Vegetation and Wetland Assessment for borrow pit Site 1 for the Mulilo Newcastle Wind Energy Facility (WEF) situated near Newcastle in KwaZulu-Natal.

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DECLARATION OF INDEPENDENCE

DPR Ecologists and Environmental Services is an independent company and has no financial, personal, or other interest in the proposed project, apart from fair remuneration for work performed in the delivery of ecological services. There are no circumstances that compromise the objectivity of the study.

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Title	**Vegetation and Wetland Assessment for borrow pit Site 1 for the Mulilo Newcastle Wind Energy Facility (WEF) situated near Newcastle in KwaZulu-Natal.**		
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Executive Summary

The proposed borrow pit development has considered five different alternative sites. An overview of all five these alternatives, especially in terms of wetland delineation, has been included within the assessment. However, detailed assessment of vegetation and wetlands will only be applicable to Borrow Pit Site 1, which has been determined as being the most suitable site and will be the only site being applied for development (Appendix A: Map 3). The borrow pit development will be developed in order to meet the needs of the Mulilo Newcastle Wind Energy Facility (WEF), which is situated approximately 30 km to the north-west of the town of Newcastle (Appendix A: Map 1). The WEF development is still in the initial phases and the area is therefore still largely natural, without any prominent developments or transformation being evident. The area forms part of a mountainous area with substantial summer rainfall, resulting in the formation of numerous wetland areas, especially seepage systems in the higher lying terrain. These wetlands may not always be prominent though are easily discernible, and a combination of topography, wetland vegetation and soil wetness characteristics does still allow for adequate delineation of wetland areas (Appendix A: Map 2). Delineation of wetlands has been undertaken for all five borrow pit alternative sites, while detailed assessment has been limited to Borrow Pit Site 1, which will be the only site which will be applied for development (Appendix A: Map 3).

From the description of **Site 1** (Preferred Site), it is clear that it still consists of natural grassland, which is still in a fairly good condition (Appendix A: Map 1 & 3). Signs of disturbance are present but are indicative of only low levels of disturbance. The species diversity is moderate although the area does also contain a significant number of protected plant species, which will contribute towards its conservation value (Appendix B). The site itself therefore contains elements of significant conservation value which include protected plant species and rocky habitats providing suitable conditions for specialised species (Appendix A: Map 3). The stream and drainage line situated to the north of the site are considered as highly sensitive, though are not situated on or near the site and therefore only relevant in terms of any indirect impacts the development may still have on them (Appendix A: Map 3). Significant mitigation will therefore still have to be implemented to ensure the impact on these elements of significant conservation value is decreased. Mitigation should include the following (Appendix A: Map 1 - 3):

- Numerous protected plant species have been identified **Site 1** (Appendix B). These include the protected succulent and geophytic species, *Gladiolus ecklonii, Raphionacme hirsuta, Dierama galpinii, Aloe maculata, Schizocarpus nervosus* and *Crinum macowanii*. Where development will affect these species, the necessary permits should be obtained and a significant proportion of these transplanted to adjacent areas where they will remain unaffected.
- Though the site itself does not currently contain any significant weed or invasive plant infestations, mining will increase disturbance in the area and this will pose a risk of weeds and invasive species establishing and spreading into surrounding natural areas. This is particularly relevant to invasive *Acacia mearnsii* (Wattle), present in several clumps in the surroundings, which should be the main focus of eradication efforts. The proposed development will therefore have to implement a comprehensive monitoring and eradication programme to ensure that invasive plant species are removed from the area and prevented from re-establishing.

An overview of the wetlands and watercourses at all five alternative sites will be provided, though detailed assessment will focus only on **Site 1**, which is also the preferred site, which will be the subject of the mining permit application (Appendix A: Map 3). **Site 1** is situated on the lower lying

foot slopes of the mountain and is dominated by a longitudinal low ridge from south-west to north-east and has a moderate slope from south-east to north-west. The site itself is devoid of any wetland systems and is dominated by dolerite outcrops. A prominent but small mountain stream is situated in the lower lying valley, approximately 90 metres to the north-west of the site, while an even smaller drainage line is situated approximately 40 metres to the south-west of the site, also flowing into, and forming a tributary, of the larger stream system (Appendix A: Map 3). Both these watercourses are fairly fast flowing, draining from west to east and have a well-defined channel. The stream is clearly a strictly seasonal system, currently containing no connected main channel flow and will contain no flow during winter, while flowing strongly for short periods after rainfall events. As a result, wetland conditions are present, but not extensive.

The stream and drainage line adjacent to Site 1 (Preferred Site) are largely intact, though affected by some impacts, which will certainly have some effect on them. The most prominent impacts are associated with erosion upslope and infestation by invasive trees. On the upslope of the stream, within its catchment and especially where steep slopes are present, erosion does take place, especially along dirt tracks and livestock footpaths. This will have some effect on sediment load within the stream. The infestation by invasive *Acacia mearnsii*, is considered a significantly higher impact and will certainly decrease the condition of the stream. Several clumps of this invasive tree occur along the stream and can be quite extensive in some areas. This has many large impacts which may include removal of riparian vegetation, increased sedimentation, severe decrease in biodiversity and modification of its hydrology. These impacts are also discussed in more detail in Section 4.2.4. An IHI determination was undertaken for both the stream system and the smaller drainage line, in order to determine their current condition given the impacts affecting them (Appendix D). The results of the IHI indicated that the stream system has a Present Ecological State of Category C: Moderately Modified, while the drainage line has a Present Ecological State of Category B/C: Largely Natural to Moderately Modified. This is considered relatively accurate given the impacts in the catchment of these watercourses. The system will have a high conservation value as it forms the origin of the downslope stream system and performs important functions in terms of water transportation, storm water and groundwater recharge, bioremediation and flood attenuation. The entire system should therefore still be considered as sensitive and the proposed development should not lead to altering it any further (Appendix A: Map 3). The EI&S of the affected stream and drainage line has been rated as being High.

As indicated, the stream and drainage line are both still fairly natural, forming part of the Northern Drakensberg SWSA, having a high conservation value and impacts on them by the proposed borrow pit should be avoided (Appendix A: Map 2). The mining operations should therefore aim to completely exclude these watercourses and prevent impacts on them (Appendix A: Map 3). The stream and associated drainage line should be treated as no-go areas and no construction or operational activities, vehicle movement, laydown areas, vegetation clearing or any other associated activities should occur in or near these watercourses. In addition, a suitable buffer for the stream and drainage line can be provided by using the Buffer Zone Tool for the Determination of Aquatic Impact Buffers and Additional Setback Requirements for River Ecosystems (2014) (Appendix E). By using the above tools a suitable buffer of 47 metres for the stream and 44 metres for the drainage line has been determined (Appendix A: Map 3). Should mining operations be able to exclude these watercourses and operations within the determined buffer zone, it will result in the lowest impacts, while the anticipated risk will increase as mining encroaches into the buffer.

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Vegetation and Wetland Assessment

1. Introduction

1.1 Background

Natural vegetation is an important component of ecosystems. Some of the vegetation units in a region can be more sensitive than others, usually as a result of a variety of environmental factors and species composition. These units are often associated with water bodies, water transferring bodies or moisture sinks. These systems are always connected to each other through a complex pattern. Degradation of a link in this larger system, e.g. tributary, pan, wetland, usually leads to the degradation of the larger system. Therefore, degradation of such a water related system should be prevented.

Though vegetation may seem to be uniform and low in diversity it may still contain species that are rare and endangered. The occurrence of such a species may render the development unviable. Should such a species be encountered the development should be moved to another location or cease altogether.

South Africa has a large number of endemic species and in terms of plant diversity ranks third in the world. This has the result that many of the species are rare, highly localised and consequently endangered. It is our duty to protect our diverse natural resources.

South Africa's water resources have become a major concern in recent times. As a water scarce country, we need to manage our water resources sustainably in order to maintain a viable resource for the community as well as to preserve the biodiversity of the system. Thus, it should be clear that we need to protect our water resources so that we may be able to utilise this renewable resource sustainably. Areas that are regarded as crucial to maintain healthy water resources include wetlands, streams as well as the overall catchment of a river system.

In order to better manage our water resources several guidelines and research sources have been developed. Amongst these are the National Freshwater Ecosystem Priority Areas for South Africa 2011 (NFEPA).

It is well known that quarry mining operations have several detrimental impacts on the environment. These impacts are numerous, but the most pronounced impacts are associated with the excavation of large amounts of earth materials, the storage and disposal thereof and the sedimentation associated with it, especially where mining takes place near watercourses. This usually causes degradation of waterways due to sedimentation as well as the transformation of the vegetation and ecosystem on the site.

For the above reasons it is necessary to conduct a vegetation and wetland assessment of the area proposed for the borrow pit sites.

The proposed borrow pit development has considered five different alternative sites. An overview of all five these alternatives, especially in terms of wetland delineation, has been included within the assessment. However, detailed assessment of vegetation and wetlands will only be applicable to Borrow Pit Site 1, which has been determined as being the most suitable site and will be the only site being applied for development (Appendix A: Map 3). The borrow pit development will be developed in order to meet the needs of the Mulilo Newcastle Wind Energy

Facility (WEF), which is situated approximately 30 km to the north-west of the town of Newcastle (Appendix A: Map 1). The WEF development is still in the initial phases and the area is therefore still largely natural, without any prominent developments or transformation being evident. Impacts that are however evident include significant infestation by invasive *Acacia mearnsii* (Black Wattle), particularly affecting watercourses, a moderate level of overgrazing by domestic livestock and transformation of smaller portions due to planted pasture. The impacts on wetlands are significant, especially where infestation by *A. mearnsii* occurs. The area forms part of a mountainous area with substantial summer rainfall, resulting in the formation of numerous wetland areas, especially seepage systems in the higher lying terrain. These wetlands may not always be prominent though are easily discernible, and a combination of topography, wetland vegetation and soil wetness characteristics does still allow for adequate delineation of wetland areas (Appendix A: Map 2). Delineation of wetlands has been undertaken for all five borrow pit alternative sites, while detailed assessment has been limited to Borrow Pit Site 1, which will be the only site which will be applied for development (Appendix A: Map 3).

A site visit was conducted on 30 October 2024. The study area included a survey of each of the five considered alternative sites which varied from 5 to 20 hectares as well as any wetland areas along the borders of these sites. The extent of the study area, limited accessibility, and recent burning of vegetation influenced the accuracy of the delineation of wetland areas and identification of vegetation. Although the survey was conducted during early spring, before the rainy season had started in earnest, sufficient soil moisture, flow and vegetation identification could still be done, which aided in accurate delineation of wetland systems and identification of affected vegetation composition.

The report together with its recommendations should be used to minimise the impact of the borrow pit development on vegetation, biodiversity and wetland areas and also to inform the layout and design of the development.

1.2 Project information

Mulilo Newcastle Wind Power (Pty) Ltd. proposes to develop, construct, and operate the 200 MW Mulilo Newcastle Wind Power (MNWP) WEF as part of the Mulilo Newcastle Wind Energy Facility (WEF) Complex located near Newcastle in KwaZulu-Natal. The MNWP WEF will comprise up to 35 wind turbines and will have an anticipated lifespan of 20 – 25 years. The WEF will be located on six (6) land parcels with a total extent of 2,940 ha.

Mulilo Newcastle Wind Power 2 (Pty) Ltd. proposes to develop, construct, and operate the 160 MW Mulilo Newcastle Wind Power 2 (MNWP 2) WEF as part of the Mulilo Newcastle Wind Energy Facility (WEF) Complex located near Newcastle in KwaZulu-Natal. The MNWP 2 WEF will comprise up to 16 wind turbines and will have an anticipated lifespan of 20 – 25 years. The WEF will be located on eight (8) land parcels with a total extent of 1,626 ha.

Considering the above, Mulilo Newcastle Wind Power (Pty) Ltd. (the Applicant) intends to apply for a mining permit (MP) and environmental authorisation (EA) from the Department of Mineral Resources and Energy (DMRE) for the development of a 5 hectares quarry that will supply aggregate, gravel, and stone for the construction of the Mulilo Newcastle Wind Power WEF (MNWP WEF) projects.

During the design phase the Applicant identified five potential mining areas that all lie within the footprint of the six land parcels of the MNWP WEF authorisation. From these five sites, the

preferred mining area has been identified as Borrow Pit 1, during the screening phase by the specialists and EAP who will now apply for the mining permit for this preferred site.

Mining Method

The proposed mining footprint will entail the development of a greenfield site as no existing quarries/borrow pits exist on the earmarked farms that can be sourced/expanded. The proposed mining method will make use of blasting to loosen the hard rock; the material will then be loaded and hauled to the crushing plant where it will be screened to various sized stockpiles. When necessary, the material will be washed at an on-site washing plant prior to use. The material will be stockpiled until it is transported from the mining area to the relevant construction sites.
The proposed MP project will therefore entail the following:

- site establishment and infrastructure development;
- stripping and stockpiling of topsoil from the proposed mining footprint area;
- blasting and excavation of the mining area;
- crushing and screening of the loosened material at the processing plant;
- washing of material (when needed), and
- stockpiling the product until used in the construction phase of the MNWP WEF projects.

Access Roads

The current road infrastructure of the earmarked farms (for the MNWP WEF) is not sufficient to support the proposed development, and therefore the development and upgrading of the roads formed part of the EIA application of the MNWP WEF and subsequent environmental approval. The proposed mining area will be accessible from the roads to be constructed as part of the MNWP WEF and no additional roads will be needed to access the mining area and/or transport materials from site.

1.3 The value of biodiversity

The diversity of life forms and their interaction with each other and the environment has made Earth a uniquely habitable place for humans. Biodiversity sustains human livelihoods and life itself. Although our dependence on biodiversity has become less tangible and apparent, it remains critically important.

The balancing of atmospheric gases through photosynthesis and carbon sequestration is reliant on biodiversity, while an estimated 40% of the global economy is based on biological products and processes.

Biodiversity is the basis of innumerable environmental services that keep us and the natural environment alive. These services range from the provision of clean water and watershed services to the recycling of nutrients and pollution. These ecosystem services include:

- Soil formation and maintenance of soil fertility.
- Primary production through photosynthesis as the supportive foundation for all life.
- Provision of food, fuel and fibre.
- Provision of shelter and building materials.
- Regulation of water flows and the maintenance of water quality.

- Regulation and purification of atmospheric gases.
- Moderation of climate and weather.
- Detoxification and decomposition of wastes.
- Pollination of plants, including many crops.
- Control of pests and diseases.
- Maintenance of genetic resources.

1.4 Value of wetlands and watercourses

Freshwater ecosystems provide valuable natural resources, which contribute toward economic, aesthetic, spiritual, cultural and many recreational values. Yet the integrity of freshwater ecosystems in South Africa has been rapidly declining in recent times. This crisis is largely a consequence of a variety of challenges that are practical (managing vast areas of land to maintain connectivity between freshwater ecosystems), socio-economic (the need to utilise these recourses between different stakeholders, i.e., individuals, communities, corporate and industrial) and institutional (implementing appropriate governance and management). Water affects every activity and aspiration of human society and sustains all ecosystems.

Freshwater ecosystems provide many of our fundamental needs, enable important regulating ecosystem services, supports functional faunal and floral communities:

- Water for drinking and irrigation.
- Food, such as fish and water plants.
- Building material, such as clay and reeds.
- Preventing floods and easing the impacts of droughts.
- Removing excess nutrients and toxic substances from water.
- Rivers, wetlands, and groundwater systems maintain water supplies and buffer the effects of storms, reducing the loss of life and property to floods.
- Riverbanks help to trap sediments, stabilise
- river banks and break down pollutants draining from the surrounding land.

1.5 Details and expertise of specialist

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Professional registration:
South African Council for Natural Scientific Professions No. (400284/13) (Ecological Science).

Membership with relevant societies and associations:
- South African Society of Aquatic Scientists (SASAQS0091)
- South African Association of Botanists
- South African Wetlands Society (3SLY4IG4)

Expertise:

- Qualifications: B.Sc. (Hons) Botany (2008), M.Sc. in Vegetation Ecology (2012) with focus on ephemeral watercourses.
- Vegetation ecologist with over 10 years' experience of conducting ecological assessments.
- Founded DPR Ecologists & Environmental Services (Pty) Ltd. in 2016.
- Has conducted over 200 ecological and wetland assessments for various developments.
- Regularly attends conferences and courses in order to stay up to date with current methods and trends:

  2017: Kimberley Biodiversity Symposium.
  2018: South African Association of Botanists annual conference.
  2018: National Wetland Indaba Conference.
  2019: SASS5 Aquatic Biomonitoring Training.
  2019: Society for Ecological Restoration World Congress 2019.
  2019: Wetland rehabilitation: SER 2019 training course.
  2020: Tools For Wetlands (TFW) training course.
  2022: National Wetland Indaba Conference.

2. Scope and limitations

- To evaluate the present state of the vegetation and ecological functioning of the area proposed for the borrow pit development.
- To identify possible negative impacts that could be caused by the proposed clearing of vegetation and construction of the borrow pit development.
    - Severity relates to the nature of the event, aspect or impact to the environment and describes how severely the aspects may impact on the ecosystem.
    - Duration refers to the amount of time that the environment will be affected by the event, risk or impact, if no intervention e.g. remedial action takes place.
    - Extent refers to the spatial influence of an impact.
    - Frequency refers to how often the specific activity, related to the event, aspect or impact, is undertaken.
    - Probability refers to how often the activity/event or aspect has an impact on the environment.
- To provide a description of watercourses, wetlands and riparian vegetation included within the study area.
- Identify watercourses including rivers, streams, pans, and wetlands and determine the presence of wetland conditions within these systems.
- Where wetland conditions have been identified the classification of the wetland system will be given.
- Determine the Present Ecological State (PES) and Ecological Importance & Sensitivity (EIS) for the watercourses in close proximity to construction.
- Conduct a risk assessment and determine the likelihood that watercourses and wetlands will be adversely affected by the development.

2.1 Vegetation

Aspects of the vegetation that will be assessed include:

- The vegetation types of the region with their relevance to the proposed site.
- The overall status of the vegetation on site.
- Species composition with the emphasis on dominant-, rare- and endangered species.

The amount of disturbance present on the site assessed according to:

- The amount of grazing impacts.
- Disturbance caused by human impacts.
- Other disturbances.

2.2 Wetlands and watercourses

Aspects of the wetlands and watercourses that will be assessed include:

- Identification of watercourses including rivers, streams, pans, and wetlands.
- Determine the presence of wetland conditions and riparian vegetation using obligate wetland and riparian species.
- Describe watercourses and wetlands and importance relative to the larger system.

2.4 Limitations

- Some geophytic or succulent species may have been overlooked due to a specific flowering time or cryptic nature.
- Although a comprehensive survey of the site was done it is still likely that several species were overlooked.

The following aspects have affected the accuracy of wetland delineation and should be taken into account where this will affect layout and design of the borrow pit development:

- Due to the time of year, wetlands are not hydrologically active, and delineation of the wetland border requires more effort to determine.
- During early spring and before the onset of the rainy season, vegetation is not easily identifiable and coupled with the recent burning of vegetation and overgrazing by domestic livestock, vegetation provides a limited indicator of wetland conditions.
- As a result of the above, the delineation of the border of wetland areas may include errors and where smaller wetland patches occur, these may have been overlooked.
- Due to time constraints only limited soil sampling could be done.
- Where surface vegetation has been burnt or where surface wetness indicators are absent or not clearly defined, wetland patches may have been overlooked.
- Although a comprehensive survey of the site was done, it is still likely that smaller wetland areas may have been overlooked.

3. Methodology

3.1 Several literature works were used for additional information.

General ecology:

- Red Data List (Raymondo *et al.* 2009).
- Vegetation types (Mucina & Rutherford 2006).
- NBA 2018: South African Inventory of Inland Aquatic Ecosystems (SAIIAE).
- NBA 2018 Technical Report: Inland Aquatic (Freshwater) Realm.
- NBA 2018 Technical Report Volume 1: Terrestrial Realm.
- NEM:BA: List of threatened ecosystems and Threatened Or Protected Species (TOPS).
- National Freshwater Ecosystem Priority Areas 2011 (NFEPA).
- Strategic Water Source Areas 2018 (SWSA).
- SANBI (2011): List of threatened ecosystems.
- EKZNW (2010/2016) Terrestrial Systematic Conservation Plan (TSCP).

Vegetation:

- Red Data List (Raymondo *et al.* 2009)
- Vegetation types (Mucina & Rutherford 2006)
- Vegetation type conservation targets, status and level of protection in KwaZulu-Natal in 2016.
- Field guides used for species identification (Bromilow 1995, 2010, Coates-Palgrave 2002, Court 2010, Fish *et al.* 2015, Gerber *et al.* 2004, Gibbs-Russell *et al.* 1990, Griffiths & Picker 2015, Manning 2009, Moffett 1997, Pooley 1998, 2003, Retief & Meyer 2017, Van Ginkel & Cilliers 2020, Van Ginkel *et al.* 2011, Van Oudtshoorn 2004, Van Wyk & Malan 1998, Van Wyk & Van Wyk 1997, Venter & Joubert 1985).

Wetland methodology, delineation, and identification:

- Department of Water Affairs and Forestry 2004, 2005, 2008, Collins 2006, Marnewecke & Kotze 1999, Nel *et al.* 2011, SANBI 2009.

Several studies have been undertaken as part of the larger WEF development and these will also be utilised to improve the accuracy and baseline information of the five borrow pit sites. These studies include:

- Edwards, R. & Russell, T. 2023. Mulilo Newcastle Wind Power (Pty) Ltd. Newcastle Wind Energy Facility in the Newcastle Local Municipality, KwaZulu-Natal: Aquatic and Wetland Ecosystem Impact Assessment Report. Verdant Environmental (Pty) Ltd: VE21-35-MNWP-02.
- Reljic, E. & Wienand, N. 2022. Botanical and Faunal Impact Assessment Report for the Proposed Mulilo Newcastle Wind Power Facility, near Newcastle within the KwaZulu-Natal Province. Coastal and Environmental Services (Pty) Ltd.
- Hawley, G. & Reeves, B. 2023. Mulilo Newcastle Wind Power Wind Energy Facility (MNWP WEF). Big Thorn Environmental.

