Royal HaskoningDHV

# Final Environmental Impact Assessment Report for the Proposed Continuous Ash Disposal Facility for the Matimba Power Station in Lephalale, Limpopo Province

December 2015

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# Document Description

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**Eskom Holdings SOC Ltd**

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**Environmental Impact Assessment Report for the Proposed Continuous Ash Disposal Facility for the Matimba Power Station in Lephalale, Limpopo Province**

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Compiled by:

**Prashika Reddy**

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Location:

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Review and approval:

**Malcolm Roods**

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# Glossary

**Alternatives** - Different means of meeting the general purpose and requirements of the activity, which may include site or location alternatives; alternatives to the type of activity being undertaken; the design or layout of the activity; the technology to be used in the activity and the operational aspects of the activity.

**Construction** – The building, erection or establishment of a facility, structure or infrastructure that is necessary for the undertaking of a listed or specified activity but excludes any modification, alteration or expansion of such a facility, structure or infrastructure and excluding the reconstruction of the same facility in the same location, with the same capacity and footprint.

**Cumulative impact** - The impact of an activity that in itself may not be significant but may become significant when added to the existing and potential impacts eventuating from similar or diverse activities or undertakings in the area.

**Do-nothing alternative** - The 'do-nothing' or 'No go' alternative is the option of not undertaking the proposed activity, that is, the maintenance of the status quo.

**Environmental Assessment Practitioner (EAP)** - The individual responsible for planning, management and coordination of environmental impact assessments, strategic environmental assessments, environmental management programmes or any other appropriate environmental instrument introduced through the EIA Regulations.

**Environmental Management Programme (EMPr)** - A detailed plan of action prepared to ensure that recommendations for enhancing or ensuring positive impacts and limiting or preventing negative environmental impacts are implemented during the life cycle of a project. The EMPr focuses on the construction phase, operation (maintenance) phase and decommissioning phase of the proposed project.

**Environmental Impact** - A change to the environment, whether adverse or beneficial, wholly or partially, resulting from an organisation's activities, products or services.

**Expansion** - The modification, extension, alteration or upgrading of a facility, structure or infrastructure at which an activity takes place in such a manner that the capacity of the facility or the footprint of the activity is increased.

**Fatal Flaw** – Issue or conflict (real or perceived) that could result in a development being rejected or stopped. Such an issue or conflict would be considered to be a significant issue that mitigation could not address.

**Integrated Environmental Management** - A philosophy that prescribes a code of practice for ensuring that environmental considerations are fully integrated into all stages of the development and decision-making process. The IEM philosophy (and principles) is interpreted as applying to the planning, assessment, implementation and management of any proposal (project, plan, programme or policy) or activity - at local, national and international level - that has a potentially significant effect on the environment. Implementation of this philosophy relies on the selection and application of appropriate tools for a particular proposal or activity. These may include environmental assessment tools (such as strategic environmental assessment and risk assessment), environmental management tools (such as monitoring, auditing and reporting) and decision-making tools (such as multi-criteria decision support systems or advisory councils).

**Interested and Affected Party** - For the purposes of Chapter 5 of the NEMA and in relation to the assessment of the environmental impact of a listed activity or related activity, means an interested and affected party contemplated in Section 24(4)(a)(v), and which includes - (a) any person, group of persons or organisation interested in or affected by such operation or activity; and (b) any organ of state that may have jurisdiction over any aspect of the operation or activity.

**Mitigate** - The implementation of practical measures designed to avoid, reduce or remedy adverse impacts, or to enhance beneficial impacts of an action.

**Watercourse** – Means:

a) a river or spring;
b) a natural channel or depression in which water flows regularly or intermittently;
c) a wetland, lake or dam into which, or from which, water flows; and
d) any collection of water which the Minister may, by notice in the Gazette, declare to be a watercourse as defined in the National Water Act, 1998 (No. 36 of 1998) and a reference to a watercourse includes, where relevant, its bed and banks.

**Wetland** - Land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil.

# Abbreviations and Acronyms

| | |
|---|---|
| AIDS | Acquired Immune Deficiency Syndrome |
| ADF | Ash Disposal Facility |
| CA | Competent Authority |
| CFA | Coal Fly Ash |
| DEA | National Department of Environmental Affairs |
| DWA | Department of Water Affairs |
| DWS | Department of Water and Sanitation (previously DWA) |
| EAP | Environmental Assessment Practitioner |
| EC | Electrical Conductivity |
| EIA | Environmental Impact Assessment |
| EIAR | Environmental Impact Assessment Report |
| EMF | Environmental Management Framework |
| EMPr | Environmental Management Programme [previous terminology – Environmental Management Plan (EMP)] |
| ESR | Environmental Scoping Report |
| ESS | Environmental Scoping Study |
| GIS | Geographic Information System |
| GNR | Government Notice Regulation |
| GRIP | Groundwater Resource Information Project |
| HDNS | High Density Noise Sensitive |
| HIV | Human Immunodeficiency Virus |
| I&AP | Interested and Affected Party |
| IDP | Integrated Development Plan |
| IEM | Integrated Environmental Management |
| IEA | Integrated Environmental Authorisation |
| IUCN | International Union for Conservation of Nature |
| LDEDET | Limpopo Department of Economic Development, Environment and Tourism |
| LLM | Lephalale Local Municipality |
| MAE | Mean Average Evaporation |
| MAP | Mean Annual Precipitation |
| MAR | Mean Annual Run-off |
| NEM: AQA | National Environmental Management: Air Quality Act (No. 39 of 2004) |
| NEM: BA | National Environmental Management: Biodiversity Act (No. 10 of 2004) |
| NEM: WA | National Environmental Management: Waste Act (No. 59 of 2008) |
| NEMA | National Environmental Management Act (No. 107 of 1998) |

| | |
|---|---|
| NGA | National Groundwater Archive |
| NGO | Non-Governmental Organisation |
| NHRA | National Heritage Resources Act (No. 25 of 1999) |
| NWA | National Water Act (No. 36 of 1998) |
| PP | Public Participation |
| PoS | Plan of Study |
| PFD | Process Flow Diagram |
| SAHRA | South African Heritage Resources Agency |
| SA | Site Alternative |
| SANBI | South African National Biodiversity Institute |
| SANS | South African National Standard |
| SDF | Spatial Development Framework |
| SIA | Social Impact Assessment |
| SWMP | Stormwater Management Plan |
| TWINSPAN | Two Way Indicator Species Analysis Technique |
| US EPA | United States Environmental Protection Agency |
| WML | Waste Management Licence |
| WUL | Water Use Licence |

# 1 INTRODUCTION

Eskom Holdings SOC Ltd (Eskom) is mandated by the South African Government to ensure the provision of reliable and affordable power to South Africa. Eskom's core business is the generation, transmission and distribution of electricity. Eskom generates approximately 95% of the electricity used in South Africa. The reliable provision of electricity by Eskom is critical for economic development in South Africa.

The Matimba Power Station in Lephalale, Limpopo Province, is a 3990 MW installed capacity base load coal-fired power station, consisting of six units. Matimba is a direct dry cooling power station, an innovation necessitated by the severe shortage of water in the area where it is situated. The station obtains its coal from Exxaro's Grootegeluk Colliery for the generation of electricity.

Ash is generated as a by-product from combustion of coal from the power station and Matimba produces approximately 6 million tons of ash annually. This ash is currently being disposed by means of 'dry ashing' approximately 3 km south of the Matimba Power Station.

The proposed project entails the development of an ash disposal facility (ADF) and associated infrastructure which may be a continuation of the existing facility or may be a new facility requiring an airspace capacity of 276 249 000 $m^3$ for the next 40 years of operation (2015 – 2055) of the power station.

This proposed project is located within the Lephalale Local Municipality in the Waterberg District Municipality, Limpopo Province (Figure 1 and **Appendix A**).

## 1.1 Project Justification

Approximately 6 million tons of ash is produced annually from the Matimba Power Station. The proposed ADF will ensure that the power station is able to accommodate the ashing requirements for its remaining life (approximately 40 years). If the ADF is not constructed, Matimba Power Station will not be able to continue with its electricity generation operations for its remaining life because of unavailability of an ADF.

Matimba Power Station thus, envisages aligning the continuation of the ash disposal (dry ashing) processes for the remaining life of the power station with the current waste legislation i.e. the National Environmental Management: Waste Act (NEM:WA), Act 59 of 2008. Therefore, the necessary licencing in terms of the Environmental Impact Assessment (EIA) Regulations (2010) promulgated under the National Environmental Management Act (NEMA) Act 107 of 1998 (as amended) is required.

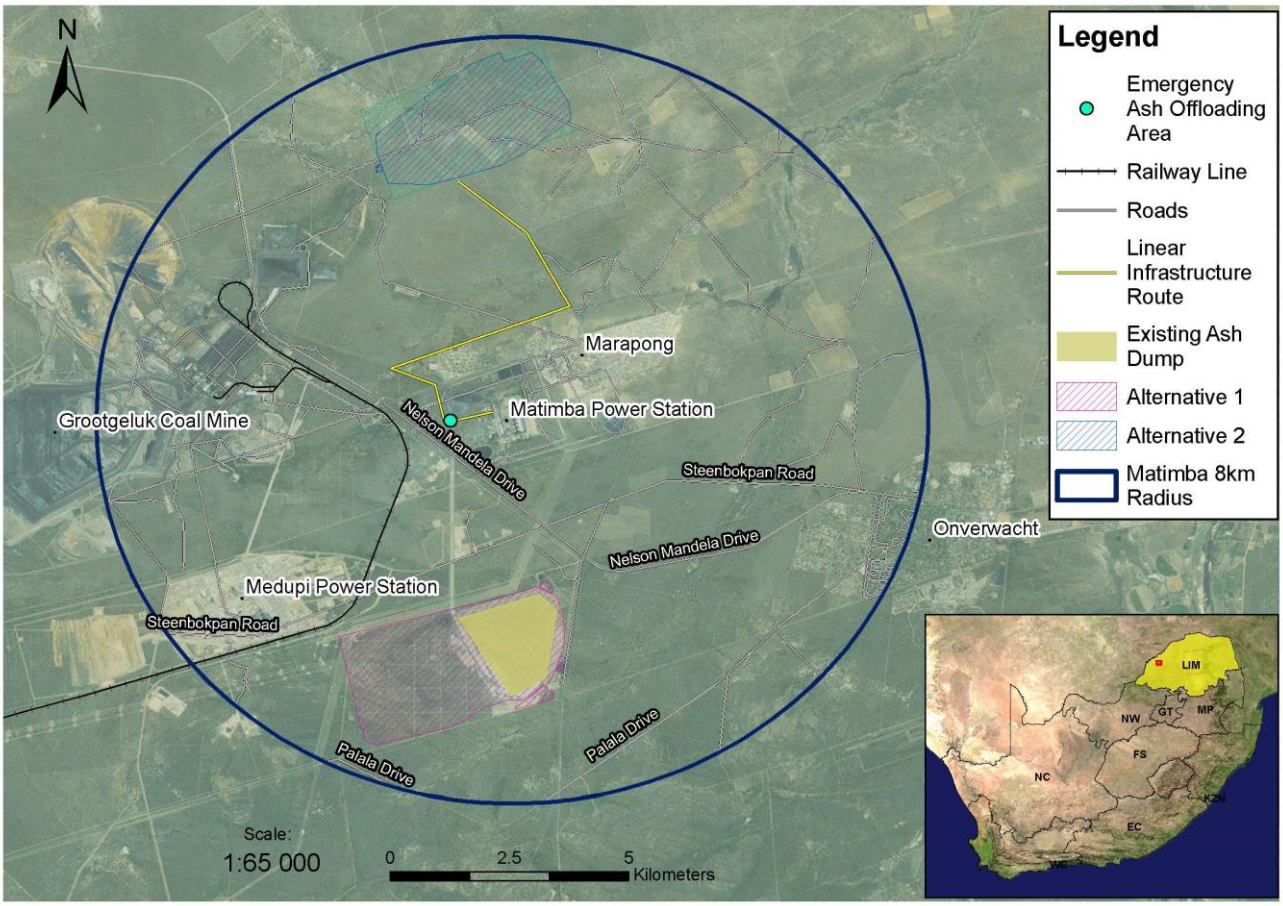



**Figure 1: Locality map**

## 1.2 Approach to the Environmental Impact Assessment Study

The environmental impacts associated with the proposed project require investigation in compliance with the EIA Regulations (2010) published in Government Notice (GN) No. R. 543 to No. R. 546 and read with Section 24 (5) of the National Environmental Management Act (No 107 of 1998) as amended. In addition, GN No. 921 of 2013 (*List of waste management activities that have, or are likely to have a detrimental effect on the environment),* GN R. 634 of 2013 (*Waste Classification and Management Regulations*); GN R. 635 of 2013 (*National Norms and Standards for Assessment of Waste for Landfill Disposal*) and GN R. 636 of 2013 (*National Norms and Standards for Disposal of Waste to Landfill*) of the National Environmental Management: Waste Act (No 59 of 2008) will also be considered in this study.

An Integrated Environmental Authorisation (IEA) process is being undertaken; this is because a Waste Management Licence (WML) and an Environmental Authorisation (EA) are required for the proposed project. The Department of Environmental Affairs (DEA) is the Competent Authority (CA) that will issue a decision for the project and the Limpopo Department of Economic Development, Environment and Tourism (LDEDET) is the commenting authority for this IEA process.

The EIA process is being undertaken in two phases (Figure 2) that will ultimately allow the Competent Authority to make an informed decision:

- Phase 1 – Environmental Scoping Study (ESS) including, site selection and Plan of Study for EIA - *complete*; and
- Phase 2 – Environmental Impact Assessment (EIA) and Environmental Management Programme (EMPr).

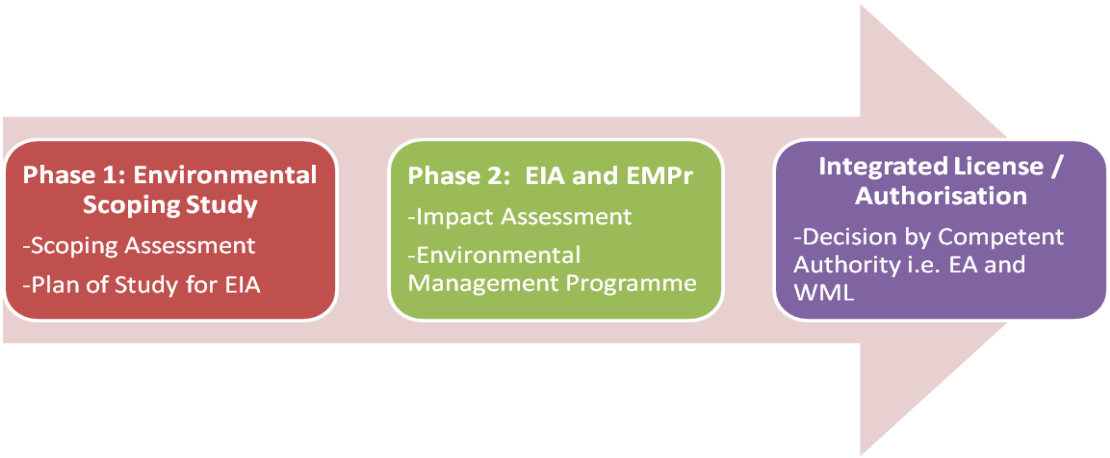



**Figure 2: Environmental studies flowchart**

### 1.2.1 Conclusions of the Environmental Scoping Study (ESS)

The ESS provided a description of the receiving environment and how the environment may be affected by the proposed continuous ADF. The ESS aimed to identify any fatal flaws, alternatives and mitigation options to be evaluated and investigated during the EIA phase of the project.

Desktop studies making use of existing information and a site visit were used to highlight and assist in the identification of potential significant impacts (both social and biophysical) associated with the proposed project.

Additional issues for consideration were extracted from feedback during the public participation process, which commenced at the beginning of the Scoping phase, and which will continue throughout the duration of the project. All issues identified during the ESS were documented within the Environmental Scoping Report. The final Environmental Scoping Report (ESR) and Plan of Study for EIA were submitted to the Department of Environmental Affairs on 25 July 2013 and accepted on 03 September 2013.

### 1.2.2 Environmental Impact Study

The Environmental Impact Study aimed to achieve the following:

- to provide an overall assessment of the social and biophysical environments of the affected area by the proposed project;
- to undertake a detailed assessment of the site alternatives and linear infrastructure route in terms of environmental criteria including the rating of significant impacts;
- to identify and recommend appropriate mitigation measures (to be included in an EMPr) for potentially significant environmental impacts; and
- to undertake a fully inclusive public participation process to ensure that Interested and Affected Party (I&AP) issues and concerns are recorded and commented on and addressed in the EIA process.

#### *1.2.2.1 Environmental Impact Assessment Report Structure*

This Environmental Impact Assessment Report (EIAR) has therefore, been compiled in accordance with the accepted Plan of Study and incorporates the findings and recommendations from the Scoping Study as well as specialist studies conducted for the project.

In addition, this EIAR is being compiled according to the guidelines provided in Section 31 of Government Notice R.543 of the EIA Regulations (2010).

## Table 1: EIAR requirements according to Section 31 of GN R. 543

| EIAR Requirements according to Section 31 of GN R. 543 | Chapter/Section |
|---|---|
| (a) details of<br>i) the EAP who prepared the report; and<br>ii) the expertise of the EAP to carry out an environmental impact assessment | 1.4 |
| (b) a detailed description of the proposed activity | 2 |
| (c) a description of the property on which the activity is to be undertaken and the location of the activity on the property, or if it is<br>(i) a linear activity, a description of the route of the activity; or<br>(ii) an ocean-based activity, the coordinates where the activity is to be undertaken. | 2.2; 3.1 |
| (d) a description of the environment that may be affected by the activity and the manner in which the physical, biological, social, economic and cultural aspects of the environment may be affected by the proposed activity | 6 |
| (e) details of the public participation process conducted in terms of sub regulation (1), including-<br>(i) steps undertaken in accordance with the plan of study;<br>(ii) a list of all persons, organizations and organs of state that were registered as interested and affected parties;<br>(iii) a summary of comments received from, and a summary of issues raised by registered interested and affected parties, the date of receipt of these comments and the response of the EAP to those comments; and<br>(iv) copies of any representations and comments received from registered interested and affected parties. | 7 |
| (f) a description of the need and desirability of the proposed activity | 4 |
| (g) a description of identified potential alternatives to the proposed activity including advantages and disadvantages that the proposed activity or alternatives may have on the environment and the community that may be affected by the activity | 3 |
| (h) an indication of the methodology used in determining the significance of potential environmental impacts | 9.1 |
| (i) a description and comparative assessment of all alternatives identified during the environmental impact assessment process | 9; 9.14 |
| (j) a summary of the findings and recommendations of any specialist report or report on a specialised process | 8 |
| (k) a description of all environmental issues that were identified during the environmental impact assessment process, an assessment of the significance of each issue and an indication of the extent to which the issue could be addressed by the adoption of mitigation measures | 9 |
| (l) an assessment of each identified potentially significant impact, including-<br>i) cumulative impacts<br>ii) the nature of the impact<br>iii) the extent and duration of the impact<br>iv) the probability of the impact occurring<br>v) the degree to which the impact can be reversed<br>vi) the degree to which the impact may cause irreplaceable loss of resources<br>vii) the degree to which the impact can be mitigated | 9 |
| (m) a description of any assumptions, uncertainties and gaps in knowledge | 10.4 |
| (n) a reasoned opinion as to whether the activity should or should not be authorised, and if the opinion is that it should be authorised, any conditions that should be made in respect of the authorisation | 10 |
| (o) an environmental impact statement which contains-<br>i) A summary of the key findings of the environmental impact assessment; and<br>ii) A comparative assessment of the positive and negative implications of the proposed activity and identified alternatives | 10 |
| (p) a draft environmental management programme containing the aspects contemplated in regulation 33; | **Appendix S** |
| (q) copies of any specialist reports and reports on specialised processes complying with regulation 32; | **Appendix S** |
| (r) any specific information that may be required by the competent authority; and | - |
| (s) any other matters required in terms of sections 24 (4) (a) and (b) of the Act | - |

### 1.2.2.2 Specialist Studies

Royal HaskoningDHV was assisted by various specialists in order to comprehensively identify both potentially positive and negative environmental impacts (social and biophysical) associated with the project and where possible mitigate these potential impacts. These specialists and their fields of expertise are outlined in Table 2.

**Table 2: Specialist studies**

| Specialist Field | Specialist and Organisation | Peer Reviewer |
|---|---|---|
| Soils and Agricultural Potential | *Dr Johan van der Waals – Terra Soil Science* | Not applicable |
| Biodiversity Assessment | *Riaan Robbeson – Bathusi Environmental Consulting*<br>*Dewald Kamffer – Faunal Specialists Incorporated* | Not applicable |
| Geohydrology Assessment | *Claudia Brites – GCS Water & Environmental Consultants* | Not applicable |
| Hydrology Assessment | *Karen King – GCS Water & Environmental Consultants* | Not applicable |
| Geology and Geotechnical | *Sodhie Naicker – Kai Batla Mineral Industry Consultants* | Not applicable |
| Social Impact Assessment | *Hilda Bezuidenhout - Private* | Not applicable |
| Heritage Assessment | *Johnny van Schalkwyk – Private* | Not applicable |
| Noise Impact Assessment | *Derek Cosijn – Jongens Keet Associates* | Not applicable |
| (Environmental) Engineering Design (including waste classification study) | *Richard Emery and Lloyd Wallace – Jeffares and Green (Pty) Ltd* | Not applicable |
| Surface Water (Wetlands) Assessment | *Paul da Cruz – Royal HaskoningDHV* | Stephen van Staden - Scientific Aquatic Services |
| Visual Impact Assessment | *Paul da Cruz – Royal HaskoningDHV* | Paul Buchholz - Aurecon |
| Air Quality Impact Assessment | *Stuart Thompson – Royal HaskoningDHV* | Nicola Walton - Rayten Engineering Solutions |
| Traffic Impact Assessment | *Ivan Reutener – Royal HaskoningDHV* | Andrew Bulman - Gibb |

### 1.2.2.3 Draft Environmental Management Programme

As part of this EIAR, a draft EMPr (finalised with comments from the draft EIAR review period) has been compiled in accordance with Section 33 of the EIA Regulations (2010). The draft EMPr provides the actions for the management of identified environmental impacts emanating from the proposed ADF and a detailed outline of the implementation programme to minimise and/or eliminate the anticipated negative environmental impacts. The draft EMPr provides strategies to be used to address the roles and responsibilities of environmental management personnel on site, and a framework for environmental compliance and monitoring.

