FAUNAL, AVIFAUNAL, FLORAL AND WETLAND ECOLOGICAL ASSESSMENT AS PART OF THE ENVIRONMENTAL IMPACT ASSESSMENT AND AUTHORISATION PROCESS FOR THE PROPOSED SOLAR PHOTOVOLTAIC POWER PLANT WITH ASSOCIATED INFRASTRUCTURE AT THE ARNOT COAL FIRED POWER STATION, MPUMALANGA PROVINCE

Prepared for

ILISO Consulting (Pty) Ltd

May 2015

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Declaration

This report has been prepared according to the requirements of Section 32 (3b) of the Environmental Impact Assessments EIA Regulations, 2010 (GNR 543). We (the undersigned) declare the findings of this report free from influence or prejudice.

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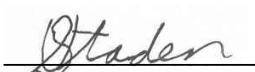


Stephen van Staden

Date: 05/05/2015

EXECUTIVE SUMMARY

Based on the findings of the ecological assessment it is the opinion of the ecologists that from an ecological viewpoint, the proposed project be considered favorably. However, all essential mitigation measures and recommendations presented in this report should be adhered to as to ensure the ecology within the proposed construction areas as well as surrounding zone of influence is protected or adequately rehabilitated in order to minimise the deviations from the Present Ecological State. Particular attention needs to be paid to the location and extent of sensitive terrestrial habitat and wetland systems in order to ensure development related activities do not encroach unnecessarily into these zones and that ongoing functionality of these systems is ensured.

terrestrial ecological assessment as well as wetland assessment as part of environmental impact assessment for the proposed solar photovoltaic power plant with associated infrastructure at the Arnot Coal Fired Power Station, Mpumalanga Province (hereafter referred to as "study area"). The study area is situated close to the Arnot Power Station that is located in Arnot suburb in the Middelburg District in Mpumalanga.

The study area is surrounded by cultivated land and the Arnot Power Station. The ecological assessment was confined to the study area; specifically areas that will be affected by the proposed activity and did not include an ecological assessment of surrounding properties. The surrounding area was however considered as part of the desktop assessment of the area.

This report, after consideration and the description of the ecological integrity of the study area, must guide the Environmental Assessment Practitioner (EAP), regulatory authorities and proponent, by means of presentation of results and recommendations, as to the ecological viability of the proposed development activities.

Floral assessment

- The vegetation assessment was performed within the study area. As the floral characteristics of all alternatives were similar, the floral ecology of the alternatives is discussed together. Two main habitat units/vegetation types were identified during the assessment, namely transformed habitat and wetland habitat.
- The transformed habitat unit comprises areas where historical agricultural activities have occurred and where vegetation has been cleared/mowed as part of maintenance activities around the powerstation. Additional vegetation transformation has also taken place due to the establishment of alien and invasive floral communities, and overgrazing. This habitat unit covers the majority of the study area. The diversity of alien plant species and severe vegetation transformation result in this habitat unit having a low ecological sensitivity and little conservation value from a floral biodiversity perspective.
- Several wetland features were identified around the proposed alternative footprint areas. However, no natural wetlands were encountered within the footprint areas of any of the alternative footprints. All of the natural wetlands have been affected to varying degrees by edge effects from the powerstation, road construction, historic agriculture and general anthropogenic activities, which has negatively affected the habitat integrity of these systems. The wetlands are considered to be in a moderately modified state, and a moderate change in ecosystem processes and loss of natural habitat has taken place, but the natural habitat remains predominantly intact. Therefore, although some wetland areas are more transformed than others, the wetland habitat unit as a whole is considered to be of increased conservational importance from a floral perspective in relation to the surrounding terrestrial areas.
- Thus, where any activities or edge effects associated with the proposed project or infrastructure are likely to affect wetlands, it must be ensured that the disturbance footprint is minimised and that the duration of disturbance is limited. Connectivity of the wetland features in the systems need to be maintained in order to ensure linear protection of water quality within these systems as well as ensuring the continuity of the habitats and resources.

- The Vegetation Index Score (VIS) calculation for the two habitat units can be summarised in the table below:

Habitat unit	Score	Class	Motivation
Transformed habitat	13	**D – Largely modified**	Transformation has occurred within this habitat unit to the degree that secondary grassland conditions prevail and alien and invader species abundance is high. Therefore, this habitat unit is classified as largely modified.
Wetland habitat	15	**C – Moderately modified**	Transformation of the wetland systems include draining of wetlands for agriculture, erosion, vegetation transformation and sedimentation. The wetland systems have an important ecological function in terms of habitat provision for faunal and floral species.

- A moderate to high diversity of alien species occurs within the study area, especially within the transformed areas. Alien species located on the study area need to be removed on a regular basis as part of maintenance activities according to the Conservation of Agricultural Resources Act (Act No. 43 of 1983) (CARA)
- Of the medicinal species found, none are listed as protected or species of conservational concern. Thus, no important medicinal floral communities are considered threatened by the proposed development.
- In terms of floral Species of Conservation Concern (SCC), the PRECIS plant list for the grid reference (2529DD) indicated that no floral SCC occur in this grid. Past disturbance such as crop cultivation activities and overgrazing in the area have led to degradation in overall natural habitat throughout most of the study area. No floral SCC were encountered. However, the most likely habitat for any floral SCC, should they be present, will be the wetlands. Thus by conserving the wetland areas, possible habitat for floral SCC will also be conserved.

Faunal assessment

- No mammal SCC were observed during the site survey. Due to the disturbed nature of the habitat and the proximity to human habitation and development, the probability of any mammal SCC as listed by the Mpumalanga Province State of Environment Report (MP SoER, 2003) being observed within the study area is deemed to be very low. During the site survey, the only mammal observed was that of *Rhabdomys pumilio* (Four-striped Grass Mouse). This is a common species within the province, generally found in open grassland areas and is capable of living in close proximity to human habitation. Due to the transformed nature of the study area, and specifically the transformed grassland areas, it is likely that only the more common mammal species may be encountered within the study area at varying times of the year. Species most likely to be encountered within the study area may include *Galerella sanguinea* (Slender Mongoose), *Lepus saxatilis* (Scrub Hare) and *Ictonyx sriatus* (Striped Polecat).
- The majority of the study area comprises of habitat suitable for grassland birds. Birds occurring in the area have already adapted to the historical anthropogenic activities, and at this stage more common species are present. Several bird species were identified, primarily throughout the transformed habitat areas and in and around the wetland areas located in the study area. The avifaunal species found in the study area are all commonly occurring species, which are well adapted to the already transformed habitat and are presented in the table below. The proposed solar photovoltaic power plant with associated infrastructure is unlikely to pose a threat to avifaunal SCC, provided that the sensitivity map is adhered to and no infringement of possible surface infrastructure occurs within the identified sensitive habitat areas of the study area.
- No reptile species or signs thereof were observed during the site visit. The study area did not contain any rocky areas or structures that may be favoured by reptiles for shelter and refuge, and as such it is deemed highly unlikely that any species listed in the MP SoER (2003) will occur within the study area. The prevalence of better suited habitat in the surrounding areas, not just for reptile species but also for their preferred prey items, is a good indication that the

study area will not be favoured by many reptile species as a permanent habitat zone. As such, any development occurring within the study area is likely to have a very minimal impact on reptile species within the area.

- During the site visit, no amphibian species were identified within the study area, nor was there any ideal amphibian habitat present. The areas surrounding the study area however, are more suited to the habitation of amphibian species. Common amphibian species which may inhabit surrounding areas may include the Plain Grass Frog *(Ptychadena anchietae),* Common Caco *(Cacosternum boettgeri),* Red toad (*Schismaderma carens*), Tremolo sand frog (*Tomopterna cryptotis*) and the Guttural toad (*Amietophrynus gutturalis*). The above mentioned amphibians are all considered not threatened in Mpumalanga Province (MP SoER, 2003) and Least Concern by the IUCN.
- The results from the invertebrate survey indicate that only invertebrate species more common to the area are presently found on the study area. No RDL invertebrate species were observed during the site visit, nor are they expected to occur on the study area due to the present anthropogenic activities and a lack of suitable habitat. The proposed development is unlikely to contribute to a loss of invertebrate diversity in the region.
- During the assessment, specific attention was paid to the identification of suitable habitat for spiders and scorpions. After thoroughly searching, no scorpion or spider species were observed within the study area, nor was any suitable habitat found. As such, it is highly unlikely that the Photovoltaic power plant will impact negatively upon any spider or scorpion species within the study area.