EIA Screening Tool: The EIA Screening Tool provides a general indication of elements of sensitivity that may occur in a development area and was also utilised during the assessment for the following aspects:

- Aquatic Biodiversity – A very high sensitivity is indicated as Site 1 (Preferred Site), falls within the Northern Drakensberg Strategic Water Source Area (SWSA). The survey also confirms that a stream and drainage line are situated near the site, forming part of an area with a large number of wetland systems. It is therefore important to undertake a detailed aquatic/wetland assessment of the systems around the site. Given the distance between the site and surrounding stream and drainage line, this will significantly reduce the anticipated risk that the development will have (See Section 4.2) (Appendix A: Map 3).

- Plant species – A medium sensitivity is indicated for Site 1 (Preferred Site), as several plant species, *Lotononis amajubica,* Sensitive Species #851 and #998 are known to occur in the region. Of these, suitable habitat is absent from the site for Sensitive Species #851 and #998, which require rock sheets, forest edges and wetland systems respectively and are therefore highly unlikely to occur on the site. Suitable habitat is present for *Lotononis amajubica,* though this is a fairly conspicuous plant, even when not in flower and was confirmed to be absent from the site. Overall, a moderate sensitivity should therefore be maintained (Appendix A: Map 3).

- Terrestrial Biodiversity – Site 1 (Preferred Site), is listed as having a Very High Sensitivity. This is associated with Critical Biodiversity Areas (CBA), Strategic Water Source Areas (SWSA) and National Protected Areas Expansion Strategy (NPAES): Focus Areas. The site has however been confirmed to be situated outside any CBAs, ESA or important habitat for threatened species and is not considered essential for meeting conservation targets. However, the site is situated within the Northern Drakensberg Strategic Water Source Area (SWSA) as well as the National Protected Areas Expansion Strategy (NPAES): Moist Escarpment Grassland Focus Area. In both instances, the proposed borrow pit development is unlikely to have any significant impact, both in terms of the regional water source and any future expansion of protected areas, largely as a result of its small footprint and therefore limited impact.

3.2 Survey

The site was assessed by means of transects and sample plots. Observation w.r.t. the general ecology of the area includes:

- Noted species include rare and dominant species.
- The broad vegetation types present at the site were determined.
- The state of the environment was assessed in terms of condition, grazing impacts, disturbance by humans, erosion and presence of invader and exotic species.
- The state of the habitat was also assessed.

Ecological aspects surveyed and recorded include:

- The overall ecology of an area including the diversity of species, uniformity or diversity of habitats and different vegetation communities.
- Identification and delineation of distinct vegetation communities and habitats and the ecological drivers responsible for these distinct communities, i.e. soil, geology, topography, aspect, etc.
- A comprehensive plant species survey including the identification of protected, rare or threatened species.

- Any ecological process or function which is important to the ecosystem including ecological drivers such as fire, frost, grazing, browsing, etc. and any changes to these processes.

In order to provide a visually representative overview of the results obtained from the survey, site sensitivity mapping will also be done. This should indicate the relative importance of different ecological elements on the site as obtained from the survey. In general, these levels of sensitivity will include:

- Low Sensitivity – normally confined to areas that are completely transformed from the natural condition or degraded to such an extent that they are no longer representative of the natural ecosystem. Such areas will also no longer contain any ecological processes of importance relative to the surrounding areas, i.e. in some instances such as watercourses which are completely transformed but still provide important ecological functions, a low level of sensitivity will not apply.

- Moderate Sensitivity – normally applicable to areas that are still natural and therefore do still have some ecological importance but which do not contain elements of high conservation value and are not essential to the continued functioning of surrounding areas. Areas of Moderate Sensitivity usually require some mitigation but can be developed without resulting in high impacts.

- High Sensitivity – areas of high sensitivity contain one or more ecological elements which are considered of high conservation value. Such areas are normally preferred to be excluded from a development but where this is not possible, will require comprehensive mitigation and are also likely to result in high impacts.

- Very High Sensitivity – these areas are critical to the continued functioning of the ecosystem on and around the site. Development of such areas normally represent a fatal flaw and should be excluded from development. No manner of mitigation is able to decrease the anticipated impact in these areas.

All rivers, streams, pans, and wetlands were identified and surveyed where they occurred in the study area. These systems were determined by use of topography (landform and drainage pattern) and riparian vegetation with limited soil sampling (Appendix B & C). The following outline the process applied during the on-site survey in order to obtain all required data:

- Perform desktop overview of the study area utilising available resources (Section 3.1). From the desktop overview identify the different landscape forms, possible wetland areas, watercourses, and their relative flow patterns. Using this information, identify transects and sample plots for possible on-site survey. This should be both representative of the wetland or watercourse as a whole but should also include any prominent or significantly unique features.
- Possible sites identified during the desktop overview should be surveyed on-site. Where access is not possible or where desktop features are considered poor representatives of the wetland or watercourse the survey site or transect should be moved to another location, without compromising a comprehensive overview of the system.
- Where a lateral transect is taken of a watercourse this is done from the water's edge, across the marginal, lower and upper zones and extended across the floodplain until the edge of the riparian zone is reached.

- Where a transect is taken of a wetland system, this should preferably be taken across the entire wetland at its widest part or where it is most relevant to the proposed development, from the terrestrial surroundings, across the temporary, seasonal, and perennial zones across the wetland.
- Soil samples are taken at 10 metres intervals along the survey transect, or where a distinct transition into a different zone is observed.
- A survey of the plant species within each distinct riparian or wetland zone is undertaken and includes the identification of obligate wetland species, riparian species, terrestrial species, exotic species and the general species composition and vegetation structure which allows for an accurate description of the watercourse or wetland.
- Visual survey of the general topography which substantiates the presence of riparian zones and wetland forms.
- Other general observations include any impacts observed, the overall ecosystem function, presence of fauna, surrounding land uses and the overall condition of the watercourse or wetland.
- Data is recorded by means of photographs with GPS coordinates taken at all relevant soil sampling sites and borders of riparian and wetland zones.

Data obtained during the on-site survey is utilised to provide the following information on the system:

- Desktop overview and assimilation of information on the likely impacts and functioning of the wetland system.
    - Review all available spatial data and resources in order to provide an estimate of the likely impacts and condition of the wetland or watercourse system.
- Confirm the presence of the wetland or watercourse system and provide an estimate of its borders.
    - The border of wetland conditions or the edge of the riparian zone will be confirmed by using soil sampling, obligate wetland vegetation and topography. This will also include the delineation of any temporary, seasonal, or perennial zones of wetness along wetlands and the marginal, lower, upper, and riparian zones along watercourses.
- Provide a description of the wetland or watercourse.
    - Provide the hydrogeomorphic setting of the wetland, a longitudinal profile which will aid in determining the erodibility of the wetland and provide an overall description of the wetland and impacts affecting it.
    - Provide a general description of the lateral zonation of the watercourse banks including the marginal, lower, upper, and riparian zones, and a description of the riparian vegetation along the banks of the watercourse. This will also include the description of any impacts or modification of the watercourse.

The following guidelines and frameworks were also used to determine the presence of the rivers, streams, pans, and wetlands in the study area:

- Department of Water Affairs and Forestry. 2005. A practical field procedure for identification and delineation of wetlands and riparian areas. Edition 1. Department of Water Affairs and Forestry, Pretoria.
- Marnewecke & Kotze 1999. Appendix W6: Guidelines for delineation of wetland boundary and wetland zones. In: MacKay (Ed.), H. Resource directed measures for

protection of water resources: wetland ecosystems. Department of Water Affairs and Forestry, Pretoria.

These guidelines provide the characteristics which can be utilised to determine if a wetland or watercourse is present and also aid in determining the boundary of these systems.

3.3 Criteria used to assess sites

Several criteria were used to assess the study area and determine the overall status of the environment.

3.3.1 Vegetation characteristics

Characteristics of the vegetation in its current state. The diversity of species, sensitivity of habitats and importance of the ecology as a whole.

Habitat diversity and species richness: normally a function of locality, habitat diversity and climatic conditions.
Scoring: Wide variety of species occupying a variety of niches – 1, Variety of species occupying a single niche – 2, Single species dominance over a large area containing a low diversity of species – 3.

Presence of rare and endangered species: The actual occurrence or potential occurrence of rare or endangered species.
Scoring: Occurrence actual or highly likely – 1, Occurrence possible – 2, Occurrence highly unlikely – 3.

Ecological function: All plant communities play a role in the ecosystem. The ecological importance of all areas can vary significantly though, e.g., wetlands, drainage lines, ecotones, etc.
Scoring: Ecological function critical for greater system – 1, Ecological function of medium importance – 2, No special ecological function (system will not fail if absent) – 3.

Degree of rarity/conservation value:
Scoring: Very rare and/or in pristine condition – 1, Fair to good condition and/or relatively rare – 2, Not rare, degraded and/or poorly conserved – 3.

3.3.2 Vegetation condition

The sites are compared to a benchmark site in a good to excellent condition. Vegetation management practices (e.g., grazing regime, fire, management, etc.) can have a marked impact on the condition of the vegetation.

Percentage ground cover: Ground cover is under normal and natural conditions a function of climate and biophysical characteristics. Under poor grazing management, ground cover is one of the first signs of vegetation degradation.
Scoring: Good to excellent – 1, Fair – 2, Poor – 3.

Vegetation structure: This is the ratio between tree, shrub, sub-shrubs, and grass layers. The ratio could be affected by grazing and browsing by animals.
Scoring: All layers still intact and showing specimens of all age classes – 1, Sub-shrubs and/or grass layers highly grazed while tree layer still fairly intact (bush partly opened up) – 2, Mono-layered structure often dominated by a few unpalatable species (presence of barren patches notable) – 3.

Infestation with exotic weeds and invader plants or encroachers:
Scoring: No or very slight infestation levels by weeds and invaders – 1, Medium infestation by one or more species – 2, Several weed and invader species present and high occurrence of one or more species – 3.

Degree of grazing/browsing impact:
Scoring: No or very slight notable signs of browsing and/or grazing – 1, Some browse lines evident, shrubs show signs of browsing, grass layer grazed though still intact – 2, Clear browse line on trees, shrubs heavily pruned and grass layer almost absent – 3.

Signs of erosion: The formation of erosion scars can often give an indication of the severity and/or duration of vegetation degradation.
Scoring: No or very little sign of soil erosion – 1, Small erosion gullies present and/or evidence of slight sheet erosion – 2, Gully erosion well developed (medium to large dongas) and/or sheet erosion removed the topsoil over large areas – 3.

3.3.3 Faunal characteristics

Presence of rare and endangered species: The actual occurrence or potential occurrence of rare or endangered species on a proposed site plays a large role in the feasibility of a development. Depending on the status and provincial conservation policy, presence of a Red Data species or very unique and sensitive habitats can potentially be a fatal flaw.
Scoring: Occurrence actual or highly likely – 1, Occurrence possible – 2, Occurrence highly unlikely – 3.

3.4 Biodiversity sensitivity rating (BSR)

The total scores for the criteria discussed in section 3.3 were used to determine the biodiversity sensitivity ranking for the sites. On a scale of 0 – 30, five different classes are described to assess the biodiversity of the study area. The different classes are described in Table 1:

Table 1: Biodiversity sensitivity ranking

BSR	BSR general floral description	Floral score equating to BSR class
Totally transformed (5)	Vegetation is totally transformed or in a highly degraded state, generally has a low level of species diversity, no species of concern and/or has a high level of invasive plants. The area has lost its inherent ecological function. The area has no conservation value and potential for successful rehabilitation is very low.	29 – 30
Advanced Degraded (4)	Vegetation is in an advanced state of degradation, has a low level of species diversity, no species of concern and/or has a high level of invasive plants. The area's ecological function is seriously hampered, has a very low conservation value and the potential for successful rehabilitation is low.	26 – 28
Degraded (3)	Vegetation is notably degraded, has a medium level of species diversity although no species of concern are present. Invasive plants are present but are still controllable. The area's ecological function is still intact but may be hampered by the current levels of degradation. Successful rehabilitation of the area is possible. The conservation value is regarded as low.	21 – 25
Good Condition (2)	The area is in a good condition although signs of disturbance are present. Species diversity is high and species of concern may be present. The ecological function is intact and very little rehabilitation is needed. The area is of medium conservation importance.	11 – 20
Sensitive/Pristine (1)	The vegetation is in a pristine or near pristine condition. Very little signs of disturbance other than those needed for successful management are present. The species diversity is very high with several species of concern known to be present. Ecological functioning is intact and the conservation importance is high.	0 - 10

4. Ecological overview of the site

For the purpose of this report the general ecology of the study area will first be discussed followed by a discussion of the watercourses and wetland systems.

4.1 Overview of ecology and vegetation types

Refer to the list of species encountered on the site in Appendix B.

The proposed borrow pit development has considered five different alternative sites. An overview of all five these alternatives, especially in terms of wetland delineation, has been included within the assessment. However, detailed assessment of vegetation and wetlands will only be applicable to Borrow Pit Site 1, which has been determined as being the most suitable site and will be the only site being applied for development (Appendix A: Map 3). The borrow pit development will be developed in order to meet the needs of the Mulilo Newcastle Wind Energy Facility (WEF), which is situated approximately 30 km to the north-west of the town of Newcastle (Appendix A: Map 1). The WEF development is still in the initial phases and the area is therefore still largely natural, without any prominent developments or transformation being evident. Impacts that are however evident include significant infestation by invasive *Acacia mearnsii* (Black Wattle), particularly affecting watercourses, a moderate level of overgrazing by domestic livestock and transformation of smaller portions due to planted pasture. The impacts on wetlands are significant, especially where infestation by *A. mearnsii* occurs. The area forms part of a mountainous area with substantial summer rainfall, resulting in the formation of numerous wetland areas, especially seepage systems in the higher lying terrain. These wetlands may not always be prominent though are easily discernible, and a combination of topography, wetland vegetation and soil wetness characteristics does still allow for adequate delineation of wetland areas (Appendix A: Map 2). Delineation of wetlands has been undertaken for all five borrow pit alternative sites, while detailed assessment has been limited to Borrow Pit Site 1, which will be the only site which will be applied for development (Appendix A: Map 3).

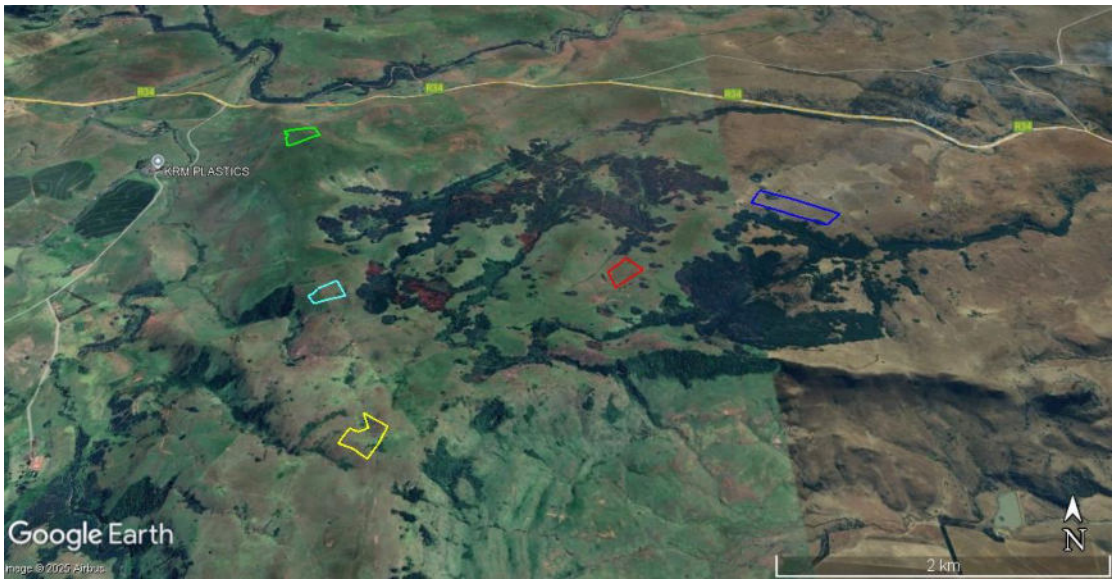


Figure 1: Aerial view of the area indicating the locations of the five borrow pit sites alternatives (Red – Site 1 (Preferred Site), Light Blue – Site 2, Yellow – Site 3, Green – Site 4, Blue – Site 5). The area is clearly still natural, though note significant infestation by invasive *Acacia mearnsii* (Dark green/black patches) (Google Earth 2024).

According to Mucina & Rutherford (2006) the area consists of KwaZulu-Natal Highland Thornveld and Low Escarpment Moist Grassland. Both these vegetation types are currently listed as being of Least Concern (LC) within the National List of Threatened Ecosystems (Notice 1477 of 2009) (National Environmental Management Biodiversity Act, 2004). This is also further confirmed by Jewitt (2018) who has undertaken a more recent assessment of the vegetation types within KZN. The area is affected by some development pressures, though not to such an extent to be considered as being threatened. Of these the former is limited to the lower lying areas (which will only be applicable to Site 5) while the latter dominates the higher lying moist grassland areas (applicable to Sites 1 – 4) (Appendix A: Map 1). This is also quite evident within the vegetation composition and -structure in these different vegetation types.

The conservation status of these vegetation types is also confirmed by the KZN Wildlife Vegetation Map (2009) and the Amajuba District Municipality: Biodiversity Sector Plan (BSP) (2014). However, a few of the larger wetland systems in the area have been identified as containing a sufficiently distinct vegetation type namely Freshwater Wetlands: Eastern Temperate Wetlands vegetation which is considered as Vulnerable (VU) within the above-mentioned conservation plans. However, these will not be directly affected by any of the proposed borrow pit sites.

According to the EKZNW (2010/2016) Terrestrial Systematic Conservation Plan (TSCP) the study area consists of natural biodiversity areas, though large portions also consist of Critical Biodiversity Areas (CBA). These areas are largely concentrated around important wetland systems and their associated catchment also functions as habitat for threatened faunal and floral species. Their continued preservation is therefore important. These CBA areas have also been refined by recent assessment (Hawley & Reeves 2023). According to the original mapping of CBA areas, the following sites are relevant to the EKZNW (2010/2016) Terrestrial Systematic Conservation Plan (TSCP):

- Site 1, the preferred site, is not listed as a CBA, ESA or important habitat for threatened species and is not considered essential for meeting conservation targets.
- Sites 1, 3 and 4 are situated outside any CBA areas and are not considered essential for meeting conservation targets, while these habitats are also not considered as important for threatened species.
- Site 5 is partially situated within a CBA 1, which is associated with wetland habitats to the south, which will increase its conservation value.
- Site 2 is completely situated within a CBA 1, which also forms part of the origin of several wetland systems and will have a higher conservation value.

According to the refined mapping of CBA areas (Hawley & Reeves 2023), none of the proposed sites fall within any CBA areas.

Additional resources also indicated that the site is situated within the Northern Drakensberg Strategic Water Source Area (SWSA) as well as the National Protected Areas Expansion Strategy (NPAES): Moist Escarpment Grassland Focus Area. In both instances, the proposed borrow pit development is unlikely to have any significant impact, both in terms of the regional water source and any future expansion of protected areas, largely as a result of its small footprint and therefore limited impact. The borrow pit will avoid the surrounding watercourses and wetland, incorporating a suitable buffer and should therefore not have an effect on the strategic surface water resources. Being a borrow pit, it may have some impact on the groundwater source, though as long as adequate storm water management principles are implemented, should not have a

significant impact on the resource. Likewise, the footprint (5 hectares) will be so small as not to have any significant impact in terms of any proposed future protected area. In addition, the broader Wind Energy Facility (WEF) has also taken into account management measures in order to preserve and maintain the remaining natural areas.

The larger area consists almost completely of natural vegetation and is dominated by dense grassland habitats. Only localised patches have been transformed by previous ploughing and planted pasture (Appendix A: Map 1). However, all five proposed sites are situated in natural grassland areas. The area is utilised for grazing by domestic livestock and the survey indicates that significant overgrazing also takes place. Overgrazing and trampling result in a decrease in vegetation cover and it was notable that significant erosion is taking place along livestock tracks and steep slopes where trampling is prominent. An additional impact, which is considered one of the main impacts in the area, is heavy infestation by the invasive *Acacia mearnsii* (Black Wattle), especially along wetlands and watercourses. This species is well known for its impacts in terms of a decrease in natural biodiversity, transformation of natural habitats and its impacts on watercourses and wetlands in terms of the drawdown of the water table. This affects fairly large portions of the study area; where such infestations occur, it was notable that almost no natural vegetation has remained. Natural vegetation is however likely to re-establish should clearing of these infestations be undertaken. The study area is therefore largely natural, though significant impacts and disturbances are present.

Figure 2: General view of the study area which indicates a mountainous terrain with steep slopes and valleys.

Figure 3: The area is still largely natural, with vegetation dominated by species rich grassland habitats. Note however infestation by invasive *Acacia mearnsii*, along drainage lines.

Figure 4: Though the area is still largely natural, significant impacts include quite severe infestation by *Acacia mearnsii* (Top) and significant erosion occurring along livestock tracks and steep slopes (Bottom).

As indicated, the area is almost completely natural and as a result, the vegetation structure is dominated by species rich grassland habitats. These grassland areas also contain a significant herbaceous and geophytic growth form component. Where rocky outcrops occur as well as along watercourses, a shrub and tree layer also become prominent. This is also considered natural to the vegetation types occurring in the area. However, where infestation by *Acacia mearnsii* occurs, this vegetation structure becomes heavily modified. These infested areas are dominated by a fairly dense tree layer, with the understorey being almost devoid of vegetation and in these areas the vegetation structure and species composition are heavily modified.