The EMPr includes the following:

a) Details of the person who prepared the EMPr and the expertise of the person to prepare an EMPr;

b) Information on any proposed management or mitigation measures that will be taken to address the environmental impacts that have been identified in the EIAR, including environmental impacts or objectives in respect of operation:

   i. Planning and design
   ii. Pre-construction and construction activities
   iii. Operation or undertaking of the activity
   iv. Rehabilitation of the environment
   v. Closure where relevant

c) A detailed description of the aspects of the activity that are covered by the draft EMPr;

d) An identification of the persons who will be responsible for the implementation of the measures;

e) Proposed mechanisms for monitoring compliance with and performance assessment against the EMPr and reporting thereon;

f) Measures to rehabilitate the environment affected by the undertaking of any listed activity to its natural or predetermined state or to a land use which conforms to the generally accepted principle of sustainable development, including where appropriate, concurrent or progressive rehabilitation measures;

g) A description of the manner in which it intends to-

   i. Modify, remedy, control or stop any action, activity or process which causes pollution or environmental degradation.

   ii. Remedy the cause of pollution or degradation and migration of pollutants.

   iii. Comply with any prescribed environmental management standards or practises.

   iv. Comply with any applicable provisions of the Act regarding closure, where applicable.

   v. Comply with any provisions of the Act regarding financial provisions for rehabilitation, where applicable.

h) Time periods within which the measures contemplated in the draft EMPr must be implemented;

i) The process for managing any environmental damage, pollution or ecological degradation as result of undertaking a listed activity.

j) An environmental awareness plan describing the manner in which-

   i. The Applicant intends to inform his or her employees of any environmental risk which may result from their work; and

   ii. Risks must be dealt with in order to avoid pollution or the degradation of the environment.

k) Closure plans including closure objectives where relevant.

#### *1.2.2.4 Finalisation of the draft EIAR and EMPr*

The draft EIAR and EMPr has been finalised with comments received during the review period (28 April to 01 June 2015). Additions/revisions from the draft EIAR to the final EIAR have been underlined and highlighted for ease of reference to the reader.

The final EIAR was released for registered I&AP comment from 23 July – 12 August 2015. No comments were received.

## 1.3 Concurrent Licencing Processes

### 1.3.1 Water Use Licence

In terms of Chapter 4 of the National Water Act [NWA], (No 36 of 1998) activities and processes associated with the proposed ADF are required to be licenced by the Department of Water and Sanitation (DWS).

The Matimba Power Station currently holds a Water Use Licence (WUL) for the power station's operations and all its related activities. Following the advice of DWS, Eskom will need to amend its current WUL, but this will be in the form of a new application. Consultation with the DWS is currently underway and a pre-application meeting has taken place with the Department (**Appendix E – Authority Consultation**).

The following water uses as defined in section 21 of the NWA, are applicable for the proposed project (Table 3):

**Table 3: Water uses associated with the proposed project**

| Water Use | Description |
|---|---|
| Section 21 (c) | Impeding or diverting the flow of water in a watercourse |
| Section 21 (e) | Engaging in a controlled activity identified as such in section 37 (1) (which includes the intentional recharging of an aquifer with any waste or water containing waste) or declared under section 38 (1) |
| Section 21 (g) | Disposing of waste in a manner which may detrimentally impact on a water resource |
| Section 21 (i) | Altering the bed, banks, course or characteristics of a watercourse |

## 1.4 Details of the Environmental Assessment Practitioner

Royal HaskoningDHV is the service provider appointed by Eskom to provide independent Environmental Assessment Practitioner (EAP) services in the undertaking of appropriate environmental studies for this proposed project.

The professional team of Royal HaskoningDHV have considerable experience in the environmental management and EIA fields. Royal HaskoningDHV has been involved in and/or managed several of the largest Environmental Impact Assessments undertaken in South Africa to date. A specialist area of focus is on the assessment of multi-faceted projects, including the establishment of linear developments (national and provincial roads, and power lines), bulk infrastructure and supply (e.g. wastewater treatment works, pipelines, landfills), electricity generation and transmission, the mining industry, urban, rural and township developments, environmental aspects of Local Integrated Development Plans (LIDPs), as well as general environmental planning, development and management.

The particulars of the EAP are presented in Table 4 below.

**Table 4: Details of EAP**

| Details | |
|---|---|
| Consultant: | Royal HaskoningDHV (formerly known as SSI Engineers and Environmental Consultants (Pty) Ltd) |
| Contact Persons: | Prashika Reddy and Malcolm Roods |
| Postal Address | PO Box 867; Gallo Manor; 2052, Johannesburg |
| Telephone: | 012 367 5800 / 011 798 6442 |
| Facsimile: | 012 367 5878 / 011 798 6010 |
| E-mail: | prashika.reddy@rhdhv.com / malcolm.roods@rhdhv.com |
| Expertise: | Prashika Reddy is a Principal Associate (*Pr Sci Nat* 400133/10) with a BSc Honours in Geography. Ms Reddy has the necessary experience in various environmental fields including: environmental impact assessments, environmental management plans/programmes, public participation and environmental monitoring and auditing. Ms Reddy has extensive experience in compiling environmental reports (Screening, Scoping, EIA and *Status Quo* Reports). Ms Reddy is/has been part of numerous multi-faceted large–scale projects, including the establishment of linear developments (roads, and power lines); industrial plants; electricity generation plants and mining-related projects.<br><br>Malcolm Roods is a Principal with Royal HaskoningDHV specializing in Environmental Impact Assessments (EIA) for electricity supply (generation, transmission and distribution), road infrastructure, residential developments as well as water management projects. His past experiences include 6 years public service which included policy development, environmental law reform and EIA reviews. His experience also includes 5 years of environmental consulting in the field of Impact Assessment and Authorisation Applications, with a focus on legislative requirements and sector area management. He is also a certified Environmental Assessment Practitioner with the Interim Certification Board (ICB) for EAP of South Africa. |

CVs of the EAPs are attached in **Appendix B**.

# 2 PROJECT DESCRIPTION

## 2.1 Current Ashing Philosophy

The ash (coarse and fly ash) generated through the combustion of coal at the power station is transported via a series of conveyors (Coarse ash, Transverse, Cross and Overland conveyors) to the ADF located on the farm Zwartwater 507 LQ. At the ADF, the ash conveyor system consists of two conveyor systems running parallel to each other. The first system serves the front system (Spreader) and the second system serves the back system (Stacker). These systems are interchangeable at the transfer houses until Transfer House 6 where the ash will be placed onto a specific system (either the main or standby system) – refer to Figure 3.

The stacker and spreader machines are linked to the tripper car by a link conveyor (refer to Figure 3). At the spreader machine, the link conveyor is fixed to the tripper car and is not able to be slewed. The ash is deposited directly onto the spreader discharge boom. The spreader machine is a mobile crawler mounted machine with a single fixed boom. The spreader is designed to operate in a number of parallel operations and cannot slew in operation as it is not fixed to the link conveyor. The spreader is, thus, less flexible in operation than the stacker and is only intended to be used as a standby system.

The stacker machine also receives ash from the tripper car. Ash is transferred from the shiftable conveyor via the tripper car onto the stacker link conveyor and then onto the stacker discharge boom. In contrast to the spreader machine's single fixed discharge boom, the stacker consists of separate link and discharge boom conveyors, each of which is capable of slewing independently of each other. The stacker link boom is connected to both the stacker and the tripper car and can move both radially and vertically relative to the tripper car. The stacker can deposit more ash per shift due to its flexibility in slewing and its longer reach. It is, therefore, used as the main ash disposal system. The split in operation between the stacker and spreader machines is 70% and 30% respectively.

The ash is currently deposited using a radial shifting stacker and spreader system. It is envisaged that the operators of the ADF will make use of a combination of parallel and radial shifting stacker systems in order to accommodate the total volume of disposed ash over the design life of the facility.

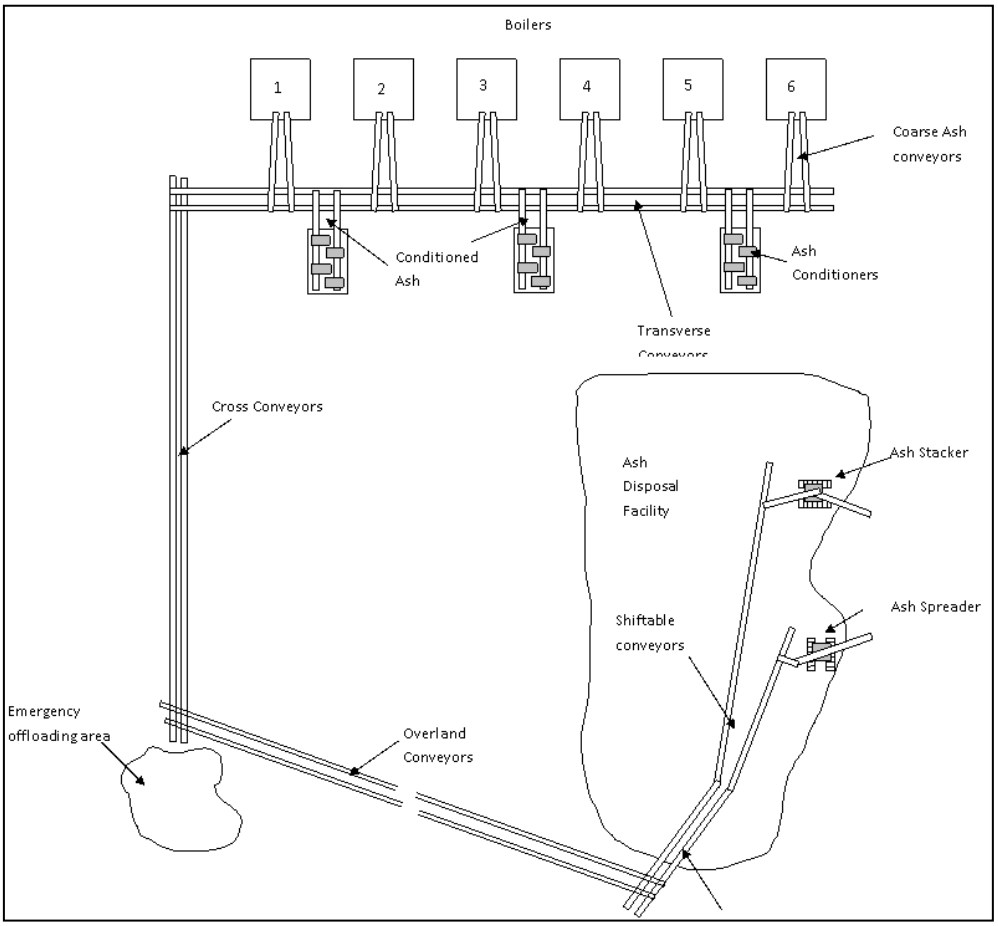



**Figure 3: Current ashing process**

The stacker-spreader system develops a front stack area in lifts of approximately 45 m high. The back stack face develops behind the initial front stack lift and is placed in lifts of approximately 12 m high. The ash that is placed in this manner will come to rest at the angle of repose, at approximately 1V:2H (refer to Figure 4).

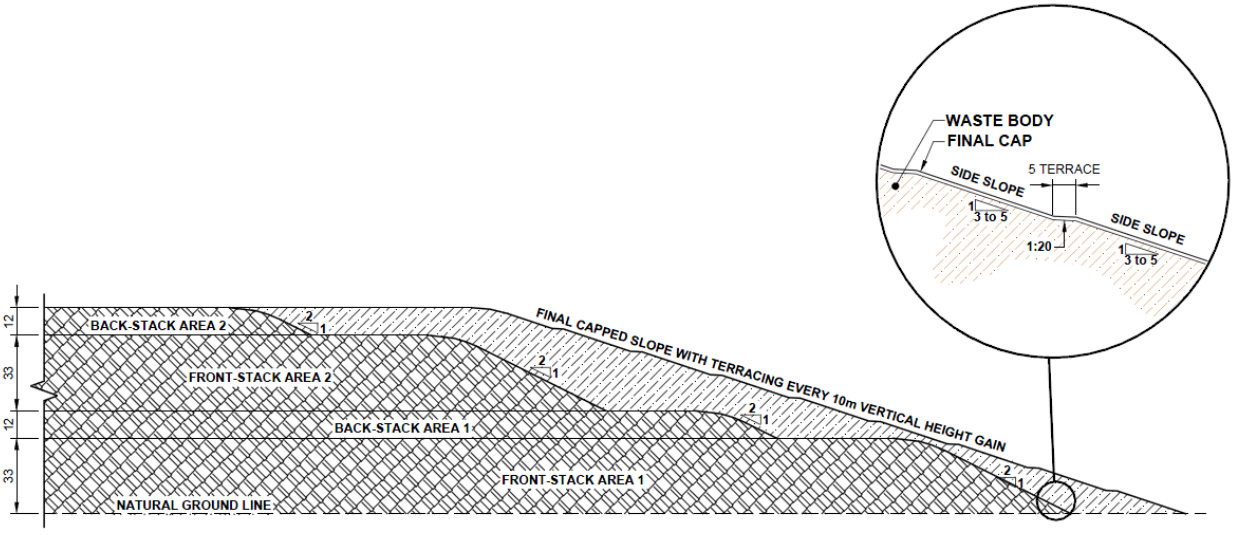



**Figure 4: Ash landfill development**

### 2.1.1 Emergency Ash Offloading Area

Emergency ash offloading is an integral part of the ash management system at the Matimba Power Station. It offers the temporary disposal of the ash whilst the ash conveyors systems, that dispose the ash at the ADF, are maintained. It is essential that the emergency ash offloading area is capacitated to adequately handle the amount of ash stored and for proper management of any surface run-off water.

The emergency ash offloading area is located within the perimeter boundary and to the western side of Matimba Power Station (Grootestryd 465 LQ, Figure 5). It is situated adjacent to the transfer house between the Cross and Overland conveyors. Currently, the emergency ash offloading area is a 30 m x 30 m reinforced concrete slab. The function of the area is to offload ash in instances where the Overland Conveyor is unable to transport the ash to the ADF due to breakdown or maintenance activities.

- Operational Philosophy

Ash is offloaded at the emergency area by allowing the Cross Conveyor belt to bypass discharging onto the Overland Conveyor and to offload on the existing concrete slab. Front-end loaders are used to spread the ash around the concrete slab and also to in-load the ash onto the Overland Conveyor once it is in operational to transport it to the ADF.

In cases where the Cross and Transverse Conveyors are also unavailable and cannot be used to offload at the emergency area, the ash is offloaded at the Coarse Ash Conveyors, at the units, and collected by means of trucks and taken to the emergency ash offloading area. On average, two trucks would be used to transport the ash from the units to the emergency ash offloading area.

The ash must be moved from the emergency area as quickly as possible to prevent it from hardening, or the possibility of unacceptable amounts of ash being stockpiled. At present, the emergency offloading area is insufficient and needs to be extended by 4680 $m^2$ to a total area of 5580 $m^2$.

The average volume of ash being stored at the area is approximated at 19500 tons given the amount of days it takes to maintain and bring back the conveyor system back online, which can take a maximum of 5 days.


| Point | X_DD | Y_DD | X_DMS | Y_DMS | X_DDM | Y_DDM |
|---|---|---|---|---|---|---|
| A | 27.600029 | -23.668236 | 27° 36' 0.10" E | 23° 40' 5.65" S | 27° 36.002' E | 23° 40.094' S |
| B | 27.599559 | -23.668355 | 27° 35' 58.41" E | 23° 40' 6.08" S | 27° 35.974' E | 23° 40.101' S |
| C | 27.599629 | -23.668964 | 27° 35' 58.66" E | 23° 40' 8.27" S | 27° 35.978' E | 23° 40.138' S |
| D | 27.600204 | -23.668838 | 27° 36' 0.73" E | 23° 40' 7.82" S | 27° 36.012' E | 23° 40.130' S |
| E | 27.600144 | -23.668685 | 27° 36' 0.52" E | 23° 40' 7.26" S | 27° 36.009' E | 23° 40.121' S |
| F | 27.599909 | -23.668734 | 27° 35' 59.67" E | 23° 40' 7.44" S | 27° 35.995' E | 23° 40.124' S |
| G | 27.599870 | -23.668561 | 27° 35' 59.53" E | 23° 40' 6.82" S | 27° 35.992' E | 23° 40.114' S |
| H | 27.600100 | -23.668475 | 27° 36' 0.36" E | 23° 40' 6.51" S | 27° 36.006' E | 23° 40.109' S |

**Figure 5: Google Earth™ image of the proposed expansion of the emergency ash offloading area and coordinates**

- Stormwater Management

The overall storm water management of the area will be upgraded to comply with the GN 704 regulations as the current infrastructure is inadequate to properly manage the surface run-off water.

The expanded emergency ash offloading area will be equipped with stormwater channels surrounding the site to collect any ash contaminated surface run-off water (Figure 6). The collecting stormwater canal that transports water to the PCDs is not lined. However, it will be lined through a project (*C.GMT0213 – Lining extension of stormwater canal at coal yard*) already registered and included in the Station's technical plan.

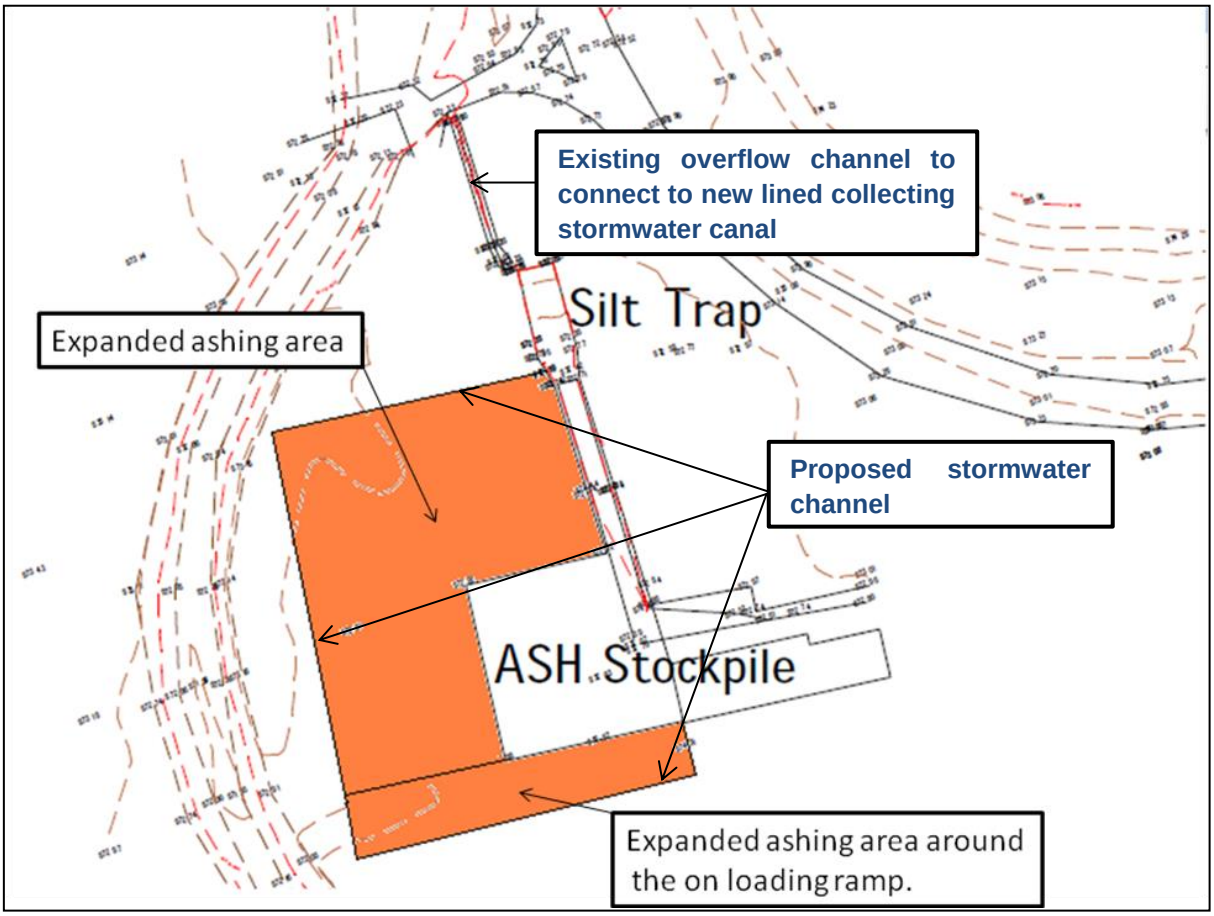



**Figure 6: Proposed expansion and stormwater management of the emergency ash offloading area**

### 2.1.2 Ancillary Works around the ADF

These works include the road network, drainage and stormwater control and erosion protection.