SCCIS assessment

- The SCCSIS assessment of the study areas potential faunal SCC yielded a score of 43%, indicating a medium importance with regards to faunal SCC within the region. All species with a Probability of Occurrence (POC) of 60% or more have an increased probability of either permanently or occasionally inhabiting the study area. The species listed in table 5 are the only species that attained a POC of greater than 60%. These species will most likely only utilise the study area for foraging purposes, however, due to the surrounding areas being more suitable for foraging purposes, these avifaunal species will most likely predominate in these areas and not within the study area.

Wetland assessment

The following general conclusions were drawn upon completion of the wetland assessment:

- Two wetland types, namely a channelled valley bottom wetland and seepage wetland were encountered in close proximity to the study area. All wetland features have been affected by historical on-going agricultural activities and edge effects from the power station and adjacent roads such as stormwater runoff, resulting in inundation, augmentation of sediment deposition and vegetation clearing within the wetlands.
- From the results of the wetland ecological and socio-cultural service assessment, it is evident that the channelled valley bottom wetland feature associated with the study area has moderately high levels of ecological function and service provision. This wetland feature is the most important in terms of flood attenuation, streamflow regulation and Phosphate, Nitrate and toxicant assimilation as it is situated in an agricultural area. Furthermore, this system also plays an important role in erosion control, carbon storage and biodiversity maintenance.
- The seepage wetland feature within the study area obtained a moderately low score in terms of ecological function and service provision, and has been subjected to more transformation than the valley bottom wetland. This wetland feature is most important in terms of Phosphate, Nitrate and Toxicant assimilation as well as being important in terms of carbon storage, biodiversity maintenance and water supply. The results obtained were mainly due to the fact that the wetland feature is situated in an agricultural area and have been subjected to grazing, maize cultivation and topographic alteration.
- The present hydrological state of the seepage wetland falls within Category C (Moderately modified). Erosion and changes in runoff intensity is considered moderate within the wetland system, as a result the calculated score falls within the present geomorphic Category C (Moderately modified) with a possibility of the system deteriorating slightly in future. The

present vegetation state is considered to fall within Category C (Moderately modified). Vegetation composition has been moderately altered but introduced alien and/or ruderal species are still clearly less abundant than characteristic indigenous wetland species, with marginal deterioration of vegetation likely due to edge effects associated with the power station and roads in the area.

- The average score calculated for the channelled valley bottom wetland feature with the use of the IHI, indicates that the feature falls within PES Category C: moderately modified. The wetland feature is located within an area dominated by agricultural activities and livestock grazing. As a result, deviations in water quality are expected to be high. The major impacts noted within the feature are related to alien floral invasion, impoundments traversing the valley bottom wetlands and isolated eroded areas, dominated by bank erosion.
- The score achieved for the EIS assessment places the channelled valley bottom wetland within Category B (The biodiversity of these wetlands may be sensitive to flow and habitat modifications). The wetland feature was important in terms of IHI functionality and a diversity of wetland habitat type for wetland species. The seepage wetland feature falls within Category C (Wetlands that are considered to be ecologically important and sensitive on a provincial or local scale.). This wetland feature did not score a high importance in terms of diversity, habitat and wetland function. However, due to the high score value (critical value) of the wetland vegetation group according to the NFEPA protection stated, this increased the overall score and value of the EIS of the wetland feature.
- The results of the wetland function assessment and IHI assessment, together with the results of the EIS assessment, were used to inform the REC, which is deemed to be a Class B (largely natural with few modifications) for the channelled valley bottom wetland, while for the seepage wetland a Class C (moderately modified) category is recommended.

Impact Assessment Synthesis and Conclusion

Based on the impact assessment, it is evident that there are three possible impacts on flora and fauna and three possible impacts on the wetland ecology within the study area, and the most significant impacts are anticipated to be in the construction phase, while the operational phase impacts are anticipated to be less significant. However, if mitigation measures as provided in this report are implemented, all impacts can be reduced to low to very low significance impacts. The tables below present a summary of anticipated ecological impacts.

Summary of floral impact assessment

Construction phase		
Impact	**Unmanaged**	**Managed**
1: Impact on habitat for floral species	Low	Low
2: Impact on floral diversity	Low	Low
3: Impact on important species	Medium-Low	Low
Operational phase		
Impact	**Unmanaged**	**Managed**
1: Impact on habitat for floral species	Low	Very Low
2: Impact on floral diversity	Low	Low
3: Impact on important species	Medium-Low	Low

Summary of faunal impact assessment

Construction phase		
Impact	**Unmanaged**	**Managed**
1: Impact on faunal habitat and ecological structure	Low	Low
2: Impact on faunal diversity and ecological integrity	Low	Very Low
3: Impact on potential RDL faunal species	Low	Very Low
Operational phase		
Impact	**Unmanaged**	**Managed**
1: Impact on faunal habitat and ecological structure	Low	Very Low
2: Impact on faunal diversity and ecological integrity	Low	Very Low
3: Impact on potential RDL faunal species	Very Low	Very Low

Summary of the wetland impact assessment

Construction phase		
Impact	**Unmanaged**	**Managed**
1: Impact on the loss of wetland habitat and ecological structure	Low	Low
2: Impact on the changes to wetland ecological service provision	Low	Very-Low
3: Impact on wetland hydrological function and sediment balance	Low	Very-Low
Operational phase		
Impact	**Unmanaged**	**Managed**
1: Impact on the loss of wetland habitat and ecological structure	Low	Very-Low
2: Impact on the changes to wetland ecological service provision	Low	Very-Low
3: Impact on wetland hydrological function and sediment balance	Low	Very-Low

Sensitivity

The figure below conceptually illustrates the areas considered to be of increased ecological sensitivity in relation to the proposed project. The areas are depicted according to their sensitivity in terms of faunal and floral habitat integrity and their suitability to provide habitat to faunal and floral communities. The wetlands are considered to be sensitive, as they provide faunal and floral habitat in an area characterised by transformation due to agriculture and also provide migratory corridors for faunal species. The National Environmental Management Act (Act 107 of 1998) stipulates that no activity can take place within 32m of a wetland without the relevant authorisation. In addition, the National Water Act (Act 36 of 1998) states that no diversion, alteration of bed and banks or impeding of flow in watercourses (which includes wetlands) may occur without obtaining a water use licence authorising the proponent to do so. Furthermore, General Notice (GN) 1199 as published in the Government Gazette 32805 of 2009 as it relates to the NWA, 1998 (Act 36 of 1998) states that any activities occurring within 500m of watercourses must be authorised by the DWS.

After consideration of findings during the wetland assessment, a suitable buffer zone was considered for the proposed development. A 32m buffer was prescribed and all non-essential activities should be situated outside of wetland areas and the development footprint and activity footprint in the wetland and associated buffer should be prevented as far as possible. This buffer zone is deemed sufficient to maintain the Present Ecological State, limit any further impact that the proposed development could have and ultimately support the REC. A 500m buffer around the wetlands is also indicated in the figure below in terms of GN1199.

The transformed habitat unit is considered to be of low ecological sensitivity, and any activities situated in these areas, provided that they are implemented responsibly and the mitigation measures contained in this report are adhered to, are expected to have an insignificant impact on the receiving environment.

Analysis of Alternatives

Considering the results of the above faunal and floral assessments, the wetland sensitivities and the locality of the proposed alternatives, no significant difference in impact on faunal, floral or wetland resources is anticipated for any of the footprint alternatives associated with the proposed photovoltaic plants. However, Alternative 1 is anticipated to have the least significant impact on ecological resources associated with the study area, and as such is supported from an ecological perspective.