The surrounding topography is dominated by a large mountain along the western border of the study area, with narrow plateau, sloping steeply to the east (Appendix A: Map 2). The plateau forms the origin of many watercourses and here seepage wetland systems are prominent. Sites 2, 3 and 4 are all situated on top of the plateau and several seepage wetland systems are also situated in close proximity to these sites. From the plateau the mountain slopes steeply to the east, where deep valleys and fast flowing mountain streams dominate. The lower lying foot slopes of the mountain also contain mountain streams, though here flow slows somewhat and lower lying valley-bottom wetlands are present. Sites 1 and 5 are both situated on the lower lying foot slopes and here streams are situated in close proximity.

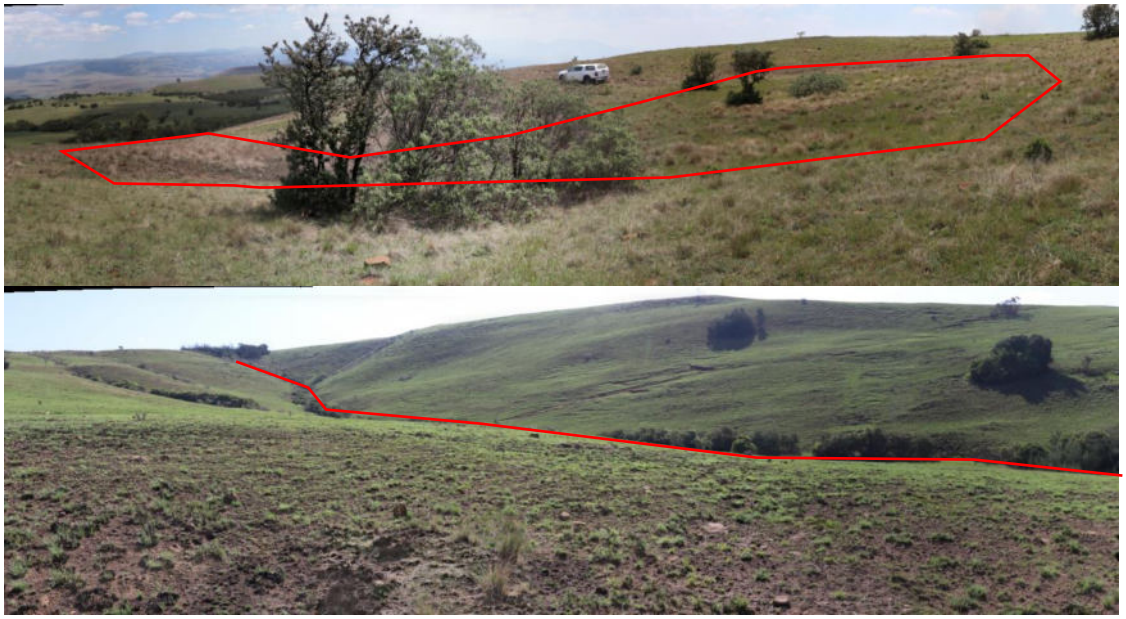


Figure 5: The combination of climate and topography results in the formation of numerous wetlands and watercourses. Along the plateau, seepage wetlands dominate (Top), while the lower lying terrain results in the formation of mountain streams (Bottom).

The sites and surroundings are situated in a region experiencing fairly high rainfall, especially along the crest of the mountainous terrain, with cold, dry winters and temperate summers. According to the climate statistics from the South African Weather Service, the highest mean maximum temperature in December is 26.7 °C, while the lowest mean minimum occurs in July at 4.5 °C (Reljic & Wienand 2022). Climate for the site can be relatively accurately reflected by rainfall and evaporation data from the weather station V3E006 (Volksrust). The region receives an average of 726 mm per year. Precipitation occurs mainly during summer, with most rainfall received during November to March. This is considered a fairly high rainfall and the area is considered to form part of the higher rainfall, temperate region of South Africa. This will also promote the formation of wetlands and watercourses which are numerous in the study area, increasing the likelihood that the proposed development will have an impact on these systems.

The following description of the soils and geology of the study area was taken from (Reljic & Wienand 2022). Geology in the area is dominated by the Karoo Dolerite Suite, which is dominated by a network of dolerite sills, sheets, and dykes, which are mainly intrusive into the Karoo Supergroup. The remaining geology is underlain by mudstones and sandstones deposited by a variety of fluvial systems. Surface rock was also prominent at all five sites, promoting the formation of seepage wetlands. Sandstone often acts as an aquifer and where it crops out or along the contact zone with dolerite, often leads to the formation of seepage wetland areas. Soils in the study area are dominated by Leptosols which are shallow soils that overlie continuous rock. These soils may also contain a high degree of gravel, rock and stones derived from the parent material. Such soils dominate the higher lying areas in the study area including Sites 1 – 4. Nitosols are deeper, well-drained, red, clayey soils that are generally found in hilly landscapes and occur in the lower lying areas of the study area. Such soils may be present at Site 5 and partially Site 1.

In order to provide a site specific description of the Preferred Site (Site 1), a separate description of the vegetation at the site will be provided. This will also aim to provide the condition of the habitat at the site, while also indicating the presence of elements of conservation value where this will be relevant to the borrow pit development (Appendix A: Map 3).

Site 1 (Preferred Site)

The vegetation composition indicates a largely natural area which is still relatively unmodified (Appendix A: Map 1 & 3). The grass layer consists of a diversity of species, with the majority being climax species. The grass composition includes *Cymbopogon pospischillii, Themeda triandra, Eragrostis curvula, Tristachya leucothrix* and *Melinis nerviglumis*. Species diversity on the site is significant due to a variety of micro-habitats, though still considered as moderate. As a result, a variety of different growth forms is present which includes many herbaceous species such as *Scabiosa columbaria, Berkheya echinacea, Acalypha peduncularis, Ocimum odoratum, Euryops laxus, Berkheya setifera, Gerbera ambigua, Cyanotis speciosa, Pentanisia angustifolia, Dyschoriste setigera, Eriosema cordatum* and *Pseudopegolettia tenella*. Other prominent growth forms include terrestrial ferns, *Cheilanthes virides,* creepers, *Cucumis hirsutus, Ipomoea crassipes,* Sedges, *Cyperus obtusiflorus* and succulents, *Euphorbia clavaroides, Aloe maculata*. Another prominent component within the grass layer consists of geophytic species (plants with underground storage organs) which include *Hypoxis rigidula, Pelargonium luridum, Schizocarpus nervosus, Hypoxis multiceps, Crinum macowanii, Tulbaghia acutiloba, Gladiolus ecklonii, Raphionacme hirsuta, Dierama galpinii* and *Ledebouria ovatifolia*. Several of these geophytic species are also listed as protected and have a significant conservation value. Surface rock is present as boulders and this also creates suitable habitat for scattered trees and shrubs to establish and these include *Diospyros lycioides, Searsia dentata, Buddleja salviifolia, Gymnosporia buxifolia* and *Searsia discolor.* Exotic weeds are present on the site but in low abundance and are also indicative of low levels of disturbance and include species such as *Richardia braziliensis*. This is a common weed, which is not considered invasive. Though not present on the site, several clumps of invasive *Acacia mearnsii* (Wattle) are present in the surroundings, especially the stream systems situated on the downslope of the site.

As indicated, several of the geophytic species occurring on the site are also regarded as protected within the KwaZulu-Natal Province (Provincial Nature Conservation Ordinance of 1974) (Appendix B). These include *Gladiolus ecklonii, Raphionacme hirsuta, Dierama galpinii, Aloe maculata, Schizocarpus nervosus* and *Crinum macowanii*. Where the development will affect any of these, permits will also have to be obtained, and affected plants transplanted to adjacent areas where they will remain unaffected. These geophytic species are easily transplanted with a high success rate. The surrounding proposed WEF has already initiated a protected species transplanting process and the mining permit application area can therefore also be incorporated into this process.

From the description of the vegetation composition on the site it would seem to be largely intact and in a fairly good condition (Appendix A: Map 1 & 3). Signs of disturbance are present but are indicative of only low levels of disturbance. The species diversity is moderate although the area does contain a significant number of protected plant species which will contribute towards its conservation value (Appendix B). The site would therefore be regarded as generally of Moderate sensitivity (Appendix A: Map 3).

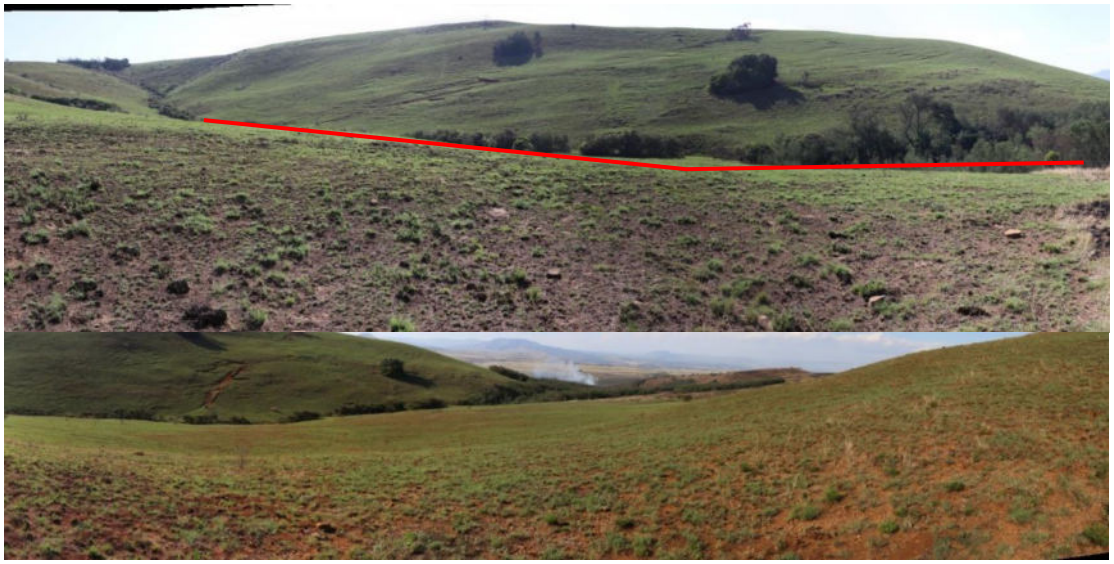


Figure 6: The vegetation composition on the site is dominated by a grass layer, here affected by recent burning (which is fairly natural for this type of ecosystem). Also note the stream system (red) visible on the downslope of the site.

Figure 7: Where surface dolerite boulders occur, these provide a higher diversity of micro-habitats which also promote species diversity on the site.

Figure 8: Protected species occurring on the site include, clockwise from top left: *Aloe maculata, Crinum macowanii, Raphionaceme hirsuta, Dierama galpinii* and *Schizocarpus nervosus*. It should be noted that these may also be quite difficult to identify at some certain times of the year, especially during the dormant winter season.

Conclusions

From the description of the vegetation on **Site 1** (Preferred Site), it is clear that it still consists of natural grassland which is still in a fairly good condition (Appendix A: Map 1 & 3). Signs of disturbance are present but are indicative of only low levels of disturbance. The species diversity is moderate although the area does also contain a significant number of protected plant species which will contribute towards its conservation value (Appendix B). The site itself therefore still contains elements of significant conservation value which include protected plant species and rocky habitats providing suitable conditions for specialised species (Appendix B). The stream and drainage line situated to the north of the site are considered as highly sensitive, though are not situated on or near the site and therefore only relevant in terms of any indirect impacts the development may still have on them (Appendix A: Map 3). Significant mitigation will therefore still

have to be implemented to ensure that the impact on these elements of significant conservation value is decreased.

Mitigation as indicated in the previous paragraph should include the following (Appendix A: Map 3):

- Numerous protected plant species have been identified **Site 1** (Appendix B). These include the protected succulent and geophytic species, *Gladiolus ecklonii, Raphionacme hirsuta, Dierama galpinii, Aloe maculata, Schizocarpus nervosus* and *Crinum macowanii*. Where development will affect these species, the necessary permits should be obtained and a significant proportion of these transplanted to adjacent areas where they will remain unaffected.

- **Site 1** (Preferred Site) is situated approximately 90 metres to the south of a small stream system and approximately 40 metres to the east of a small drainage line. (Appendix A: Map 3). These watercourses will both have a very high conservation value, especially so since they form part of the Northern Drakensberg SWSA and should be excluded from development, while a suitable buffer should also be maintained between them and any mining activities. The stream and drainage line will be discussed in detail within the wetland assessment section.

- Surface rock on the site provides a higher diversity habitat, which is regarded as having a Moderate Sensitivity. These types of habitats are also quite abundant and well represented in the surroundings and the loss of the habitat on the site itself should therefore still not result in a significant impact, provided that similar habitats remaining in the surroundings are retained intact.

- Though the site itself does not currently contain any significant weed or invasive plant infestations, mining will increase disturbance in the area and this will pose a risk of weeds and invasive species establishing and spreading into surrounding natural areas. This is particularly relevant to invasive *Acacia mearnsii* (Wattle), present in several clumps in the surroundings, which should be the main focus of eradication efforts. The proposed development will therefore have to implement a comprehensive monitoring and eradication programme to ensure that invasive plant species are removed from the area and prevented from re-establishing.

4.2 Wetland and Watercourses Delineation

4.2.1 Introduction

From the description of the area, especially the topography and climate, it should be clear that the area forms the origin of many wetlands and watercourses. In general, the plateau of the mountain system in the area causes the formation of seepage wetland systems, which then drain downslope, resulting in the formation of fast flowing mountain streams (Appendix A: Map 2). Such a small mountain stream and drainage line are also situated to the north and west of **Site 1** (Preferred Site) and may therefore still be indirectly affected by the proposed borrow pit site (Appendix A: Map 3). An overview of the wetlands and watercourses at all five alternative sites will be provided, though detailed assessment will focus only on **Site 1**, which is also the preferred site, which will be the subject of the mining permit application:

Site 1 (Preferred Site): The site is situated on the lower lying foot slopes of the mountain and is dominated by a longitudinal low ridge from south-west to north-east and has a moderate slope from south-east to north-west. The site itself is devoid of any wetland systems and is dominated by dolerite outcrops. A prominent but small mountain stream is situated in the lower lying valley, approximately 90 metres to the north-west of the site, while an even smaller drainage line is situated approximately 40 metres to the south-west of the site, also flowing into, and forming a tributary, of the larger stream system (Appendix A: Map 3). Both these watercourses are fairly fast flowing, draining from west to east and have a well-defined channel. The stream is clearly a strictly seasonal system, currently containing no connected main channel flow and will contain no flow during winter, while flowing strongly for short periods after rainfall events. As a result, wetland conditions are present, but not extensive.

Site 2: The site is situated on top of the plateau of the large mountain in the area. Though on the plateau, it does have a prominent slope from east to west. The site therefore only forms the catchment of watercourses draining from east to west and will not be able to affect any systems draining from west to east. Several small mountain streams originate here via seepage wetland areas (Appendix A: Map 2). A small seepage wetland area transects the northern corner of the site, from where it drains into a prominent stream, draining westwards. This wetland is most likely to be affected by the site. Two other similar drainage lines also occur to the west and south of the site but are both situated outside the footprint of the site and will only be indirectly affected by it. All of these drainage lines flow into, and form tributaries, of a large mountain stream draining westwards along steep slopes of the mountainous terrain. Given the terrain and the site being situated on top of the plateau, drainage will occur via seepage and diffuse flows will dominate. Given the seasonality of the rainfall pattern and being situated on the plateau, these seepage areas will also be strictly seasonal. Wetland conditions are also not prominent in these seepage wetland areas and the border between them, and terrestrial areas is also not well defined.

Site 3: The site is situated on top of the plateau of the large mountain in the area. Though on the plateau, it does have a prominent slope from east to west. The site will therefore be largely applicable to any wetlands and watercourses draining from east to west. The site itself forms the origin of a prominent seepage wetland and mountain stream which forms on the site and drains westwards (Appendix A: Map 2). It is therefore likely that this site will have a large impact on the wetland and stream system. In addition, several drainage lines also originate to the west and south, and although not being directly affected by the development, they are still likely to be indirectly affected by it. All of these drainage lines flow into, and form tributaries, of a large mountain stream draining westwards along steep slopes of the mountainous terrain. These wetlands and watercourses are all strictly seasonal and coupled to the terrain and seasonality of rainfall. Wetland conditions are much better defined, though the border between the wetland areas and terrestrial areas is not well defined.

Site 4: The site is situated on top of the plateau of the large mountain and is the northernmost site being considered. The site slopes toward the north and west and will therefore only be applicable to wetland and watercourses draining from this area, i.e., the catchment can only affect those systems which it is draining into. The site is situated immediately to the east and borders on a small seepage wetland which forms the origin of a small mountain drainage line, flowing to the west (Appendix A: Map 2). The site is therefore unlikely to directly affect this wetland though forming its catchment, is still likely to indirectly affect it and should therefore also be taken into account. The seepage wetland is clearly seasonal and will be hydrologically active during the rainy season. Wetland conditions are clearly present, though the border between the wetland and terrestrial areas is not well defined.

Site 5: The site is situated on the longer lying foot slopes of the mountain and is dominated by a longitudinal low ridge from east to west and has a moderate slope that slopes toward the north and south. The site itself is devoid of any wetland systems and is dominated by dolerite outcrops. Several seepage areas and drainage lines originate around the site, approximately 100 to 250 metres from the border of the site footprint (Appendix A: Map 2). These wetlands will therefore not be directly affected by the site and given the distance from the site, only a low likelihood of residual impacts is probable. All of the systems around the site are characteristic of seepage wetland systems, which form small drainage lines, draining toward the lower lying, larger stream systems. These all drain via slow velocity, diffuse flows, are clearly seasonal systems and will be hydrologically active during the rainy season. Wetland conditions are clearly present, though the border between the wetlands and terrestrial areas is not well defined.

The term watercourse refers to a river, stream, wetland or pan. The National Water Act (NWA, 1998) includes rivers, streams, pans, and wetlands in the definition of the term watercourse. This definition is as follows:

Watercourse means:

- A river or spring.
- A natural channel in which water flows regularly or intermittently.
- A wetland, lake, or dam into which water flows.
- Any collection of water which the Minister may, by notice in the Gazette, declare to be a watercourse, and a reference to a watercourse includes, where relevant, its bed and banks.

Riparian habitat is an accepted indicator of watercourses used to delineate the extent of wetlands, rivers, streams, and pans (Department of Water Affairs and Forestry 2005).

The classification of stream orders from 1 to 3 can be illustrated by means of the Strahler 1952 classification (Figure 9). The drainage lines which will be affected by the borrow pit sites are all situated at or near their origin and are all therefore considered as first order stream systems.

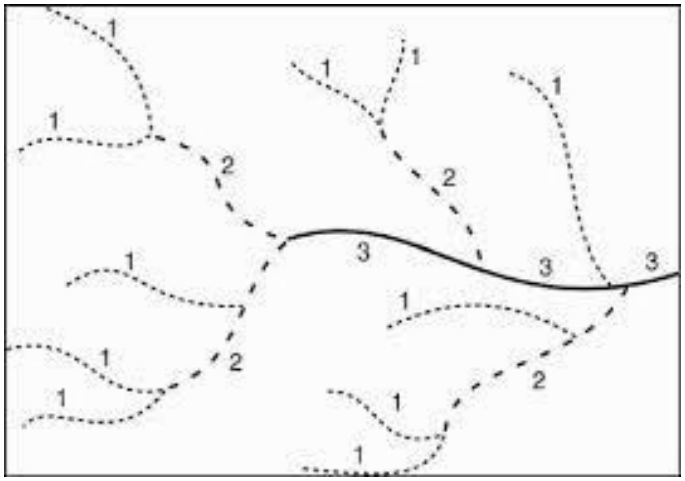


Figure 9: The classification of stream orders from 1 to 3 (Strahler 1952)

4.2.2 Wetland and riparian indicators

The following guidelines and frameworks were used to determine and delineate the watercourses and wetlands in the study area:

- Department of Water Affairs and Forestry. 2005. A practical field procedure for identification and delineation of wetlands and riparian areas. Edition 1. Department of Water Affairs and Forestry, Pretoria.
- Marnewecke & Kotze 1999. Appendix W6: Guidelines for delineation of wetland boundary and wetland zones. In: MacKay (Ed.), H. Resource directed measures for protection of water resources: wetland ecosystems. Department of Water Affairs and Forestry, Pretoria.

Obligate wetland vegetation was utilised to determine the presence and border of wetland conditions along seepage wetland areas as well as the drainage lines for all five of the alternative sites (Table 2). However, this was of limited use in some instances. Due to the time of year, many grasses were not identifiable and coupled with recent burning of some areas, this prevented adequate identification of obligate wetland vegetation. In order to augment the use of riparian and wetland vegetation, soil sampling was also utilised (Appendix C). However, due to time constraints soil samples were only taken at sample survey sites to confirm the presence of soil wetness indicators and therefore the presence of wetland conditions. Soil samples were investigated for the presence of anaerobic evidence which characterises wetland soils (Appendix C). However, in some instances, especially where small or indistinct seepage areas were present these did not contain conclusive soil wetness indicators. This will also influence the accuracy of wetland delineation (Appendix A: Map 2).

Although wetland vegetation and soils could not provide an accurate indication of the boundary of wetland areas, this could at least conclusively confirm the presence of wetland conditions. The use of topography and geomorphology at each site could also provide significant additional confirmation of wetland areas. Drainage occurs along lower lying areas, while seepage will also tend to form within basins on the plateau and lower lying foot slopes and this therefore also provides useful information when determining the presence of wetland systems. Combined with the use of aerial images, it is considered to give a fairly good indication of where wetland conditions will occur.