Permanent gravel roads provide access to the ADF, the site office and contractors yards along the eastern and northern toes of the existing ash dump, up the extendible conveyor ramp and alongside the overland ash conveyor. Access ways are also constructed along the eastern side of the ash dump alongside the shiftable conveyors primarily for use by the ADF personnel as well as electrical and mechanical maintenance teams. Further access ways are provided along the back stack and side slopes of the ADF and are used for the rehabilitation and irrigation of the completed areas.

Permanent concrete-lined canals and berms are provided along the eastern, northern and western toes of the ash dump to collect stormwater run-off from the back stack and side slopes. Stormwater is then channelled in to existing lined stormwater dams/pollution control dams (PCDs) situated in the north-eastern and south-eastern corners of the ADF.

### 2.1.3 Dust suppression

The dry ashing method of ash disposal has the potential to create dust problems even though the ash is conditioned from the station before it reaches the ash dump where it conditioned further. Water sourced from the PCDs is used to suppress dust. The following methods, used on their own or combined, have been considered for dust control on the existing ash dump:

- Spraying the ash dump with water using a sprinkler system.

- Spraying the ash dump with water using mobile plant (water bowsers).
- Using a sacrificial sand layer - a thin (50 mm) layer of sand spread over the ash surface has proved successful in controlling dust-blown problems. The use of sand also reduces the amount of water required for dust suppression. A truck load of sand dozed over the crest of the advancing face to some degree reduces the amount of ash blown on the crest caused by the eddying effect of the wind at the crest of the ash dump. The sand layer is spread over the ash dump once the advancing front stack has been levelled.

### 2.1.4 Rehabilitation

The ash dump is rehabilitated progressively. Areas where final shaping and levelling of the ash have been completed are topsoiled immediately and rehabilitated as soon as possible. The ash dump is covered daily with a 50 mm thick layer of soil/sandy material while the final rehabilitation cover consists of 300 mm thick topsoil material with seeding for grass and the manual planting of trees.

## 2.2 Development of Ash Disposal Facility

As described in Section 1, the proposed project entails the development of an ash disposal facility (ADF) with an airspace capacity of 276 249 000 $m^3$ for the next 40 years of operation (2015 – 2055) of the power station. Two site alternatives were identified during the Scoping Phase for the establishment of the ADF:

- Site Alternative 1 (SA1) – located south of the Matimba Power Station the farm Zwartwater 507 LQ. Part of this farm is currently utilized as an ADF.
- Site Alternative 2 (SA2) - This site is located north of the Matimba Power Station and straddles four different farms namely Vooruit 449 LQ, Appelvlakte 448 LQ, Droogeheuvel 447 LQ and Ganzepan 446 LQ. This is a greenfields site.

Subsequent to the identification of the two feasible site alternatives, the engineering consultants (Jeffares and Green Pty Ltd) were tasked to provide technical arguments regarding the engineering aspects of the two proposed site alternatives and provided a technical view of the probable licence and design requirements for the operation of the ADF (**Appendix C - Technical Engineering Report**).

### 2.2.1 Site Alternative 1 (Preferred)

The ADF was designed with the intention to maximise the available footprint of the site to meet the airspace requirements for future waste disposal. Of the site area available, approximately 510 ha is available as a greenfields site. In order to accommodate the full airspace requirements, the conceptual design of SA1 proposes that approximately one third of the new ADF (190 ha) is constructed over the existing ADF, using the piggy-backing concept as an optimisation strategy.

Therefore, the total footprint area required for the ADF development is 700 ha (510 ha greenfields and 190 ha existing ADF) creating an airspace of approximately 325 000 000 $m^3$ which is 17.6% in excess of the airspace required.

The greenfields site area will be developed to reach a final finished height of approximately 90 m above natural ground level (NGL) while the piggy-backed area will be developed to reach a final finished height of approximately 45 m above the existing ADF. The ADF will be terraced every 10 m for increased slope stability.

A 3D representative model of the proposed ADF over the existing ADF has been created and is shown in Figure 7. A conceptual profile of the proposed ADF is shown in Figure 8.

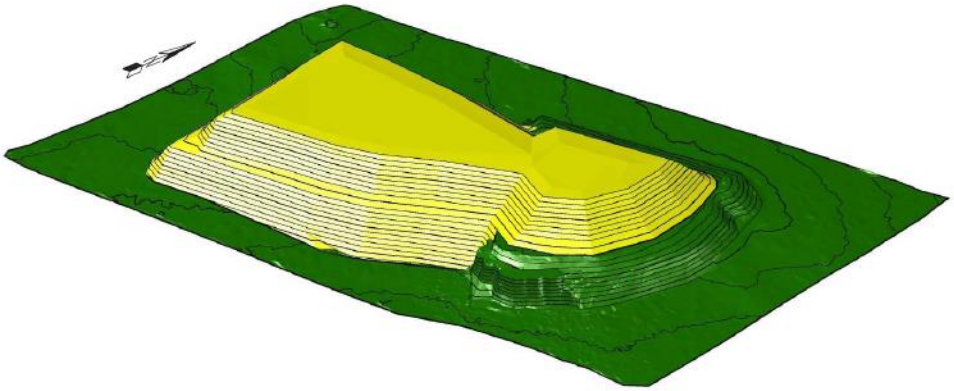


**Figure 7: 3D representative model of Site Alternative 1**

#### *2.2.1.1 Ancillary Works*

A 10 m wide servitude area between the site boundary and the foot of the ash dump has been incorporated into the design. This servitude area makes allowances for a haul road, stormwater channels and any services such as electrical cables, leachate collection pipes and manholes.

A haul road along the perimeter of the site will allow for easy access to all areas of the ash dump for loading and maintenance.

An open contaminated stormwater channel will run next to the foot of the ash dump and will collect all run-off from the dump and from the haul road. All run-off from the open channel and leachate from the leachate collection system within the dump will collect at a third PCD. The PCD (that spills on average only once in 50 years) was designed to accommodate 203 600 $m^3$ of dirty water. The resulting dam size is 450 m x 350 m with side slopes of 1V:3.5H to a total depth of 2 m (1.5 m water level and 0.5 m freeboard).

SA1 has already been developed and it is envisioned that the existing office and plant-yard facilities will remain in use throughout the construction of the new ADF. Access to SA1 will be via a gravel road with a level crossing from the road D1675.


**Figure 8: Site Alternative 1 conceptual profile**

### 2.2.2 Site Alternative 2

Site Alternative 2 is a greenfields site of approximately 660 ha that will create an airspace of approximately 303 090 250 $m^3$ which is 9.7% in excess of the airspace required. The site will be developed to reach a final finished height of approximately 85 m above NGL and terraced every 10 m for increased slope stability.

A 3D representative model of the proposed ADF has been created and is shown in Figure 9. A conceptual profile of the proposed ADF is shown in Figure 10.

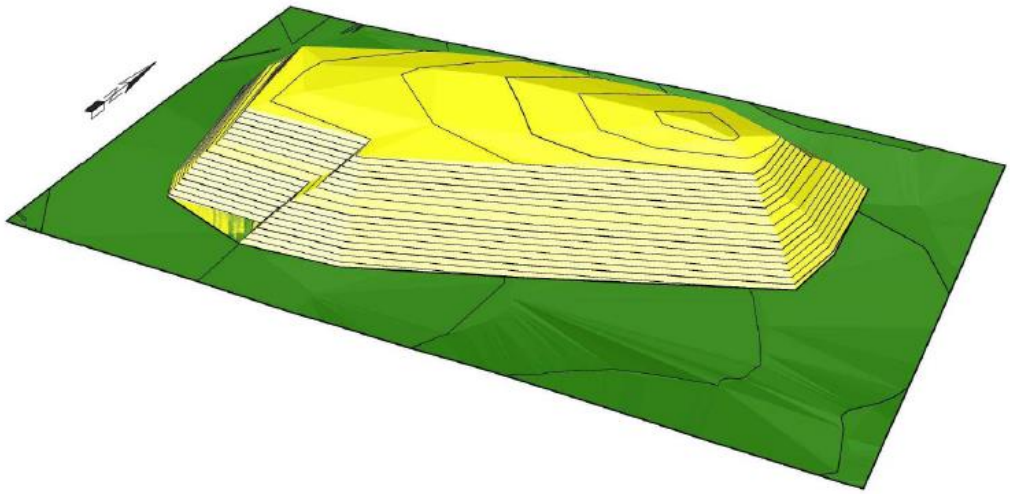


**Figure 9: 3D representative model of Site Alternative 2**

#### *2.2.2.1 Ancillary Works*

A 10 m wide servitude area between the site boundary and the foot of the ash dump has been incorporated into the design. This servitude area makes allowances for a haul road, stormwater channel and any services such as electrical cables, leachate collection pipes and manholes. A haul road along the perimeter of the site will allow for easy access to all areas of the dump for loading and maintenance.

An open contaminated stormwater channel will run next to the foot of the dump and will collect all run-off from the dump and from the haul road. All run-off from the open channel and leachate from the leachate collection system within the dump will collect at a PCD. A PCD (that spills on average only once in 50 years) needs to be designed to accommodate 180 000 $m^3$ of dirty water. The resulting dam size is 450 m x 190 m with side slopes of 1V:3.5H to a total depth of 2 m (1.5 m water level and 0.5 m freeboard).

SA2 is an undeveloped site and an additional area has been allocated to allow for infrastructure such as access control; guardhouse; weighbridge system; office and ablutions; plant yard; parking; and vehicle wash. Access to the SA2 will be from Road D2001. A short right-turn lane from Road D2001 into the access road is recommended to ensure that a turning vehicle will not hinder through traffic on Road D2001.

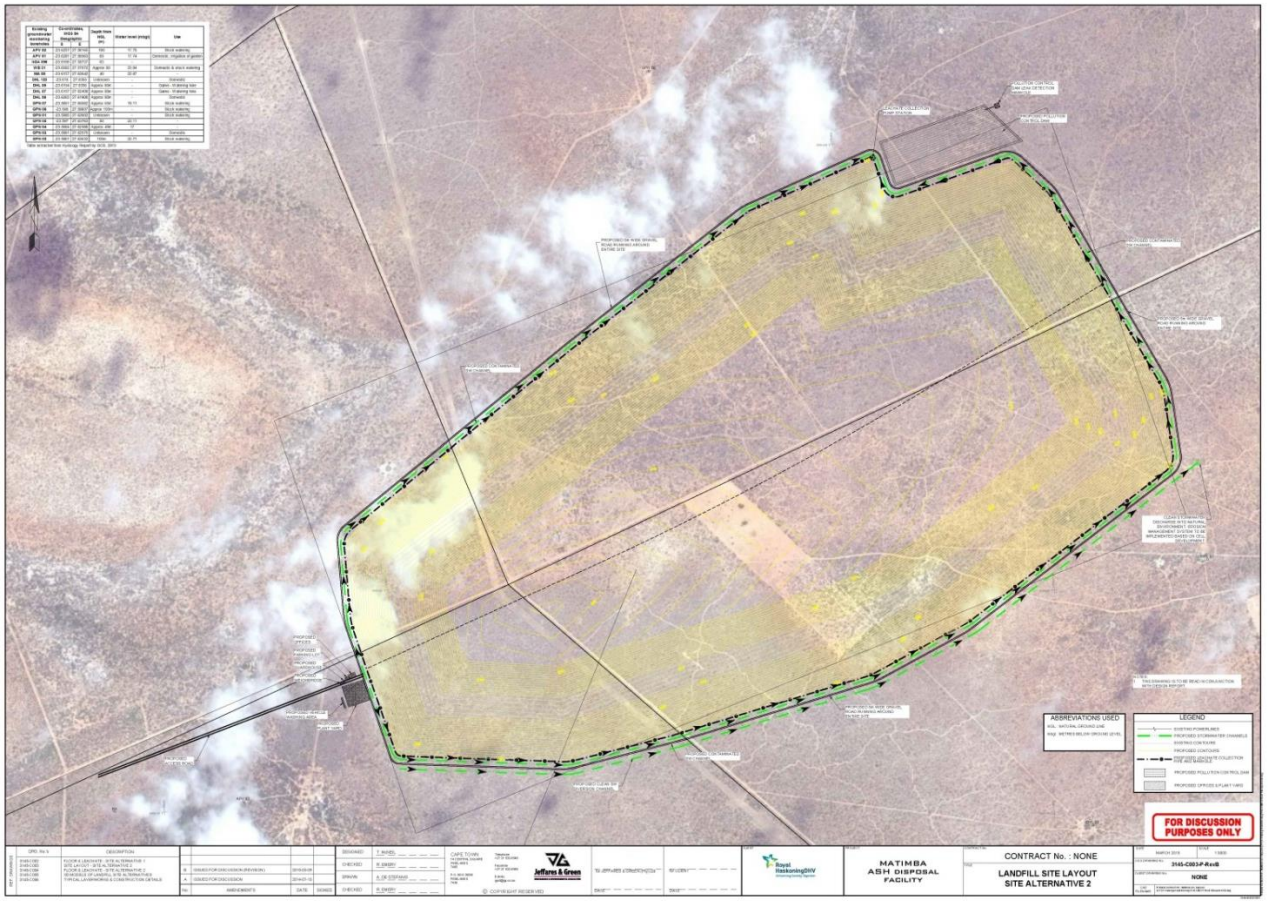



**Figure 10: Site Alternative 2 conceptual profile**

### 2.2.3 Basal Lining System

The ash has been classified as a Type 3 waste in accordance with the National Norms and Standards for Disposal of Waste to Landfill (GN R. 636, 2013). The specified basal lining system is classified as a Class C system. The ash classification report is attached as **Appendix D – Ash Classification Report**.

The presence of clay (suitable for the Compacted Clay Liner (CCL) in the basal lining system) in the area immediately surrounding the proposed ADF is limited. The proposed basal liner system presented in the conceptual design therefore substitutes the required CCL with a Geosynthetic Clay Liner (GCL) of equivalent or better performance.

The geosynthetic lining system is proposed over greenfield areas, on embankment slopes and under the proposed pollution control dam. The current construction methodology for piggy-backing a portion of the new proposed ADF over the existing ADF (SA1) does not entail the installation of a geosynthetic basal lining system over the existing ADF before the development over the existing ADF takes place.

### 2.2.4 Exemption from Lining

Due to the processes that need to be followed and the timeframes required for preparation of the footprint and construction of the lining system, there will be a period from current operations to disposal on the lining system. The final arrangements for this process are still to be determined.

The area that will not be lined during the 4.69 year period is estimated to be approximately 105.9 ha. The orange area is the area that will be covered in ash, placed by the main system shiftable conveyor and is approximately 55.1 ha (Figure 11). The blue area placed by the standby system shiftable conveyor, is 40.4 ha (Figure 11). The ash will not cover the entire blue section (it will be more triangular shape). This is because the main system still has to catch up with the standby system. The area indicated in red in Figure 11, will also be covered in ash, however, only once the conveyors reach the end of the ADF, around 2038.

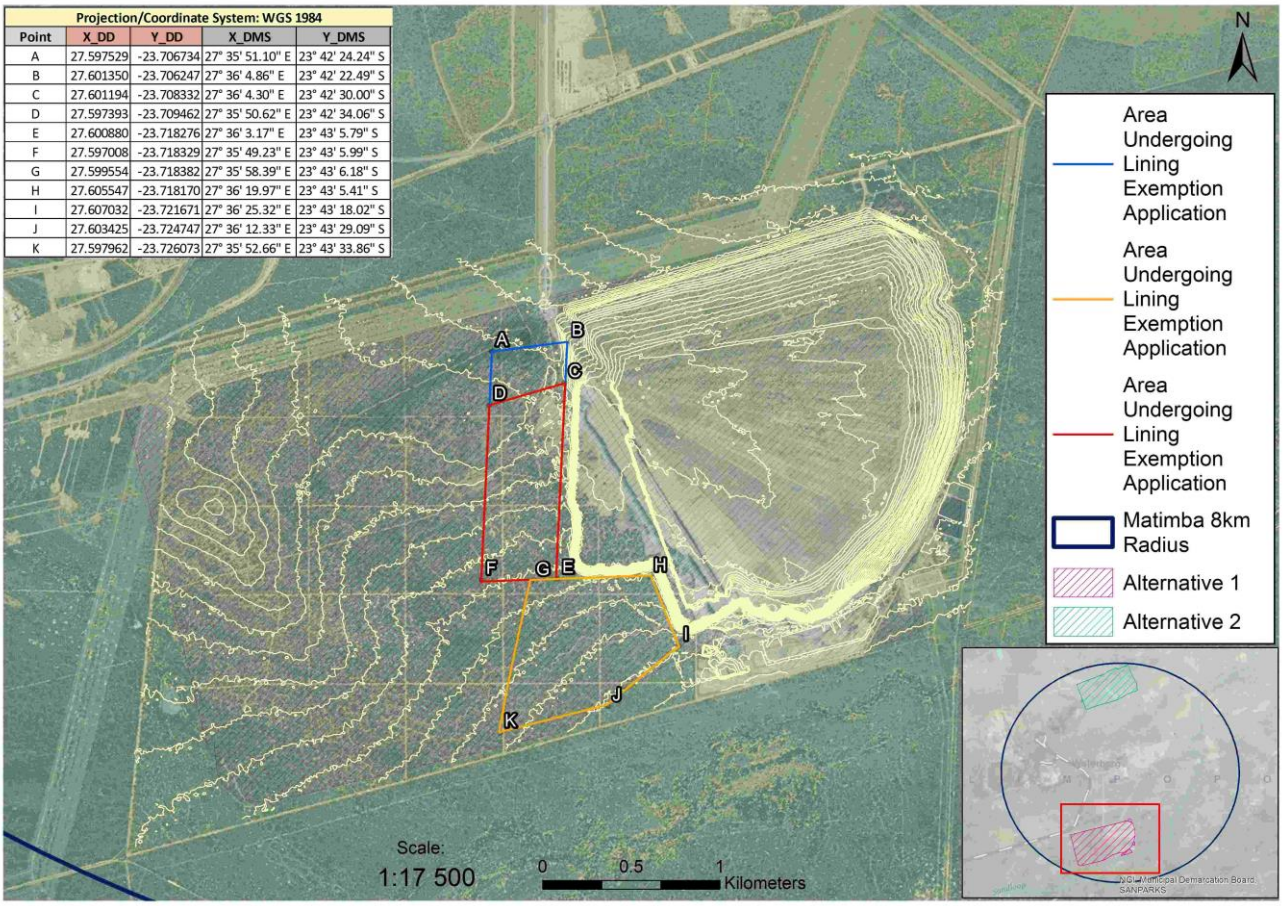



**Figure 11: Map of area undergoing exemption application (SA1)**

Based on the groundwater studies, there will be additional groundwater impacts as the current ADF is not lined. The impact on groundwater is currently evident, however this is due to the presence of the ADF, since disposal commenced. It is anticipated that the additional impacts of 4.69 years of ash disposal will therefore be less significant than the current impacts. Mitigation measures which must be enforced during the 4.69 year ash disposal includes the following:

- Any boreholes located on the site footprint where ash disposal will occur must be backfilled so as to prevent direct migration of potentially poor quality water into the aquifers and further groundwater pollution. The sealing procedure will be finalised with an appointed Contractor.
- Prevent excess water on the ADF, dust suppression must be controlled.
- The groundwater monitoring programme must be continued as detailed in Section 9.3 of this report as well as the EMPr (**Appendix S**).

The Applicant, will lodge an Application for Exemption (with the DEA) as stipulated under Section 44(1)(a) read with the Section 24M(3) of NEMA (No 107 of 1998) and the National Exemption Regulations (No R.994). In proposing and motivating for the exemption from lining, it must be noted that this situation is practically unavoidable as the basal lining system must first be approved before work can commence on the ground preparation and construction. During this time, it is in the Nation's best interest that the Matimba Power Station continue to operate according to its current ashing model, requiring ash disposal continue as at present. This will mean continued ashing on an unlined surface during this period.

### 2.2.5 Dust Suppression

The methodology for dust suppression presented in Section 2.1.3 will be applicable to either SA1 or SA2.

### 2.2.6 Capping and Rehabilitation

The methodology for rehabilitation presented in Section 2.1.4 will be applicable to either SA1 or SA2. Progressive capping/rehabilitation activities are to be carried out in order to protect the side slopes of the proposed ADF from erosion, reduce stormwater collection volumes and to lessen the visual impact of the ash dump. The maximum final finished capped side slope of the proposed ADF should not be steeper than 1V:3H to ensure long term stability of the slope.

In addition, the Applicant is considering the use of sludge as soil ameliorant for the rehabilitation of the ash dump. Wastewater sludge is generated at the power station and dried first on drying beds before being collected and stored in skips for a period of 2 - 3 months. Estimated average monthly volume generated is 11 $m^3$ per month. Currently, the sludge is dried and disposed at Holfontein. Based on the volume of sludge produced, distance and cost of landfilling, one option being assessed is the use of the sludge to be applied with topsoil in rehabilitation of the ash dump.

The sludge is applied with topsoil as a soil ameliorant providing organic matter and nutrients to augment the qualities of the soil.

# 3 PROJECT ALTERNATIVES

In terms of the EIA Regulations, Section 28 (1)(c) feasible alternatives are required to be considered as part of the environmental investigations. In addition, the obligation that alternatives are investigated is also a requirement of Section 24(4) of the National Environmental Management Act (No. 107 of 1998) (as amended).