Mitigation Measures and Recommendations

Development footprint

- A sensitivity map has been developed for the study area, indicating wetlands and an associated 32m buffer zone, which are considered to be of increased ecological importance. It is recommended that this sensitivity map be considered during all development phases to aid in the conservation of floral habitat within the study area.
- No activities are to infringe upon these sensitive areas or associated buffer zones.
- In this regard, Alternative 1 is recommended as the preferred alternative from an ecological perspective.
- All development footprint areas should remain as small as possible.
- All areas of increased ecological sensitivity should be designated as No-Go areas and be off limits to all unauthorised vehicles and personnel. Vehicles should be restricted to travelling

only on designated roadways to limit the ecological footprint of the proposed development activities.
- It must be ensured that waste or spillage and effluent do not affect the sensitive habitat boundaries and associated buffer zones.

Alien floral species
- Removal of the alien and weed species encountered on the property must take place in order to comply with existing legislation (amendments to the regulations under the Conservation of Agricultural Resources Act, 1983 and Section 28 of the National Environmental Management Act, 1998). Removal of species should take place throughout the construction and operational phases.
- Species specific and area specific eradication recommendations:
  - Care should be taken with the choice of herbicide to ensure that no additional impact and loss of indigenous plant species occurs due to the herbicide used.
  - Footprint areas should be kept as small as possible when removing alien plant species.
  - No vehicles should be allowed to drive through designated sensitive wetland areas during the eradication of alien and weed species.

Soils
- It must be ensured that the pollution control system is managed in such a way as to prevent discharge to the receiving environment.

Rehabilitation
- All disturbed habitat areas must be rehabilitated as soon as possible to ensure that floral ecology is re-instated.
- Reseeding with indigenous grasses should be implemented in all affected areas and strategic planting of grassland species should take place to re-establish microclimates and niche habitats.

Fires
- Informal fires should be prohibited during all development phases.

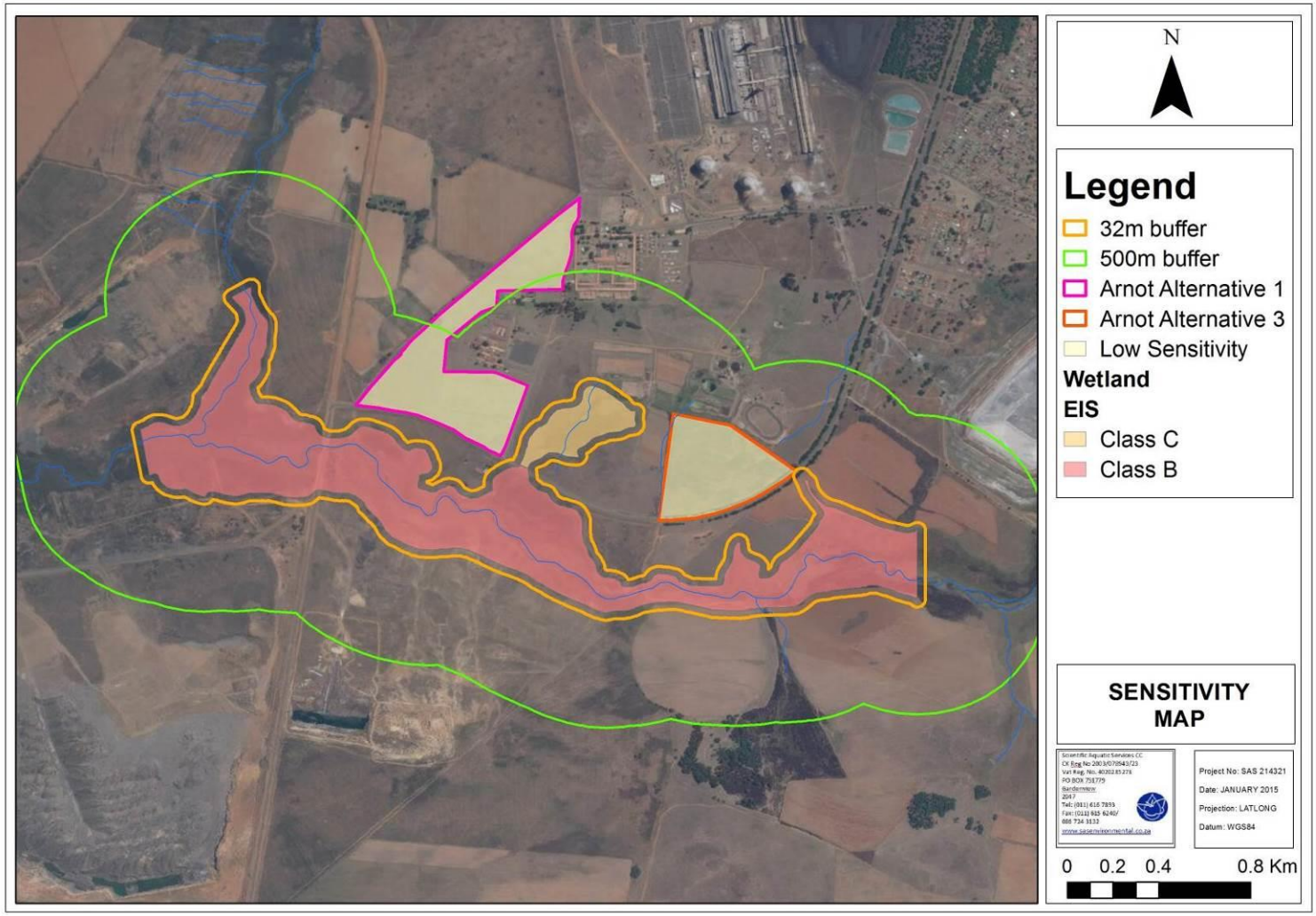
Floral SCC
- Sensitive floral species, if encountered, must be rescued and relocated and are to be handled with care and the relocation of sensitive plant species is to be overseen by a botanist.
- Should any floral SCC be encountered within the proposed development footprint areas, the following should be ensured:
  - If any threatened species, or nationally or provincially protected floral will be disturbed, ensure effective relocation of individuals to suitable similar habitat.
  - All rescue and relocation plans should be overseen by a suitably qualified specialist.

Fauna

- With respect to faunal diversity and habitat intactness, Alternative 1 presents the best option for the construction of the photovoltaic power plant. Although Alternative 3 does not present a higher level of faunal habitat intactness or diversity, the presence of wetlands in close proximity may mean that faunal species utilising the wetlands may be affected by the proposed development if this alternative is pursued.
- It must be ensured that, as far as possible, any proposed surface infrastructure is placed outside of sensitive faunal habitat areas such as wetlands and associated buffer zone.
- No trapping or hunting of fauna is to take place.

Wetlands
- Limit the footprint area of the construction activities to what is absolutely essential in order to minimise environmental damage. Construction vehicles must use existing roads where possible.
- Limit vegetation clearance during the operational phase to the absolute minimum to avoid increased silt loads and runoff velocities and volumes which may affect the hydrology of downstream wetland areas.
- During construction all building materials should be kept out of the wetland areas as well as the associated buffer zones;

- Keep all demarcated sensitive zones outside of the construction area off limits during the construction and rehabilitation phases of the development.
- Appropriate sanitary facilities must be provided during the construction phase and all waste removed to an appropriate waste facility.



Sensitivity Map for the study area.

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SECTION A

Background Information and Methods of Assessment

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GLOSSARY OF TERMS

Biome	A broad ecological unit representing major life zones of large natural areas – defined mainly by vegetation structure and climate.
Endangered	Organisms in danger of extinction if causal factors continue to operate.
Indigenous vegetation	Vegetation occurring naturally within a defined area.
RDL (Red Data listed) species	Organisms that fall into the *Extinct in the Wild (EW), critically endangered (CR), Endangered (EN), Vulnerable (VU)* categories of ecological status.