Utilising the methods as indicated above, the seepage wetlands forming along the slopes of the plateau and lower lying foot slopes can, in most instances, be confirmed to contain wetland conditions except where the border is not always well defined and transitions into the surrounding terrestrial areas. These seepage wetlands drain into drainage lines or streams which are more easily visible as defined channels, and which have a better-defined border between riparian and terrestrial areas.

Figure 10: Soils within seepage areas (left) contain a high clay content and are easily differentiated from surrounding terrestrial soils with high sand content, no clay content and large percentage gravel. This conclusively confirms the presence of wetland conditions. However, there is a gradual transition between these soils and the border between wetland and terrestrial is also gradual and not clearly defined.

4.2.3 Classification of wetland systems

The wetland conditions identified along the systems in the study area can be utilised to classify a specific wetland type.

The wetland conditions associated with the seepage wetlands around Sites 2 – 5 can be characterised as hillslope seepage wetlands (SANBI 2009):

"Wetland area located on (gently to steeply) sloping land, which is dominated by the colluvial (i.e. gravity-driven), unidirectional movement of material down-slope. Water inputs are primarily from groundwater or precipitation that enters the wetland from an up-slope direction in the form of subsurface flow. Water movement through the wetland is mainly in the form of interflow, with diffuse overland flow ('sheetwash') often being significant during and after rainfall events. Water leaves a 'hillslope seep with channelled outflow' mostly by means of concentrated surface flow, whereas water leaves a 'hillslope seep without channelled outflow' by means of a combination of diffuse surface flow, interflow, evaporation, and infiltration (as distinguished at Level 4C)."

"Seeps are characterised by their association with geological formations (lithologies) and topographic positions that either cause groundwater to discharge to the land surface or rain-derived water to 'seep' down-slope as subsurface interflow" (Ollis *et al.* 2013).

This description fits the wetland conditions in the seepage wetlands very well. These seepage wetlands are situated on the plateau or lower foot slopes, they all contain a prominent slope and flow in this area is clearly unidirectional and also occurs largely as diffuse surface flow, being quite prominent after rainfall events (Appendix A: Map 2). The geology in this area, sandstone

and dolerite, also supports the formation of a seepage wetland where groundwater discharge occurs from a shallow groundwater table associated with the underlying geology. All of these seepage wetlands drain into fast flowing mountain streams and drainage lines, and can therefore be considered to be seepage wetlands with channelled outflow.

Figure 11: The seepage wetlands are situated along a prominent slope which results in unidirectional, but diffuse flows.

The small drainage lines and mountain streams around Sites 1 to 5 which seepage wetlands drain into can be characterised as a channel wetland system (SANBI 2009):

"An open conduit with clearly defined margins that (i) continuously or periodically contains flowing water, or (ii) forms a connecting link between two water bodies. Dominant water sources include concentrated surface flow from upstream channels and tributaries, diffuse surface flow or interflow, and/or groundwater flow. Water moves through the system as concentrated flow and usually exits as such but can exit as diffuse surface flow because of a sudden change in gradient. Unidirectional channel-contained horizontal flow characterises the hydrodynamic nature of these units. Note that, for purposes of the classification system, channels generally refer to rivers or streams (including those that have been canalised) that are subject to concentrated flow on a continuous basis or periodically during flooding, as opposed to being characterised by diffuse flow (see unchannelled valley-bottom wetland). As a result of the erosive forces associated with concentrated flow, channels characteristically have relatively obvious active channel banks. An active channel is a channel that is inundated at sufficiently regular intervals to maintain channel form and keep the channel free of established terrestrial vegetation. These channels are typically filled to capacity during bankfull discharge (i.e., during the annual flood, except for intermittent rivers that do not flood annually)."

This accurately describes the drainage lines and mountain streams (Appendix A: Map 2). The wetland conditions are confined to the main channel of these systems which experience surface flow on a seasonal basis. Here wetland conditions are most prominent along the main channel and decrease in distance from the channel. Being mountain stream systems, they are fast draining, with concentrated flow after rainfall, as opposed to diffuse flow. Another consequence of the fast flow is a very narrow floodplain occurring along these watercourses. As these streams reach the lower lying bottomlands, flow will slow down and may then form valley-bottom wetland systems. Such systems are however not present around any of the proposed sites.

Figure 12: Smaller mountain streams and drainage lines form a clear channel, with defined banks (red), clearly draining via concentrated flow as opposed to diffuse flows.

4.2.4 Current impacts on the affected wetlands

The proposed sites and affected wetlands and watercourses are all situated within an area that is still largely natural (Appendix A: Map 1). Consequently, the wetlands and watercourses will still be largely intact, and their functioning will also be fairly natural. However, several significant impacts are present, and it was notable that wetlands and watercourses have been modified to a significant degree.

The seepage wetlands form the origin of the watercourses in the area and any impacts on these wetlands would therefore be propagated to downstream areas as well. One of the main impacts that affects seepage wetlands, as well as stream and drainage lines, is erosion and sedimentation. Almost all of the surveyed seepage wetland areas contained some degree of head-cutting. This is erosion that takes hold at a nick point, resulting in progressive erosion taking place. Such erosion causes an increase in sedimentation of the system, destabilising the wetland system and is highly unlikely to be reversible. The main cause of this erosion, at least along seepage wetland areas, is trampling by livestock which decreases the vegetation cover and disturbs the soil surface and when rainfall occurs, this then results in nick points forming and erosion taking hold. This erosion directly affects the wetland and watercourses in the area, however, erosion within the catchment is also prominent. This is also caused by livestock trampling, tracks, as well as the steep slopes, and the formation of gulley erosion was observed in several areas. This will also contribute toward increased sedimentation of wetlands and watercourses.

Figure 13: View of a head-cut forming at one of the seepage wetlands on the plateau. This will likely continue to increase over time and will progressively destabilise the wetland system.

Figure 14: View of another seepage wetland (red), where head-cut erosion has progressed considerably and will eventually result in gulley formation. This is clearly resulting in significant impacts on the wetland.

Figure 15: Within the catchment, erosion along tracks is also prominent and will still contribute to impacts on the surrounding wetlands.

One of the main impacts on wetlands and watercourses is the fairly severe infestation by invasive *Acacia mearnsii* (Black Wattle) which is especially prominent along the watercourses in the foot slopes in the area. These infestations result in a severe decrease in the grass layer, with an understorey being largely absent. This in turn results in much greater runoff, which increases

erosion and will substantially increase sedimentation within watercourses. This infestation also results in a large loss of biodiversity, alters the riparian vegetation composition, and also contributes toward the modification of the hydrology and geomorphology of affected watercourses. These wattle infestations also result in a substantial increase in evapotranspiration and contribute to lowering of the groundwater table which may then also affect the flow regime within the affected watercourses.

Figure 16: Infestations by *Acacia mearnsii* are substantial in several areas.

Figure 17: Within these infested areas and within watercourses, the natural biodiversity is low to almost absent, while the understorey is also devoid of vegetation. The stream system has clearly become choked with debris.

The wetlands and watercourses in the study area are clearly still situated in a natural area and their functioning is largely intact (Appendix A: Map 2). They have however been modified to some extent, though they remain highly important in terms of ecological function and services, especially since these systems are situated at the origin and will therefore influence the condition and functioning of all downstream systems.

4.2.5 Site specific descriptions

The description of wetland and watercourse systems situated in the study area confirms that all five of the proposed borrow pit sites will be situated in or near such systems and will therefore have an impact on them (Appendix A: Map 2). This will differ from each site and the following section will provide a short description of the wetlands situated at each site. Considering the presence of wetlands and watercourses on and around each of these sites and taking into consideration all other factors influencing the feasibility of the development (including financial, environmental, aesthetic, visibility, etc.), **Site 1** has been identified as the preferred alternative which will be applied for through a mining permit process (Appendix A: Map 3).

Where FW or OW is indicated it refers to Facultative or Obligate Wetland species. A facultative wetland species is often associated with wetlands but is also able to occur in non-wetland areas. Obligate wetland species are confined to wetlands and are only able to occur in wetlands. They are therefore reliable indicators of wetland conditions. Field observations over time as well as the following sources were used to determine FW and OW species:

- Marnewecke, G. & Kotze, D. 1999. Appendix W6: Guidelines for delineation of wetland boundary and wetland zones. In: MacKay (Ed.), H. Resource directed measures for protection of water resources: wetland ecosystems. Department of Water Affairs and Forestry, Pretoria.

- DWAF. 2008. Updated manual for the identification and delineation of wetlands and riparian areas, prepared by M.Rountree, A.L. Batchelor, J. MacKenzie and D. Hoare. Stream Flow Reduction Activities, Department of Water Affairs and Forestry, Pretoria, South Africa.

- Van Ginkel, C.E. & Cilliers, C.J. 2020. Aquatic and wetland plants of Southern Africa. Briza Publications, Pretoria.

Table 2: Description of specific wetland systems and areas which are currently relevant to the proposed borrow pit sites (FW – Facultative wetland species, OW – Obligate wetland species, * - Exotic species).

Site name:	**Coordinates of sampling:**	**Wetness regime:**
Site 1 (Preferred Site) – Affected stream and drainage line (Appendix A: Map 2 & 3)	S 27.655930°, E 29.816803° S 27.658907°, E 29.813802° S 27.661113°, E 29.813270°	Seasonal
Description of wetland at the site: The site is situated on the lower lying foot slopes and is dominated by a longitudinal low ridge from south-west to north-east and has a moderate slope from south-east to north-west. The site itself is devoid of any wetland systems and is dominated by dolerite outcrops. A prominent but small mountain stream is situated in the lower lying valley, approximately 90 metres to the north-west of the site, while an even smaller drainage line is situated approximately 40 metres to the south-west of the site, also flowing into, and forming a tributary, of the larger stream system. Both these watercourses are fairly fast flowing, draining from west to east and having a well-defined channel. The stream is clearly a strictly seasonal system, currently containing no connected main channel flow and will contain no flow during winter, while flowing strongly for short periods after rainfall events.		

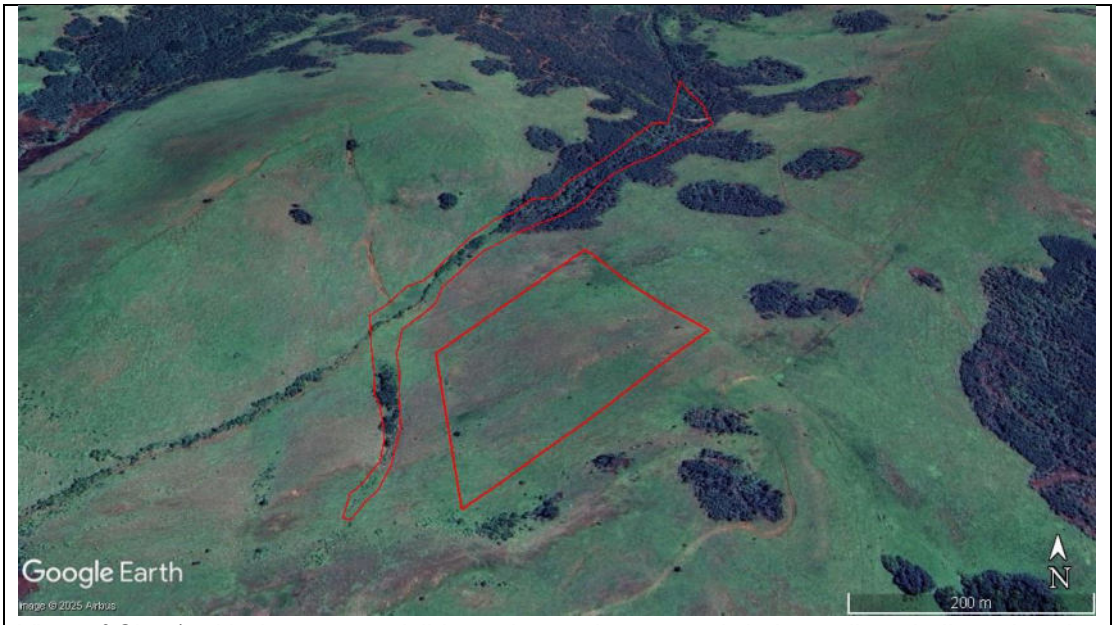
Current impacts on the stream and drainage line are largely concerned with a significant infestation of *Acacia mearnsii* which especially affects the lower section of the stream. This results in several impacts as previously discussed (See Section 4.2.5).

The stream and drainage line are both fairly well defined and their borders with the surrounding terrestrial areas are also fairly easily discerned. The system itself has a well-defined channel, with banks and clearly discharges by means of high velocity surface flows, though only after rainfall events and on a seasonal basis. Because the stream discharges by fast flows, the floodplain is quite narrow. The stream channel and floodplain contain ample obligate wetland vegetation as a variety of sedges, rushes, and herbaceous plant species occur. A prominent tree and shrub component is also present along the channel of the stream and drainage line. Soils do not contain prominent soil wetness indicators. The soils contain a dark red colouration, without a prominent grey matrix though a few high chroma mottles were notable, indicating the presence of wetland conditions, though only on a seasonal basis. Both in terms of obligate wetland vegetation and soil wetness indicators, the drainage line is devoid of wetland conditions, though still forming a defined watercourse.

As indicated, the stream is situated approximately 90 metres to the north-west of the site, while the drainage line is situated approximately 40 metres to the south-west of the site. Both are therefore a fair distance from the site footprint though still within the regulated area and will require authorisation for the applicable water uses. The anticipated impact should however remain low as long as a suitable buffer zone is implemented and maintained, and suitable mitigation implemented to limit any indirect impacts that the proposed borrow pit will have. This site should therefore be feasible, and impacts anticipated to be limited.

Dominant plant species:
Mountain stream: *Gnapahalium sp., *Acacia mearnsii, Halleria lucida, *Solanum mauritianum, *Lantana cumara, Eragrostis sp., Sporobolus africanus, Diospyros lycioides, Eragrostis racemosa, Schoenoplectus sp.* (OW), *Juncus exertus* (OW), *Euclea crispa, Gymnosporia buxifolia, Scolopia zeyheri, Cheilanthes viridis, Myrsine africana, Limosella longiflora* (OW), *Miscanthus juncea* (OW), *Buddleja salviifolia, Pentanisia angustifolia, Centella asiatica, Agapanthus campanulatus*.

Drainage line: *Diospyros lycioides, Euclea crispa, Clematis brachiata, Searsia pyroides, *Rubus rigidus, Buddleja salviifolia.*



View of Site 1 with the stream visible to the north-west and drainage lines indicated to the south-west. There is a substantial distance between the borrow pit footprint and watercourses. Note also substantial infestation by *Acacia mearnsii*, especially in the downstream sections.

The drainage lines are very small but retain a defined channel (red).

The stream system is larger though still a small system. Note the narrow floodplain with trees also being prominent along the stream.

Site name:	Coordinates of sampling:	Wetness regime:
Site 2 – Three seepage wetland areas, forming the origin of several mountain streams (Appendix A: Map 2)	S 27.663451°, E 29.793800° S 27.662949°, E 29.792269° S 27.665647°, E 29.794206°	Seasonal

Description of wetland at the site:

The site is situated on top of the plateau of the large mountain in the area. Though on the plateau, it does have a prominent slope from east to west. The site therefore only forms the catchment of watercourses draining from east to west and will not be able to affect any systems draining from west to east. Several small mountain streams originate here via seepage wetland areas. A small seepage wetland area transects the northern corner of the site, from where it drains into a prominent stream, draining westwards. This wetland is most likely to be affected by the site. Two other similar drainage lines occur to the west and south of the site but are both situated outside the footprint of the site and will only be indirectly affected by it. All of these drainage lines flow into, and form tributaries, of a large mountain stream draining westwards along steep slopes of the mountainous terrain. Given the terrain and the site being situated on top of the plateau, drainage will occur via seepage and diffuse flows will dominate. Given the seasonality of the rainfall pattern and being situated on the plateau, these seepage areas will also be strictly seasonal. Wetland conditions are not prominent in these seepage wetland areas and the border between them, and terrestrial areas is also not well defined.

Current impacts on the seepage wetlands are largely associated with prominent erosion occurring along dirt tracks and livestock paths where gulley formation has been observed. Head-cutting was also noted at least along the northernmost seepage wetland, where it drains into the mountain stream. This results in several impacts as previously discussed (See Section 4.2.5).

The border of these seepage wetlands is not well defined. Some portions may contain more prominent wetland conditions, though in general, wetland conditions are not prominent. Wetland conditions were most prominent in depressional areas within the seepage wetland and also where the seep drains into the mountain stream in the downslope areas. These wetlands are therefore variable in terms of their surface hydrology. The flow within the wetlands follows the slope from east to west, occurring only as diffuse flows. Several factors also influence the determination of the exact border of the seepage wetlands which include the time of year when the wetlands are not hydrologically active and recent burning of vegetation which results in the absence of vegetation. Vegetation could therefore not be utilised as a reliable indicator of wetland conditions, though several obligate wetland species were prominent where the northern seepage wetland drains into the mountain stream downslope of the site. Soil samples would generally provide a much more conclusive indication of the presence of wetland conditions. The terrestrial areas contain reddish soils, high in loam, low in clay with high gravel content, while the seepage wetlands contain soils with a dark colouration, high in clay and organic content and with a low grey matrix visible.

The seepage wetland to the south and east of the site is situated approximately 100 and 40 metres respectively from the borrow pit footprint and it is therefore not anticipated to be directly affected by it. However, the seepage wetland in the north transects the corner of the site and will therefore be directly affected by it. This will result in high impacts and permanent loss of at least a portion of the wetland and will also affect the downstream section of the system. It should be possible to adjust the borrow pit footprint to avoid this seepage wetland and should

the wetland be excluded, a suitable buffer zone be maintained between the borrow pit and surrounding wetlands, and suitable mitigation implemented, the site should remain feasible, and impacts anticipated to be limited.

Dominant plant species:
Seepage wetlands: *Buddleja salviifolia, Leucosidea sericea, Eragrostis sp., Acalypha schinzii, Senecio poyodon, Gerbera piloselloides, Helichrysum nudifolium, Hypoxis angustifolia, Hilliardiella aristata, Dyschoriste setigera, Eleocharis dregeana* (OW), *Aster squamatus, Schoenoplectus sp.* (OW), *Juncus exertus* (OW), *Limosella longiflora* (OW), *Urticularia bisquamata* (OW), *Carex glomerabilis* (OW), *Gunnera perpensa* (OW).

Mountain streams: *Dierama galpinii, Greyia sutherlandii, Merwilla plumbea, Euphorbia pulvinata*.

View of Site 2 with several seepage wetlands indicated to the north, east and south of the site. Note that the northern seepage wetland will also be transected by the site and will require adjustment of the footprint in order to avoid it.

The northern seepage wetland is not very prominent but can be discerned by vegetation and forming a shallow depression along the slope.

Where the northern seepage wetland drains into the mountain stream system, wetland conditions become much more pronounced.

Site name:	**Coordinates of sampling:**	**Wetness regime:**
Site 3 – Large seepage wetland system, with surrounding drainage lines (Appendix A: Map 2)	S 27.676073°, E 29.798867° S 27.675507°, E 29.796490° S 27.676957°, E 29.797497°	Seasonal

Description of wetland at the site:

The site is situated on top of the plateau of the large mountain in the area. Though on the plateau, it does have a prominent slope from east to west. The site will therefore be largely applicable to any wetlands and watercourses draining from east to west. The site itself forms the origin of a prominent seepage wetland and mountain stream which form on the site and drain westwards. It is therefore likely that this site will have a large impact on the wetland and stream system. In addition, several drainage lines also originate to the west and south, and although not being directly affected by the development, they are still likely to be indirectly affected by it. All of these drainage lines flow into, and form tributaries, of a large mountain stream draining westwards along steep slopes of the mountainous terrain. These wetlands and watercourses are all strictly seasonal and coupled to the terrain and seasonality of rainfall. Wetland conditions are much better defined, though the border between them and terrestrial areas is not well defined.

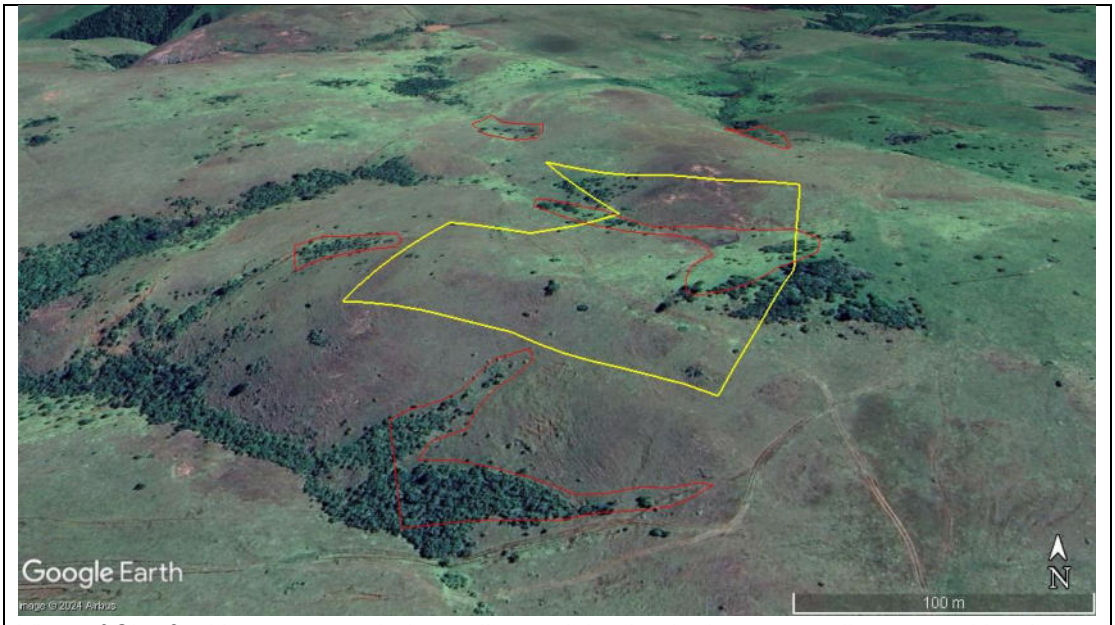
Current impacts on the main seepage wetland on the site are largely associated with head-cut erosion which has clearly started forming at the edge of the wetland and which is likely to progressively worsen over time. This is most likely the result of trampling by livestock, which results in vegetation decrease and soil surface disturbance, forming a nick point, which then initiates the formation of erosion. This results in several impacts as previously discussed (See Section 4.2.5).