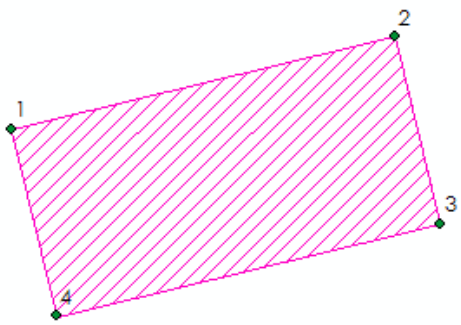
During the Environmental Scoping Study, the following feasible alternatives were identified and they are being assessed in this EIA Study:

## 3.1 Location/ Site Alternatives

### 3.1.1 Site Alternative 1

This site is located south of the Matimba Power Station on the farm Zwartwater 507 LQ which is owned by Eskom. Part of this farm (approximately 320 ha) is currently utilized as an ADF. A total footprint area required for the ADF development to meet the airspace requirements is 700 ha (510 ha greenfields and 190 ha over the existing ADF). Ashing onto this alternative would result in a continuation of the ashing activities.

#### *3.1.1.1 Co-ordinates of Site Alternative 1*

| Site Alternative 1 | | | |
|---|---|---|---|
|  | 1 | 23° 42' 33.48" S | 27° 34' 43.83" E |
| | 2 | 23° 42' 2.66" S | 27° 36' 50.78" E |
| | 3 | 23° 43' 5.09" S | 27° 37' 5.94" E |
| | 4 | 23° 43' 35.63" S | 27° 34' 58.93" E |

### 3.1.2 Site Alternative 2

This site is located north of the Matimba Power Station and straddles four different farms namely:

- Vooruit 449 LQ owned by Exxaro Coal (Pty) Ltd
- Appelvlakte 448 LQ owned by Exxaro Coal (Pty) Ltd
- Droogeheuvel 447 LQ owned by Triple M Game Ranch
- Ganzepan 446 LQ owned by Susara Maria Gouws

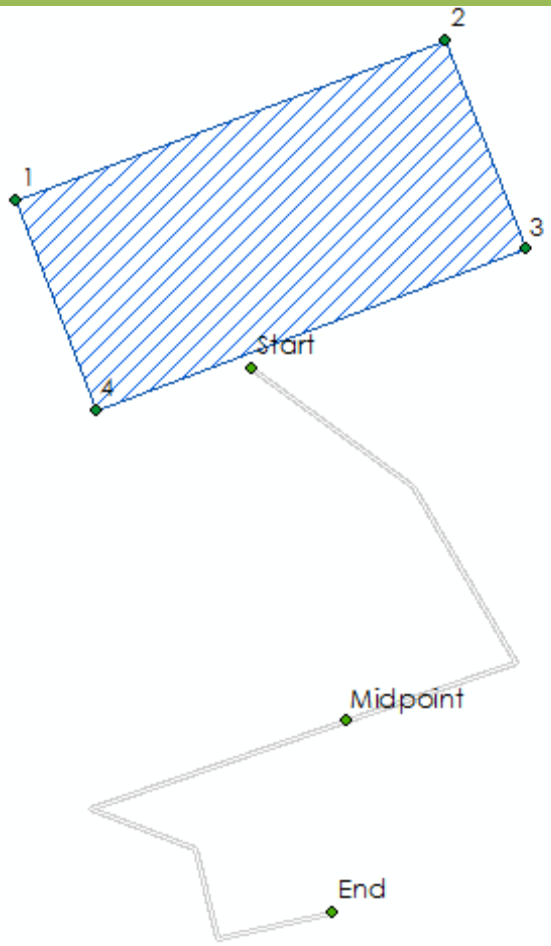
A total footprint area required for the ADF development to meet the airspace requirements is 660 ha. Ashing onto this site would result in establishment of a new ADF.

As SA2 is a greenfields site in its entirety, a new conveyor belt system as well as access road (linear infrastructure route - LIR) would have to be developed in order to transport ash from the Matimba Power Station to the new ADF.

The conveyor belt will be raised above the ground, and as such would be a visually prominent structure, due to its height and linear nature. The proposed linear infrastructure route alignment runs in close proximity to the Marapong community. To the north of Marapong, the linear infrastructure would start at the Matimba Power Station (Farm Grootestryd 465 LQ) and run along a cadastral boundary between the Nelsonskop 464 LQ and Zongezien 467 LQ properties and between the Appelvlakte 448 LQ and Droogeheuvel 447 LQ boundary before linking up to SA2.

During the review of the draft EIAR and EMPr, it was also brought to the EAP's attention by Exxaro Coal that they are currently considering prospecting activities on the farm Zonderwater and a possible future servitude corridor of roads and linear infrastructure between Grootegeluk and the Zonderwater Farm will traverse the farms Vooruit, Appelvlakte, Droogeheuvel and Ganzepan.

#### 3.1.2.1 *Co-ordinates of Site Alternative 2 and Linear Infrastructure Route*

| Site Alternative 2 and LIR | | | |
|---|---|---|---|
|  | 1 | 23° 36' 36.88" S | 27° 34' 58.58" E |
| | 2 | 23° 35' 50.72" S | 27° 37' 0.79" E |
| | 3 | 23° 36' 50.82" S | 27° 37' 23.49" E |
| | 4 | 23° 37' 36.98" S | 27° 35' 21.29" E |
| | LIR Start | 23° 40' 1.29" S | 27° 36' 28.42" E |
| | LIR Midpoint | 23° 39' 6.34" S | 27° 36' 32.38" E |
| | LIR End | 23° 37' 25.04" S | 27° 36' 5.69" E |

## 3.2 Do-nothing Alternative

The Matimba Power Station produces approximately 6 million tons of ash annually and which is currently being disposed by means of 'dry ashing'. An ADF is required in order to accommodate the ashing requirements of the power station for the next (40) years from 2015 - 2055. If this project does not proceed, the Matimba Power Station will be unable to dispose ash due to space limitations as well as non-compliance with environmental legislation i.e.

- National Environmental Management: Waste Act (No. 59 of 2008) – NEM: WA and its corresponding Waste Classification and Management Regulations (GN R. 634 of 2013) and Norms and Standards (GN R. 635 and 636).
- EIA Regulations (2010) promulgated under the National Environmental Management Act (No. 107 of 1998) - NEMA (as amended).
- National Water Act (No. 36 of 1998).

SA1 and SA2 as well as the linear infrastructure route to SA2 are being assessed in the EIA Study. If on completion of the EIA study, SA1 is recommended for the proposed facility, the existing ADF will be expanded. Alternatively if SA2 is recommended, a new ADF will need to be established. New infrastructure (as indicated in 2.2.2.1) will also need to be established to enable the operation of the ADF.

# 4 PROJECT NEED AND DESIRABILITY

The subsequent section addresses the project's need and desirability according to the DEA's Guideline on Need and Desirability[1]. A number of questions are presented in the Guideline, which assists in the identification of the project's need and desirability. These key questions and answers are presented in Table 7 and further serve as confirmation that the proposed project is in line with the planning requirement of the Municipality and that reasonable measures have been taken to determine the best practicable environmental option for the proposed site.

**Table 5: Project needs and desirability**

| |
|---|
| **1. Is the activity permitted in terms of the property's existing land use rights? Yes** |
| It is proposed, that ashing continues at the existing ADF as well as a greenfield portion to the west of the existing ADF. This site is located south of the Matimba Power Station on the farm Zwartwater 507 LQ which is owned by Eskom. Part of this farm (approximately 320 ha) is currently utilized as an ADF. Therefore the proposal for continuous ashing on the existing ADF (piggy-backing) as well as the greenfield portion of the farm Zwartwater 507 LQ is permitted in term of the property's existing land use rights. |
| **2. Will the activity be in line with the planning requirements (i.e. Integrated Development Plan – IDP and Spatial Development Framework - SDF)) of the Local Municipality? Yes** |
| According to KPA 4 (Local Economic Development) of the Lephalale IDP - Lephalale is defined by the Limpopo Growth and Development Strategy as a coal mining and petrochemical cluster. Three clusters that are most relevant to Lephalale are firstly - Coal & Petrochemical, secondly - Red Meat and thirdly - Tourism. The area is currently experiencing growth driven by mining expansion and the construction of Medupi Power Station.<br><br>The LLM will continue using its mining, agriculture and tourism as its economic core pillars to optimise its socio-economic priorities aimed at improving the lives of all people of Lephalale by reducing the unemployment rate within the Region. Furthermore, the construction of energy infrastructure (Matimba and Medupi Power Stations) in Lephalale has brought enormous economic spin-offs to the Waterberg District within which the Lephalale Local Municipality (LLM) is situated, which will address both maintenance backlogs as well as future maintenance programmes in the Region.<br><br>The Lephalale Local Spatial Development Framework (LSDF) confirmed that Lephalale town is a Provincial Growth Point (PGP) and therefore the municipal capital. The LSDF broadly divided the municipal area into six zones. The central core (around Lephalale town) comprises of three zones, including an Industrial Development Zone, an Aero Zone and a Mining Zone. The Industrial Development Zone includes the Matimba Power Station and the Medupi Power Station (under construction).<br><br>The Municipality is further divided into three development nodal areas for the purpose of resource allocation and infrastructure development with the intention for service delivery i.e. urban functional zone, rural zone and mining zone. This project falls within the urban functional zone (focus area 1) - the focus of this zone is around Lephalale town and Onverwacht and includes the activities and land uses in Marapong, Grootegeluk Mine and Matimba Power Station. The development interventions in this area is guided by the principles and objectives contained in various policy documents, of which the most important are the Medium Term Strategic Framework, BNG, Spatial Rationale/ SDF and Limpopo Employment Growth & Development plan/LED strategy and IDP.<br><br>The proposed project is therefore in line with the LLM IDP as well as the LSDF. |

[1] Department of Environmental Affairs. (2014). Guideline on Need and Desirability in terms of the Environmental Impact Assessment Regulations, 2010.

| |
|---|
| **3. Is the land use (associated with the activity being applied for) considered within the timeframe intended by the existing approved SDF agreed to by the relevant environmental authority (i.e. is the proposed development in line with the projects and programmes identified as priorities within the credible IDP)? Yes** |
| The Municipality is divided into three development nodal areas for the purpose of resource allocation and infrastructure development with the intention for service delivery i.e. urban functional zone, rural zone and mining zone. This project falls within the urban functional zone (focus area 1) - the focus of this zone is around Lephalale town and Onverwacht and includes the activities and land uses in Marapong, Grootegeluk Mine and Matimba Power Station. The development interventions in this area is guided by the principles and objectives contained in various policy documents, of which the most important are the Medium Term Strategic Framework, BNG, Spatial Rationale/ SDF and Limpopo Employment Growth & Development plan/LED strategy and IDP. |
| **4. Would the approval of this application compromise the integrity of the existing environmental management priorities for the area and if so, can it be justified in terms of sustainability considerations? No** |
| According to the Waterberg EMF, the proposed project falls within Environmental Management Zone 5 (Potential large industrial and related activities focus areas) but is also surrounded by Zone 4 (Mining Focus Area) and Zone 7 (Urbanisation Focus Area).<br><br>Zone 5 areas are in close proximity to major coal fields which are being considered for the development of industrial activities to beneficiate the mineral product and where infrastructure like power generation facilities (Medupi) are being constructed. The preferred activities for Zone 5 include: heavy industrial activities that operate within national standards that regulate pollution; urban support functions such as residential and commercial development that is directly related to large industries of national magnitude and in accordance with the local authority approval process; and support services and light industrial activity directly related and in support of the heavy industrial activities.<br><br>The proposed project, is considered a preferred activity for the stipulated Environmental Management Zone, therefore the existing environmental priorities for the area will not be compromised. |
| **5. Does the community/area need the activity and the associated land use concerned (is it a societal priority)? (This refers to the strategic as well as local level (e.g. development is a national priority, but within a specific local context it could be inappropriate.) Yes** |
| Lephalale is defined by Limpopo Growth and Development Strategy as a coal mining and petrochemical cluster. Mining and Quarrying is the largest employer in Lephalale. The trade and accommodation sector is the second biggest employer. It responds to the consumption needs of the local workforce, but also includes game lodges and accommodation for hunters on game farms. Employment in the electricity sector, is the sixth biggest employer, but this is likely to improve when Medupi Power Station becomes operational.<br><br>The Matimba Power Station is the biggest direct dry-cooled power station in the country and contributes largely to the GDP. Should the project not go ahead, the Matimba Power Station will be unable to dispose ash due to space limitations as well as non-compliance with environmental legislation and would have to cease operations. This would place a constraint on the already constrained energy supply not to mention the number of jobs that would lost. |
| **6. Are the necessary services with adequate capacity currently available (at the time of application), or must additional capacity be created to cater for the development? Yes** |
| The necessary services (water, electrical etc.) and adequate capacity are currently available. No additional services are needed. |

| |
|---|
| **7. Is this development provided for in the infrastructure planning of the municipality, and if not what will the implication be on the infrastructure planning of the municipality (priority and placement of services and opportunity costs)? Yes** |
| As indicated in Point 2 above, the continued operation of the Matimba Power Station is intrinsically planned for in the LLM IDP as it contributes to KPA 4 Local Economic Development.<br><br>The LLM will continue using its mining, agriculture and tourism as its economic core pillars to optimise its socio-economic priorities aimed at improving the lives of all people of Lephalale by reducing unemployment rate within the Region. |
| **8. Is this project part of a national programme to address an issue of national concern or importance? Yes** |
| Eskom is mandated by the South African Government to ensure the provision of reliable and affordable power to South Africa. Eskom's core business is the generation, transmission and distribution of electricity. Eskom generates approximately 95% of the electricity used in South Africa. Electricity cannot be stored in large quantities and must be used as it is generated. Therefore, electricity must be generated in accordance with supply-demand requirements. In addition, increasing economic growth and social development within southern Africa is placing a growing demand on energy supply. The reliable provision of electricity by Eskom is critical for economic development in South Africa.<br><br>The Matimba Power Station in Lephalale, is a 3990 MW installed capacity base load coal-fired power station. Approximately 6 million tons of ash is produced annually and which is currently being disposed by means of 'dry ashing'. An ADF is required in order to accommodate the ashing requirements of the power station for the next (40) years from 2015 - 2055.<br><br>If this project does not proceed, the Matimba Power Station will be unable to dispose ash due to space limitations as well as non-compliance with environmental legislation and would have to cease operations. This would place a constraint on the already constrained energy supply (loss of 3990 MW generation capacity) not to mention the number of jobs that would lost. This project is therefore considered a national priority. |
| **9. Do location factors favour this land use (associated with the activity applied for) at this place? (This relates to the contextualisation of the proposed land use on this site within its broader context.) Yes** |
| SA1 is located on the farm Zwartwater 507 LQ which is owned by Eskom. Part of this farm (approximately 320 ha) is currently utilized as an ADF. SA1 is already within an industrial hub. SA1 is preferred over SA2 as the development of the ADF on SA1 entails the continuation of ashing at the existing facility whilst SA2 is a greenfields site (in its entire extent) that would require new infrastructure e.g. linear infrastructure route, haul road, stormwater channels and leachate collection system, pollution control dam, access control; guardhouse; weighbridge system; office and ablutions; plant yard; parking; and vehicle washing area. |

| |
|---|
| **10. Is the development the best practicable environmental option for this land/site? Yes** |
| The results of the impact assessment indicate that the most significant impacts as a result of the proposed project would include impacts on biodiversity, geohydrology, hydrology, wetlands, air quality and visual. These impacts can be successfully mitigated through the measures and recommendations proposed by the various specialist disciplines and the EMPr.<br><br>Based on the comparative assessment of the two site alternatives, SA1 is preferred over SA2 as the development of the ADF on SA1 entails the continuation of ashing at the existing facility whilst SA2 is a greenfields site (in its entire extent) that would require new infrastructure e.g. linear infrastructure route, haul road, stormwater channels and leachate collection system, pollution control dam, access control; guardhouse; weighbridge system; office and ablutions; plant yard; parking; and vehicle washing area.<br><br>The conceptual design for SA1 proposes that approximately one third of the new ADF (190 ha) is constructed over the existing ADF, using the piggy-backing concept as an optimisation strategy. The remaining 510 ha will be constructed over a greenfields portion of the farm Zwartwater 507 LQ. Therefore, the total footprint area required for the ADF development for SA1 is 700 ha (510 ha greenfields and 190 ha existing ADF) creating an airspace of approximately 325 000 000 $m^3$ to cater for the Matimba Power Station's ashing requirements for its remaining life (approximately 40 years). |
| **11. Will the benefits of the proposed land use/development outweigh the negative impacts of it? Yes** |
| As indicated in Point 8 above, Eskom is mandated by the South African Government to ensure the provision of reliable and affordable power to South Africa. Approximately 6 million tons of ash is produced annually and which is currently being disposed by means of 'dry ashing'. An ADF is required in order to accommodate the ashing requirements of the power station for the next (40) years from 2015 - 2055.<br><br>If this project does not proceed, the Matimba Power Station will be unable to dispose ash due to space limitations as well as non-compliance with environmental legislation and would have to cease operations. This would place a constraint on the already constrained energy supply (loss of 3990 MW generation capacity) not to mention the number of jobs that would lost. |
| **12. Will the proposed activity/ies contribute to any of the 17 Strategic Integrated Projects (SIPS)? No** |
| Not applicable. |

**13. How does the project fit into the National Development Plan for 2030?**

According to the National Development Plan 2030, South Africa needs to invest in a strong network of economic infrastructure designed to support the country's medium- and long-term economic and social objectives. This economic infrastructure is a precondition for providing basic services such as electricity, water, sanitation, telecommunications and public transport, and it needs to be robust and extensive enough to meet industrial, commercial and household needs. The plan envisages that, by 2030, South Africa will have an energy sector that promotes:

- Economic growth and development through adequate investment in energy infrastructure. The sector should provide reliable and efficient energy service at competitive rates, while supporting economic growth through job creation;
- Social equity through expanded access to energy at affordable tariffs and through targeted, sustainable subsidies for needy households; and
- Environmental sustainability through efforts to reduce pollution and mitigate the effects of climate change.

This proposed project is therefore in line with the objectives, presented above as it will ensure that South Africa (through Eskom) maintains and expands its electricity infrastructure in order to support economic growth and social development goals.

The National Development Plan 2030 further identifies the LLM as a mining area, a Growth Management Zone and a Possible Green Economy Zone. It is one of three identified Growth Management Zones in the country (together with the West Coast Peninsula and George). This is because rapid growth is anticipated in the mining, petro-chemical and industrial sectors in the area around Lephalale.

The LLM seeks to position itself to relate directly to the, National Development Plan 2030, Millennium Development Goals, National Outcomes, in particular the outputs from Outcome Nine, and the Provincial Employment Growth and Development Plan (PEGDP) in terms of planning, development and management of provincial infrastructure. To this end, the LLM will continue using its mining, agriculture and tourism as its economic core pillars to optimise its socio-economic priorities aimed at improving the lives of all people of Lephalale by reducing unemployment rate within the Region.

**14. Have the general objectives of Integrated Environmental Management as set out in section 23 of NEMA have been taken into account. Yes**

The EIA study for the proposed project, had the following key objectives:

- Undertake an assessment of the social and biophysical environments of the affected area by the proposed project;
- Undertake a detailed assessment of the site alternatives and linear infrastructure route in terms of environmental criteria including the rating of significant impacts as well as cumulative impacts (Section 9);
- Identify and recommend appropriate mitigation measures (included in **Appendix S** - EMPr) for potentially significant environmental impacts; and
- Undertake a fully inclusive public participation process to ensure that Interested and Affected Party (I&AP) issues and concerns were recorded and commented on and addressed in the EIA process (refer to **Appendix F**).

All of these objectives have been met and this has culminated in the formulation of an Environmental Impact Statement by the EAP, which recommends that SA1 be authorised (Section 10).

**15. Describe how the principles of environmental management as set out in section 2 of NEMA have been taken into account.**

- Socio-economic: Eskom is mandated by the South African Government to ensure the provision of reliable and affordable power to South Africa. Approximately 6 million tons of ash is produced annually and which is currently being disposed by means of 'dry ashing'. An ADF is required in order to accommodate the ashing requirements of the power station for the next (40) years from 2015 - 2055.

  If this project does not proceed, the Matimba Power Station will be unable to dispose ash due to space limitations as well as non-compliance with environmental legislation and would have to cease operations. This would place a constraint on the already constrained energy supply (loss of 3990 MW generation capacity) not to mention the number of jobs that would lost.
- Environmentally: The results of the impact assessment indicate that the most significant impacts as a result of the proposed project would include impacts on biodiversity, geohydrology, hydrology, wetlands, air quality and visual. These impacts can be successfully mitigated through the measures and recommendations proposed by the various specialist disciplines and the EMPr (refer to Section 9 and **Appendix S**).
- Public Participation (PP) - One of the general objectives of integrated environmental management laid down in Section 23(2)(d) of NEMA is to "ensure adequate and appropriate opportunity for public participation in decisions that may affect the environment". A comprehensive PP process has been undertaken for the project (refer to **Appendix F**) that started during the Scoping Study and carried through to the EIA Study, to meet this objective.
- A draft EMPr (**Appendix S**) has been compiled that provides the actions for the management of identified environmental impacts emanating from the project and a detailed outline of the implementation programme to minimise and /or eliminate the anticipated negative environmental impacts.

# 5 LEGISLATION

In order to protect the environment and ensure that this development is undertaken in an environmentally responsible manner, there are a number of significant pieces of environmental legislation that will need to be complied with.

## 5.1 National Environmental Management Act (No 107 of 1998)

The National Environmental Management Act (No. 107 of 1998) - NEMA (as amended) states that the principles of Integrated Environmental Management (IEM) should be adhered to in order to ensure sustainable development.