ACRONYMS

°C	Degrees Celsius
EIA	Environmental Impact Assessment
ha	Hectares
m	Metres.
mm	Millimetres.
MAMSL	Metres above mean sea level.
MAP	Mean annual precipitation.
MAPE	Mean annual potential for evaporation.
MASMS	Mean annual soil moisture stress.
MAT	Mean Annual Temperature
MRA	Mining Rights Application
PES	Present Ecological State
PRECIS	Pretoria Computer Information Systems.
QDS	Quarter degree square (1:50,000 topographical mapping references).
RDSIS	Red Data Sensitivity Index Score
SANBI	South African National Biodiversity Institute

1 INTRODUCTION

1.1 Background

Scientific Aquatic Services (SAS) was appointed to conduct a faunal, avifaunal, floral and general terrestrial ecological assessment as well as wetland assessment as part of environmental impact assessment for the proposed solar photovoltaic power plant with associated infrastructure at the Arnot Coal Fired Power Station, Mpumalanga Province (hereafter referred to as “study area”). The study area is situated within the Arnot Power Station that is located in Arnot suburb in the Middelburg District in Mpumalanga.

The study area is surrounded by cultivated land and the Arnot Power Station. The ecological assessment was confined to the study area (approximately 26 hectares for Alternative 1 and 15 hectares for Alternative 3); specifically areas that will be affected the proposed activity and did not include an ecological assessment of surrounding properties. The surrounding area was however considered as part of the desktop assessment of the area.

This report, after consideration and the description of the ecological integrity of the study area, must guide the Environmental Assessment Practitioner (EAP), regulatory authorities and proponent, by means of the presentation of results and recommendations, as to the ecological viability of the proposed development activities.

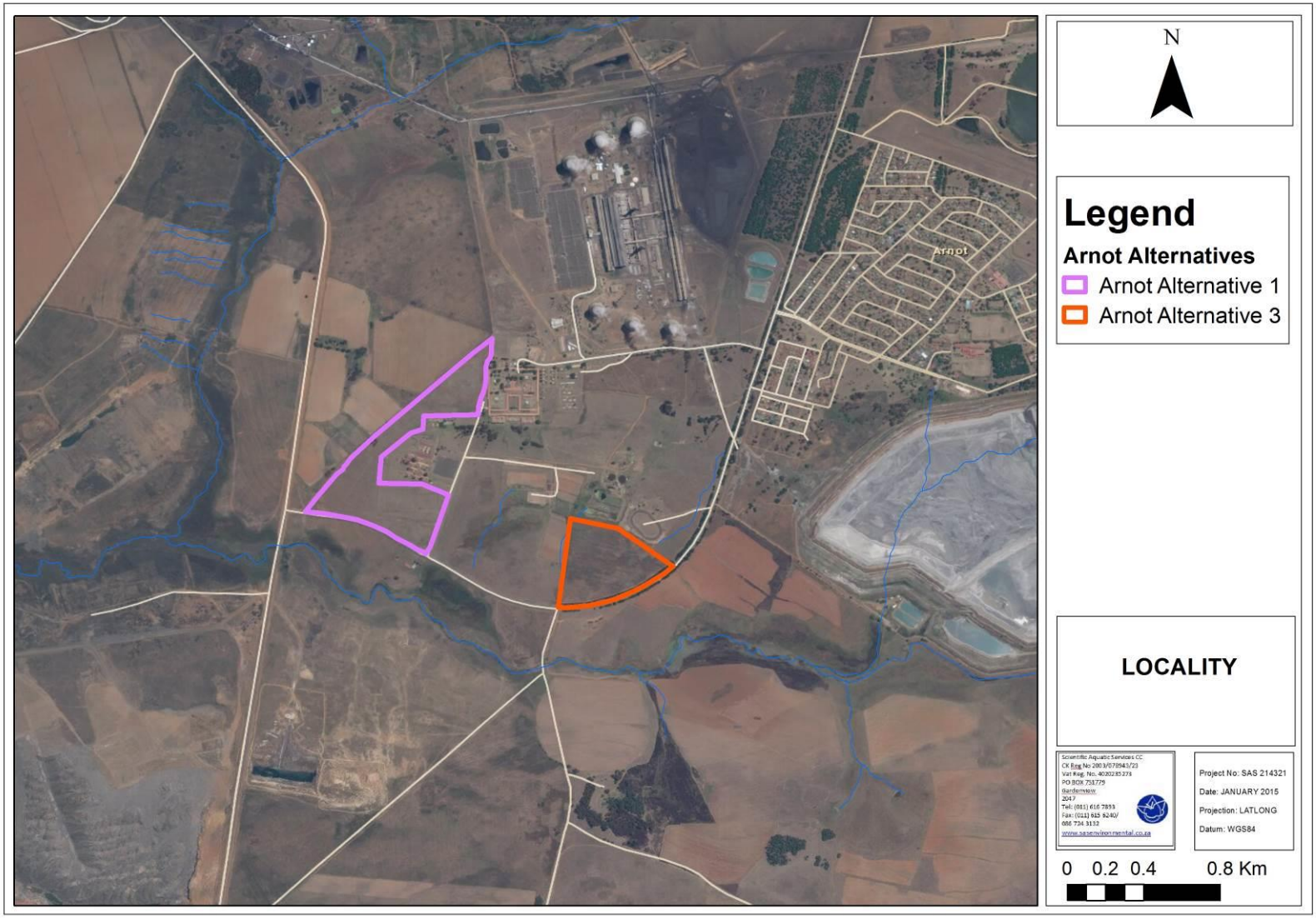

Figure 1: Digital Satellite image depicting the location of the study area in relation to surrounding areas.