The large seepage wetland is quite prominent and easily identified, though its borders with the surrounding terrestrial areas are still not well defined, being transitional over some distance, therefore not having a definite border. The wetland itself does however have quite prominent wetland conditions which increase as the seepage wetland drains into the mountain stream downslope of the site. The flow within the wetland follows the slope from east to west and occurs only as diffuse flows. As indicated, because the wetland is transitional between saturated and terrestrial areas, its border is not well defined. Given the time of year and delays in the onset of the rainy season, vegetation could provide only limited application in determining the presence of wetland conditions. Soil samples would generally provide a much more conclusive indication of the presence of wetland conditions. The terrestrial areas contain reddish soils, high in loam, low in clay with high gravel content, while the seepage wetland contains soils with a dark colouration, high in clay and organic content and with a low grey matrix visible.

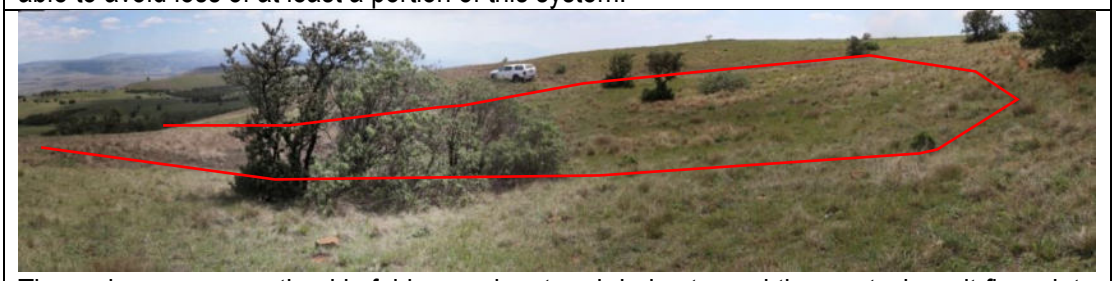
Several drainage lines originate to the north, west and south of the site at distances of approximately 100, 70 and 10 metres respectively. These would therefore still be affected indirectly by the borrow pit development. However, due to its size, the large seepage wetland situated on the site itself would be unavoidable by the borrow pit footprint. This would therefore almost certainly result in direct wetland loss. This would entail a permanent loss of a large portion of the wetland and will also affect the downstream section of the system. As a result, this alternative is considered unfeasible and would result in a large impact which would not be possible to avoid or mitigate.

Dominant plant species:
Seepage wetland: *Buddleja salviifolia, Leucosidea sericea, Helictotrichon turgidulum* (FW), *Helichrysum rugulosum, Berkheya radula, Cyperus sp.* (OW), *Hleichrysum arenarium, Empodium monophyllum* (OW), *Pennisetum sp.*

Mountain streams: *Buddleja salviifolia, Leucosidea sericea, *Rubus ludwigii, Diospyros lycioides, *Plantago major, Eragrostis curvula, Hypoxis angustifolia, *Hypochaeris radicata.*



View of Site 3 with numerous drainage lines originating in the surrounding area with a large, prominent seepage wetland also being situated on the site itself. The borrow pit would not be able to avoid loss of at least a portion of this system.



The main seepage wetland is fairly prominent and drains toward the west where it flows into a prominent mountain stream.

Several drainage lines also originate in the surrounding area and are likely to be affected indirectly by the borrow pit development.

Site name:	**Coordinates of sampling:**	**Wetness regime:**
Site 4 – Single seepage wetland system, giving rise to a small drainage line (Appendix A: Map 2)	S 27.646432°, E 29.786189° S 27.646606°, E 29.785787° S 27.646613°, E 29.785577°	Seasonal

Description of wetland at the site:

The site is situated on top of the plateau of the large mountain in the area. Though on the plateau, it does have a prominent slope from east to west. The site therefore only forms the catchment of watercourses draining from east to westwards and northwards and will not be able to affect any systems draining from north to south and eastwards. A single seepage wetland has been identified adjacent to the site footprint which forms the origin of a small drainage line. The seepage wetland is still quite likely to be affected by the site. A seepage wetland occurs to the south of the site (approximately 200 metres away) but falls outside the catchment of the site and can therefore not be affected by it. Given the terrain and the site being situated on top of the plateau, drainage will occur via seepage and diffuse flows will dominate. Given the seasonality of the rainfall pattern and being situated on the plateau, the seepage wetland will also be strictly seasonal. Wetland conditions are also not prominent in this seepage wetland and the border between it and terrestrial areas is also not well defined.

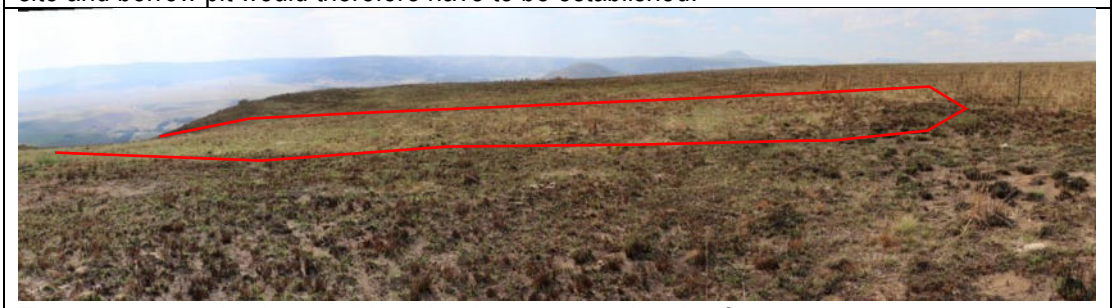
The seepage wetland is fairly natural with few impacts currently affecting it. Some significant erosion was noted within the catchment of the wetland though will have a limited impact on it. Impacts are therefore limited although several impacts are probable as previously discussed (See Section 4.2.5).

Although the seepage wetland is quite small, it is still clearly visible. However, the borders between the wetland and the surrounding terrestrial areas are still not well defined and are transitional over some distance, therefore not displaying a definite border. The wetland itself does however have quite prominent wetland conditions which increase as the seepage wetland drains into the mountain stream downslope of the site. The flow within the wetland follows the slope from east to west and occurs only as diffuse flows. As indicated, because the wetland is transitional between saturated and terrestrial areas, its border is not well defined. Several factors also influence the determination of the exact border of the seepage wetland which include the time of year when the wetland is not hydrologically active and recent burning of vegetation causing the absence of vegetation. Vegetation could therefore not be utilised as a reliable indicator of wetland conditions, though several obligate wetland species were prominent where the northern seepage wetland drains into the mountain stream downslope of the site. Soil samples would generally provide a much more conclusive indication of the presence of wetland conditions. The terrestrial areas contain reddish soils, high in loam, low in clay with high gravel content, while the seepage wetlands contain soils with a dark colouration, high in clay and organic content and with a low grey matrix visible.

The small seepage wetland is situated immediately to the west of the site, approximately 5 metres from the borrow pit footprint and it is therefore still likely to have significant impacts on it. If the borrow pit site should therefore remain viable, it would be necessary to ensure the seepage wetland is designated a no-go area, a suitable buffer zone is maintained between the borrow pit and the wetland, and suitable mitigation implemented, the site should remain feasible, and impacts should then remain at moderate levels.

Dominant plant species:
Seepage wetland: *Berkheya echinacea, Hypoxis sp., Gerbera ambigua, Cyrtanthus tuckii, Helichrysum pilosellum, Aloe maculata, Euphorbia pulvinata.*

View of Site 4 with a mall seepage wetland originating immediately to the east of the site. Impacts on it are therefore anticipated to be significant and a suitable buffer zone between the site and borrow pit would therefore have to be established.



The seepage wetland is small but clearly present and drains from east to west.

The seepage wetland drains into a small drainage line along a very steep slope.

Site name:	**Coordinates of sampling:**	**Wetness regime:**
Site 5 – Three seepage wetland areas, forming the origin of several drainage lines (Appendix A: Map 2)	S 27.648810°, E 29.828061° S 27.651450°, E 29.823734° S 27.653608°, E 29.826584°	Seasonal

Description of wetland at the site:

The site is situated on a low ridge within the foot slopes of the area. Being situated on top of the ridge, it has a moderate slope in all directions, especially to the north and south. The site itself is devoid of any wetland systems though several small drainage lines do originate in the surroundings via seepage wetland areas. These are not situated near the site, being between 100 and 140 metres from it. They are therefore unlikely to be affected by the borrow pit, though some indirect impacts may still be relevant. These small seepage wetlands and drainage lines drain toward the north and east and feed into a large, lower lying wetland system. These seepage wetland areas near the site, will also drain via diffuse flow, though concentrated flow will be present in the downslope drainage lines. Given the seasonality of the rainfall pattern and being fed by the catchment along the low ridge system, these wetlands and drainage lines are clearly seasonal. Wetland conditions are generally not prominent, especially along the southern and northern seepage areas, though the eastern seepage wetland does contain perennial saturation. Furthermore, the border between these wetlands and terrestrial areas is also not well defined.

Current impacts on the seepage wetlands are largely associated with prominent erosion occurring along dirt tracks and livestock paths where gulley formation has been observed. Head-cutting was also noted within all three seepage wetlands. These drainage lines are also heavily affected by infestation by invasive *Acacia mearnsii,* especially the eastern and southern systems. This results in several impacts as previously discussed (See Section 4.2.5).

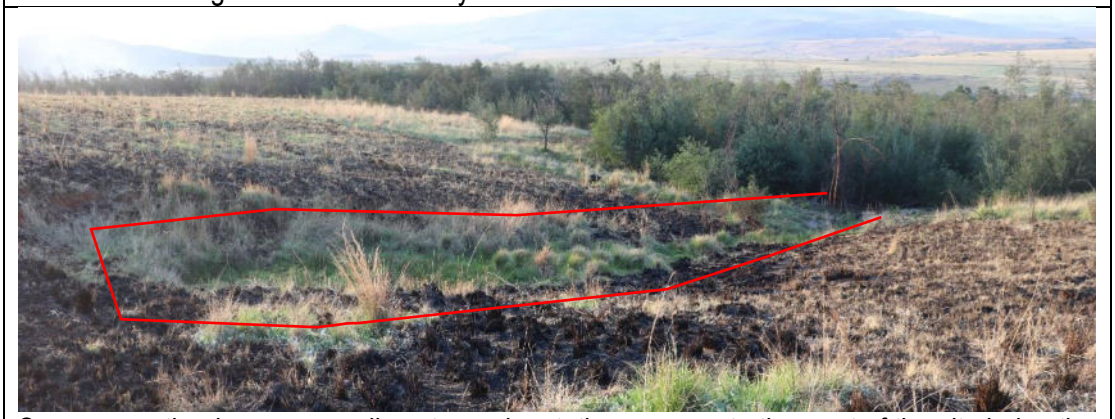
The border of these seepage wetlands is not well defined. Some portions may contain more prominent wetland conditions though in general wetland conditions are not prominent. Wetland conditions were most prominent in the eastern seepage system. These wetlands are therefore variable in terms of their surface hydrology. The flow within the wetlands follows the slope from the low ridge and drains toward the north and east. Several factors also influence the

determination of the exact border of the seepage wetlands which include the time of year when the wetlands are not hydrologically active and recent burning of vegetation resulting in the absence of vegetation. Vegetation could therefore not be utilised as a reliable indicator of wetland conditions, though several obligate wetland species were prominent within the eastern seepage wetland. Soil samples would generally provide a much more conclusive indication of the presence of wetland conditions. The terrestrial areas contain reddish soils, high in loam, low in clay with high gravel content, while the seepage wetlands contain soils with a dark colouration, high in clay and organic content and with a low grey matrix visible.

These affected seepage wetlands are all situated a significant distance from the site, ranging from 100 to 140 metres. They are therefore unlikely to be affected by the borrow pit, though some indirect impacts may still be relevant. The site should therefore be feasible though the borrow pit will still need to implement adequate mitigation, such as storm water management, to ensure that it will not be affected by direct impacts.

Dominant plant species:
Seepage wetlands: *Hypoxis sp., Hyparrhenia tamba, Eragrostis chloromelas, *Acacia mearnsii, Eragrostis sp., Sporobolus africanus, Schoenoplectus sp.* (OW), *Eleocharis dregeana* (OW), *Limosella longiflora* (OW).

View of Site 5 with several seepage wetlands indicated to the north, west and south of the site. Note also significant infestation by invasive *Acacia mearnsii.*



Seepage wetlands are generally not prominent, the seepage to the west of the site being the most prominent of all.

The northern seepage is not well defined, though drainage along it is clearly visible. Note also significant erosion taking place here.

4.2.6 Condition and importance of the affected wetland

The determination of the condition of the affected watercourses will be limited to **Site 1**, which is the preferred site. This will include assessment of the main stream as well as the smaller drainage line tributary (Appendix A: Map 3). Both of these form clearly defined watercourses, while the stream system also contains prominent wetland conditions. They are natural systems and though situated some distance from the site, are still likely to be affected to some degree by mining operations and the determination of their condition is therefore important. The small drainage line flows into the main stream system, therefore forming part of one system, located in close proximity to each other, being affected by the same impacts, situated in the same environmental setting and affecting the same downstream section of the larger stream system. The system can therefore be assessed as a whole, though a separate Index of Habitat Integrity (IHI) will be conducted for each. This is considered to give a good representation of the condition of the system within the study area which will be affected by the proposed mining operations. The IHI will be taken as representative of the Present Ecological State (PES) of this system.

Table 3 refers to the determination and categorisation of the Present Ecological State (PES: health or integrity) of various biophysical attributes of rivers relative to the natural or close to the natural reference condition. The purpose of the EcoClassification process is to gain insights and

understanding into the causes and sources of the deviation of the PES of biophysical attributes from the reference condition. This provides the information needed to derive desirable and attainable future ecological objectives for the river (Kleynhans & Louw 2007).

Table 4 refers to the Ecological Importance and Sensitivity (EIS) of wetlands. "Ecological importance" of a water resource is an expression of its importance to the maintenance of ecological diversity and functioning on local and wider scales. "Ecological sensitivity" refers to the system's ability to resist disturbance and its capability to recover from disturbance once it has occurred. The Ecological Importance and Sensitivity (EIS) provides a guideline for determination of the Ecological Management Class (EMC).

Table 3: Ecological categories for Present Ecological Status (PES).

Ecological Category	Description
A	Unmodified, natural
B	Largely natural with few modifications. A small change in natural habitats and biota may have taken place but the ecosystem functions are essentially unchanged.
C	Moderately modified. Loss and change of natural habitat and biota have occurred, but the basic ecosystem functions are still predominantly unchanged.
D	Largely modified. A large loss of natural habitat, biota and basic ecosystem function has occurred.
E	Seriously modified. The loss of natural habitat, biota and basic ecosystem functions is extensive.
F	Critically/Extremely modified. Modifications have reached a critical level and the system has been modified completely with an almost complete loss of natural habitat and biota. In the worst instances the basic ecosystem functions have been destroyed and the changes are irreversible.

Table 4: Ecological importance and sensitivity categories.

Ecological Importance and Sensitivity Category (EIS)	Range of Median	Recommended Ecological Management Class
Very High Wetlands that are considered ecologically important and sensitive on a national or even international level. The biodiversity of these wetlands is usually very sensitive to flow and habitat modifications.	>3 and <=4	A
High Wetlands that are considered to be ecologically important and sensitive. The biodiversity of these wetlands may be sensitive to flow and habitat modifications.	>2 and <=3	B
Moderate Wetlands that are considered to be ecologically important and sensitive on a provincial or local scale. The biodiversity of these wetlands is not usually sensitive to flow and habitat modifications.	>1 and <=2	C
Low/marginal		D

Wetlands that are not ecologically important and sensitive at any scale. The biodiversity of these wetlands is ubiquitous and not sensitive to flow and habitat modifications.	>0 and <=1	

According to previous desktop assessments of the area, this particular stream system was not included in the assessments, probably as a result of its small size (Kleynhans 2000, Van Deventer *et al.* 2018). Lower down where the stream forms a valley-bottom system, previous desktop assessments vary greatly, indicating a condition from Category A/B: Largely Natural (Kelynhans 2000) to as low as a Category E/F: Extremely Modified (Deventer *et al.* 2018).

The stream and drainage line adjacent to the site are largely intact, though affected by some impacts, which will certainly have some effect on them. The most prominent impacts are associated with erosion upslope and infestation by invasive trees. On the upslope of the stream, within its catchment and especially where steep slopes are present, erosion does take place, especially along dirt tracks and livestock footpaths. This will have some effect on sediment load within the stream. The infestation by invasive *Acacia mearnsii*, is considered a significantly higher impact and will certainly decrease the condition of the stream. Several clumps of this invasive tree occur along the stream and can be quite extensive in some areas. This has many large impacts, which may include removal of riparian vegetation, increased sedimentation, severe decrease in biodiversity and modification of its hydrology. These impacts are also discussed in more detail in Section 4.2.4. An IHI determination was undertaken for both the stream system and the smaller drainage line, in order to determine their current condition given the impacts affecting them (Appendix D). The results of the IHI indicated that the stream system has a Present Ecological State of Category C: Moderately Modified, while the drainage line has a Present Ecological State of Category B/C: Largely Natural to Moderately Modified. This is considered relatively accurate given the impacts in the catchment of these watercourses. The system will have a high conservation value as it forms the origin of the downslope stream system and performs important functions in terms of water transportation, storm water and groundwater recharge, bioremediation and flood attenuation. The entire system should therefore still be considered as sensitive and the proposed development should not lead to altering it any further (Appendix A: Map 3).

The EI&S of the affected stream and drainage line has been rated as being High: Wetlands that are considered to be ecologically important and sensitive. The biodiversity of these wetlands may be sensitive to flow and habitat modifications. This is largely a result of the system still being relatively natural and therefore being more susceptible to changes in hydrology and water quality. In addition, the system forms part of the Northern Drakensberg SWSA, further increasing its importance.

4.2.7 Buffer zone determination

As indicated in previous sections, the stream and drainage line are both still fairly natural, form part of the Northern Drakensberg SWSA, have a high conservation value and impacts on them by the proposed borrow pit should be avoided (Appendix A: Map 2). The mining operations should therefore aim to completely exclude these watercourses and prevent impacts on them (Appendix A: Map 3). The stream and associated drainage line should be treated as no-go areas and no construction or operational activities, vehicle movement, laydown areas, vegetation clearing or any other associated activities should occur in or near these watercourses. In addition, where vehicles require crossing these watercourses, only existing roads and tracks should be utilised.

In addition, a suitable buffer for the stream and drainage line can be provided by using the Buffer Zone Tool for the Determination of Aquatic Impact Buffers and Additional Setback Requirements for River Ecosystems (2014) (Appendix E). This determination was also done in conjunction with Macfarlane *et al.* (2014). It should be noted however that the buffers determined by this model only cater for watercourses and impacts associated with diffuse-source surface runoff. By using the above tools a suitable buffer of 47 metres for the stream and 44 metres for the drainage line has been determined (Appendix A: Map 3). Should mining operations be able to exclude these watercourses and operations within the determined buffer zone, it will result in the lowest impacts, while the anticipated risk will increase as mining encroaches into the buffer.

4.3 Risk Assessment

A Risk Assessment for the proposed Borrow Pit Site 1 (Preferred Site) which will affect the stream system and drainage line tributary, has been undertaken according to the Department of Water & Sanitation's requirements for risk assessment and the provisional Risk Assessment Matrix for Section 21(c) & (i) water use (Appendix E). Activities likely to be associated with the mining operations and which will likely affect the stream and drainage line are largely associated with mining in close proximity to these systems (Appendix A: Map 3).

The anticipated activities as indicated above are also confirmed to a large extent by previous studies. According to research concerning small scale mining, several impacts of similar mining operations occur and are likely to take place during these operations (Heath *et al.* 2004):

- Accelerated erosion of areas adjacent to workings that have been de-vegetated leads to increased suspended sediment loads in nearby streams and rivers.
- Excavation of flood terraces and riverbanks increases the instability of these riverbanks and enhances the likelihood of increased flood scouring.
- Excavation of river sediments exposes these sediments to oxidising conditions and enhances the solubility and release of any metal ions that may previously have been previously trapped as insoluble sulphides.
- Wind-blown dusts from unprotected tailings and waste rock dumps enter aquatic environment.

The proposed mining operations at Site 1 (Preferred Site) should completely exclude the stream and drainage line (Appendix A: Map 3). As a result, no direct impacts are possible, though several residual and indirect impacts, largely associated with storm water runoff and sedimentation, are still likely and the following risks are still anticipated to occur:

- The stream and drainage line are completely excluded from the development footprint and are therefore unlikely to be directly affected by it. However, several indirect impacts are still likely and this is especially relevant to the system forming part of the Northern Drakensberg SWSA and therefore any downstream impacts should be prevented.

- The affected stream and drainage line are likely to be affected by the mining operations, largely as a result of increased sediment load. This can be managed through adequate mitigation, including storm water management measures and provided that adequate rehabilitation is undertaken, it should have no long-term impact on them. Provided that adequate storm water management is implemented, the risk should remain Low.

Low Risks: Acceptable as is or consider requirement for mitigation. Impact to watercourses and resource quality small and easily mitigated.

Mitigation as recommended should be implemented as far as possible.

For the complete risk assessment please refer to Appendix E.