A vital underpinning of the IEM procedure is accountability to the various parties that may be interested in or affected by a proposed development. Public participation is a requirement of the IEM procedure, in terms of the identification of potentially significant environmental impacts during the EIA process.

The IEM procedure aims to ensure that the environmental consequences of development proposals are understood and adequately considered during all stages of the project cycle, and that negative aspects are resolved or mitigated and positive aspects enhanced. Furthermore, Section 28(1) of the Act states that "*every person who causes or may cause significant pollution or degradation of the environment must take reasonable measures to prevent such pollution or degradation from occurring, continuing or recurring*". If such pollution cannot be prevented then appropriate measures must be taken to minimise or rectify such pollution.

In 2010, the EIA Regulations were promulgated in terms of NEMA, in order to outline the processes relating to environmental authorisations for the commencement of activities in order to avoid detrimental impacts on the environment or, where it cannot be avoided, to mitigate and effectively manage these impacts and optimise positive environmental impacts. These Regulations and a revised set of Listed Activities (Listing Notices 1, 2 and 3)[2] came into force on 02 August 2010 and were further amended on 29 November 2013.

The listed activities applicable to the project are listed in Table 6.

[2] Listing Notice 1 – GN R.544; Listing Notice 2 – GN R.545 and Listing Notice 3 – GN R.546. Listing Notice 1 and were further amended in November 2013 – GN R.922 and GN R.923 respectively.

## Table 6: Listed activities applicable to the project

| Activities subject to a Basic Assessment in terms of GN R.544 – Listing Notice 1 | Activities subject to a Scoping and EIA in terms of GN R.545 – Listing Notice 2 | Activities subject to a Basic Assessment in terms of GN R.545 – Listing Notice 3 |
|---|---|---|
| ***Activity 9:***<br>The construction of facilities or infrastructure exceeding 1000 meters in length for the bulk transportation of water, sewage or stormwater<br>(i) with an internal diameter of 0.36 meters or more or<br>(ii) with a peak throughput of 120 litres per second or more.<br><br>***Applicability:***<br>Stormwater channels/berms will be required for the diversion of stormwater run-off to the new or existing pollution control dams. | ***Activity 3:***<br>The construction of facilities or infrastructure for the storage, or storage and handling, of a dangerous good, where such storage occurs in containers with a combined capacity of more than 500 cubic metres.<br><br>***Applicability:***<br>Diesel may be stored at the site for the fuelling of construction vehicles and equipment. Quantities have not been determined. | ***Activity 4:***<br>The construction of a road wider than 4 metres with a reserve less than 13.5 metres.<br>(a) In Limpopo province:<br>ii. Outside urban areas, in:<br>(cc) Sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority;<br>(gg) Areas within 10 kilometres from national parks or world heritage sites or 5 kilometres from any other protected area identified in terms of NEMPAA or from the core areas of a biosphere reserve.<br><br>***Applicability:***<br>SA1 is 4 km from the eastern edge of the Tierkop Private Nature Reserve. According to the Limpopo C-Plan metadata, this area is designated as a nature reserve. |
| ***Activity 11:***<br>The construction of:<br>~~(i) canals;~~<br>(ii) channels;<br>~~(iii) bridges;~~<br>(iv) dams;<br>~~(v) weirs;~~<br>(vi) bulk stormwater outlet structures;<br>~~(vii) marinas;~~<br>~~(viii) jetties exceeding 50 square meters in size;~~<br>~~(ix) slipways exceeding 50 square meters in size;~~<br>(x) buildings exceeding 50 square meters in size; or<br>(xi) infrastructure or structures covering 50 square meters or more<br>where such construction occurs within a watercourse or | ***Activity 6:***<br>The construction of facilities or infrastructure for the bulk transportation of dangerous goods –<br>(iii) in solid form, outside an industrial complex, using funiculars or conveyors with a throughput capacity of more than 50 tons day.<br><br>***Applicability:***<br>Construction of a new conveyor (that forms part of the linear infrastructure route) to transport ash to SA2. | ***Activity 16***<br>The construction of infrastructure covering 10 square meters or more<br>where such construction occurs within a watercourse or within 32 meters of a watercourse, measured from the edge of a watercourse, excluding where such construction will occur behind the development setback line.<br>(a) In Limpopo.<br>ii. Outside urban areas, in:<br>(dd) Sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority;<br>(hh) Areas within 10 kilometres from national parks or |

| Activities subject to a Basic Assessment in terms of GN R.544 – Listing Notice 1 | Activities subject to a Scoping and EIA in terms of GN R.545 – Listing Notice 2 | Activities subject to a Basic Assessment in terms of GN R.545 – Listing Notice 3 |
|---|---|---|
| within 32 metres of a watercourse, measured from the edge of a watercourse, excluding where such construction will occur behind the development.<br><br>***Applicability:***<br>SA1 – applicable to the construction of stormwater channels and leachate collection pipes that are constructed within a watercourse, or within 32 m of a watercourse.<br>SA2 - applicable to the construction of stormwater channels, leachate collection pipes and pollution control dam that are constructed within a watercourse, or within 32 m of a watercourse. | | world heritage sites or 5 kilometres from any other protected area identified in terms of NEMPAA or from the core area of a biosphere reserve.<br><br>***Applicability:***<br>SA1 is 4 km from the eastern edge of the Tierkop Private Nature Reserve. According to the Limpopo C-Plan metadata, this area is designated as a nature reserve. |
| ***Activity 18:***<br>The infilling or depositing of any material of more than 5 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock or more than 5 cubic metres from<br>(i) a watercourse<br><br>***Applicability:***<br>Infilling or depositing of material exceeding the 5 cubic meter threshold into a watercourse. | ***Activity 15***<br>Physical alteration of undeveloped, vacant or derelict land for residential, retail, commercial, recreational, industrial or institutional use where the total area to be transformed is 20 hectares or more.<br><br>***Applicability:***<br>SA1 - approximately 510 ha is available as a greenfields site with the remaining 190 ha being available through construction of the new ADF over the existing ADF by piggy-backing.<br>SA2 - approximately 660 ha will be needed for the development of the facility. | |
| ***Activity 22:***<br>The construction of a road, outside urban areas,<br>(i) with a reserve wider than 13,5 meters or,<br>(ii) where no reserve exists where the road is wider than 8 metres, or<br>(iii) for which an environmental authorisation was obtained for the route determination in terms of activity 5 in Government Notice 387 of 2006 or activity 18 in Notice 545 of 2010. | | |

| Activities subject to a Basic Assessment in terms of GN R.544 – Listing Notice 1 | Activities subject to a Scoping and EIA in terms of GN R.545 – Listing Notice 2 | Activities subject to a Basic Assessment in terms of GN R.545 – Listing Notice 3 |
|---|---|---|
| ***Applicability:***<br>SA1 – construction of haul roads to allow for easy access to the dump for loading and maintenance.<br>SA2 – construction of haul roads to allow for easy access to the dump for loading and maintenance as well as access to the conveyor belt route for maintenance purposes. | | |
| ***Activity 28:***<br>The expansion of or changes to existing facilities for any process or activity where such expansion will result in the need for a permit or licence in terms of national or provincial legislation governing the release of emissions or pollution, excluding where the facility, process or activity is included in the list of waste management activities published in terms of section 19 of the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) in which case that Act will apply.<br><br>***Applicability:***<br>A Water Use Licence (WUL) will need to be applied for the proposed ADF operations. | | |
| ***Activity 37:***<br>The expansion of facilities or infrastructure for the bulk transportation of water, sewage or stormwater where:<br>(a) the facility or infrastructure is expanded by more than 1000 meters in length; or<br>(b) where the throughput capacity of the facility or infrastructure will be increased by 10% or more.<br><br>***Applicability:***<br>Expansion of existing stormwater channels will be required for the diversion of stormwater run-off to the new or existing pollution control dams. | | |

| Activities subject to a Basic Assessment in terms of GN R.544 – Listing Notice 1 | Activities subject to a Scoping and EIA in terms of GN R.545 – Listing Notice 2 | Activities subject to a Basic Assessment in terms of GN R.545 – Listing Notice 3 |
|---|---|---|
| ***Activity 39:***<br>The expansion of<br>~~(i) canals;~~<br>(ii) channels;<br>~~(iii) bridges;~~<br>~~(iv) weirs;~~<br>(v) bulk stormwater outlet structures;<br>~~(vi) marinas;~~<br>within a watercourse or within 32 m of a watercourse, measured from the edge of a watercourse, where such expansion will result in an increased development footprint but excluding where such expansion will occur behind the development setback line.<br><br>***Applicability:***<br>If SA1 is selected as the preferred site then existing stormwater channels may be expanded. This activity is applicable if the expansion occurs within a watercourse or within 32 m of a watercourse. | | |
| ***Activity 40:***<br>The expansion of:<br>(iv) infrastructure or structures covering 50 square meters or more<br>where such construction occurs within a watercourse or within 32 metres of a watercourse, measured from the edge of a watercourse, excluding where such construction will occur behind the development setback line.<br><br>***Applicability:***<br>Applicable to SA1 if existing infrastructure is expanded. | | |
| ***Activity 47:***<br>The widening of a road by more than 6 meters or the lengthening of a road by more than 1 kilometre where | | |

| Activities subject to a Basic Assessment in terms of GN R.544 – Listing Notice 1 | Activities subject to a Scoping and EIA in terms of GN R.545 – Listing Notice 2 | Activities subject to a Basic Assessment in terms of GN R.545 – Listing Notice 3 |
|---|---|---|
| no reserve exists, where the existing reserve is wider than 13,5 meters or where the existing road is wider than 8 meters.<br><br>***Applicability:***<br>Access roads may be widened in order to reach all sections of the ADF during the construction and operational (maintenance) phases of the project. | | |
| ***Activity 49:***<br>The expansion of facilities or infrastructure for the bulk transportation of dangerous goods in solid form, outside an industrial complex or zone, by an increased throughput capacity of 50 tons or more per day.<br><br>***Applicability:***<br>The overland ash conveyor facilities may be expanded if SA1 is selected for continuous ashing. | | |

## 5.2 National Environmental Management: Waste Act (No 59 of 2008)

The National Environmental Management: Waste Act (No. 59 of 2008) and Regulations, reforms the law regulating waste management in order to protect health and the environment by providing reasonable measures for the prevention of pollution and ecological degradation and for securing ecologically sustainable development; to provide for institutional arrangements and planning matters; to provide for national norms and standards for regulating the management of waste by all spheres of government; to provide for specific waste management measures; to provide for the licencing and control of waste management activities; to provide for the remediation of contaminated land; to provide for the national waste information system; to provide for compliance and enforcement; and to provide for matters connected therewith.

In November 2013, the Waste Regulations (Government Notice 718) went through an amendment process. Specific activities relating to the construction of facilities for the treatment of sewage, wastewater or effluent was removed from the NEM:WA and provided for in the EIA Regulations as amended in 2013. Government Notice No 921 was published on 29 November 2013 with a revised list of waste management activities that have, or are likely to have a detrimental effect on the environment. GN 921 makes reference to three categories of licencing i.e. Category A, B and C. Category A activities require a Basic Assessment, Category B activities require a full scoping and EIA. Category C activities do not require a Waste Management Licence but must be registered with the Competent Authority and must comply with relevant requirements or standards determined by the Minister.

This list of applicable waste activities requiring a Waste Management Licence for this project, in terms of the NEM: WA, is presented in Table 7.

**Table 7: List of waste activities requiring a Waste Management Licence**

| **GN 921 – Category B**<br>**A person who wishes to commence undertake or conduct an activity listed under this Category, must conduct an EIA process, as stipulated in the EIA Regulations (2010) made under section 24(5) of the NEMA (No 107 of 1998) as part of a waste management licence application** |
|---|
| ***Activity 1:***<br>The storage including the temporary storage of hazardous waste in lagoons.<br><br>***Applicability:***<br>A new pollution control dam will need to be constructed if SA2 is selected as the preferred option. |
| ***Activity 7:***<br>The disposal of any quantity of hazardous waste to land.<br><br>***Applicability:***<br>Ash classified as being hazardous will be disposed of at either the existing ADF (SA1) or a new ADF (SA2). |
| ***Activity 10:***<br>The construction of facilities for activities listed in Category B of this Schedule (not in isolation to associated activity).<br><br>***Applicability:***<br>Applicable to the construction of a new ADF or the expansion of the existing ADF. |

It should be noted, that the project proposes the following two additional components:

a) Use of treated sludge as a soil ameliorant for the rehabilitation of the ash dump. Wastewater sludge is generated at the power station and dried first on drying beds before being collected and stored in skips for a period of 2 - 3 months. Estimated average monthly volume generated is 11 $m^3$ per month. Currently, the sludge is dried and disposed at Holfontein. Based on the volume of sludge produced, distance and cost of landfilling, one option being assessed is the use of the sludge to be applied with

topsoil in rehabilitation of the ash dump. No additional activities are triggered in terms of GN 921 for the use of treated sludge as a soil ameliorant.

b) Expansion of the emergency ash offloading area - the emergency offloading area is insufficient and needs to be extended. It is proposed the that the area needs to be extended by 4680 $m^2$ to a total area of 5580 $m^2$ and whilst the 80 $m^3$ capacity will be reached, it is considered the temporary storage of hazardous waste and therefore this activity is excluded i.e. the average volume of ash being stored at the area is approximated at 19500 tons given the amount of days it takes to maintain and bring back the conveyor system back online, which can take a maximum of 5 days.

In addition to GN 921, this EIA study also takes into consideration the following Regulations and Norms and Standards:

- Government Notice R.634 of 2013 - Waste Classification and Management Regulations (WCMR);
- Government Notice R.635 of 2013 - National Norms and Standards for the Assessment of Waste for Landfill Disposal;
- Government Notice R.636 of 2013 - National Norms and Standards for Disposal of Waste to Landfill.

## 5.3 National Water Act (No 36 of 1998)

According to Chapter 4 of the NWA, all water users must have permission to do so. This aspect is termed as "Permissible Water Use". There are several different ways in which Permissible Water Uses are exercised.

Water use is defined broadly, and includes taking and storing water, activities which reduce stream flow, waste discharges and disposals, controlled activities (activities which impact detrimentally on a water resource), altering a watercourse, removing water found underground for certain purposes, and recreation. In general, a water use must be licenced unless it is listed in Schedule 1, is an existing lawful use, is permissible under a general authorisation, or if a responsible authority waives the need for a licence. The Minister may limit the amount of water which a responsible authority may allocate. In making regulations the Minister may differentiate between different water resources, classes of water resources and geographical areas.

The purpose of the NWA is to provide for fundamental reform of the law relating to water resources. In Section 21 of the NWA, all freshwater water uses are defined and will require authorisation from the Department of Water and Sanitation (DWS) before the water use can commence.

The Matimba Power Station currently holds a Water Use Licence (WUL) for the operation of the Matimba Power Station and all its related activities. The following water uses (Table 8) are authorised under this licence:

**Table 8: Licenced water uses for the Matimba Power Station**

| Relevant water use | Description | Properties on which to Exercise Licence |
|---|---|---|
| Section 21 (a) | Taking water from a water resource | Farm Grootestryd 465 LQ |
| Section 21 (b) | Storing water | Farm Grootestryd 465 LQ |
| Section 21 (e) | Engaging in a controlled activity identified as such in section 37 (1) (which includes the intentional recharging of an aquifer with any waste or water containing waste) or declared under section 38 (1) | Farms Grootestryd 465 LQ, Nelson's Kop 464, Zwartwater 507 LQ |
| Section 21 (g) | Disposing of waste in a manner which may detrimentally impact on a water resource | Farm Altoostyd 506 LQ |

**Table 9: Additional water uses to be applied for the proposed project**

| Water Use | Description |
|---|---|
| Section 21 (c) | Impeding or diverting the flow of water in a watercourse |
| Section 21 (e) | Engaging in a controlled activity identified as such in section 37 (1) (which includes the intentional recharging of an aquifer with any waste or water containing waste) or declared under section 38 (1) |
| Section 21 (g) | Disposing of waste in a manner which may detrimentally impact on a water resource |
| Section 21 (i) | Altering the bed, banks, course or characteristics of a watercourse |

Dependent on the final site that will be selected for the location of the ADF, an application for amendment of the current WUL will be lodged or a new WUL will be applied for by Eskom.

## 5.4 National Environmental Management: Air Quality Act (No 39 of 2004)

The National Environmental Management: Air Quality Act (No. 39 of 2004) [NEM: AQA) repeals the Air Pollution Prevention Act (No. 45 of 1965) in its entirety. The purpose of the Air Quality Act is to reform the law regulating air quality in order to protect the environment by providing measures for the prevention of pollution and ecological degradation, while, promoting justifiable economic and social development. The Air Quality Act seeks to provide national standards regulating air quality monitoring management and control.

NEM: AQA has shifted the approach of air quality management from source-based control to receptor-based control. The main objectives of the Act are to:

- Give effect to everyone's right 'to an environment that is not harmful to their health and well-being'
- Protect the environment by providing reasonable legislative and other measures that (i) prevent pollution and ecological degradation, (ii) promote conservation and (iii) secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development.

NEM: AQA makes provision for the setting and formulation of national ambient air quality standards for "*substances or mixtures of substances which present a threat to health, well-being or the environment*". These standards prescribe the allowable ambient concentrations of pollutants which are not to be exceeded during a specified time period in a defined area. If the air quality standards are exceeded, the ambient air quality is poor and the potential for health effects is greatest. More stringent standards can be established at the provincial and local levels.

The control and management of emissions in the NEM: AQA relates to the listing of activities that are sources of emission and the issuing of emission licences. Listed activities are defined as activities which '*result in atmospheric emissions and are regarded as having a significant detrimental effect on the environment, including human health*'. Listed activities have been identified by the Minister of Environmental Affairs and atmospheric emission standards have been established for each of these activities. These listed activities now require an atmospheric emission licence to operate. The issuing of emission licences for Listed Activities is the responsibility of the Metropolitan and District Municipalities.

NEM:AQA in Part 6 – Sections 32, 34 and 35 makes provision for the control of dust, noise and offensive odours respectively. The National Dust Control Regulations (GN R.827) were promulgated on 01 November 2013. This document now enforces the monitoring of dust fallout from activities that are suspected of contributing significantly to dust fallout in the affected region. The regulation provides a set standard for dust fallout to comply to, enforces that a baseline should be established to projects that would give rise to increased dust fallout, specifications for dust fallout monitoring and the format of reports if the activity should exceed the threshold.

## 5.5 National Heritage Resources Act (No 25 of 1999)

In terms of section 38 (subject to the provisions of subsections (7), (8) and (9) of the National Heritage Resources Act (No. 25 of 1999) [NHRA], any person who intends to undertake a development categorised as:

- *The construction of a road, wall, power line, pipeline, canal or other similar form of linear development or barrier exceeding 300 m in length;*
- *The construction of a bridge or similar structure exceeding 50 m in length;*
- *Any development or other activity which will change the character of a site:*
    - *Exceeding 5,000 m² in extent;*
    - *Involving three or more existing erven or subdivisions thereof; or*
    - *Involving three or more erven or divisions thereof which have been consolidated within the past five years; or*
    - *The costs of which will exceed a sum set in terms of regulations by South African Heritage Resources Agency (SAHRA) or a provincial heritage resources authority;*
- *The re-zoning of a site exceeding 10,000 $m^2$ in extent; or*
- *Any other category of development provided for in regulations by SAHRA or a provincial heritage resources authority –*

must at the very earliest stages of initiating such a development, notify the responsible heritage resources authority and furnish it with details regarding the location, nature and extent of the proposed development.

The SAHRA is listed on the database as an interested and affected party and has been updated on the progress of the EIA study during the different phases.