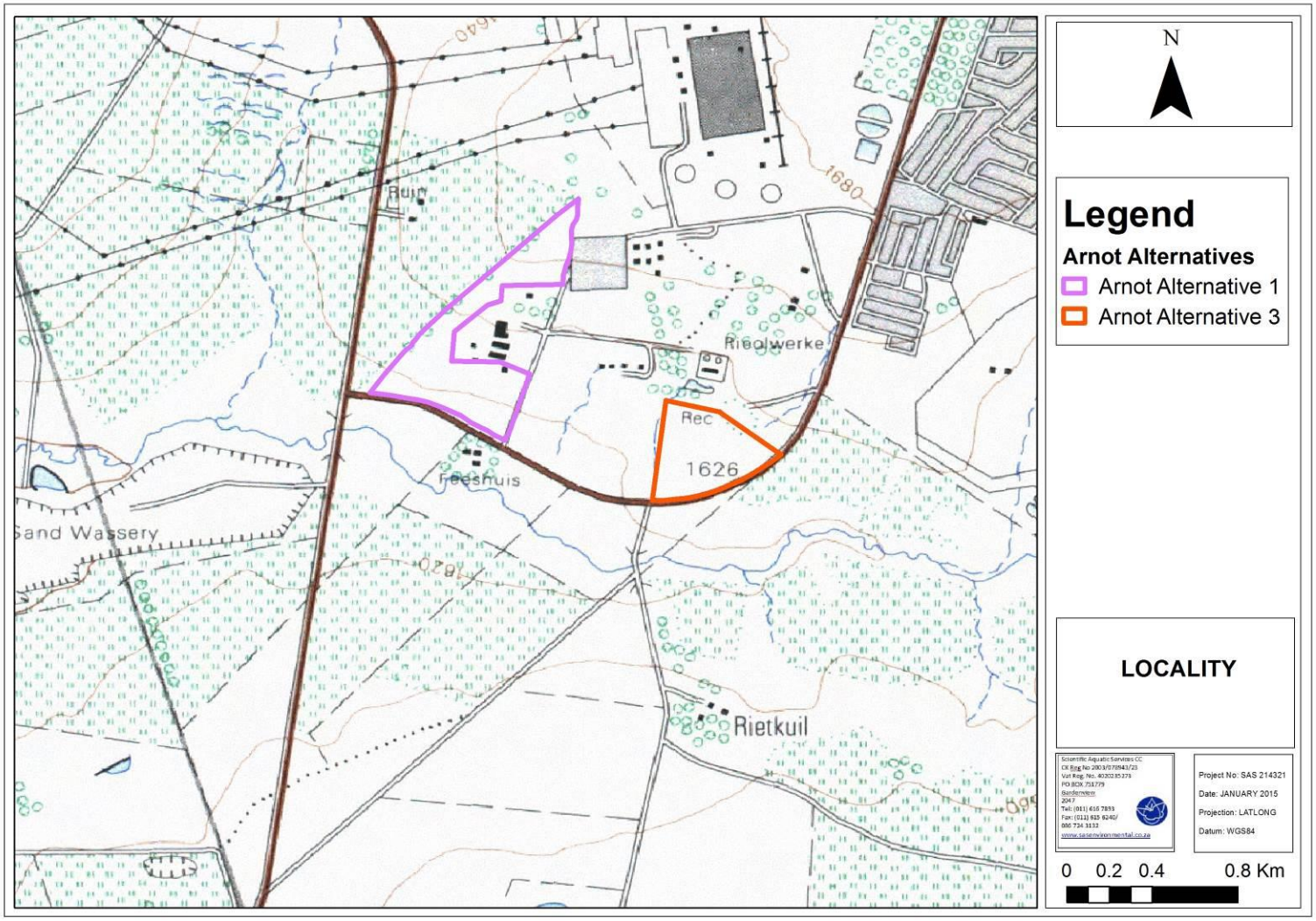

Figure 2: Study area depicted on a 1:50 000 topographical map in relation to its surrounding area.

1.2 Project Scope

Specific outcomes in terms of this report are outlined below.

Ecological Assessment:

- To conduct a Red Data Listed (RDL) species assessment, including potential for species to occur on the study area and the implementation of a Red Data Sensitivity Index Score (RDSIS) for the study area;
- To provide faunal and floral inventories of species as encountered on site;
- To determine and describe habitats, communities and ecological state of the study area;
- To describe the spatial significance of the study area with regards to surrounding natural areas; and
- To identify and consider all sensitive landscapes including rocky ridges, wetlands and/or any other special features; and
- To determine the environmental impacts of the proposed activity on the terrestrial ecology within the study area.
- To present management and mitigation measures in order to assist in minimising the impact on the receiving environment

Wetland Assessment:

- To define the Present Ecological State (PES) of each wetland system within the study area;
- To characterise the identified HGM Units according to the Classification System for Wetlands (Ollis *et al*., 2013);
- To determine the functioning of each system and the environmental and socio-cultural services that the system provide;
- To advocate a Recommended Ecological Category (REC) for each wetland feature;
- To delineate all wetlands or riparian zones occurring within the assessment site and
- To determine the environmental impacts of the proposed activity on the wetland areas within the study area.
- To present management and mitigation measures which should be implemented during the various development phases to assist in minimising the impact on the receiving aquatic environment.

1.3 Assumptions and Limitations

The following assumptions and limitations are applicable to this report:

- The ecological assessment is confined to the study area and does not include the neighbouring and adjacent properties; these were however considered as part of the desktop assessment.
- Due to the nature and habits of most faunal taxa it is unlikely that all species would have been observed during a site assessment of limited duration. Therefore, site observations are compared with literature studies where necessary.
- With ecology being dynamic and complex, some aspects (some of which may be important) may have been overlooked. It is, however, expected that most faunal and floral communities have been accurately assessed and considered.
- Sampling by its nature, means that not all individuals are assessed and identified. Some species and taxa on the study area may therefore been missed during the assessment.
- The wetland assessment is confined to the study area as illustrated in Figures 1 & 2, as well as areas of relevance immediately adjacent to the study area and does not include the neighbouring and adjacent properties. The general surroundings were however considered in the desktop assessment of the study area.
- The wetland delineation as presented in this report is regarded as a best estimate of the wetland boundary based on the site condition present at the time of the assessment and limitations in the accuracy of the delineation due to disturbances created by grazing, existing development and anthropogenic disturbances are deemed possible.
- Wetland and terrestrial areas form transitional areas where an ecotone is formed as vegetation species change from terrestrial species to facultative and obligate wetland species. Within the transition zone some variation of opinion on the wetland boundary may occur, however if the Department of Water Affairs (DWA), 2005 method is followed, all assessors should get largely similar results.

2 ASSESSMENT APPROACH

2.1 General approach

In order to accurately determine the PES of the study area and capture comprehensive data with respect to wetland, faunal and floral taxa, the following methodology was used:

- Maps, aerial photographs and digital satellite images were consulted prior to the field assessment in order to determine broad habitats, vegetation types and potentially sensitive sites. An initial visual on-site assessment of the study area was made in order to confirm the assumptions made during consultation of the maps.
- Literature review with respect to habitats, vegetation types and species distribution was conducted.
- Relevant data bases considered during the assessment of the study area included the South African National Biodiversity Institute (SANBI) Threatened species programme (TSP) and Pretoria Computer Information Systems (PRECIS).
- Site visits were undertaken during December 2014 to determine the ecological status within the study area. A reconnaissance 'drive around' followed by thorough 'walk through' on foot was undertaken.
- Specific methodologies for the assessment, in terms of field work and data analysis of faunal, floral and wetland ecological assemblages will be presented in the relevant sections along with the methodologies for assessing the integrity and function of wetland systems.

2.2 Ecological Impact Assessment Methodology

In order for the EAP to allow for sufficient consideration of all environmental impacts, impacts were assessed using a common, defensible method of assessing significance that will enable comparisons to be made between risks/ impacts and will enable authorities, stakeholders and the client to understand the process and rationale upon which risks/ impacts have been assessed. The method to be used for assessing risks/ impacts is outlined in the sections below.

The first stage of risk/ impact assessment is the identification of environmental activities, aspects and impacts. This is supported by the identification of receptors and resources, which allows for an understanding of the impact pathway and an assessment of the sensitivity to change. The definitions used in the impact assessment are presented below.

- An **activity** is a distinct process or task undertaken by an organisation for which a responsibility can be assigned. Activities also include facilities or infrastructure possessed by an organisation.
- An **environmental aspect** is an 'element of an organizations activities, products and services which can interact with the environment'[1]. The interaction of an aspect with the environment may result in an impact.

[1] The definition has been aligned with that used in the ISO 14001 Standard.

- **Environmental risks/impacts** are the consequences of these aspects on environmental resources or receptors of particular value or sensitivity, for example, disturbance due to noise and health effects due to poorer air quality. In the case where the impact is on human health or wellbeing, this should be stated. Similarly, where the receptor is not anthropogenic, then it should, where possible, be stipulated what the receptor is.
- **Receptors** can comprise, but are not limited to, people or human-made systems, such as local residents, communities and social infrastructure, as well as components of the biophysical environment such as wetlands, flora and riverine systems.
- **Resources** include components of the biophysical environment.
- **Frequency of activity** refers to how often the proposed activity will take place.
- **Frequency of impact** refers to the frequency with which a stressor (aspect) will impact on the receptor.
- **Severity** refers to the degree of change to the receptor status in terms of the reversibility of the impact; sensitivity of receptor to stressor; duration of impact (increasing or decreasing with time); controversy potential and precedent setting; threat to environmental and health standards.
- **Spatial extent** refers to the geographical scale of the impact.
- **Duration** refers to the length of time over which the stressor will cause a change in the resource or receptor.

The significance of the impact is then assessed by rating each variable numerically according to the defined criteria. The purpose of the rating is to develop a clear understanding of influences and processes associated with each impact. The severity, spatial scope and duration of the impact together comprise the consequence of the impact and when summed can obtain a maximum value of 15. The frequency of the activity and the frequency of the impact together comprise the likelihood of the impact occurring and can obtain a maximum value of 10. The values for likelihood and consequence of the impact are then read off a significance rating matrix and are used to determine whether mitigation is necessary[2].

The assessment of significance is undertaken twice. Initial significance is based only natural and existing mitigation measures (including built-in engineering designs). The subsequent assessment takes into account the recommended management measures required to mitigate the impacts. Measures such as demolishing infrastructure, and reinstatement and rehabilitation of land, are considered post-mitigation.