Phases	Activity	Impact	Risk Rating	Confidence level	Control measures
Construction/ Operation/ Decommissioning	Site 1, seasonal stream	Mining will require removal of the vegetation layer in the catchment of the adjacent stream. This activity will not entail modification of the geomorphology but will nonetheless also entail erosion and increased sedimentation of the drainage line. Establishment of exotic weeds is likely due to disturbance caused by mining. The functioning of the stream is anticipated to remain largely intact.	**L**	**High**	This impact will be mainly during the operational phase but will only cease once rehabilitation has been completed and an indigenous vegetation layer has become established. This activity is anticipated to have a low risk of impact as long as adequate mitigation and comprehensive rehabilitation is adhered to. Measures must be implemented to minimise the amount of sediment entering the stream. A comprehensive storm water management plan should be compiled and adhered to. Comprehensive rehabilitation should be applied and should aim to re-instate the natural topography as far as possible and establish an indigenous vegetation layer.
Construction/ Operation/ Decommissioning	Site 1, drainage line	Mining will require removal of the vegetation layer in the catchment of the adjacent drainage line. This activity will not entail modification of the geomorphology but will nonetheless also entail erosion and increased sedimentation of the drainage line. Establishment of exotic weeds is likely due to disturbance caused by mining. The functioning of the drainage line is anticipated to remain largely intact.	**L**	**High**	This impact will be mainly during the operational phase but will only cease once rehabilitation has been completed and an indigenous vegetation layer has become established. This activity is anticipated to have a low risk of impact as long as adequate mitigation and comprehensive rehabilitation is adhered to. Measures must be implemented to minimise the amount of sediment entering the drainage line. A comprehensive storm water management plan should be compiled and adhered to. Comprehensive rehabilitation should be applied and should aim to re-instate the natural topography as far as possible and establish an indigenous vegetation layer.

5. Biodiversity Sensitivity Rating (BSR)

Habitat diversity and species richness:
Habitat diversity for the study area is quite high, containing a highly variable topography and mountainous terrain, with habitats and vegetation communities also varying greatly (Appendix A: Map 1 & 2). However, due to the limited extent of the proposed borrow sites (being limited to a 5 hectares footprint), this limits the localised habitat diversity to moderate values. Likewise, the local species diversity is quite high, though considered moderate for the borrow pit sites themselves, given their small extent. This is also the case for Site 1 (Preferred Site) which therefore retains a moderate habitat and species diversity (Appendix B). The surrounding wetlands and watercourses also increase the habitat and species diversity considerably, but which will be completely avoided by Site 1 (Preferred Site).

Presence of rare and endangered species:
The area contains a multitude of protected plant species of which some are also considered less common and though no Red Listed species were confirmed in the area, they are known to occur here and there remains a likelihood that some of these may still be present in the area (Appendix B). There is still a likelihood that such a species could have been overlooked during the survey. Site 1 (Preferred Site) also contains numerous protected plant species though all are considered fairly widespread and common.

Ecological function:
The site functions as habitat for a variety of fauna, supports a specific vegetation type and also functions as part of the catchment of the wetlands and watercourses (Appendix A: Map 2). All of these functions are still intact and largely natural. However, due to the small extent of the borrow pit site being selected (limited to 5 hectares), the loss of ecological function should remain limited. This is however dependent on the borrow pit footprint, excluding all wetlands and watercourses, maintaining a suitable buffer zone, and implementing adequate storm water management in which case the impact on the ecological functioning should remain limited.

Degree of rarity/conservation value:
The borrow pit sites (Including Site 1) contain numerous protected plant species (Appendix B) and the species diversity is therefore rated as moderate. There is also a likelihood that rare or endangered species could have been overlooked during the survey. In terms of species diversity, species composition and uniqueness of the habitat all five borrow pit sites are therefore considered to have a moderate conservation value.

According to the EKZNW (2010/2016) Terrestrial Systematic Conservation Plan (TSCP), Site 1 (Preferred Site), is not listed as a CBA, ESA or important habitat for threatened species and is not considered essential for meeting conservation targets. However, it is still situated within the Northern Drakensberg Strategic Water Source Area (SWSA) as well as the National Protected Areas Expansion Strategy (NPAES): Moist Escarpment Grassland Focus Area. In both instances, the proposed borrow pit development is unlikely to have any significant impact, both in terms of the regional water source and any future expansion of protected areas, largely as a result of its small footprint and therefore limited impact.

All seepage wetlands and watercourses in the area should be regarded as having a very high conservation value (Appendix A: Map 2). They should however remain intact as long as they are excluded from the borrow pit footprint and a suitable buffer is maintained between the site and the affected watercourses.

Percentage ground cover:
Percentage ground cover is moderate in the area and dominated by a grassland layer. The ground cover is considered to be somewhat decreased from the natural condition, most probably as a result of overgrazing by domestic stock.

Vegetation structure:
The vegetation structure in the area is dominated by a short grass layer indicative of shallow soils and pockets of shrubs and trees, long ravines, and watercourses. This is considered a largely natural and unmodified vegetation structure. Significant infestation of *Acacia mearnsii* is however present, especially along watercourses and will result in a significant modification of the natural vegetation structure.

Infestation with exotic weeds and invader plants:
The areas of natural grassland contain only a low degree of exotic weeds (Appendix B). However, significant infestation by *Acacia mearnsii* is also present, especially along watercourses, and is quite evidently highly problematic in this area. Eradication of this infestation will be difficult and only achievable over a long period.

Degree of grazing/browsing impact:
Grazing by domestic stock in the area is considered as moderate.

Signs of erosion:
Due to the slope and moderate overgrazing of the area, including trampling by domestic livestock, erosion is significant and gulley formation was noted along some dirt tracks and paths, while head-cutting was problematic at several of the seepage wetlands.

Terrestrial animals:
Signs and tracks of mammal species on the site are present. The mammal population is anticipated to be largely natural, however, due to the small extent of the selected borrow pit (5 hectares), the impact on the mammal population should remain limited.

Table 5: Biodiversity Sensitivity Rating for the proposed borrow pit sites.

	Low (3)	Medium (2)	High (1)
Vegetation characteristics			
Habitat diversity & Species richness		2	
Presence of rare and endangered species		2	
Ecological function			1
Uniqueness/conservation value		2	
Vegetation condition			
Percentage ground cover		2	
Vegetation structure		2	
Infestation with exotic weeds and invader plants or encroachers		2	
Degree of grazing/browsing impact		2	
Signs of erosion		2	
Terrestrial animal characteristics			
Presence of rare and endangered species		2	
Sub total	0	18	1
Total		19	

6. Biodiversity sensitivity rating (BSR)

Table 6: Interpretation of Biodiversity Sensitivity Rating.

Site	Score	Site Preference Rating	Value
Newcastle WEF (Preferred Site 1)	18	Good Condition	3

7. Discussion (Appendix A: Map 1 - 3)

The five borrow pit sites in general and more specifically Site 1 (Preferred Site), are all situated in a natural area, containing a significant habitat and species diversity, with several wetlands and watercourses occurring in the surroundings, which are considered to have a high conservation value (Appendix A: Map 3).

The proposed borrow pit development has considered five different alternative sites. An overview of all five these alternatives, especially in terms of wetland delineation, has been included within the assessment. However, detailed assessment of vegetation and wetlands will only be applicable to Borrow Pit Site 1, which has been determined as being the most suitable site and will be the only site being applied for development (Appendix A: Map 3). The borrow pit development will be developed in order to meet the needs of the Mulilo Newcastle Wind Energy Facility (WEF), which is situated approximately 30 km to the north-west of the town of Newcastle (Appendix A: Map 1). The WEF development is still in the initial phases and the area is therefore still largely natural, without any prominent developments or transformation being evident. The area forms part of a mountainous area with substantial summer rainfall, resulting in the formation of numerous wetland areas, especially seepage systems in the higher lying terrain. These wetlands may not always be prominent though are easily discernible, and a combination of topography, wetland vegetation and soil wetness characteristics does still allow for adequate delineation of wetland areas (Appendix A: Map 2). Delineation of wetlands has been undertaken for all five borrow pit alternative sites, while detailed assessment has been limited to Borrow Pit Site 1, which will be the only site which will be applied for development (Appendix A: Map 3).

According to Mucina & Rutherford (2006) the area consists of KwaZulu-Natal Highland Thornveld and Low Escarpment Moist Grassland. Both these vegetation types are currently listed as being of Least Concern (LC) within the National List of Threatened Ecosystems (Notice 1477 of 2009) (National Environmental Management Biodiversity Act, 2004). This is also further confirmed by Jewitt (2018) who has undertaken a more recent assessment of the vegetation types within KZN. The area is affected by some development pressures, though not to such an extent to be considered as being threatened. Of these the former is limited to the lower lying areas (which will only be applicable to Site 5) while the latter dominates the higher lying moist grassland areas (applicable to Sites 1 – 4). This is also quite evident within the vegetation composition and -structure in these different vegetation types.

According to the EKZNW (2010/2016) Terrestrial Systematic Conservation Plan (TSCP), Site 1, the preferred site, is not listed as a CBA, ESA or important habitat for threatened species and is not considered essential for meeting conservation targets.

Additional resources also indicated that the site is situated within the Northern Drakensberg Strategic Water Source Area (SWSA) as well as the National Protected Areas Expansion Strategy (NPAES): Moist Escarpment Grassland Focus Area. In both instances, the proposed borrow pit development is unlikely to have any significant impact, both in terms of the regional water source and any future expansion of protected areas, largely as a result of its small footprint and therefore limited impact. The borrow pit will avoid the surrounding watercourses and wetland, incorporating a suitable buffer and should therefore not have an effect on the strategic surface water resources. Being a borrow pit, it may have some impact on the groundwater source, though as long as adequate storm water management principles are implemented, should not have a significant impact on the resource. Likewise, the footprint (5 hectares) will be so small as not to have any significant impact in terms of any proposed future protected area. In addition, the

broader Wind Energy Facility (WEF) has also taken into account management measures in order to preserve and maintain the remaining natural areas.

The larger area consists almost completely of natural vegetation and is dominated by dense grassland habitats. Only localised patches have been transformed by previous ploughing and planted pasture (Appendix A: Map 1). However, all five proposed sites are situated in natural grassland areas. The area is utilised for grazing by domestic livestock and the survey indicates that significant overgrazing also takes place. Overgrazing and trampling result in a decrease in vegetation cover and it was notable that significant erosion is taking place along livestock tracks and steep slopes where trampling is prominent. An additional impact, which is considered one of the main impacts in the area, is heavy infestation by the invasive *Acacia mearnsii* (Black Wattle), especially along wetlands and watercourses. This species is well known for its impacts in terms of a decrease in natural biodiversity, transformation of natural habitats and its impacts on watercourses and wetlands in terms of the drawdown of the water table. This affects fairly large portions of the study area; where such infestations occur, it was notable that almost no natural vegetation has remained. Natural vegetation is however likely to re-establish should clearing of these infestations be undertaken. The study area is therefore largely natural, though significant impacts and disturbances are present.

From the description of the vegetation on **Site 1** (Preferred Site), it is clear that it still consists of natural grassland which is still in a fairly good condition (Appendix A: Map 1 & 3). Signs of disturbance are present but are indicative of only low levels of disturbance. The species diversity is moderate although the area does also contain a significant number of protected plant species which will contribute towards its conservation value (Appendix B). The site itself therefore still contains elements of significant conservation value which includes protected plant species and rocky habitats providing suitable conditions for specialised species (Appendix A: Map 3). The stream and drainage line situated to the north of the site are considered as highly sensitive, though are not situated on or near the site and therefore only relevant in terms of any indirect impacts the development may still have on them (Appendix A: Map 3). Significant mitigation will therefore still have to be implemented to ensure the impact on these elements of significant conservation value is decreased.

Mitigation as indicated in the previous paragraph should include the following (Appendix A: Map 1 - 3):

- Numerous protected plant species have been identified **Site 1** (Appendix B). These include the protected succulent and geophytic species, *Gladiolus ecklonii, Raphionacme hirsuta, Dierama galpinii, Aloe maculata, Schizocarpus nervosus* and *Crinum macowanii*. Where development will affect these species, the necessary permits should be obtained and a significant proportion of these transplanted to adjacent areas where they will remain unaffected.

- **Site 1** (Preferred Site) is situated approximately 90 metres to the south of a small stream system and approximately 40 metres to the east of a small drainage line. (Appendix A: Map 3). These watercourses will both have a very high conservation value, especially so since they form part of the Northern Drakensberg SWSA and should be excluded from development, while a suitable buffer should also be maintained between them and any mining activities. The stream and drainage line will be discussed in detail within the wetland assessment section.

- Surface rock on the site provides a higher diversity habitat, which is regarded as having a Moderate Sensitivity. These types of habitats are also quite abundant and well represented in the surroundings and the loss of the habitat on the site itself should therefore still not result in a significant impact, provided that similar habitats remaining in the surroundings are retained intact.

- Though the site itself does not currently contain any significant weed or invasive plant infestations, mining will increase disturbance in the area and this will pose a risk of weeds and invasive species establishing and spreading into surrounding natural areas. This is particularly relevant to invasive *Acacia mearnsii* (Wattle), present in several clumps in the surroundings, which should be the main focus of eradication efforts. The proposed development will therefore have to implement a comprehensive monitoring and eradication programme to ensure that invasive plant species are removed from the area and prevented from re-establishing.

From the description of the area, especially the topography and climate, it should be clear that the area forms the origin of many wetlands and watercourses. In general, the plateau of the mountain system in the area causes the formation of seepage wetland systems, which then drain downslope, resulting in the formation of fast flowing mountain streams (Appendix A: Map 2). Such a small mountain stream and drainage line are also situated to the north and west of **Site 1** (Preferred Site) and may therefore still be indirectly affected by the proposed borrow pit site. An overview of the wetlands and watercourses at all five alternative sites will be provided, though detailed assessment will focus only on **Site 1**, which is also the preferred site which will be the subject of the mining permit application (Appendix A: Map 3):

Site 1 (Preferred Site): The site is situated on the lower lying foot slopes of the mountain and is dominated by a longitudinal low ridge from south-west to north-east and has a moderate slope from south-east to north-west. The site itself is devoid of any wetland systems and is dominated by dolerite outcrops. A prominent but small mountain stream is situated in the lower lying valley, approximately 90 metres to the north-west of the site, while an even smaller drainage line is situated approximately 40 metres to the south-west of the site, also flowing into, and forming a tributary, of the larger stream system (Appendix A: Map 3). Both these watercourses are fairly fast flowing, draining from west to east and have a well-defined channel. The stream is clearly a strictly seasonal system, currently containing no connected main channel flow and will contain no flow during winter, while flowing strongly for short periods after rainfall events. As a result, wetland conditions are present, but not extensive.

Obligate wetland vegetation was utilised to determine the presence and border of wetland conditions along seepage wetland areas as well as the drainage lines on the site (Table 2). However, this was of limited use in some instances. In order to augment the use of riparian and wetland vegetation, soil sampling was also utilised (Appendix C). Soil samples were investigated for the presence of anaerobic evidence which characterises wetland soils (Appendix C). Although wetland vegetation and soils could not provide an accurate indication of the boundary of wetland areas, this could at least conclusively confirm the presence of wetland conditions. The use of topography and geomorphology at each site could also provide significant additional confirmation of wetland areas. Combined with the use of aerial images, it is considered to give a fairly good indication of where wetland conditions will occur.

Although delineation of the seepage wetlands forming along the slopes of the plateau and lower lying foot slopes can, in most instances, be confirmed to contain wetland conditions, the border

is not always well defined and transitions into the surrounding terrestrial areas (Sites 2 – 5). These seepage wetlands drain into drainage lines or streams which are more easily visible as defined channels, and which have a better-defined border between riparian and terrestrial areas (Mostly applicable to Site1).

The small drainage lines and mountain streams around Sites 1 to 5 which seepage wetlands drain into can be characterised as a channel wetland system (SANBI 2009). The wetland conditions are confined to the main channel of these systems which experiences surface flow on a seasonal basis (Appendix A: Map 2). Here wetland conditions are most prominent along the main channel and decrease in distance from the channel. Being mountain stream systems, they are fast draining, with concentrated flow after rainfall, as opposed to diffuse flow. Another consequence of the fast flow is also a very narrow floodplain occurring along these watercourses. As these streams reach the lower lying bottomlands, flow will slow down and may then form valley-bottom wetland systems. Such systems are however not present around any of the proposed sites.

The determination of the condition of the affected watercourses will be limited to **Site 1**, which is the preferred site. This will include assessment of the main stream as well as the smaller drainage line tributary (Appendix A: Map 3). Both of these form clearly defined watercourses, while the stream system also contains prominent wetland conditions. They are natural systems and though situated some distance from the site, are still likely to be affected to some degree by mining operations and the determination of their condition is therefore important. The small drainage line flows into the main stream system, therefore forming part of one system, located in close proximity to each other, being affected by the same impacts, situated in the same environmental setting and affecting the same downstream section of the larger stream system. The system can therefore be assessed as a whole, though a separate Index of Habitat Integrity (IHI) will be conducted for each. This is considered to give a good representation of the condition of the system within the study area which will be affected by the proposed mining operations. The IHI will be taken as representative of the Present Ecological State (PES) of this system.

The stream and drainage line adjacent to Site 1 (Preferred Site) are largely intact, though affected by some impacts, which will certainly have some effect on them. The most prominent impacts are associated with erosion upslope and infestation by invasive trees. Upslope of the stream, within its catchment and especially where steep slopes are present, erosion does take place, especially along dirt tracks and livestock footpaths. This will have some effect on sediment load within the stream. The infestation by invasive *Acacia mearnsii*, is considered a significantly higher impact and will certainly decrease the condition of the stream. Several clumps of this invasive tree occur along the stream and can be quite extensive in some areas. This has many large impacts which may include removal of riparian vegetation, increased sedimentation, severe decrease in biodiversity and modification of its hydrology. These impacts are also discussed in more detail in Section 4.2.4. An IHI determination was undertaken for both the stream system and the smaller drainage line, in order to determine their current condition given the impacts affecting them (Appendix D). The results of the IHI indicated that the stream system has a Present Ecological State of Category C: Moderately Modified, while the drainage line has a Present Ecological State of Category B/C: Largely Natural to Moderately Modified. This is considered relatively accurate given the impacts in the catchment of these watercourses. The system will have a high conservation value as it forms the origin of the downslope stream system and performs important functions in terms of water transportation, storm water and groundwater recharge, bioremediation and flood attenuation. The entire system should therefore still be considered as sensitive and the proposed development should not lead to altering it any further

(Appendix A: Map 3). The EI&S of the affected stream and drainage line has been rated as being High.

As indicated, the stream and drainage line are both still fairly natural, form part of the Northern Drakensberg SWSA, have a high conservation value and impacts on them by the proposed borrow pit should be avoided (Appendix A: Map 2). The mining operations should therefore aim to completely exclude these watercourses and prevent impacts on them (Appendix A: Map 3). The stream and associated drainage line should be treated as no-go areas and no construction or operational activities, vehicle movement, laydown areas, vegetation clearing or any other associated activities should occur in or near these watercourses. In addition, a suitable buffer for the stream and drainage line can be provided by using the Buffer Zone Tool for the Determination of Aquatic Impact Buffers and Additional Setback Requirements for River Ecosystems (2014) (Appendix E). By using the above tools a suitable buffer of 47 metres for the stream and 44 metres for the drainage lines has been determined (Appendix A: Map 3). Should mining operations be able to exclude these watercourses and operations within the determined buffer zone, it will result in the lowest impacts, while the anticipated risk will increase as mining encroaches into the buffer.

A Risk Assessment for the proposed Borrow Pit Site 1 (Preferred Site) which will affect the stream system and drainage line tributary, has been undertaken according to the Department of Water & Sanitation's requirements for risk assessment and the provisional Risk Assessment Matrix for Section 21(c) & (i) water use (Appendix E). Activities likely to be associated with the mining operations and which will likely affect the stream and drainage line are largely associated with mining in close proximity to these systems (Appendix A: Map 3). The proposed mining operations at Site 1 (Preferred Site) should completely exclude the stream and drainage line. As a result, no direct impacts are possible, though several residual and indirect impacts, largely associated with storm water runoff and sedimentation, are still likely and the following risks are still anticipated to occur (Appendix A: Map 3):

- The stream and drainage line are completely excluded from the development footprint and are therefore unlikely to be directly affected by it. However, several indirect impacts are still likely and these are especially relevant to the system forming part of the Northern Drakensberg SWSA and any downstream impacts should be prevented.

- The affected stream and drainage line are likely to be affected by the mining operations, largely as a result of increased sediment load. This can be managed through adequate mitigation, including storm water management measures and provided that adequate rehabilitation is undertaken, it should not have a long-term impact on them. Provided that adequate storm water management is implemented, the risk should remain Low.

8. Conclusions and Recommendations

- Where mining operations occur, it is important that comprehensive rehabilitation and monitoring of the rehabilitation take place.

- Correct topsoil and seedbank management will be paramount to rehabilitation. Where disturbance or excavation will occur, the upper 30 cm, or topsoil, should be removed, together with the vegetation, and stored on the site. The topsoil, together with the seedbank and any vegetation material, should then be placed on top of the rehabilitated soil surface. Subsoil should be used as backfilling and not as top dressing. Only removed topsoil should be utilised to rehabilitate the disturbed surface. The rehabilitated borrow pit should be incorporated into the surrounding landscape as far as possible.

- The site and surroundings contain numerous protected species which have significant conservation value and will require mitigation (Appendix B):
  - Many of the affected protected species are cryptic and inconspicuous and have a winter dormancy, when they will be nearly impossible to identify. It is recommended that a walkthrough survey be conducted prior to the site being mined. This should include identification and marking of all protected plants on the site and should be performed by an ecologist or botanist.
  - Species occurring on the site that may be affected by the development include *Gladiolus ecklonii, Raphionacme hirsuta, Dierama galpinii, Aloe maculata, Schizocarpus nervosus* and *Crinum macowanii*. Where development will affect these species, the necessary permits should be obtained and a significant proportion of these transplanted to adjacent areas where they will remain unaffected. These geophytic species are easily transplanted with a high success rate.
  - The surrounding proposed Wind Energy Facility (WEF) has already initiated a protected species transplanting process and the mining permit application area can therefore also be incorporated into this process.
  - Protected plants occurring on the site are listed as such under the KwaZulu-Natal Provincial Nature Conservation Ordinance Nr. 15 of 1974.