## 5.6 Other Legislative Requirements

**Table 10: Legislative requirements in terms of other Acts, Policies and Plans**

| Legislation | Relevant Sections | Relates to |
|---|---|---|
| The Constitution (No. 108 of 1996) | Chapter 2 | Bill of Rights. |
| | Section 24 | Environmental rights. |
| National Environmental Management Biodiversity Act (No. 10 of 2004) and Regulations:<br>• Threatened or protected species (GN 388)<br>• Lists of species that are threatened or protected (GN 389)<br>• Alien and invasive species regulations (GNR 506)<br>• Publication of exempted alien species (GNR 509)<br>• Publication of National list of invasive species (GNR 507)<br>• Publication of prohibited alien species (GNR 508) | | Provide for the protection of species and ecosystems that warrant national protection and the sustainable use of indigenous biological resources.<br>• Threatened or protected species.<br>• Alien and invasive species management and control.<br>• Exempted alien species.<br>• National list of invasive species.<br>• Prohibited alien species. |
| National Forests Act (No 84 of 1998) and Regulations | Section 7<br><br>Sections12- | No person may cut, disturb, damage or destroy any indigenous, living tree in a natural forest, except in terms of a licence issued under section 7(4) or section 23; or an exemption from the provisions of this subsection published by the Minister in the Gazette.<br><br>These sections deal with protected trees, with the Minister having the power to declare a particular tree, a |

| Legislation | Relevant Sections | Relates to |
|---|---|---|
| | 16 | group of trees, a particular woodland, or trees belonging to a certain species, to be a protected tree, group of trees, woodland or species. In terms of section 15, no person may cut, disturb, damage, destroy or remove any protected tree; or collect, remove, transport, export, purchase, sell, donate or in any other manner acquire of dispose of any protected tree, except under a licence granted by the Minister. |
| Fencing Act (No 31 of 1963) | Section 17 | Any person erecting a boundary fence may clean any bush along the line of the fence up to 1.5 meters on each side thereof and remove any tree standing in the immediate line of the fence. However, this provision must be read in conjunction with the environmental legal provisions relevant to protection of flora. |
| Occupational Health and Safety Act (No 85 of 1993) and Regulations | Section 8<br><br>Section 9 | General duties of employers to their employees.<br><br>General duties of employers and self employed persons to person other than their employees. |
| Hazardous Substance Act (No 15 of 1973) and Regulations | | Provides for the definition, classification, use, operation, modification, disposal or dumping of hazardous substances. |
| Mine Health and Safety Act (No 29 of 1996) | Chapter 2<br><br>Chapter 8 | Health and safety at mines.<br><br>General provisions. |
| Road Transportation Act (No 74 of 1977) | | |
| Construction Regulations 2014 | | |
| SANS 10103 (Noise Regulations) | | |
| Waterberg District Municipality Spatial Development Framework (2009) | | |
| Waterberg District Municipality Integrated Development Plan (2014/15) | | |
| Waterberg District Municipality Local Economic Development Strategy (2007) | | |
| Waterberg District Municipality Environmental Management Framework (2010) | | |
| Lephalale Local Municipality Integrated Development Plan (2013-2016) | | |
| Lephalale Local Municipality Spatial Development Framework (2012) | | |
| Lephalale Local Municipality Local Economic Development Strategy (2008) | | |
| Department of Water Affairs and Forestry. Guidelines for the Utilisation and Disposal of Wastewater Sludge Selection of management options: Volume 1 (2006) | | |
| Department of Water Affairs and Forestry. Guidelines for the Utilisation and Disposal of Wastewater Sludge Requirements for the agricultural use of wastewater sludge: Volume 2 (2006) | | |
| Department of Water Affairs and Forestry: Guidelines for the Utilisation and Disposal of Wastewater Sludge: Requirements for the on-site and off-site disposal of wastewater sludge: Volume 3 (2007) | | |
| Department of Water Affairs and Forestry. Guidelines for the Utilisation and Disposal of Wastewater Sludge: Requirements for the beneficial use of sludge at high loading rates: Volume 4 (2008) | | |
| Department of Water Affairs and Forestry. Guidelines for the Utilisation and Disposal of Wastewater Sludge: Requirements for thermal sludge management practices and for commercial products containing sludge: Volume 5 (2008) | | |

# 6 DESCRIPTION OF THE RECEIVING ENVIRONMENT

## 6.1 Biophysical Environment

### 6.1.1 Locality

The proposed project falls in Limpopo Province within the Waterberg District Municipality (DC 36) which consists of six local municipalities namely: Mookgopong, Bela Bela, Modimolle, Thabazimbi, Lephalale and Mogalakwena.

Site Alternatives (SA) 1 and 2 as well as the linear infrastructure route area for the proposed project is located in the Lephalale Local Municipality which is the largest in the province measuring 14,000 km$^2$. The Lephalale Local Municipality is located in the north western section of the District Municipality and is bordered by the local municipalities of Thabazimbi to the south west, Modimolle to the south east, Mogalakwena to the east and Blouberg to the north[3]. Refer to Figure 12 for the provincial map.

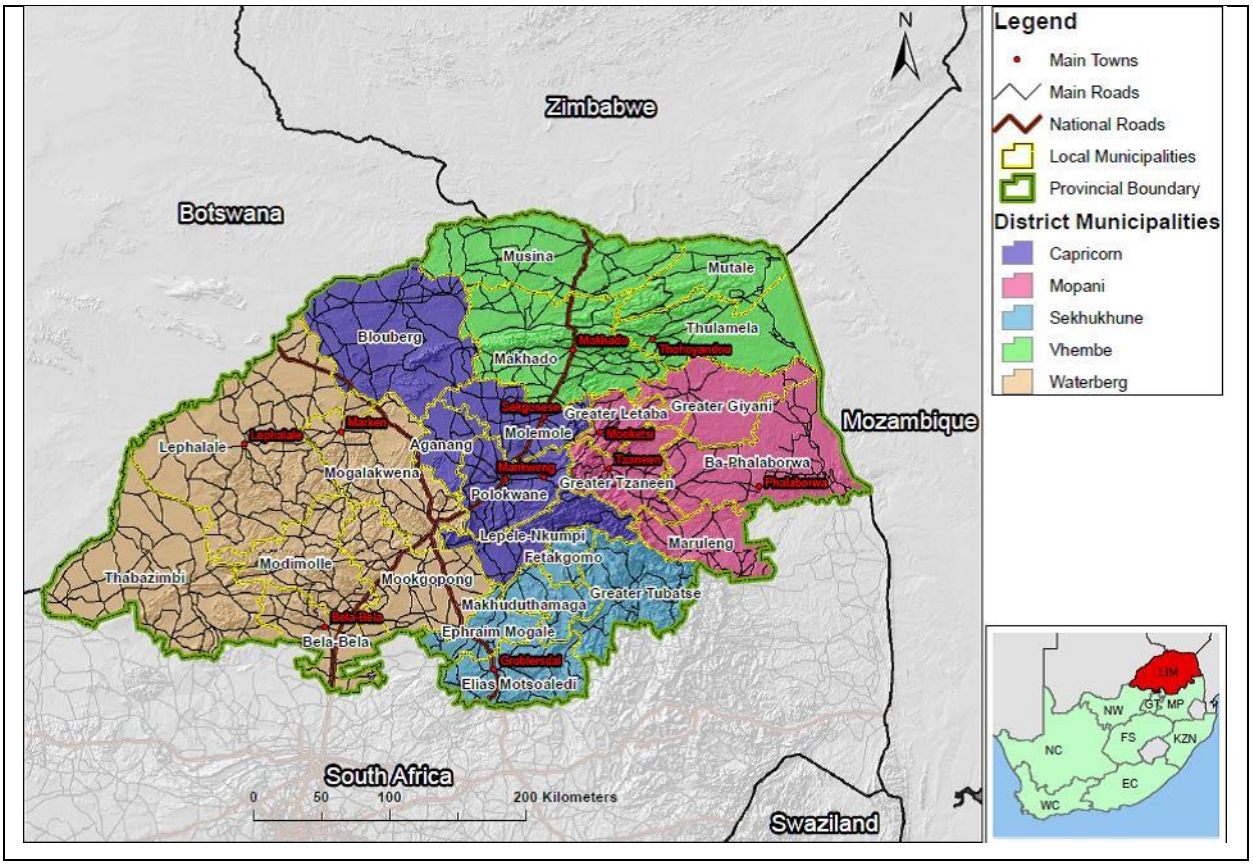



**Figure 12: Map of Limpopo Province and its constituent District and Local municipalities**

[3] Source: Lephalale Local Municipality Final IDP 2012-2013.

## 6.1.2 Climate and Local Weather Conditions

SA1 and SA2 as well as the linear infrastructure route are situated in a semi-arid rainfall region that is characterized by cool, dry winters (May to August) and warm, wet summers (October to March), with April and September being transition months.

### *6.1.2.1 Rainfall*

SA1 and SA2 as well as the linear infrastructure route lie in the summer rainfall region (as such rainfall in the area is highly seasonal) receiving an annual average of approximately 400 mm. Most of this rainfall occurs in the months of December, January and February[4] with the average annual rainfall received at Matimba Power Station being 460 mm per annum. Rainfall is however slightly unreliable and rather severe drought conditions tend to occur about 12% annually.

### *6.1.2.2 Temperature*

Summer experiences warm temperatures with daily summer temperatures ranging between 23°C and 32°C. Winter temperatures vary from mild to cool ranging between 7°C and 20°C.

### *6.1.2.3 Wind*

Wind roses comprise 16 (sixteen) spokes which represent the directions from which winds blew during the period. The colours reflect the different categories of wind speeds. The dotted circles provide information regarding the frequency of occurrence of wind speed and direction categories. The resultant vector represents the mean wind direction.

As illustrated in Figure 13 and Figure 14 respectively, it can be seen that Lephalale is not an area of high wind speeds. On average, at the current ADF, 29.74% of the time, calm conditions existed over the area. The highest frequency of wind speeds lie between 0.5 to 2.1 m/s which occurred for 45.2% of the time. The second highest wind class (2.1 – 3.6 m/s) occurs 17.5% of the time.

Figure 13 shows the prevailing winds blowing from a north easterly direction.

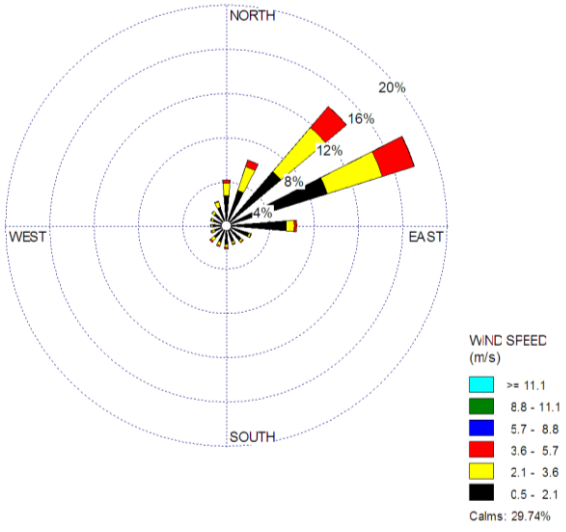



**Figure 13: Period wind rose for Lephalale (2007 to 2011)**

[4] South Africa Rainfall Atlas.

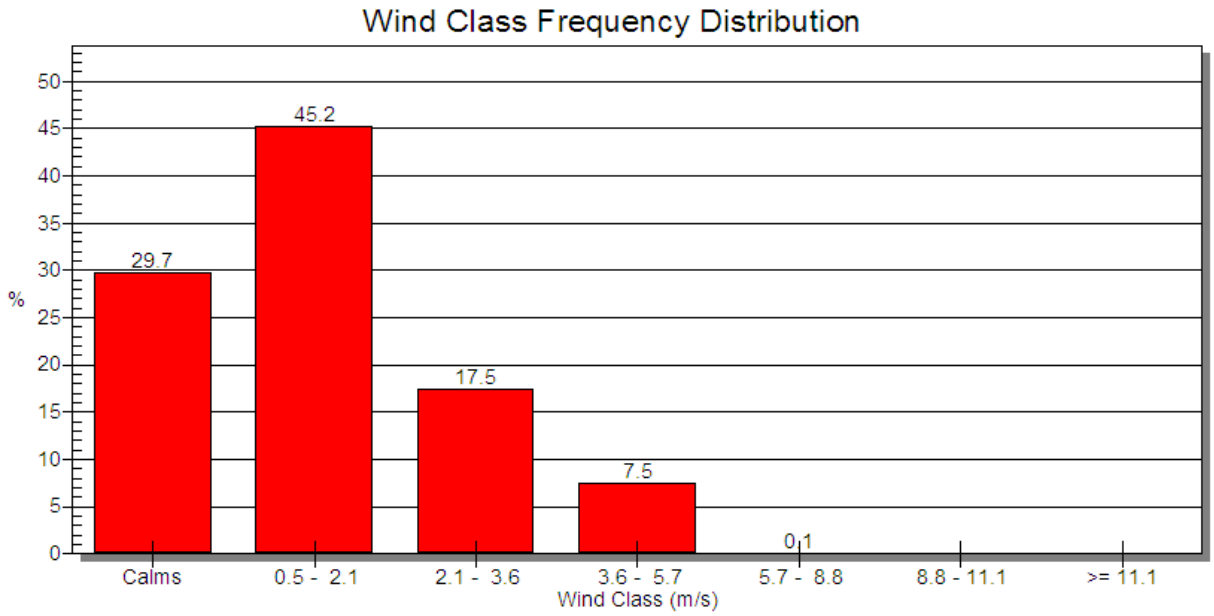



**Figure 14: Wind class frequency distribution for Lephalale (2007 to 2011)**

#### *6.1.2.4 Atmospheric Stability*

Atmospheric stability is commonly categorised into six (6) stability classes. These are briefly described in Table 11. The atmospheric boundary layer is usually unstable during the day due to turbulence caused by the sun's heating effect on the earth's surface. The depth of this mixing layer depends mainly on the amount of solar radiation, increasing in size gradually from sunrise to reach a maximum at about 5-6 hours after sunrise. The degree of thermal turbulence is increased on clear warm days with light winds. During the night-time a stable layer, with limited vertical mixing, exists. During windy and/or cloudy conditions, the atmosphere is normally neutral. Figure 12 indicates that calm very stable conditions occur 29.1% of the time, which is conducive to the formation of inversion layers and a concentration of pollutants within the valleys surrounding the site.

**Table 11: Atmospheric stability classes**

| Class | | Description |
|---|---|---|
| ***A*** | Very unstable | Calm wind, clear skies, hot daytime conditions |
| ***B*** | Moderately unstable | Clear skies, daytime conditions |
| ***C*** | Unstable | Moderate wind, slightly overcast daytime conditions |
| ***D*** | Neutral | High winds or cloudy days and nights |
| ***E*** | Stable | Moderate wind, slightly overcast night-time conditions |
| ***F*** | Very stable | Low winds, clear skies, cold night-time conditions |

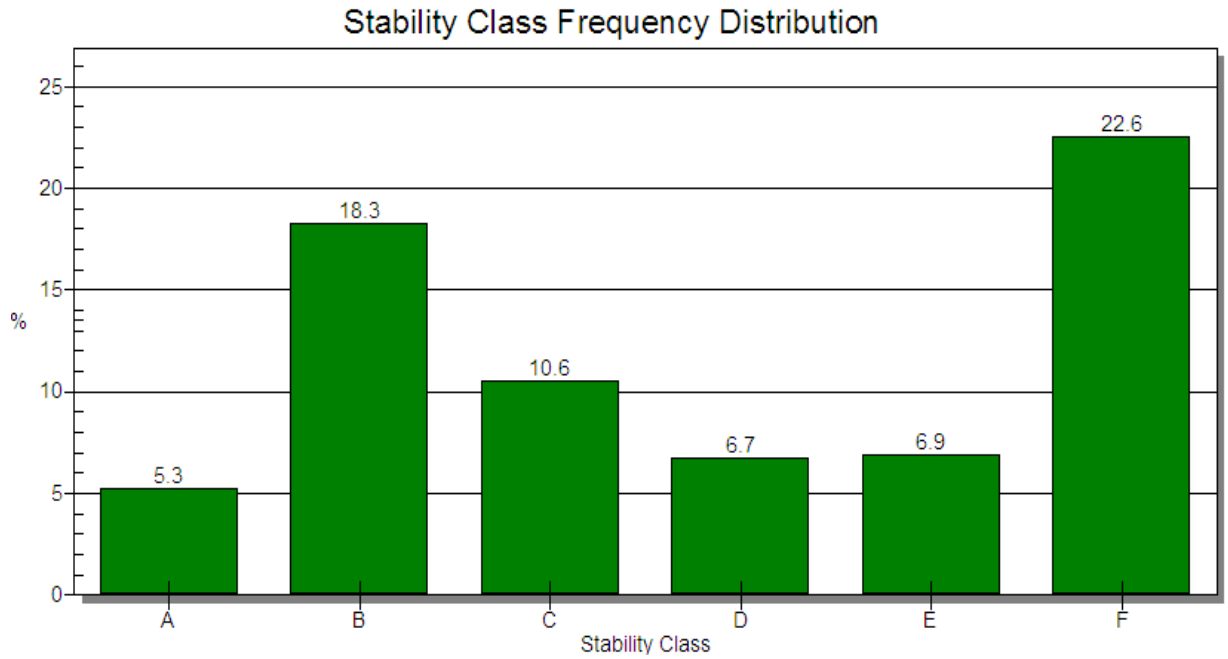



**Figure 15: Class stability frequency distribution**

### 6.1.3 Topography

The topography is relatively flat around the Onverwacht / Matimba Power Station area, and extending to the north and west. These landscape characteristics mark a change from the area to the south of the town of Lephalale where much more hilly and incised topography, forming part of the Waterberg foothills, exists.

In a more localised context, the topography on and around the site of the current ADF slopes very gently and almost imperceptibly down to the south and the east, towards the very poorly defined valley bottom that is drained by the Sandloop River. The Sandloop is a non-perennial river that runs east-west in close proximity to the south of the existing ADF. To the south of the river the topography slopes gently up towards the higher-lying ground in the south, where the Waterberg conglomerates outcrop as a series of low rocky outcrops.

### 6.1.4 Geology

Sediments and volcanics of the Waterberg Group and Karoo Supergroup underlie the broader study area.

Figure 16 illustrates a portion of the 1:250 000 geological map (2326 Ellisras) showing the geological patterns of the study area. The Matimba ADF and southern portions of the study area is underlain by the Mogalakwena Formation of the Waterberg Group. This formation is comprised of coarse-grained purplish brown sandstone.

The Eenzaamheid Fault separates the Waterberg Group in the south from the Karoo Supergroup sediments underlying the remainder of the study area to the north. The Swartrant and Grootegeluk Formations of the Karoo Supergroup are located in the central, western and eastern portions. The Swartrant Formation consists of sandstone, gritstone, mudstone and coal and the Grootegeluk Formation consists of mudstone, carbonaceous shale and coal.

The Daarby Fault separates the Swartrant Formation from the Clarens Formation to the north of the study area. The Clarens Formation consists of fine-grained cream coloured sandstone. No faults are located within the Waterberg Group sediments within the southern portions of the study area. Several smaller faults are associated with the Swartrant Formation, Grootegeluk Formation and Clarens Formation of the Karoo Supergroup.

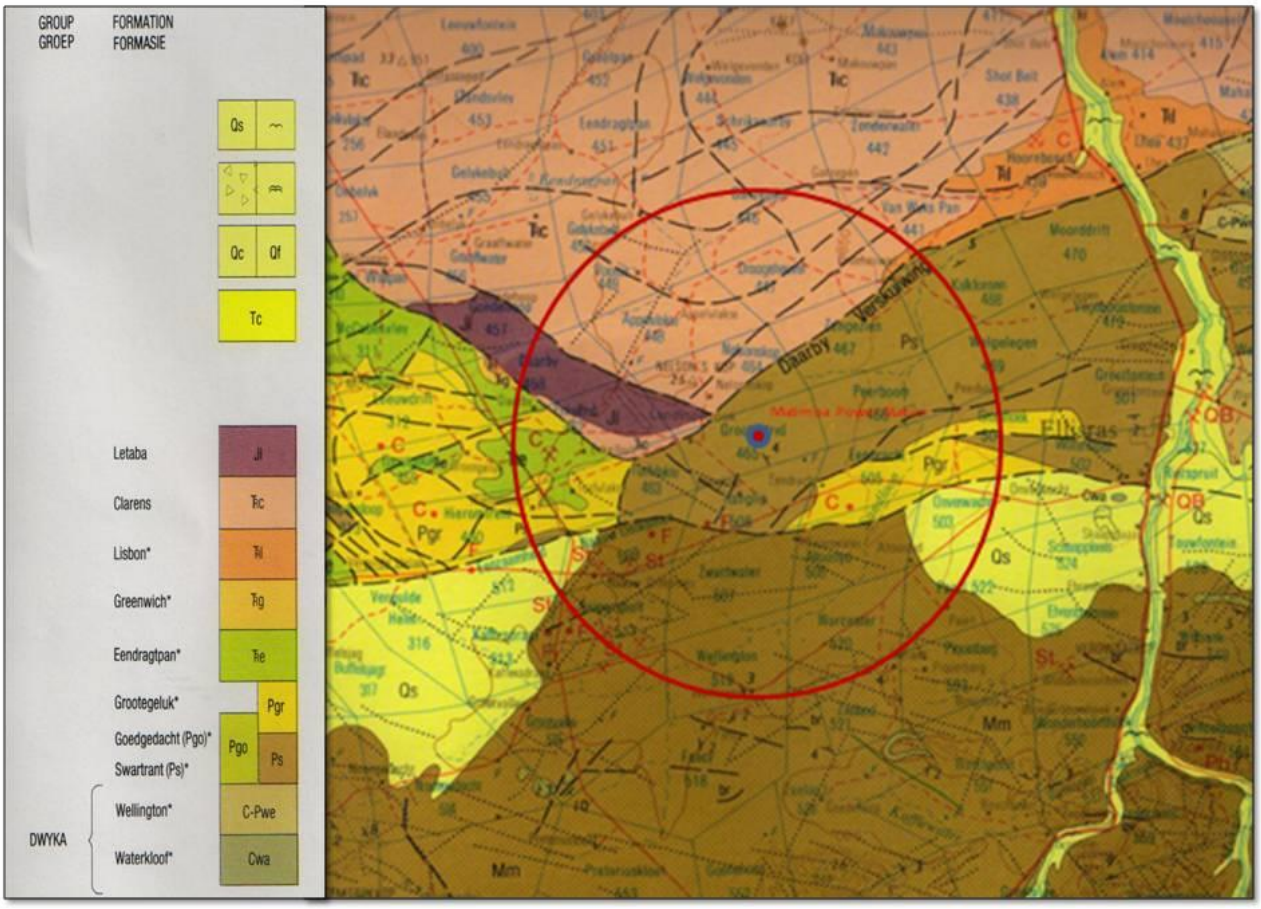



**Figure 16: 1:250 000 geological map (2326 Ellisras) showing the geological patterns of the study area**

Table 12 provides a summarised geology of the broader study area.