[2] Some risks/impacts that have low significance will however still require mitigation

The model outcome of the impacts was then assessed in terms of impact certainty and consideration of available information. The Precautionary Principle is applied in line with the National Environmental Management Act (No. 108 of 1997) (NEMA) in instances of uncertainty or lack of information by increasing assigned ratings or adjusting final model outcomes. In certain instances where a variable or outcome requires rational adjustment due to model limitations, the model outcomes have been adjusted.

Table 1: Criteria for assessing significance of impacts.

LIKELIHOOD DESCRIPTORS

Probability of impact	**RATING**
Highly unlikely	1
Possible	2
Likely	3
Highly likely	4
Definite	5
Sensitivity of receiving environment	**RATING**
Ecology not sensitive/important	1
Ecology with limited sensitivity/importance	2
Ecology moderately sensitive/ /important	3
Ecology highly sensitive /important	4
Ecology critically sensitive /important	5

CONSEQUENCE DESCRIPTORS

Severity of impact	**RATING**
Insignificant / ecosystem structure and function unchanged	1
Small / ecosystem structure and function largely unchanged	2
Significant / ecosystem structure and function moderately altered	3
Great / harmful/ ecosystem structure and function Largely altered	4
Disastrous / ecosystem structure and function seriously to critically altered	5
Spatial scope of impact	**RATING**
Activity specific/ < 5 ha impacted / Linear features affected < 100m	1
Development specific/ within the site boundary / < 100ha impacted / Linear features affected < 100m	2
Local area/ within 1 km of the site boundary / < 5000ha impacted / Linear features affected < 1000m	3
Regional within 5 km of the site boundary / < 2000ha impacted / Linear features affected < 3000m	4
Entire habitat unit / Entire system/ > 2000ha impacted / Linear features affected > 3000m	5
Duration of impact	**RATING**
One day to one month	1
One month to one year	2
One year to five years	3
Life of operation or less than 20 years	4
Permanent	5

Table 2: Significance rating matrix.

LIKELIHOOD (Frequency of activity + Frequency of impact)	CONSEQUENCE (Severity + Spatial Scope + Duration)														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30
	3	6	9	12	15	18	21	24	27	30	33	36	39	42	45
	4	8	12	16	20	24	28	32	36	40	44	48	52	56	60
	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75
	6	12	18	24	30	36	42	48	54	60	66	72	78	84	90
	7	14	21	28	35	42	49	56	63	70	77	84	91	98	105
	8	16	24	32	40	48	56	64	72	80	88	96	104	112	120
	9	18	27	36	45	54	63	72	81	90	99	108	117	126	135
	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150

Table 3: Positive/Negative Mitigation Ratings.

Significance Rating	Value	Negative Impact Management Recommendation	Positive Impact Management Recommendation
Very high	126-150	Improve current management	Maintain current management
High	101-125	Improve current management	Maintain current management
Medium-high	76-100	Improve current management	Maintain current management
Medium-low	51-75	Maintain current management	Improve current management
Low	26-50	Maintain current management	Improve current management
Very low	1-25	Maintain current management	Improve current management

The following points were considered when undertaking the assessment:

- Risks and impacts were analysed in the context of the project's area of influence encompassing:
  - Primary project site and related facilities that the client and its contractors develops or controls;
  - Areas potentially impacted by cumulative impacts for further planned development of the project, any existing project or condition and other project-related developments; and
  - Areas potentially affected by impacts from unplanned but predictable developments caused by the project that may occur later or at a different location.
- Risks/ Impacts were assessed for all stages of the project cycle including:
  - Pre-construction;
  - Construction;
  - Operation; and
  - Rehabilitation/ Decommissioning and Closure.
- If applicable, transboundary or global effects were assessed;

- Individuals or groups who may be differentially or disproportionately affected by the project because of their *disadvantaged* or *vulnerable* status were assessed.
- Particular attention was paid to describing any residual impacts that will occur after rehabilitation.

2.3 Sensitivity Mapping

All the ecological features of the study area were considered and sensitive areas were delineated with the use of a Global Positioning System (GPS). In addition identified locations of protected species were also marked by means of GPS. A Geographic Information System (GIS) was used to project these features onto aerial photographs and topographic maps. The sensitivity map should guide the design and layout of the proposed development.

2.4 Recommendations

Recommendations were developed to address and mitigate impacts associated with the proposed development. These recommendations also include general management measures which apply to the proposed development as a whole. Mitigation measures have been developed to address issues in all phases throughout the life of the operation from planning, through construction, operation and closure through to after care and maintenance.

3 LAND USE AND CONSERVATION CHARACTERISTICS OF THE STUDY AREA

The following sections (Sections 3.1 – 3.8) contain data accessed as part of the desktop assessment. It is important to note, that although all data sources used provide useful and often verifiable, high quality data, the various databases used not always provide an entirely accurate indication of the study area's actual site characteristics. This information is however considered to be useful as background information to the study. Thus, this data was used as a guideline to inform the assessment and areas where increased conservation importance is indicated were paid attention to.

3.1 National List of Threatened Terrestrial Ecosystems for South Africa (2011)

The National Environmental Management: Biodiversity Act (Act 10 of 2004) (NEMBA) provides for listing of threatened or protected ecosystems, in one of four categories: critically

endangered, endangered, vulnerable or protected. Threatened ecosystems are listed in order to reduce the rate of ecosystem and species extinction by preventing further degradation and loss of structure, function and composition of threatened ecosystems. The purpose of listing protected ecosystems is primarily to conserve sites of exceptionally high conservation value (SANBI, BGIS).

According to the National List of Threatened Terrestrial Ecosystems (2011), portions of the study area fall within the remaining extent of the Vulnerable Eastern Highveld Grassland (Figure 3).

3.2 NPAES Focus Areas for Protected Area Expansion

The goal of the National Protected Area Expansion Strategy (NPAES) is to achieve cost effective protected area expansion for ecological sustainability and adaptation to climate change. The NPAES sets targets for protected area expansion, provides maps of the most important areas for protected area expansion, and makes recommendations on mechanisms for protected area expansion. It deals with land-based and marine protected areas across all of South Africa's territory (SANBI BGIS).

According to the NPAES database, the study area is not affected by areas earmarked as part of the NPAES.

3.3 National Biodiversity Assessment (NBA), 2011

The latest NBA (2011) provides an assessment of South Africa's biodiversity and ecosystems, including headline indicators and national maps for the terrestrial, freshwater, estuarine and marine environments. The NBA 2011 was led by the South African National Biodiversity Institute (SANBI) in partnership with a range of organisations. It follows on from the National Spatial Biodiversity Assessment, 2004, broadening the scope of the assessment to include key thematic issues as well as a spatial assessment. The NBA 2011 includes a summary of spatial biodiversity priority areas that have been identified through systematic biodiversity plans at national, provincial and local levels (SANBI BGIS).

According to the NBA (2011), the study area is not protected, and it is not located within a formally or informally protected area.

3.4 Importance According to the Mpumalanga Biodiversity Sector Plan (MBSP), 2014

The purpose of the MBSP is to ensure that the most adequate and up to date spatial biodiversity information is utilised to inform land-use and development planning, environmental assessments and authorisations, natural resource management and conservation action. The MBSP aims to illustrate terrestrial and aquatic biodiversity on a fine scale and to define areas that are important for conserving biodiversity patterns and ecological processes, classified as Critical Biodiversity Areas (CBAs) or Ecological Support Areas (ESAs).

It is important to note that the MBSP was developed to update and improve the previous provincial systematic biodiversity plan known as the Mpumalanga Biodiversity Conservation Plan (MBCP, 2006) and thus the MBSP should be used as the official reference to define priority areas to be taken into account in land-use planning and decision making for the Mpumalanga Province.

The terrestrial CBAs are divided into five categories, some of which are further divided into sub-categories. These categories included: Protected Areas (sub-categories; National Parks & Nature Reserves), CBAs (Irreplaceable & Optimal), ESAs (Landscape Corridor, Local Corridor, Species Specific & Protected Buffer Area), Other Natural Areas (ONAs) and Moderately or Heavily Modified Areas. The freshwater CBAs are divided into four categories, some of which are also further divided into sub-categories. These include the following: CBA (Rivers, Wetlands & Aquatic Species), ESA (Wetland Clusters, Wetlands, Important sub-catchments, Fish Support Area &Strategic Water Source Areas), ONAs and Moderately or Heavily Modified Areas.

