini Municipality is not entirely in control of these other development processes, nor can it always prevent a development outcome on a particular site, even if it concurs that species occur that should have conservation priority.

Within the Ethekwini Municipal Area, KwaZulu-Natal Sandstone Sourveld and Natal Coastal Belt vegetation is so severely threatened that the Ethekwini Municipality's 2011 Integrated Development Plan records they “require immediate protection if they are to remain extant” (Ethekwini Municipality 2011). As a result, the Ethekwini Municipality’s Environmental Planning and Climate Protection Department seldom approves development into better quality KwaZulu-Natal Sandstone Sourveld, or requires that proper offsetting occurs.

If the site is developed as landfill, therefore, it is considered that a large offset will be need to be negotiated with the Ethekwini Municipality’s Environmental Planning and Climate Protection Department. This may also include some pullback from the rocky outcrops to spare some of the occurrence of conservation priority species and purchase of other land at Cato Ridge, a large part of which has been allocated to industrial use, on which conservation priority species occur, particularly Chaetacanthus sp. nov.

Irrespective of the outcome of the proposed development, in terms of NEMA landowners have a duty of care towards the environment. It is suggested that the Ethekwini Municipality engage with the current owner of the site to ensure that better care occurs, by preventing the grazing that seems to have greatly increased on the land, originating from the neighbouring settlement, sand-mining that appears to be occurring on an uncontrolled and extensive basis and invasion by alien trees. If this does not occur, a considerable amount of the plant diversity will be lost from the site over time.

APPENDIX II

Summarised characteristics of the landfill site and the nine sites initially considered as offset candidate areas

SITE	Landfill Site	1	2	3	4	5	6 Consists of three blocks	7	8	9
Map Sheet	2930DA	2930DC	2930DC	2930DC	2930DA	2930DB	2930DB	2930DA	2930DA	2930DB
Area (ha)	240	428	102	585	50	132	186	725	209	141
Vegetation Type	KZN Sandstone Sourveld	Dry Coast Hinterland Grassland	Dry Coast Hinterland Grassland	Dry Coast Hinterland Grassland	Dry Coast Hinterland Grassland	Ngongoni Veld	Ngongoni Veld	Dry Coast Hinterland Grassland	Dry Coast Hinterland Grassland	KZN Sandstone Sourveld
Ownership	Company	Communal	Communal	Communal	Communal	Communal	Communal	Communal	Communal	Municipal and private/commercial
Surrounding area	Company	Communal and private	Communal	Communal	Company	Company	Communal	Communal	Communal	Private/municipal/provincial
Veld Condition (Estimated)	Moderate	Moderate	Good	Good	Moderate	Very Good	Very Good	Moderate to Good	Moderate to Good	Moderate
Ease of Access	Easy	Road on one side	Difficult	Road on one side and down centre	Easy off existing roads	Remote but roads exist	Very difficult.	Difficult but there are roads on either side.	Very remote and difficult to access.	Very easy off several roads.
Comment		Vegetation similar to the landfill site. Grassy with scattered woody. Includes a stream. Not flat. Soil erosion or sand mining.	Small site selected on the basis of having an open grassland area on a ridge crest and adjacent slope.	Vegetation includes large amount of grassland but with woody component in the valleys.	Very similar to the landfill site. Small.	Flat plateau on top of a mountain. Almost all grassland. Human occupation is expanding in this area.	Not entirely within the municipal area.	Vegetation includes large amount of grassland but with woody component in the valleys.	Very rough terrain with few flat areas. Very little grassland.	Adjacent to an existing nature reserve