**Table 12: Summarised geology of the site**

| Group | Formation | Rock Types |
|---|---|---|
| | Letaba | Basalt |
| | Clarens | Fine grained cream coloured sandstone |
| | Lisbon | Red mudstone, siltstone |
| | Greenwich | Red sandstone, conglomerate |
| | Eendragtpan | Variegated shale |
| | Grootgeluk | Mudstone, carbonaceous shale, coal |
| | Goededacht | Gritty mudstone, mudstone, sandstone, coal |
| | Swartrant | Sandstone, gritstone, mudstone, coal |
| **Dwyka** | Wellington | Mudstone, siltstone, minor grit |
| **Waterberg** | Mogalakwena | Coarse grained purplish brown sandstone, conglomerate |

#### 6.1.4.1 *Structural Geology*

The study area is within the Waterberg Coalfield, which comprises a graben structure with the Eenzaamheid fault forming the southern boundary and the northern boundary is delineated by the Zoetfontein fault. Archaean granite rocks outcrop to the north of the Zoetfontein fault and sediments of the Waterberg Group outcrop to the south of the Eenzaamheid fault.

The geological structures can enhance the groundwater potential in the area by increasing the permeability and transmissivity of the host rock. Secondary processes, such as faulting and fracturing, can create secondary fractured rock aquifers.

- **The Daarby Fault**

  The Daarby Fault is a major northeast then northwest trending fault, assumed to be a combination of two faults that have the same throw and throw directions. The down throw of 360 m to the north serves to bring the Grootegeluk Formation rocks to the south in contact with the younger Clarens Formation sandstone and Letaba Formation basalts in the north. Thus the fault divides the coalfield into a shallow (opencast) coal area to the south of the Daarby Fault, and a deep north coal area. The Daarby thrust fault is impermeable.

- **The Eenzaamheid Fault**

  The Eenzaamheid fault has a throw of 250 m to the north and the fault is near vertical. The fault brings the up thrown Waterberg Group sediments on the south side of the fault in contact with shallow coal on the northern side of the fault. The permeability of the Eenzaamheid fault is not clear, initial groundwater contours indicated that the fault was impermeable and that dewatering at the mine did not impact on the Waterberg Group sediments to the south of the fault. The Eenzaamheid fault has enhanced groundwater potential and could be targeted for groundwater resource development. The fault can also act as a preferential flow path for groundwater and potential contamination.

- **Minor Faulting**

  Associated step faults are identified within the area, especially where the Eenzaamheid and Daarby faults are in the closest proximity (approximately 2 km). The associated faults have varying strikes, throws, and throw direction. These faults have increased the in situ permeability of these rocks and influence the groundwater flow patterns. Indications from exploration drilling are that the Daarby and Eenzaamheid faults are linked. This area also acts as a groundwater flow barrier as dewatering occurs within the Grootegeluk and Eendragtpan Formations, but not in the Swartrant Formation, as recognised from the groundwater modelling.

#### 6.1.4.2 *Site Alternative 1*

The general geology of the site is characterised by Aeolian (wind-blown) sands of the Karoo Supergroup, which overlie conglomerate and sandstone bedrock of the Waterberg Group, Sandriviers Formation. The Aeolian sands are described as dry to very slightly moist, yellowish/orange brown to reddish brown, medium dense to dense becoming very dense with depth, fine grained, silty sand. This layer extends to top of bedrock, at depths in the range 1.0 – 2.0 m below existing ground level.

The conglomerate bedrock occurs as outcrops in some areas and is mainly present across the central and southern portions of the site. The conglomerate is described as greyish/yellowish/orange brown to purplish grey, moderately to highly weathered, fine to coarse grained (with numerous sub-rounded to sub-angular pebbles), moderately to highly fractured, medium hard rock.

The sandstone bedrock underlies the conglomerate and is described as greyish/orange brown to pinkish brown, highly to moderately weathered, moderately bedded, highly fractured/jointed, soft rock (becoming

progressively slightly weathered and medium hard to hard with depth). In some instances conglomerate is absent and the Aeolian sandy soils are underlain directly by sandstone bedrock.

Figure 17 below shows typical Aeolian sandy soils (left) and pebbly conglomerate rocky outcrop (right).

**Figure 17: Typical subsoil materials on Site Alternative 1**

#### *6.1.4.3 Site Alternative 2*

The general geology of the site is characterised by colluvial sandy soils and Aeolian (wind-blown) sands of the Karoo Supergroup, which overlie pedogenic soils (calcrete) and sandstone bedrock of the Ellisras Basin, Clarens Formation. The colluvial topsoil is described as moderate brown, loose to medium dense, slightly clayey, fine grained, silty sand. The colluvial soils extend to an average depth of 0.3 m below existing ground level.

The Aeolian sands are described as dry to very slightly moist, orange/reddish brown, medium dense becoming dense with depth, fine grained, silty sand. This layer extends to top of calcrete at variable depths, generally in the range 1.5 to 3.5 m below existing ground level.

The nodular calcrete layer is described as whitish grey to creamish white, moderately to highly weathered, fine to medium grained, moderately to highly fractured, soft to medium hard rock.

Grey, alluvial sandy soils were encountered in Inspection Pit (IP) 2 and IP19 along the northern boundary of the site. Sandstone bedrock was not encountered across the site but is anticipated at depths in the range 5.0 to 10.0 m below existing ground level.

Figure 18 shows Aeolian sandy soils underlain by calcrete and Colluvial soils and nodular calcrete.

**Figure 18: Aeolian sandy soils underlain by calcrete (left) and colluvial soils and nodular calcrete (right)**

#### *6.1.4.4 Linear Infrastructure Route to Site Alternative 2*

The general geology along the route is characterised by colluvial sandy soils and Aeolian (wind-blown) sands of the Karoo Supergroup, which overlie pedogenic soils (calcrete) and sandstone/conglomerate bedrock of the Ellisras Basin, Clarens Formation.

The colluvial topsoil is described as greyish brown, very loose to loose, fine grained, silty sand. The colluvial soils extend to an average depth of 0.3 m below existing ground level.

The Aeolian sands are described as slightly moist to moist, orange brown, loose to medium dense, fine grained, slightly silty sand. This layer extends to top of calcrete or sandstone/conglomerate bedrock at variable depths, generally in the range 1.8 to 3.5 m below existing ground level.

The nodular calcrete layer is described as whitish grey to creamish white, moderately to highly weathered, fine to medium grained, moderately to highly fractured, soft to medium hard rock. Sandstone/conglomerate bedrock is anticipated to occur at variable depths in the range 1.8 to 5.0 m below existing ground level.

Figure 19 below provide an indication of the typical subsoil materials encountered across the site.

**Figure 19: Typical Aeolian sandy soils encountered along the linear infrastructure route**

### 6.1.5 Geohydrology

According to the 1:500 000 Geohydrological Map of Polokwane 2326, the southern portion of SA1, south of the Eenzaamheid fault as well as the Grootegeluk Formation is mostly associated with fractured aquifers based on the geology. The average groundwater yields associated with these aquifers, range from 0.5-2 l/s.

Numerous faults transect SA2 and the linear infrastructure route. Lithology north of the Eenzaamheid fault consists of intergranular and fractured aquifers associated with the Swartrant and Clarens Formations with yields ranging from of 0.5-2.0 l/s for the Swartrant Formation and 0.1-0.5 l/s for the Clarens Formation.

#### *6.1.5.1 Groundwater Levels*

Data collected from the National Groundwater Archive (NGA) boreholes, from the Department of Water Affairs as well as the GRIP (Groundwater Resource Information Project) database for the 8 km radius (with the Matimba Power Station which is the source of the ash as the centre point) indicated water levels ranging from 1.83 to 60.96 m below ground level (mbgl) measured between 1953 and 1972.

Monitoring borehole data obtained for the Matimba Power Station indicated water levels ranging from 2.75 mbgl to 29.95 mbgl.

An extensive groundwater monitoring network surrounds the Grootegeluk mine with a large proportion located within the 8 km buffer area. The water levels in these boreholes ranged from 3 mbgl to 60.95 mbgl. The variation in water levels is possibly due to the de-watering activities of the Grootegeluk open cast mining to the west of the 8 km buffer.

#### *6.1.5.2 Groundwater Direction*

The water level data obtained from the Matimba monitoring programme and selected data from the Grootegeluk monitoring was used to contour the groundwater levels and determine the groundwater flow direction.

Figure 20 presents the general groundwater flow direction across and around the 8 km study area. The groundwater flow direction is an easterly direction towards the Sandloop River.

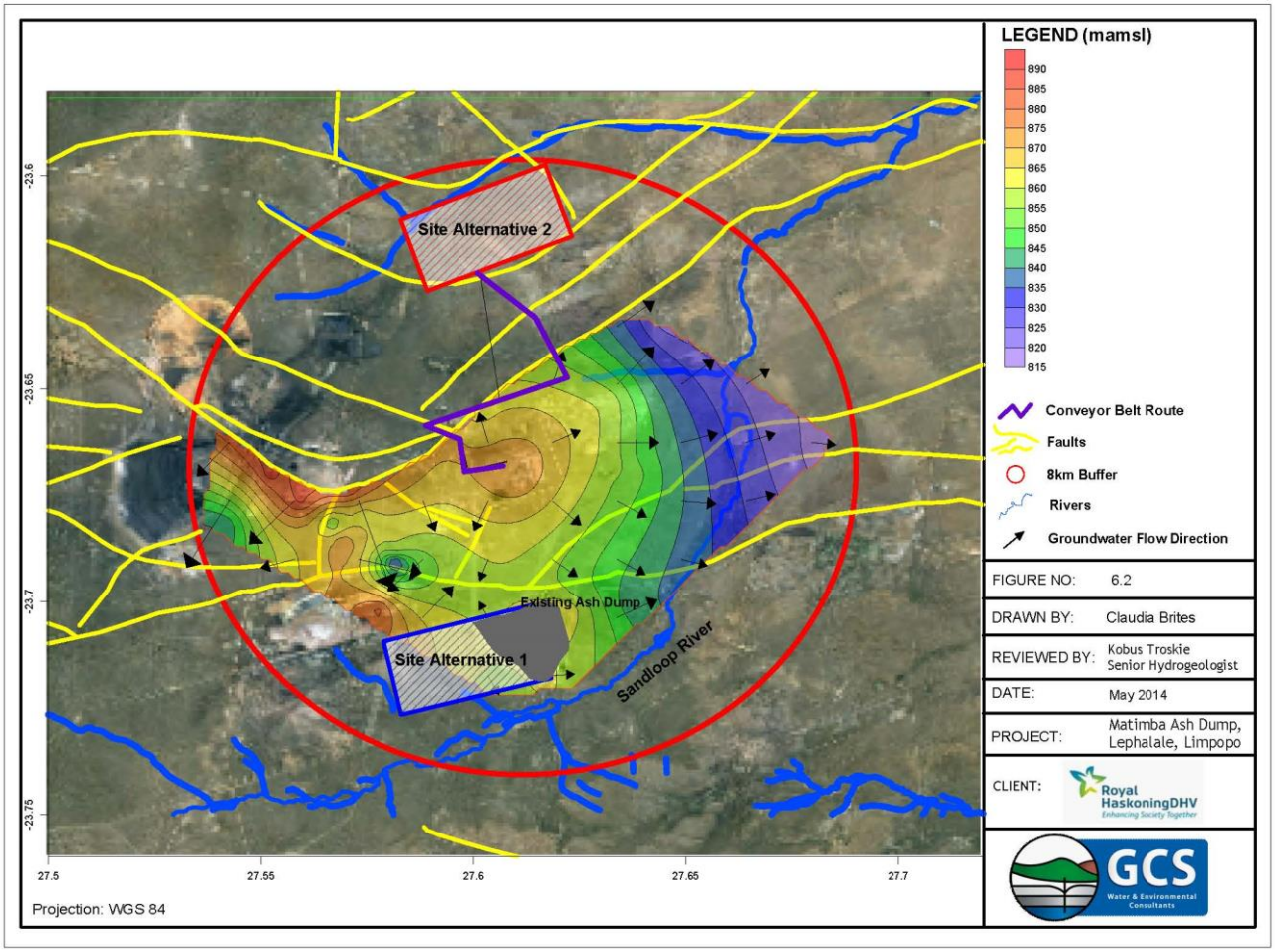



**Figure 20: Groundwater flow direction**

#### *6.1.5.3 Groundwater Use*

Groundwater abstraction occurs for the following purposes:

- Primarily stock or game watering;
- Domestic use;
- Agricultural use; and
- Reticulated (piped) water is supplied to the area, either via the Municipality, Eskom, or Grootegeluk Coal Mine.

### 6.1.6 Surface Water

#### *6.1.6.1 Macro-drainage Characteristics*

SA1 and SA2 as well as the linear infrastructure route are in a dry region of the country where surface water flow is not present all year round. The Sandloop River is the major natural surface water resource that was identified in close proximity to SA1. The river is a tributary of the Mokolo River, draining a catchment to the south-west of Lephalale and joining the Mokolo River to the north of the town.

The river is non-perennial and is defined by a sandy bed with a distinctive associated riparian zone. The river is thought to be episodic, i.e. only flowing after rainfall events. The Sandloop River drains in an east-west

direction in close proximity to the southern portion of the existing ADF site, and then northwards to the west of the farm Onverwacht. The Sandloop River drains into the Limpopo primary catchment. Within this wider context its form part of the Crocodile River sub-catchment, which drains much of the Highveld and western Bushveld. SA1 and SA2 and the linear infrastructure route fall within one quaternary catchment – namely, A42J. This is the catchment of the lower-most reaches of the Mokolo River that drains north from the Waterberg Hills into the Limpopo River.

#### *6.1.6.2 Surface Water Typology*

Surface water drainage is relatively poorly defined in the wider study area and there is a low drainage density. The low drainage density is likely to be due to the flat terrain, along with the sandy nature of soils and relatively low rainfall. The dominant soil form on the two sites is the Clovelly soil form that is deep and of sandy texture. Where drainage occurs, the most commonly-occurring expression of surface water drainage is the ephemeral drainage line. Distinct linear / fluvial drainage features occur very sparsely, however drainage lines do occur on both SA1 and SA2.

The largest drainage features are three ephemeral watercourses (the Sandloop that drains the area to the west and south of SA1 and two of its tributaries which emanate from the area to the north of Marapong and part of SA2 respectively) which are tributaries of the Mokolo. The three watercourses are relatively poorly defined in terms of hydromorphological structure. The only perennial river in the wider area is the Mokolo – draining the Waterberg Hills to the south where a greater amount of rainfall occurs. The proposed development is expected to be too distant to adversely affect this river, although it is a downstream surface water receptor.

Typical wetlands (i.e. palustrine habitats) were found to be relatively rare in the context of the two sites and the intervening area, with hydric soils only occurring within very limited parts of the sites, including within depressions along certain of the watercourses on the sites and within a small isolated pan wetland in SA2. The tributary of the Sandloop that rises to the north of Marapong displays hydric soils within depressions along its length.

Pan / depression wetlands are characterised by their endorheic character and are circular to oval shape. They occur in relatively small enclosed basins and are typically ephemeral in nature, typically being filled with shallow water levels during the rainy season. The relatively flat terrain, along with the presence of sedimentary strata of the Karoo Supergroup on which much of the pans within South Africa occur[5] (and the current and historical presence of large herbivores within this sweetveld vegetation type, suggests conditions favourable for the formation of pans. Pans occur all over the wider area, however they occur somewhat sparsely.

#### *6.1.6.3 Hydromorphology (Hydrology and Geomorphological Processes) of Ephemeral Drainage Lines*

Hydrological and geomorphological processes are the major drivers of surface water feature formation. Rivers and drainage lines as surface water features are defined by their position in the landscape (typically occurring in valley bottoms) and typically by the presence of a distinctive channel. The ephemeral drainage lines however do not typically display a distinctively incised channel, with certain reaches displaying only a very shallow depression (<30 cm deep) that would barely constitute a channel. Some reaches even display no clear channel, rather being characterised by bare patches of soil (typical of sodic areas – see Figure 21 below) or being characterised by different vegetation cover to the surrounding woodland (less woody vegetation and a more grassy substrate).

[5] Allan, D.G., Seaman, M.T., and Kaletja, B. (1995). The Endorheic Pans of South Africa. In Cowan, G.I. (ed.) 1995. *Wetlands of South Africa. Department of Environmental Affairs and Tourism*. Pretoria.

A number of small pan-like depressions were encountered along these ephemeral drainage lines, particularly along the drainage line on SA2. These depressions occurred in the context of a very flat gradient, and are areas of collection of surface water flow along the drainage system. The flat gradient in which these drainage lines occur is believed to account for the indistinct hydromorphological definition of the drainage lines. In certain reaches of the drainage lines assessed a reach downstream of an upstream reach that displayed a channel became very indistinct, being difficult to distinguish from the surrounding woodland. Thus these drainage systems appear to vary between slightly more hydromorphologically defined reaches in areas of slightly increased slope to areas where there appears to be no defined channel, with only a change in vegetation structure indicating a surface water or drainage feature.

**Figure 21: Very shallow flow depression within the northern riparian corridor of Site Alternative 2**

### 6.1.7 Soils and Agricultural Potential

#### *6.1.7.1 Land Types*

SA1 falls within the **Bd46** land type while SA2 falls within the **Ah85** land type. The linear infrastructure route to SA2 runs through land types **Ae252** and **Ah85** (refer to Figure 22). A brief description of the land type in terms of soils, land capability, land use and agricultural potential is presented in Table 13 below.

**Table 13: Characteristics of the land types**

| Land Type | Soils | Land Capability and Use | Agriculture Potential |
|---|---|---|---|
| ***Ah85*** | Predominantly deep sandy to sandy loam soils that are eutrophic. Soil colours vary from red through yellow-brown to bleached indicating a potential wetness gradient. Soils in higher lying areas lack signs of clay movement whereas soils in lower lying landscape positions often have varied cutanic character indicating signs of incipient soil formation. Shallow and rocky | Mainly extensive grazing due to climatic condition constraints. Crop production limited to areas of homogenous deep soils with irrigation. Irrigation land uses are limited due to the lack of large volumes of water. | Low potential due to relatively low and often erratic rainfall (in the region of 400 – 500 mm per year) as well as high evaporative demand. Dryland crop production is not viable in areas with rainfall lower than 500 mm unless significant shallow groundwater is available. |

| Land Type | Soils | Land Capability and Use | Agriculture Potential |
|---|---|---|---|
| | areas occur (not widespread) and are associated with incised drainage channels or stream beds. | | |
| ***Ae252*** | Predominantly deep red sandy to sandy clay loam soils that are eutrophic or lime containing. Soils in higher lying areas lack signs of clay movement whereas soils in lower lying landscape positions have varied cutanic character indicating signs of incipient soil formation. Shallow and rocky areas occur but are not widespread. | Mainly extensive grazing due to climatic constraints for crop production. Crop production limited to areas of homogenous deep soils with irrigation. Irrigation land uses are limited due to the lack of large volumes of water. | Low potential due to relatively low and often erratic rainfall (in the region of 400 – 500 mm per year) as well as high evaporative demand. Dryland crop production is not viable in areas with rainfall lower than 500 mm unless significant shallow groundwater is available (not the case for the specific survey site). The soils are suited to irrigated crop production but this land use depends on the availability of suitable water resources (quantity and quality). |
| ***Bd46*** | Predominantly variable depth apedal (structureless), sandy to sandy loam light coloured soils that are eutrophic. Structured soils occur sporadically in lower lying landscape positions. The depression areas are characterised by soils with signs of incipient pedogenesis in the form of cutanic character and alluvial stratification. | Predominantly extensive grazing due to climatic constraints in terms of dryland crop production. Due to the level terrain soil erosion is not a major factor. | Low potential due to the relatively low and erratic rainfall (around 500 mm per year). Certain areas can be use d for irrigated crop production but then only if adequate water (quantity and quality) is available. |

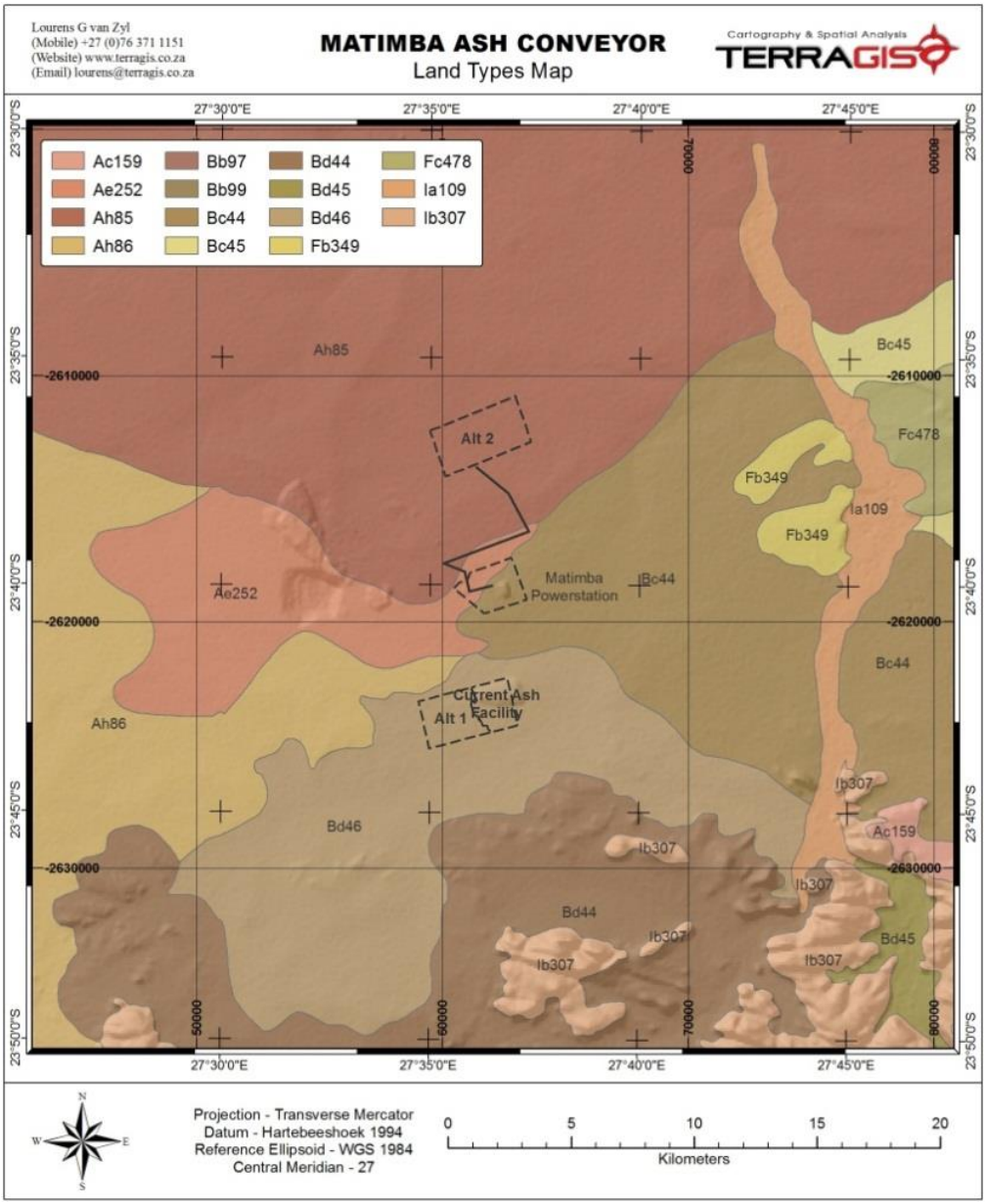



**Figure 22: Land types**

### *6.1.7.2 Digital Elevation Model*

The Digital Elevation Model (DEM) for SA1 and SA2 and the linear infrastructure route is provided in Figure 23 and from the map it is evident that the sites are situated on level terrain.