According to the MBSP the following criteria apply to the study area:

- The majority of the study area, especially Alternative 3, falls within a moderately modified (old lands) and ONAs. The south western portion of Alternative 1 also falls within a Critical Biodiversity Area (CBA) that is irreplaceable, According to the MBSP moderately modified areas are classified as cultivated lands that have been allowed to recover (within the last 80 years), and support some natural vegetation. Although biodiversity patterns and ecological functioning may have been compromised, the areas may still play a role in supporting biodiversity and providing ecosystem services (Figure 4);
- An ESA Wetland is present in close proximity of the Alternative 1 and 3 (Figure 5). ESA Wetlands are all non-FEPA wetlands. Although not classed as FEPAs, these

wetlands support the hydrological functioning of rivers, water tables and freshwater biodiversity, as well as providing a host of ecosystem services through the ecological infrastructure that they provide;

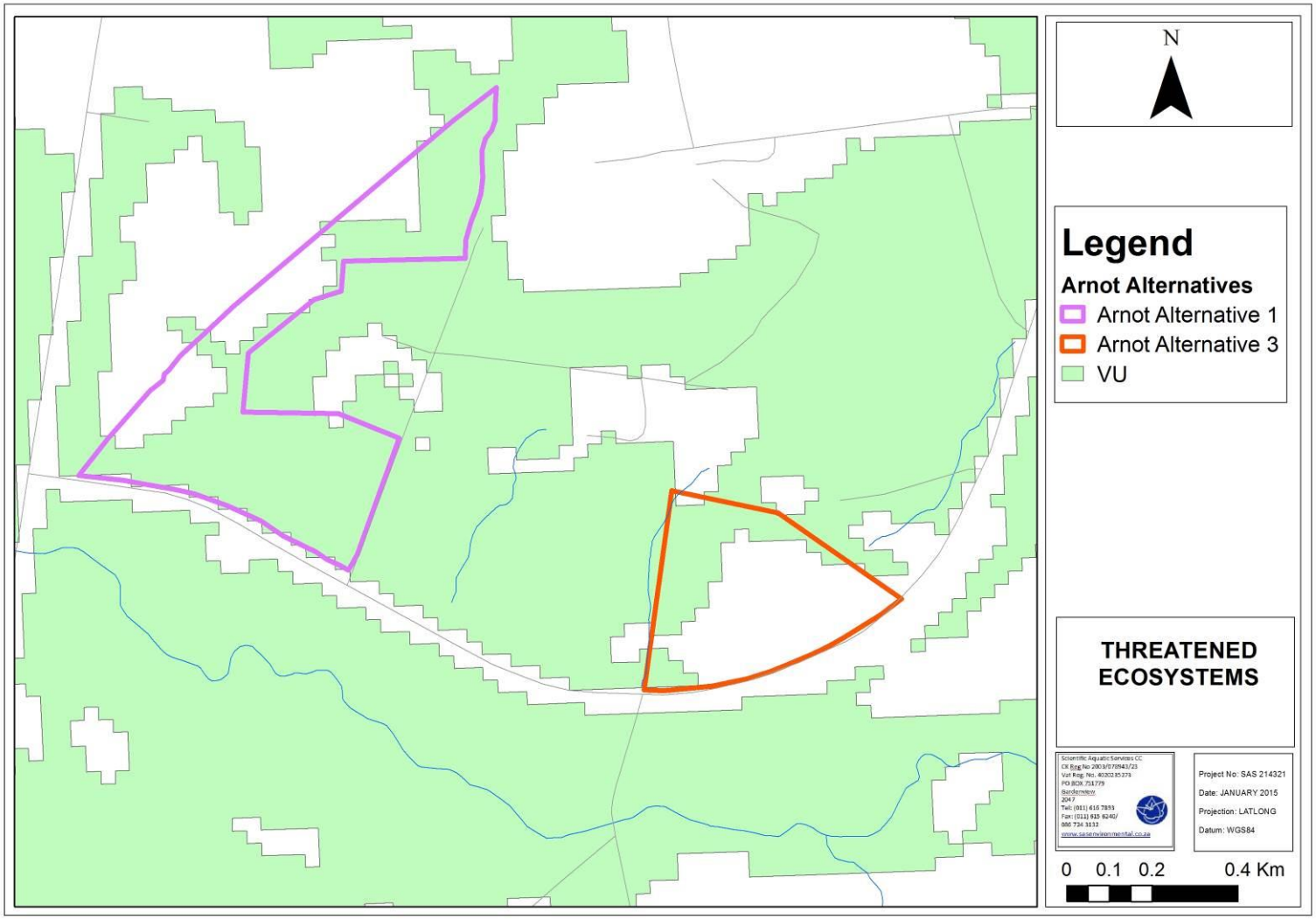

Figure 3: National Threatened Ecosystems (2011) layer illustrating the status of the area surrounding the study area.

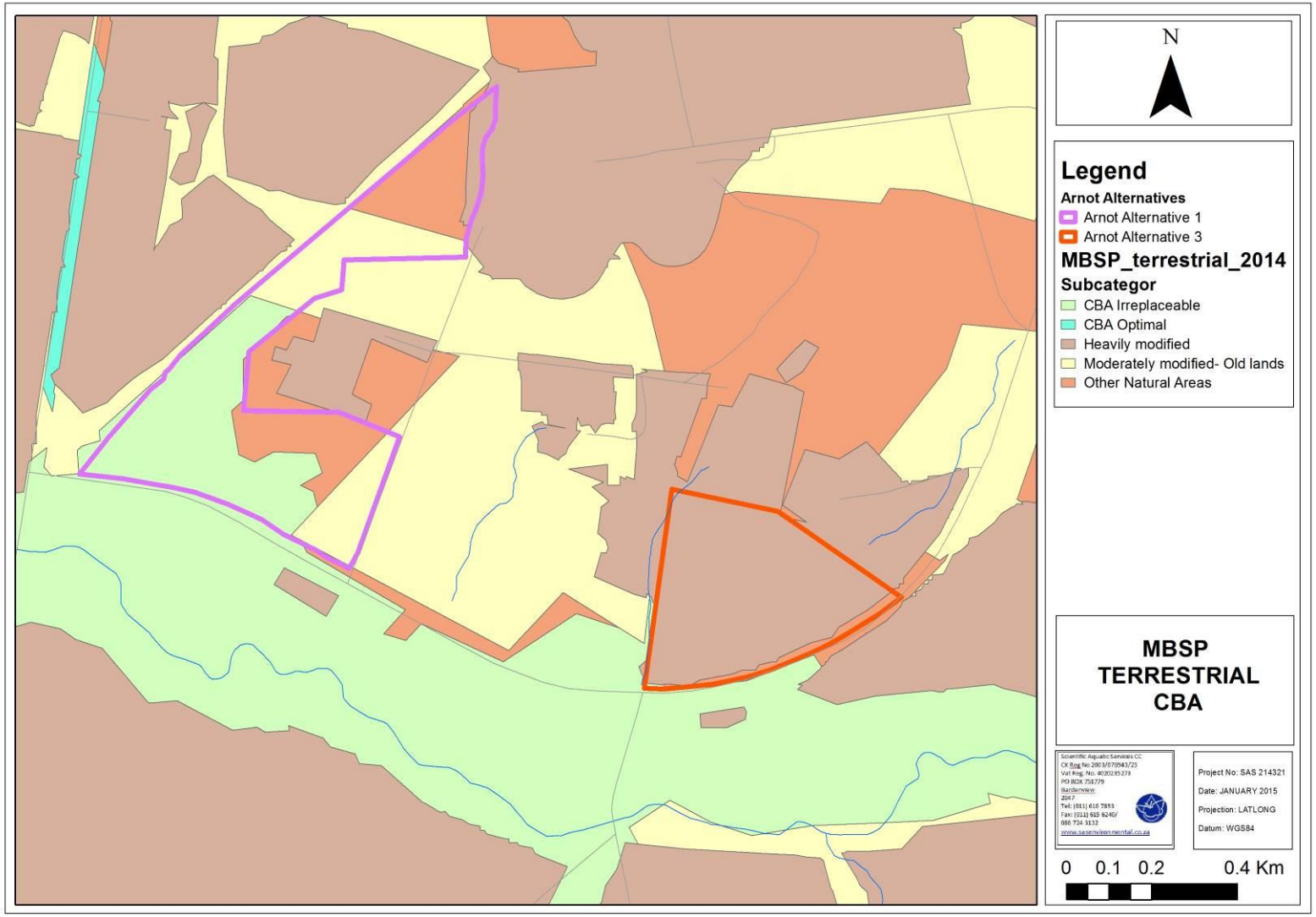

Figure 4: MBSP illustrating the Terrestrial Biodiversity Assessment of the study area and its surroundings.