- Though the site itself does not currently contain any significant weed or invasive plant infestations, mining will increase disturbance in the area and this will pose a risk of weeds and invasive species establishing and spreading into surrounding natural areas. This is particularly relevant to invasive *Acacia mearnsii* (Wattle), present in several clumps in the surroundings, which should be the main focus of eradication efforts. The proposed development will therefore have to implement a comprehensive monitoring and eradication programme to ensure that invasive plant species are removed from the area and prevented from re-establishing.

- Adequate monitoring of weed establishment and their continued eradication must be maintained (Appendix B). Where category 1 and 2 weeds occur, they require removal by the property owner according to the Conservation of Agricultural Resources Act, No. 43 of 1983 and National Environmental Management: Biodiversity Act, No. 10 of 2004.

- The seasonal stream and drainage line adjacent to Site 1 (Preferred Site) form part of the Northern Drakensberg Strategic Water Source Area (SWSA). Their continued

preservation and conservation are therefore of utmost importance and it is therefore recommended that they be excluded from mining operations (Appendix A: Map 3):

  - The seasonal stream and drainage line adjacent to Site 1, as identified within this assessment, should be treated as no-go areas and no mining activities, including construction or operational activities, vehicle movement, laydown areas, vegetation clearing or any other associated activities should occur in or near these watercourses. (Appendix A: Map 3). Given the nature of the mining operations and limited disturbance footprint (5 hectares), this should be easily attainable.
  - In order to further prevent any impacts on the identified watercourses, a buffer of 47 metres should also be maintained from the edge of the riparian zone along these watercourses (Appendix A: Map 3). This buffer area should also be treated as a no-go area.
  - Where mining operations require crossing of the watercourses only existing roads and tracks should be utilised. The study area already contains a network of dirt tracks, which will also be upgraded and utilised for the broader Wind Energy Facility (WEF) and it should therefore be possible to avoid the construction of new access roads through watercourses.

- The following mitigation should be considered to prevent impacts on any of the surrounding watercourses (Appendix A: Map 3):

  - A natural vegetation layer should be re-instated where this was disturbed/removed.
  - Adequate storm water management measures should be implemented and should include diverting storm- and floodwater around operational and excavation areas and preventing sediment and silt from entering any of the delineated watercourses.

- The necessary authorisations must be acquired from the Department of Water and Sanitation (DWS) for mining activities within 100 metres of any of the delineated watercourses around the site (Appendix A: Map 3).

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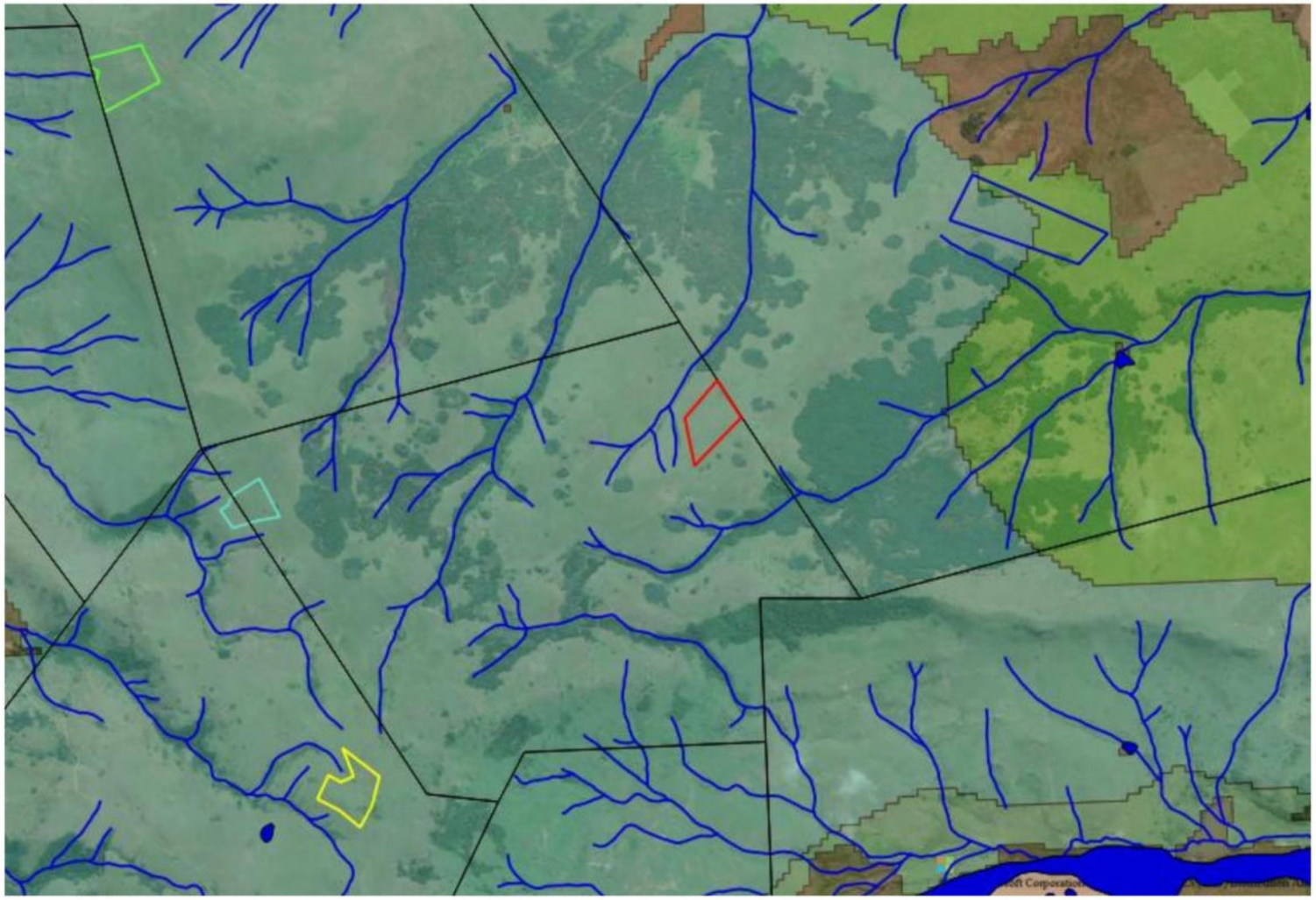
Appendix A: Maps

General ecology map for five possible borrow pit sites for the Mulilo Newcastle Wind Energy Facility (WEF) situated near Newcastle, KwaZulu-Natal Province.



Prepared for:
Greenmined Environmental
Baker Square
Somerset West
7130

Legend:

- Site 1
- Site 2
- Site 3
- Site 4
- Site 5
- Farm Boundaries
- KZN Highland Thornveld
- Low Escarpment Moist Grass
- Watercourses and wetlands

Map Information

Spheroid: WGS 84

Quantum GIS

Scale: 1:30 000

DPR Ecologists
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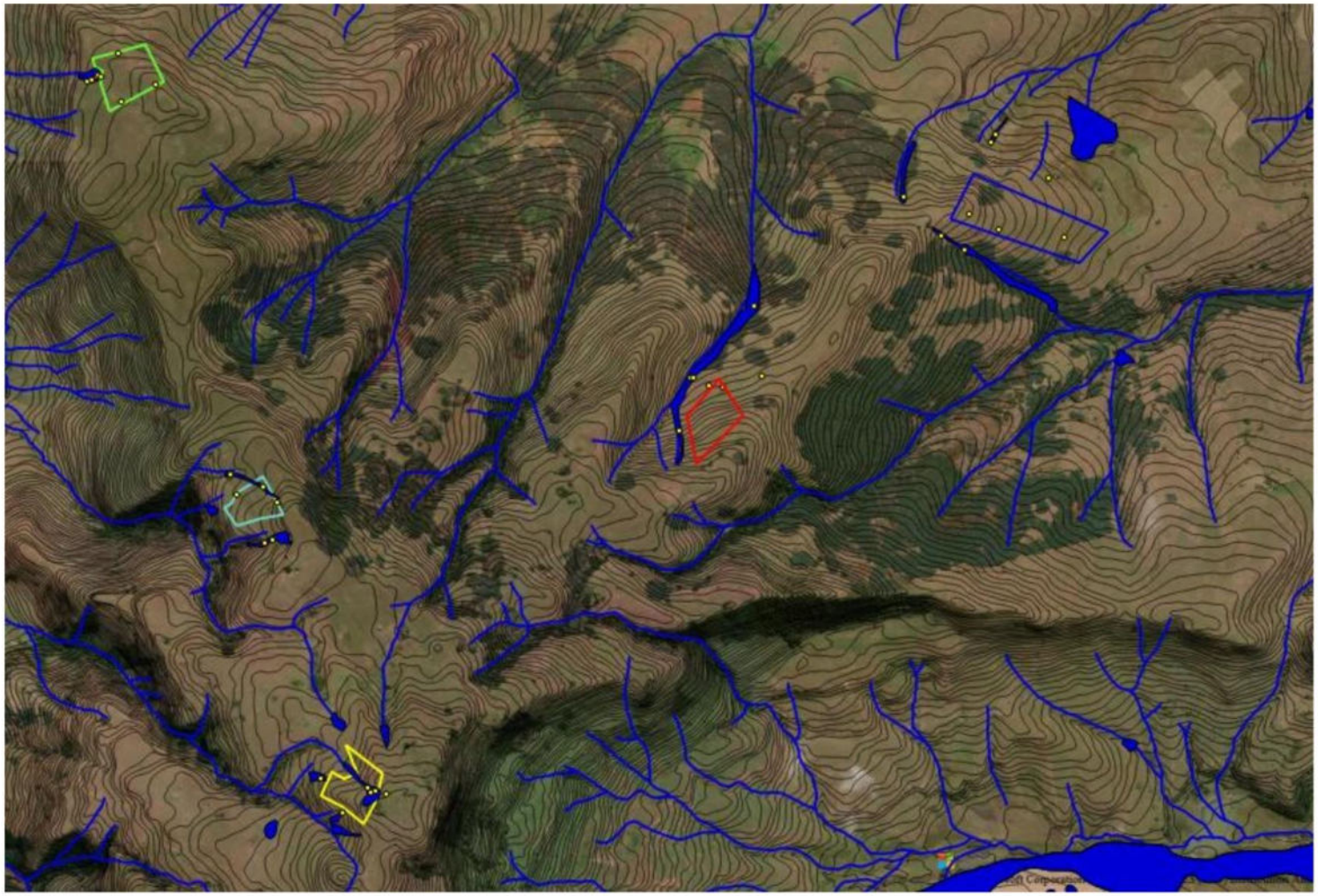
Tel: 083 410 0770

Map 1: General ecology map of the five proposed borrow pit sites for the Mulilo Newcastle WEF. The remaining natural areas are indicated (National Biodiversity Assessment 2018) and which confirms that the area is still dominated by natural areas. Note a small portion having been transformed north of Site 5 due to ploughing and planted pasture. The are also contains a multitude of watercourses and wetlands which is largely a consequence of the climate and topography. It is notable that all five sites will be situated near wetlands and watercourses and therefore also likely to impact on these systems. Note also significant infestation by invasive *Acacia mearnsii*, visible as dark patches and which also respresent a significant impact in the area.

Wetland delineation map for five possible borrow pit sites for the Mulilo Newcastle Wind Energy Facility (WEF) situated near Newcastle, KwaZulu-Natal Province.



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7130

Legend:

- Site 1
- Site 2
- Site 3
- Site 4
- Site 5
- Surface contours
- Delineated wetlands
- Wetland sampling points

Map Information

Spheroid: WGS 84

Quantum GIS

Scale: 1:30 000

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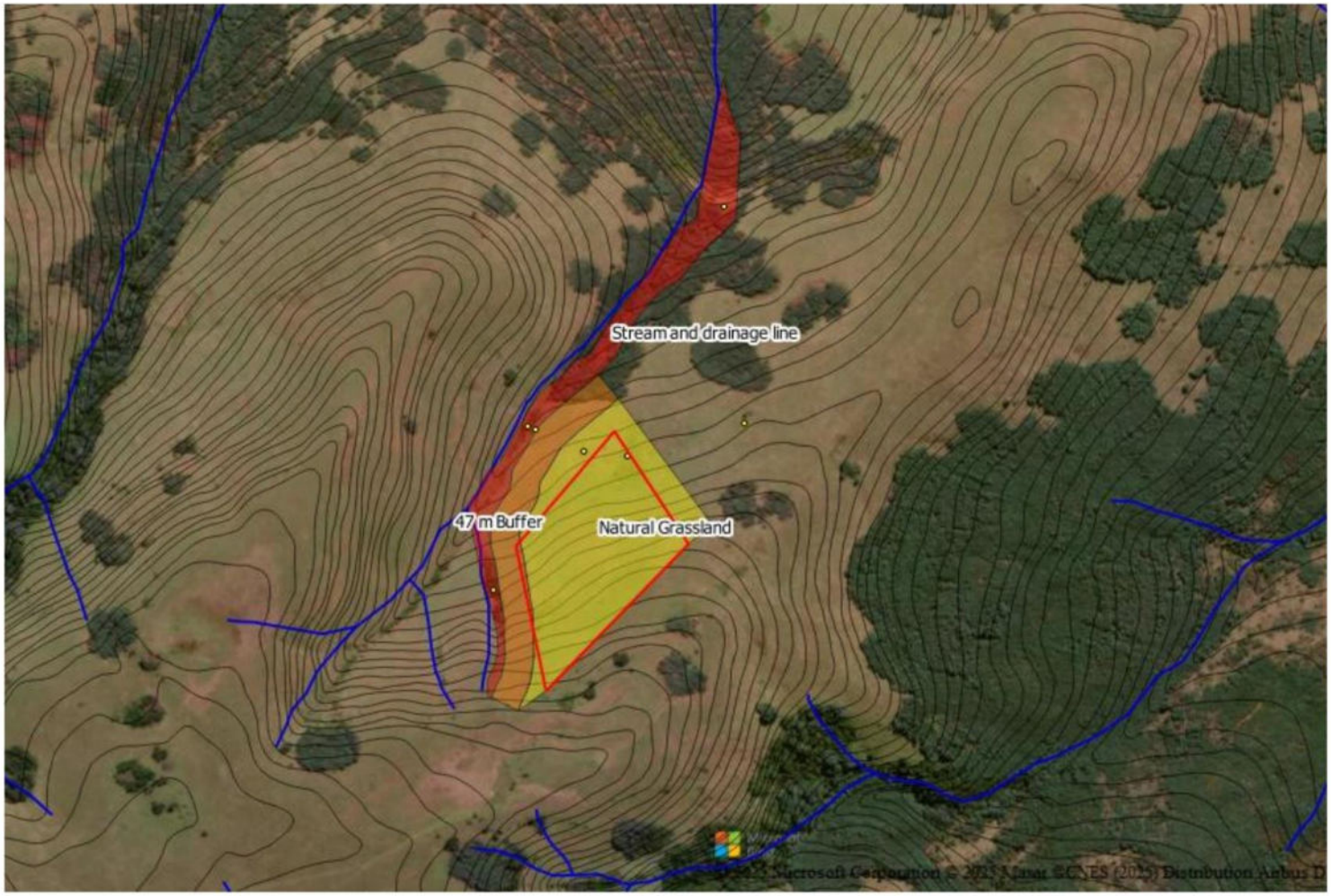
Map 2: Wetland delineation map of the five proposed borrow pit sites for the Mulilo Newcastle WEF. The wetlands on or near the proposed sites are indicated as well as the wetland sampling points in these systems. **Site 1** is situated south of a stream and drainage line and should therefore feasible. **Site 2** contains several seepage areas, with the northern seep also transecting the site, this site could remain feasible provided adequate exclusion of the wetland area are undertaken. **Site 3** contains numerous seepage wetlands, with a large seep on the site itself being almost certainly unavoidable, will lead to severe impacts and should be considered as unfeasible. **Site 4** contains a small seepage wetland to the west, but should remain feasible if an adequate buffer zone is implemented. **Site 5** contains many seepage and drainage wetland around the site, but not near it, and should feasible with limited impacts anticipated.

Sensitivity map for Site 1 (Preferred Site) for the Mulilo Newcastle Wind Energy Facility (WEF) situated near Newcastle, KwaZulu-Natal Province.



Prepared for:
Greenmined Environmental
Baker Square
Somerset West
7130

Legend:

- Site 1 (Preferred Site)
- Surface contours
- Very High Sensitivity
- High Sensitivity
- Moderate Sensitivity
- Low Sensitivity
- Wetland sampling points

Map Information

Spheroid: WGS 84

Quantum GIS

Scale: 1:10 000

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Map 3: Sensitivity map of **Site 1** (Preferred Site) for the Mulilo Newcastle WEF. The seasonal stream and drainage line to the north and west of the site is considered to be of Very High Sensitivity, which is also associated with the Northern Drakensberg SWSA. The site is therefore still likely to have indirect impacts on this system and adequate mitigation in terms of a buffer zone and storm water measures should still be applied. The 47 meter buffer between these watercourses and the site is regarded as having a High Sensitivity and should still be treated as a no-go area by the development. The site itself and surroundings still consist of natural grassland in good condition, with at least a moderate species and habitat diversity. Elements of very high conservation value are however absent and is therefore considered to of Moderate Sensitivity.

Appendix B: Species list

Species indicated with an * are exotic.

Protected species are coloured orange and Red Listed species red.

Site 1	
Species	**Growth form**
**Acacia mearnsii*	Tree
**Richardia braziliensis*	Herb
Acalypha peduncularis	Herb
Aloe maculata	Succulent
Berkheya echinacea	Herb
Berkheya setifera	Herb
Buddleja salviifolia	Shrub
Cheilanthes viridis	Fern
Crabbea acaulis	Herb
Crinum macowanii	Geophyte
Cucumis hirsutus	Creeper
Cyanotis speciosa	Herb
Cymbopogon pospischillii	Grass
Cyperus obtusiflorus	Sedge
Dierama galpinii	Geophyte
Diospyros lyscioides	Shrub
Dyschoriste setigera	Herb
Eragrostis curvula	Grass
Eragrostis gummiflua	Grass
Eriosema cordatum	Herb
Euphorbia clavaroides	Succulent
Euryops laxus	Herb
Felicia muricata	Herb
Gerbera ambigua	Herb
Gladiolus ecklonii	Geophyte
Gymnosporia buxifolia	Shrub
Helichrysum sp.	Herb
Hermannia aristata	Herb
Hermannia geniculata	Herb
Hypoxis multiceps	Geophyte
Hypoxis rigidula	Geophyte
Ipomoea crassipes	Creeper
Ledebouria ovatifolia	Geophyte
Ledebouria sp.	Geophyte
Lotononis calycina	Herb
Melinis nerviglumis	Grass
Ocimum obovatum	Herb
Parinari capensis	Suffrutex
Pelargonium luridum	Geophyte
Pentanisia angustifolia	Herb

Pseudopegolettia tenella	Herb
Raphionacme hirsuta	Geophyte
Rhynchosia sp.	Herb
Scabiosa columbaria	Herb
Schizocarpus nervosus	Geophyte
Searsia dentata	Shrub
Searsia discolor	Shrub
Senecio sp.	Herb
Senecio sp. 2	Herb
Tephrosia sp.	Herb
Themeda triandra	Grass
Tristachya leucothrix	Grass
Tulbaghia acutiloba	Geophyte
Site 2 - 4	
Species	**Growth form**
**Acacia mearnsii*	Tree
**Hypochaeris radicata*	Herb
**Lantana camara*	Shrub
**Plantago major*	Herb
**Rubus ludwigii*	Shrub
**Rubus rigidus*	Shrub
**Solanum mauritianum*	Shrub
Acalypha schinzii	Herb
Agapanthus campanulatus	Geophyte
Aloe maculata	Succulent
Aster squamatus	Herb
Berkheya echinata	Herb
Berkheya radula	Herb
Buddleja salviifolia	Shrub
Carex glomerabilis	Sedge
Centella asiatica	Herb
Cheilanthes viridis	Fern
Clematis brachiata	Climber
Cyperus sp.	Sedge
Cyrtanthus tuckii	Geophyte
Dierama galpinii	Geophyte
Diospyros lycioides	Shrub
Dyschoriste setigera	Herb
Eleocharis dregeana	Sedge
Empodium monophyllum	Geophyte
Eragrostis chloromelas	Grass
Eragrostis curvula	Grass
Eragrostis racemosa	Grass
Eragrostis sp.	Grass
Euclea crispa	Shrub
Euphorbia pulvinata	Succulent
Gerbera ambigua	Herb

Gerbera piloselloides	Herb
Gnaphalium sp.	Herb
Greyia sutherlandii	Shrub
Gunnera perpensa	Herb
Gymnosporia buxifolia	Shrub
Halleria lucida	Shrub
Helichrysum arenarium	Herb
Helichrysum nudifolium	Herb
Helichrysum pilosellum	Herb
Helichrysum rugulosum	Herb
Helictotrichon turgidulum	Grass
Hilliardiella aristata	Herb
Hyparrhenia tamba	Grass
Hypoxis angustifolia	Geophyte
Hypoxis sp.	Geophyte
Juncus exsertus	Rush
Leucosidea sericea	Shrub
Limosella longiflora	Herb
Merwilla plumbea	Geophyte
Miscanthus juncea	Grass
Myrsine africana	Shrub
Pennisetum sp.	Grass
Pentanisia angustifolia	Grass
Schoenoplectus sp.	Sedge
Scolopia zeyheri	Shrub
Searsia pyroides	Shrub
Senecio poyodon	Herb
Sporobolus africanus	Grass
Urticularia bisquamata	Herb

Appendix C: Soil Samples Methodology

Obligate wetland vegetation was utilised to determine the presence and border of wetlands. Soil samples were used to confirm the wetland conditions in the study area. Soil samples were investigated for the presence of anaerobic evidence which characterises wetland soils.

Within wetlands the hydrological regime differs due to the topography and landscape. For instance; a valley bottom wetland would have a main channel that is below the water table and consequently permanently saturated, i.e. permanent zone of wetness. As you move away from the main channel the wetland would become dependent on flooding in order to be saturated. As a result along this hydrological regime areas of permanent saturation, seasonal and temporary saturation would occur. At some point along this gradient the saturation of the soil would be insufficient to develop reduced soil conditions and therefore will not be considered as a wetland.

Within wetland soils the pores between soil particles are filled with water instead of atmosphere. As a result, available oxygen is consumed by microbes and plant roots and due to the slow rate of oxygen diffusion oxygen is depleted and biological activity continues in anaerobic conditions, and this causes the soil to become reduced.

Reduction of wetland soils is a result of bacteria decomposing organic material. As bacteria in saturated soils deplete the dissolved oxygen they start to produce organic chemicals that reduce metals. In oxidised soils the metals in the soil give it a red, brown, yellow or orange colour. When these soils are saturated and metals reduced the soil attains a grey matrix characteristic of wetland soils.

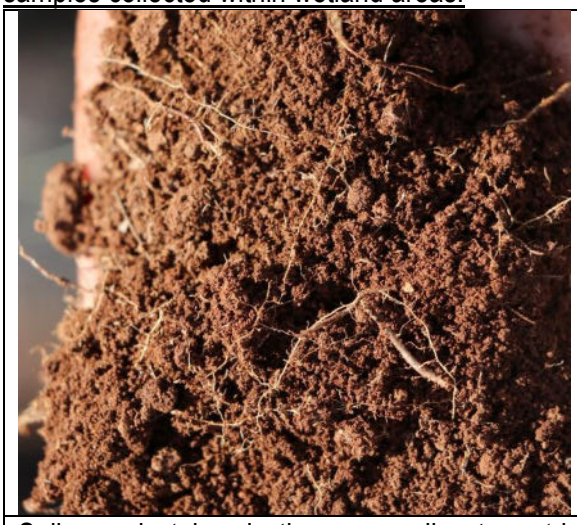
Within this reduction taking place in the wetland soils there may be reduced matrix, redox depletions and redox concentrations. The reduced matrix is characterised by a low chroma and therefore a grey soil matrix. Redox depletions result in the grey bodies within the soil where metals have been stripped out. Redox concentrations result in mottles within the grey matrix with variable shape and are recognised as blotches or spots, red and yellow in colour.

Soil wetness indicator is used as the primary indicator of wetlands. The colour of various soil components is often the most diagnostic indicator of hydromorphic soils. Colours of these components are strongly influenced by the frequency and duration of soil saturation. Generally, the higher the duration and frequency of saturation in a soil profile, the more prominent grey colours become in the soil matrix.

Coloured mottles, another feature of hydromorphic soils, are usually absent in permanently saturated soils and are at their most prominent in seasonally saturated soils, becoming less abundant in temporarily saturated soils until they disappear altogether in dry soils (Collins 2005).

The following soil wetness indicators can be used to determine the permanent, seasonal and temporary wetness zones. The boundary of the wetland is defined as the outer edge of the temporary zone of wetness and is characterised by a minimal grey matrix (<10%), few high chroma mottles and short periods of saturation (less than three months per year). The seasonal zone of wetness is characterised by a grey matrix (>10%), many low chroma mottles and significant periods of wetness (at least three months per year). The permanent zone of wetness is characterised by a prominent grey matrix, few to high chroma mottles, wetness all year round and sulphuric odour (rotten egg smell). According to convention hydromorphic soil must display signs of wetness within 50 cm of the soil surface (DWAF 2005).

Table 1: Soil samples taken in terrestrial habitats outside the identified wetlands in the study area at each of the proposed sites. These samples can be used as references to compare with the soil samples collected within wetland areas.

	
Soil sample taken in the surrounding terrestrial habitat at Site 1. Soils have a reddish colour, without any grey matrix, clay content or distinctive mottling and are clearly devoid of wetland conditions. This should contrast starkly against wetland soils.	Soil sample taken in the surrounding terrestrial habitat at Site 2. Soils have a reddish colour with high gravel content, without any grey matrix, clay content or distinctive mottling and are clearly devoid of wetland conditions. This should contrast starkly against wetland soils.
	
Soil sample taken in the surrounding terrestrial habitat at Site 3. Soils have a reddish colour with high gravel content, without any grey matrix, clay content or distinctive mottling and are clearly devoid of wetland conditions. This should contrast starkly against wetland soils.	Soil sample taken in the surrounding terrestrial habitat at Site 4. Soils have a reddish colour, without any grey matrix, clay content or distinctive mottling and are clearly devoid of wetland conditions. This should contrast starkly against wetland soils.

	
Soil sample taken in the surrounding terrestrial habitat at Site 5. Soils have a reddish colour, without any grey matrix, clay content or distinctive mottling and are clearly devoid of wetland conditions. This should contrast starkly against wetland soils.	

Table 2: Soil samples taken within the seepage wetlands and drainage lines at Site 1 (S 27.658907°, E 29.813802°).

	
Soil sample taken within the main stream system to the north of the site. Soils retain a reddish colouration, but with a grey matrix present and some mottling also discernible. Wetland conditions are therefore present but not prominent and indicate a fast flowing stream system with at least seasonal wetness conditions.	Soil sample taken in the small drainage line to the west of the site. Soils do not contain any prominent soil wetness indicators and wetland conditions are not considered as conclusively present. However, note the dark colouration and higher clay content which clearly contrast with terrestrial soils (Table 1) and the drainage line is clearly still a watercourse system.

Table 3: Soil samples taken within the seepage wetlands at Site 2 (S 27.662949°, E 29.792269°).

	
Soil sample taken within the upper section of the seepage wetland along the north of the site. Note a high clay content and grey matrix but mottling not being prominent. Wetland conditions are therefore not prominent, considered as indicative of a temporary zone of wetness, but still contrast clearly with surrounding terrestrial soils (Table 1).	Soil sample taken within the lower section of the seepage wetland along the north of the site. Soils have a prominent grey matrix, high clay and organic matter content and clearly indicate the presence of wetland conditions.

Table 4: Soil samples taken at sample sites within the seepage wetland on the site and surrounding drainage lines at Site 3 (S 27.675914°, E 29.798682°).

	
Soil sample taken within the seepage wetland situated on the site. Note a high clay and organic matter content and grey matrix but mottling not being prominent. Wetland conditions are therefore not prominent, though still clearly present and also contrast clearly with surrounding terrestrial soils (Table 1).	Soil sample taken in the small drainage line to the south of the site. Soils do not contain any prominent soil wetness indicators and wetland conditions are not considered as conclusively present. However, note the dark colouration and higher clay content which clearly contrast with terrestrial soils (Table 1) and the drainage line is clearly still a watercourse system.

Table 5: Soil samples taken at sample sites within the seepage wetland at Site 4 (S 27.646613°, E 29.785577°).

	
Soil sample taken within the seepage wetland to the west of the site. Note a high clay and organic matter content and grey matrix with mottling being visible. Wetland conditions are therefore clearly present and also contrast clearly with surrounding terrestrial soils (Table 1).	

Table 6: Soil samples taken within the seepage wetlands at Site 5 (S 27.651450°, E 29.823734°).

	
Soil sample taken within the seepage wetland to the north of the site. Note a high clay content and grey matrix but mottling not being prominent. Wetland conditions are therefore not prominent, considered as indicative of a temporary zone of wetness, but still contrast clearly with surrounding terrestrial soils (Table 1).	Soil sample taken within the seepage wetland to the west of the site. Soils have a prominent grey matrix, high clay and organic matter content and clearly indicate the presence of wetland conditions.

Appendix D: Index of Habitat Integrity (IHI)/WET-Health Summary

For the complete IHI please contact the author of this report.

ASSESSMENT UNIT INFORMATION	
ASSESSMENT UNIT INFORMATION	New astle BP Site 1
UPPER LATITUDE	S 27.660174°
UPPER LONGITUDE	E 29.812896°
UPPER ALTITUDE	1600m
LOWER LATITUDE	S 27.654756°
LOWER LONGITUDE	E 29.816964°
LOWER ALTITUDE	1515m
SURVEY SITE (if applicable)	Seasonal stream system
SITE LATITUDE (if applicable)	
SITE LONGITUDE (if applicable)	
SITE ALTITUDE (if applicable)	
WMA	Thukela
QUATERNARY	V31D
ECOREGION 2	14_2
DATE	30/10/2024
RIVER	Buffels River
TRIBUTARY	Seasonal stream system
PERENNIAL (Y/N)	**N**
GEOMORPH ZONE	**FOOTHILL**
WIDTH (m)	**>0-2**

INSTREAM IHI	
Base Flows	-1.0
Zero Flows	1.0
Floods	1.0
HYDROLOGY RATING	1.0
pH	0.0
Salts	1.0
Nutrients	1.0
Water Temperature	1.0
Water clarity	2.0
Oxygen	1.0
Toxics	0.0
PC RATING	0.8
Sediment	1.5
Benthic Growth	1.5
BED RATING	1.5
Marginal	1.5
Non-marginal	1.5
BANK RATING	1.5
Longitudinal Connectivity	1.5
Lateral Connectivity	1.5
CONNECTIVITY RATING	1.5
INSTREAM IHI %	75.8
INSTREAM IHI EC	C
INSTREAM CONFIDENCE	2.8

RIPARIAN IHI	
Base Flows	-1.0
Zero Flows	1.0
Moderate Floods	1.5
Large Floods	1.5
HYDROLOGY RATING	1.2
Substrate Exposure (marginal)	1.0
Substrate Exposure (non-marginal)	0.0
Invasive Alien Vegetation (marginal)	1.0
Invasive Alien Vegetation (non-marginal)	2.0
Erosion (marginal)	1.0
Erosion (non-marginal)	0.0
Physico-Chemical (marginal)	1.0
Physico-Chemical (non-marginal)	0.5
Marginal	1.0
Non-marginal	2.0
BANK STRUCTURE RATING	1.2
Longitudinal Connectivity	1.5
Lateral Connectivity	1.0
CONNECTIVITY RATING	1.3
RIPARIAN IHI %	75.0
RIPARIAN IHI EC	C
RIPARIAN CONFIDENCE	3.7

ASSESSMENT UNIT INFORMATION	
ASSESSMENT UNIT INFORMATION	New astle BP Site 1
UPPER LATITUDE	S 27.662447°
UPPER LONGITUDE	E 29.816964°
UPPER ALTITUDE	1661m
LOWER LATITUDE	S 27.660035°
LOWER LONGITUDE	E 29.813074°
LOWER ALTITUDE	1597m
SURVEY SITE (if applicable)	Drainage line tributary
SITE LATITUDE (if applicable)	
SITE LONGITUDE (if applicable)	
SITE ALTITUDE (if applicable)	
WMA	Thukela
QUATERNARY	V31D
ECOREGION 2	14_2
DATE	30/10/2024
RIVER	Seasonal stream system
TRIBUTARY	Drainage line tributary
PERENNIAL (Y/N)	**N**
GEOMORPH ZONE	**FOOTHILL**
WIDTH (m)	**>0-2**

INSTREAM IHI	
Base Flows	-0.5
Zero Flows	0.5
Floods	0.5
HYDROLOGY RATING	0.5
pH	0.0
Salts	1.0
Nutrients	1.0
Water Temperature	1.0
Water clarity	1.0
Oxygen	1.0
Toxics	0.0
PC RATING	0.7
Sediment	1.0
Benthic Growth	1.0
BED RATING	1.0
Marginal	1.0
Non-marginal	1.0
BANK RATING	1.0
Longitudinal Connectivity	1.0
Lateral Connectivity	1.0
CONNECTIVITY RATING	1.0
INSTREAM IHI %	84.0
INSTREAM IHI EC	B
INSTREAM CONFIDENCE	2.8

RIPARIAN IHI	
Base Flows	-0.5
Zero Flows	0.5
Moderate Floods	0.5
Large Floods	0.5
HYDROLOGY RATING	0.5
Substrate Exposure (marginal)	1.0
Substrate Exposure (non-marginal)	0.0
Invasive Alien Vegetation (marginal)	0.0
Invasive Alien Vegetation (non-marginal)	1.0
Erosion (marginal)	1.0
Erosion (non-marginal)	0.0
Physico-Chemical (marginal)	0.5
Physico-Chemical (non-marginal)	0.5
Marginal	1.0
Non-marginal	1.0
BANK STRUCTURE RATING	1.0
Longitudinal Connectivity	1.0
Lateral Connectivity	1.0
CONNECTIVITY RATING	1.0
RIPARIAN IHI %	83.3
RIPARIAN IHI EC	B
RIPARIAN CONFIDENCE	3.7

Appendix E: Risk Assessment Matrix

PROJECT:	**Proposed borrow pit Site 1 development for the Mulilo Newcastle Wind Energy Facility (WEF) situated near Newcastle in KwaZulu-Natal.**

RISK ASSESSMENT MATRIX for Section 21 (c) and (i) Water Use activities - Version 2.1

Name of Assessor:	Darius van Rensburg	**Signature:**	
SACNASP Registration Number:	400284/13		
Date of assessment:	10/11/2024		

Risk to be scored for all relevant phases of the project (**factoring in specified control measures**). MUST BE COMPLETED BY SACNASP PROFESSIONAL MEMBER REGISTERED IN AN APPROPRIATE FIELD OF EXPERTISE.

Phase	Activity	Impact	Potentially affected watercourses			Intensity of Impact on Resource Quality					Overall Intensity (max = 10)	Spatial scale (max = 5)	Duration (max = 5)	Severity (max = 20)	Importance rating (max = 5)	Consequence (max = 100)	Likelihood (Probability) of impact	Significance (max = 100)	Risk Rating	Confidence level
			Name/s	PES	Overall Watercourse Importance	Abiotic Habitat (Drivers)			Biota (Responses)											
						Hydrology	Water Quality	Geomorph	Vegetation	Fauna										
CONSTRUCTION	Mining outside the determined buffer zone but still within the regulated area (within 100 metres) from the seasonal stream and drainage line.	Mining will require removal of the vegetation layer in the catchment of the adjacent stream and drainage line. This activity will not entail	#1 Site 1 (Preferred Site) – Affected stream system	C	High	1	2	0	1	0	4	1	1	6	4	24	60%	14.4	L	High
		the geomorphology but will nonetheless also entail erosion and increased sedimentation of the stream and drainage line.	#2 Site 1 (Preferred Site) – Affected drainage line	B/C	High	1	2	0	1	0	4	1	1	6	4	24	60%	14.4	L	High
		weeds is likely due to disturbance caused by mining. The functioning of the drainage line is anticipated to remain largely																		
OPERATIONAL	Mining outside the determined buffer zone but still within the regulated area (within 100 metres) from the seasonal stream and drainage line.	Mining will require removal of the vegetation layer in the catchment of the adjacent stream and drainage line. This activity will not entail	#1 Site 1 (Preferred Site) – Affected stream system	C	High	1	2	0	1	0	4	1	1	6	4	24	60%	14.4	L	High
		the geomorphology but will nonetheless also entail erosion and increased sedimentation of the stream and drainage line.	#2 Site 1 (Preferred Site) – Affected drainage line	B/C	High	1	2	0	1	0	4	1	1	6	4	24	60%	14.4	L	High
		weeds is likely due to disturbance caused by mining. The functioning of the drainage line is anticipated to remain largely																		
DECOMMISSIONING	Mining outside the determined buffer zone but still within the regulated area (within 100 metres) from the seasonal stream and drainage line.	Mining will require removal of the vegetation layer in the catchment of the adjacent stream and drainage line. This activity will not entail	#1 Site 1 (Preferred Site) – Affected stream system	C	High	1	2	0	1	0	4	1	1	6	4	24	60%	14.4	L	High
		the geomorphology but will nonetheless also entail erosion and increased sedimentation of the stream and drainage line.	#2 Site 1 (Preferred Site) – Affected drainage line	B/C	High	1	2	0	1	0	4	1	1	6	4	24	60%	14.4	L	High
		weeds is likely due to disturbance caused by mining. The functioning of the drainage line is anticipated to remain largely																		

Appendix F: Buffer Zone Determination

water & sanitation
Department:
Water and Sanitation
REPUBLIC OF SOUTH AFRICA

BUFFER ZONE TOOL FOR THE DETERMINATION OF AQUATIC IMPACT BUFFERS AND ADDITIONAL SETBACK REQUIREMENTS FOR RIVER ECOSYSTEMS

WATER RESEARCH COMMISSION

Note: For further guidance on the application of this tool, users should refer to the preliminary guideline for the determination of buffer zones. It is also important to note that buffer widths calculated by the model only cater for impacts associated with diffuse-source surface runoff. Additional mitigation measures should therefore be defined to cater for other potential impacts. Finally, the buffer zone tool has been designed to be used one case study at a time.

Name of Assessor	Darius van Rensburg	Project Details	Newcastle Borrow Pit Site 1	Date of Assessment	10/11/2024

Step 1: Define objectives and scope of assessment and determine the most appropriate level of assessment

Level of assessment	Site-based

Step 2: Map and categorize water resources in the study area

Approach used to delineate the riparian zone & active channel?	Site-based delineation	River type	Upper foothills

Step 3: Refer to the DWA management objectives for mapped water resources or develop surrogate objectives

Present Ecological State	C	Moderately modified. Loss and change of natural habitat and biota have occurred, but the basic ecosystem functions are still predominantly unchanged.
Ecological importance & sensitivity	High	Features that are considered to be ecologically important and sensitive at a regional scale. The functioning and/or biodiversity of these features are typically moderately sensitive to anthropogenic disturbances. They typically play an important role in providing ecological services at the local scale.
Management Objective	Maintain	
Present Ecological State	B	Largely natural with few modifications. A small change in natural habitats and biota may have taken place but the ecosystem functions are essentially unchanged.
Ecological importance & sensitivity	High	Features that are considered to be ecologically important and sensitive at a regional scale. The functioning and/or biodiversity of these features are typically moderately sensitive to anthropogenic disturbances. They typically play an important role in providing ecological services at the local scale.
Management Objective	Maintain	

Step 4: Assess the risks from proposed developments and define mitigation measures necessary for protecting mapped water resources in the study area

Assess threats of planned activities on water resources and determine desktop buffer requirements

Proposed development / activity	Sector	Mining	This class comprises all mining-related activities including surface and sub-surface mining, quarrying and dredging for the extraction of minerals or materials, including sand and stone.
	Sub-Sector	Low-risk mining operations	Mining operations (including mine and mine waste but excluding underground mining operations) posing a low water quality risk to water resources including mining of the following substances: Antimony (Small mines), Base metals (Copper Cadmium, Cobalt, Iron ore, Molybdenum, Nickel, Tin, Vanadium) - oxide ore, Chrome, Diamonds and precious stones, Phosphate, Platinum, Magnesium, Manganese, Mineral sands (Ilmenite, Titanium, Rutile, Zircon), Zinc and Lead, Industrial Minerals (Andalusite, Barite, Bauxite, Cryolite, Fluorspar)

Climatic factors	MAP Class	601 - 800mm	Rainfall Intensity	Zone 3

Assess the sensitivity of water resources to threats posed by lateral land-use impacts

Stream order	Channel width	Perenniality	Average catchment slope	Inherent runoff potential of catchment soils
1st order	1 – 5m	Episodic systems	>11%	Mod. High (C)
Longitudinal river zonation	**Inherent erosion potential (K factor) of catchment soils**	**Retention time**	**Inherent level of nutrients in the landscape: Is the river/stream and its catchment underlain by sandstone?**	**Inherent buffering capacity**
Mountain stream	0.13 - 0.25	Generally free-flowing (lotic)	Partially	Pure waters with poor pH buffering
Underlying geographical formations	**River depth to width ratio**	**Mean Annual Temperature**	**Level of domestic use**	Note: See the guideline document for further information on the rationale for indicator selection and how these attributes affect the sensitivity of Rivers to lateral inputs.
Primarily Palaeozoic and Mesozoic sedimentary rock formations	> 0.25	Zone 2 (15.5 - 16.9 Deg C)	Low	

Refine desktop buffer requirements based on site-based investigations

Buffer attributes	Buffer Segment 1	Buffer Segment 2	Buffer Segment 3	Buffer Segment 4
Slope of the buffer	Moderate(10.1 - 20%)	Gentle (2.1 - 10%)		
Vegetation characteristics (Construction phase)	High: Dense vegetation, with good basal cover (e.g. natural grass stands)	High: Dense vegetation, with good basal cover (e.g. natural grass stands)		
Vegetation characteristics (Operational phase)	High: Dense vegetation, with good basal cover (e.g. natural grass stands)	High: Dense vegetation, with good basal cover (e.g. natural grass stands)		
Soil permeability	Moderately low: Moderately fine textured soils (e.g. loam)	Moderately low: Moderately fine textured soils (e.g. loam)		
Topography of the buffer zone	Uniform topography: Smooth topography with no concentrated flow paths anticipated.	Uniform topography: Smooth topography with no concentrated flow paths anticipated.		
Site-based aquatic impact buffer requirements (without additional mitigation measures)				
Construction Phase	**44**	**Not Assessed**	**Not Assessed**	**Not Assessed**
Operational Phase	**47**	**Not Assessed**	**Not Assessed**	**Not Assessed**
Site-based aquatic impact buffer requirements (without additional mitigation measures)				
Construction Phase	**42**	**Not Assessed**	**Not Assessed**	**Not Assessed**
Operational Phase	**44**	**Not Assessed**	**Not Assessed**	**Not Assessed**