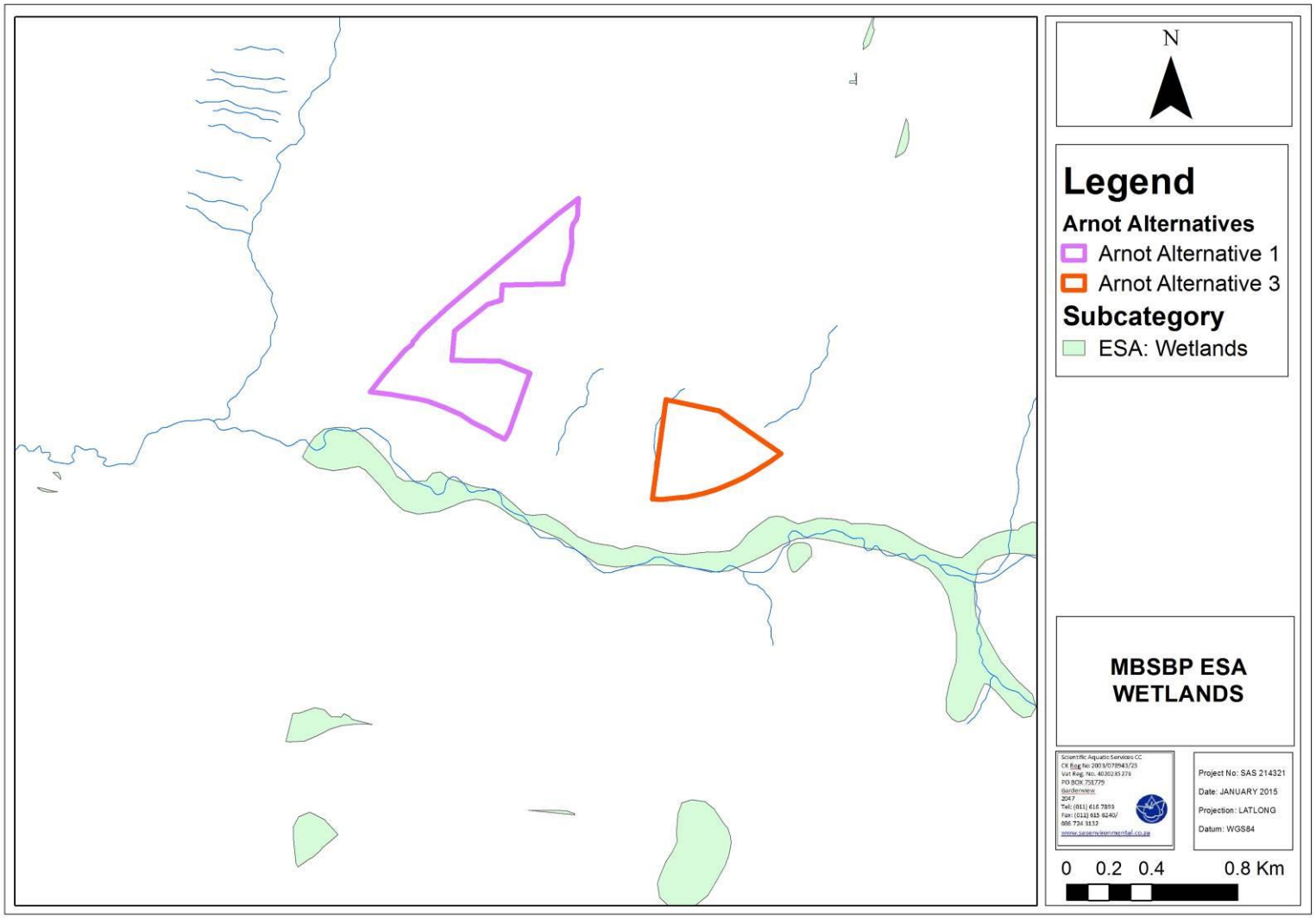

Figure 5: The MBSP Freshwater Assessment layer indicating the ESA Wetlands in relation to the study area.

4 SURROUNDING PROPERTIES/LAND USES

The study area is characterised by agricultural activities and the Arnot Power Station. Historically much of the area was utilised for agricultural activities with special mention of maize. With habitat transformation taking place in the area due to these activities, significant local and regional loss of biodiversity has taken place. In addition there has been a significant increase in the impact on water quality and wetland and aquatic resources in the area. For this reason the need to minimise the impact of proposed development activities on the remaining natural resources in the area is deemed to be of high significance. This report aims to ensure that these aspects are adequately considered during the decision making process for the proposed mining development.

5 STRUCTURE OF THE REPORT

Section A of this report served to provide an introduction to the study area, the general approach to the study as well as the method of impact assessment. Section A also presents the results of general desktop information reviewed as part of the study including the information generated by the relevant authorities as well as the context of the site in relation to the surrounding anthropogenic activities and ecological character. The section also indicates that the requirements for mitigation, monitoring and rehabilitation are addressed in each section.

Section B addresses all the issues pertaining to the assessment of the floral ecology of the study area.

Section C addresses all the issues pertaining to the assessment of the faunal ecology of the study area.

Section D addresses all the issues pertaining to the assessment of the wetland ecology of the study area.

6 REFERENCES

Acocks, J. P. H. 1988 Third Edition. *Veld Types of South Africa.* Memoirs of the Botanical Survey of South Africa No. 57, Botanical Research Institute, RSA

Kleynhans C.J. 1999. A procedure for the determination of the ecological reserve for the purposes of the national water balance model for South African River. Institute of Water Quality Studies, Department of Water Affairs & Forestry, Pretoria

Kotze D.C., Marneweck G.C., Batchelor A.L., Lindley D.S. and Collins N.B. 2005. WET-EcoServices – A technique for rapidly assessing ecosystem services supplied by wetlands

MTPA. 2014. Mpumalanga Biodiversity Sector Plan Handbook**.**

MP SoER, 2003. 2003 Mpumalanga State of the Environment Report.

Mpumalanga Department of Agriculture, Conservation and Environment, Nelspruit.

http://www.environment.gov.za/soer/reports/mpumalanga/MPU_SOE_Report_2003.pdf

Mucina, L. & Rutherford, M.C. (Eds). 2006. *The Vegetation of South Africa, Lesotho and Swaziland.* Strelitzia 19. South African National Biodiversity Institute, Pretoria, RSA

National Environmental Management Act (NEMA) 107 of 1998

National Water Act 36 of 1998

Rutherford, M.C. 1997. Categorization of biomes. In: Cowling RM, Richardson DM, Pierce SM (eds.) Vegetation of Southern Africa. Cambridge University Press, Cambridge, pp. 91-98 ISBN 0-521-57142-1

Rutherford, M.C. & Westfall, R. H. 1994. *Biomes of Southern Africa: An objective categorization.* National Botanical Institute, Pretoria, RSA

The South African National Biodiversity Institute - Biodiversity GIS (BGIS) *[online].* URL: http://bgis.sanbi.org as retrieved on 28/03/2013

The South African National Biodiversity Institute is thanked for the use of data from the National Herbarium, Pretoria (PRE) Computerised Information System (PRECIS)