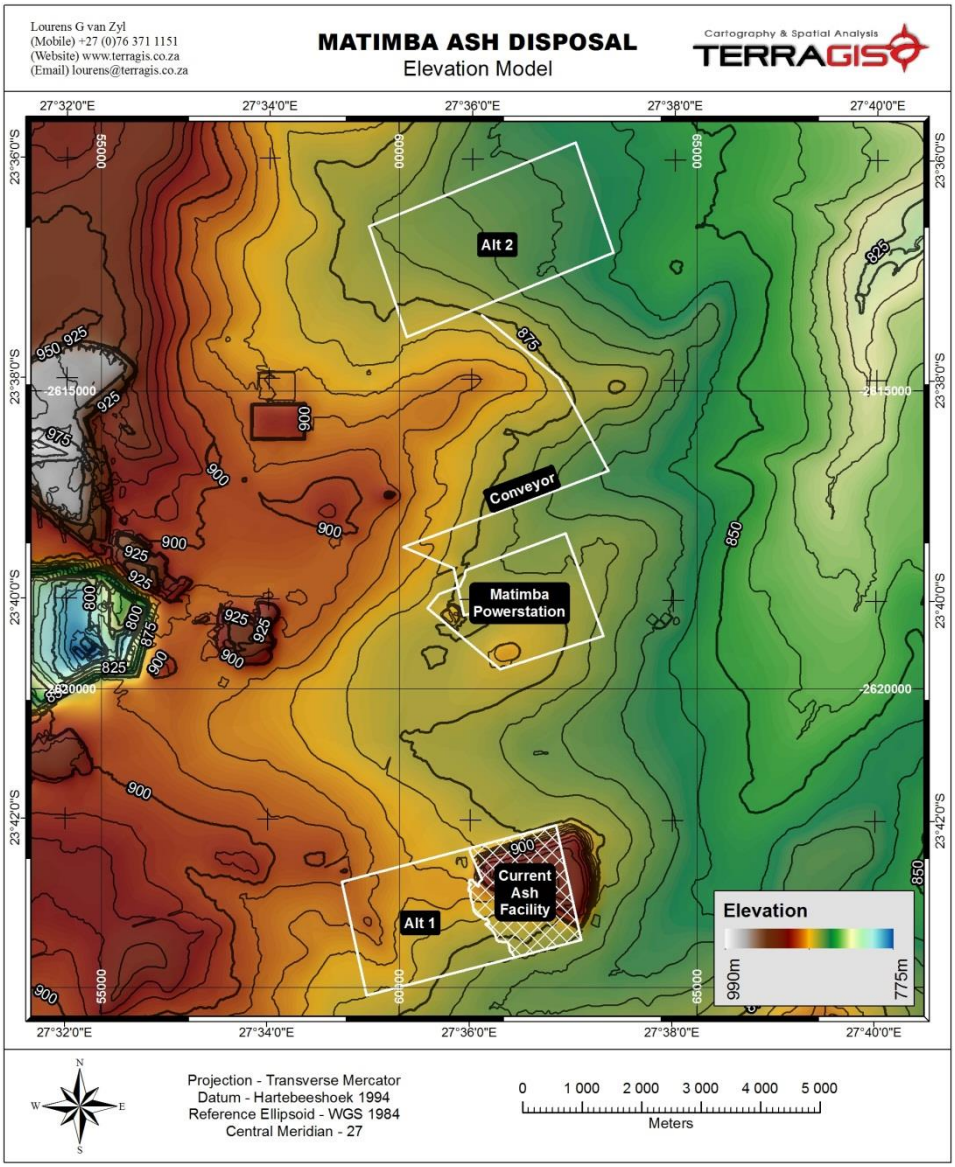



**Figure 23: Digital Elevation Model of Site Alternatives 1, 2 and linear infrastructure route**

## 6.1.8 Biodiversity

### *6.1.8.1 Flora*

Vegetation in the region is defined by Mucina and Rutherford (2006)[6] as the Limpopo Sweet Bushveld. This vegetation type extends from the lower reaches of the Crocodile and Marico Rivers down the Limpopo River valley. It is short, open woodland dominated by *Acacia mellifera* and *Dichrostachys cinerea* as well as taller tree species such as *A. robusta*, *A. burkei* and *Terminalia sericea*. The high palatability of the graminoid (i.e. grasses) composition renders this vegetation type highly suitable for game farming practices.

The 2013 survey yielded an Alpha Diversity of 164 taxa, which is regarded representative of floristic diversity on a regional scale. A basic synopsis of the growth forms recorded in the area reflects the savanna physiognomy of the region, which is dominated by a relative diverse woody layer, comprising of 52 species (small trees, shrubs, trees). Typically, the herbaceous layer is prominent and diverse; a total of 33 grass species (20.1%) were recorded. The herbaceous layer is rich in species, comprising 62 species. The diversity of plants is represented by 47 plant families, dominated by Poaceae (graminoids) and Fabaceae (legume family, 23 species).

The flora species is classified under the following categories:

- A species is Data Deficient when taxonomic problems hinder the distribution range and habitat from being well defined, so that an assessment of risk of extinction is not possible.
- A taxon is Near Threatened when it has been evaluated against the criteria but does not qualify for Critically Endangered, Endangered or Vulnerable now, but is close to qualifying for or is likely to qualify for a threatened category in the near future.
- A species is Rare when it meets at least one of four South African criteria for rarity, but is not exposed to any direct or plausible potential threat and does not qualify for a category of threat according to one of the five IUCN criteria.
- A species is Threatened when it is included in one of the Critically Endangered (Possibly Extinct), Critically Endangered, Endangered or Vulnerable categories.

The following conservation important plant taxa were recorded during the survey period:

- *Acacia erioloba* (Declining, Protected Tree);
- *Boscia albitrunca* (Protected Tree);
- *Combretum imberbe* (Protected Tree);
- *Sclerocarya birrea (*Protected Tree)
- *Securidaca longepedunculata var. longepedunculata* (Protected Tree); and
- *Spirostachys africana* (Provincially protected).

No threatened or Red Data plant species were recorded during the brief survey period. However, parts of SA1 and SA2 as well as linear infrastructure route comprise significant numbers of protected tree species. In particular, *Acacia erioloba, Boscia albitrunca* and *Spirostachys africana* were recorded in significant numbers. The submission of permit applications to authorities is therefore required. A suitable study needs to be conducted in order to determine the number and densities of protected species affected by the development.

Red Data plant taxa known to occur in the ¼-degree grids that are spatially represented in the respective site alternatives include the following:

[6] Mucina, L. and Rutherford, M.C. (2006). The vegetation of South Africa, Lesotho and Swaziland. *Strelitzia 19*. Pretoria: South African National Biodiversity Institute.

**Table 14: Red Data plant taxa known to occur in the immediate region**

| Binomial Name | Family | Status |
|---|---|---|
| ***Acalypha caperonioides var. caperonioides*** | Euphorbiaceae | Data Deficient |
| ***Corchorus psammophilus*** | Malvaceae | Threatened |
| ***Crinum stuhlmannii*** | Amaryllidaceae | Declining |
| ***Eulalia aurea*** | Poaceae | Near Threatened |
| ***Euphorbia waterbergensis*** | Euphorbiaceae | Rare |

In addition to the species currently captured in the SANBI infobase[7] , the following protected trees and plants occur within the immediate region.

**Table 15: Protected plant species within the region**

| Binomial Name | Family | Status |
|---|---|---|
| ***Acacia erioloba*** | Fabaceae | Declining, Protected tree |
| ***Adansonia digitata*** | Bombaceae | Protected tree |
| ***Ammocharis coranica*** | Amaryllidaceae | Protected species |
| ***Boscia albitrunca*** | Capparaceae | Protected tree |
| ***Combretum imberbe*** | Combretaceae | Protected tree |
| ***Duvalia polita*** | Apocynaceae | Protected species |
| ***Huernia transvaalensis*** | Apocynaceae | Protected species |
| ***Huernia zebrina*** | Apocynaceae | Protected species |
| ***Securidaca longipedunculata*** | Polygalaceae | Protected tree |
| ***Sclerocarya birrea subsp. africana*** | Anacardiaceae | Protected tree |
| ***Spirostachys africana*** | Euphorbiaceae | Protected tree |

#### *6.1.8.2 Floristic Habitat Types of Site Alternative 1 and 2*

The following communities and variations are present across SA1 and SA2 (refer to Figure 24):

- *Nymphaea – Schoenoplectus* Impoundments Community;
  - *Typha capensis* Variation;
  - *Brachiaria nigropedata* Variation;
- *Kyphocarpa angustifolia – Eragrostis rigidior* Woodland Community;
  - *Croton gratissimus - Sclerocarya birrea* – Gravel Plains Variation;
  - *Acacia nigrescens – Melhania forbesii* Woodland Variation;
- *Vernonia* species - *Panicum maximum* Degraded Woodland Community;
  - *Stipagrostis uniplumis – Eragrostis pallens* Sandveld Variation;
  - *Acacia mellifera – Acacia tortilis* Alluvial Plains Variation;
- *Portulaca – Oldenlandia* Sheetrock Community; and
- Artificial woodland habitat.

Detailed descriptions of these floristic habitats are provided in the Biodiversity specialist report (**Appendix L**).

[7] Plants of South Africa (POSA). (2011). http://posa.sanbi.org/searchspp.php.

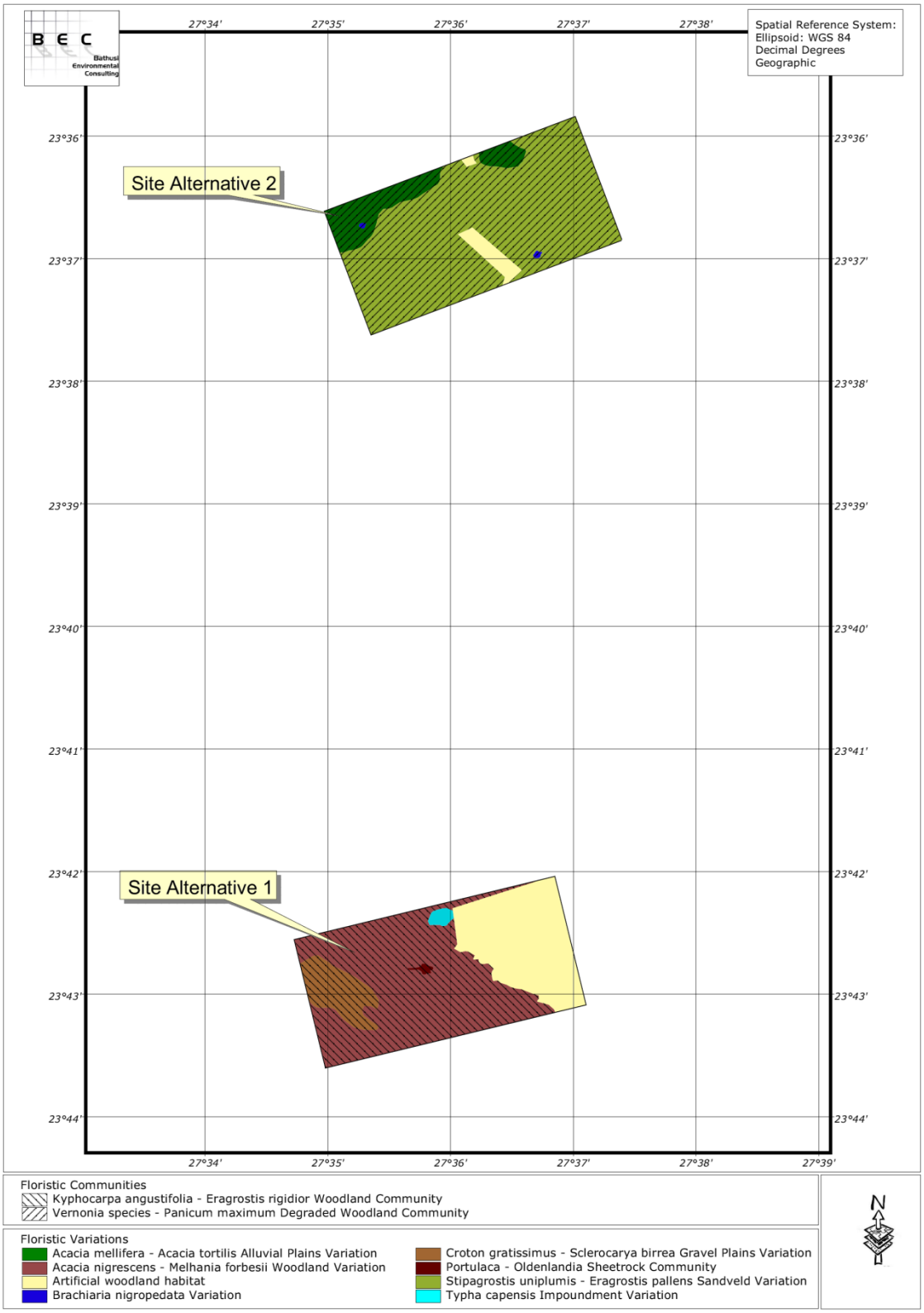



**Figure 24: Floristic habitat types for Site Alternatives 1 and 2**

- ***Nymphaea – Schoenoplectus* Impoundments Community**

  Impoundments in the respective SA1 and SA2 are artificial, comprising depressions that were created within drainage lines and alluvial plains that are seasonally inundated through sheetflow. Common and noteworthy species that are characteristic of this community include the hydrophilic taxa *Nymphaea* species, *Schoenoplectus corymbosus, Scirpus* species and *Cyperus* species, as well as the weed *Schkuhria pinnata* and the grass *Chloris virgate*. The vegetation of this community is determined by the prolonged presence of standing water, resulting in the development of an aquatic vegetation layer. Fringes are frequently inhabited by species associated with the ecotonal zones around areas of standing water, but mostly comprise weeds and forbs indicating a depleted vegetation cover. It is typical for variations within this community to exhibit dissimilar (unique) floristic compositions.

- ***Typha capensis* Variation**

  This unit is encountered within SA1, comprising two relative deep impoundments. Characteristic species of this variation comprise of the hydrophilic *Typha capensis*, the grass *Dactyloctenium aegyptium* and some forbs (weeds).

- ***Brachiaria nigropedata* Variation**

  This unit is present in SA2 and represents a typical farm dam within a drainage line/ alluvial plains areas. Surrounding habitat is typically comprises of *Acacia* species and a depleted herbaceous layer is noted. The hydrophilic vegetation associated with the standing water comprises the grasses *Brachiaria nigropedata, Eragrostis* species, *Acroceras macrum, Miscanthus junceus* as well as the forbs *Litogyne gariepina* and *Aloe* species.

- ***Kyphocarpa angustifolia – Eragrostis rigidior* Woodland Community**

  This community represents natural terrestrial woodland habitat of SA1 and is characterised by *Sclerocarya birrea*, the forb *Melhania forbesii* and the grasses *Pogonarthria squarrosa* and *Aristida stipitata*

  This unit is representative of the regional vegetation and is in a pristine condition. Two separate variations are noted within this community, defined by local soil conditions. Gravel plains where stony/ rocky soils prevail are interspersed by deeper soils, notable with the absence of surface rock. The distribution of these variations are however mosaical and the delineation thereof from aerial photography is a matter of interpretation. Mapping efforts are not regarded particularly accurate; detailed soil sampling will aid in a more accurate mapping of the extent of these variations.

  - ***Croton gratissimus - Sclerocarya birrea* Gravel Plains Variation**

    The stony nature of the soil conditions determines the extent of this variation as well as the predominantly broad-leaved nature of the woody species that characterise this variation. The only *Acacia* species recorded in this variation is *Acacia erubescens,* which occurs throughout most of the region and across a wide variety of habitat types; *Acacia* species are frequently associated with soil type characterised by a relatively high clay content and is frequently also an indication of encroachment.

    Characteristic species include the trees *Croton gratissimus, Ozoroa paniculosa, Kiggelaria africana, Ochna pulchra* and *Strychnos pungens* as well as the geophyte *Ledebouria* species and the grass *Sporobolus nitens*.

  - ***Acacia nigrescens – Melhania forbesii* Woodland Variation**

    Vegetation is typically closed woodland, in a good condition and representative of the regional vegetation. This unit comprises of trees, *Acacia nigrescens* and *Spirostachys africana*. The

prominence of both these species indicates an association with moist conditions, particularly *Spirostachys africana*.

- ***Vernonia species - Panicum maximum* Degraded Woodland Community**

  This community is present within SA2, comprising natural woodland, typical of the area. However, a high degradation factor is noted in this community and the subsequent variations, which is attributed to intensive grazing practices within floristically poor habitat. Characteristic species include the forbs *Vernonia* species, *Acrotome inflata, Sansevieria aethiopica, Gisekia africana* subsp. *africana, Melolobium candicans* and *Solanum panduriforme*, as well as the grasses *Dactyloctenium giganteum, Digitaria* species and the woody species *Tarchonanthus camphoratus*.

  - ***Stipagrostis uniplumis – Eragrostis pallens* Sandveld Variation**

    The prominence of the palatable grazing grass species *Stipagrostis uniplumis* and *Panicum maximum* is probably a reason for the high grazing factor noted in these areas. The grasses *Eragrostis pallens* and *Perotis patens* typically occur in open areas where deep sandy soils predominate. The increase in abundance of these two grasses is directly related to the high grazing factor.

  - ***Acacia mellifera – Acacia tortilis* Alluvial Plains Variation**

    Typically, these areas are analogous to alluvial plains. A flat topography and the absence of clearly defined waterlines result in sheetflow of water subsequent to raining events. Noteworthy microphyllous species, such as A*. mellifera, A. tortilis, Lycium cinereum* and *Boscia foetida* indicates a prolonged moist period subsequent to raining events.

- ***Portulaca – Oldenlandia* Sheetrock Community**

  A localised sheetrock outcrop is present in SA1. This area, comprising approximately 2.5 ha, is typified by the extensive presence of sheetrock and little vegetation. Other than occasional shrubs and lithophytic plants, the floristic composition is entirely atypical to the surrounding natural vegetation. This unit comprises the forbs *Zornia linearis, Portulaca kermesina, Oldenlandia herbacea,* the grass *Eragrostis gummiflua* and the fern *Pellaea calomelanos*.

- **Artificial Woodland Habitat**

  Localised areas of degraded woodland occur sporadically within the region, usually the result of historic agricultural practices in the case of SA2 and the existing ashing facility in the case of SA1. The natural woodland species have been removed for anthropogenic purposes and have subsequently been replaced by an artificial (sub-climax) floristic composition.

#### *6.1.8.3 Linear Infrastructure Route Floral Habitat Types*

The field investigation revealed the presence of three distinct macro-habitat types within the proposed linear infrastructure route (Figure 25):

- Degraded Woodland – This habitat types is associated with existing infrastructure where the original woodland has been affected for construction or operational purposes. The vegetatal cover and compositional aspects are characteristic of recent and historic disturbances that caused the removal of most of the original woodland vegetation, and subsequent development of a vegetatal cover of a secondary climax status.
- Natural Woodland – This community is typical of the natural woodland variations recorded in the greater region, manifesting as a moderately dense woodland, particularly the *Stipagrostis uniplumis – Eragrostis pallens* Sandveld Variation identified within SA2. The vegetation of this unit exhibits some indications of surrounding land transformation and degradation effects.
- *Spirostachys africana* Woodland – Biophysical and physiognomic characteristics, when observed from a larger scale) indicate a potentially ephemeral nature of the vegetation. However, inundated periods are

expected to be extremely infrequent and irregular and no floristic obligate characteristics was observed, other than the dominant presence of the tree *Spirostachys africana*, which is known to be strongly affiliated with drainage lines, which are extremely ill-defined.

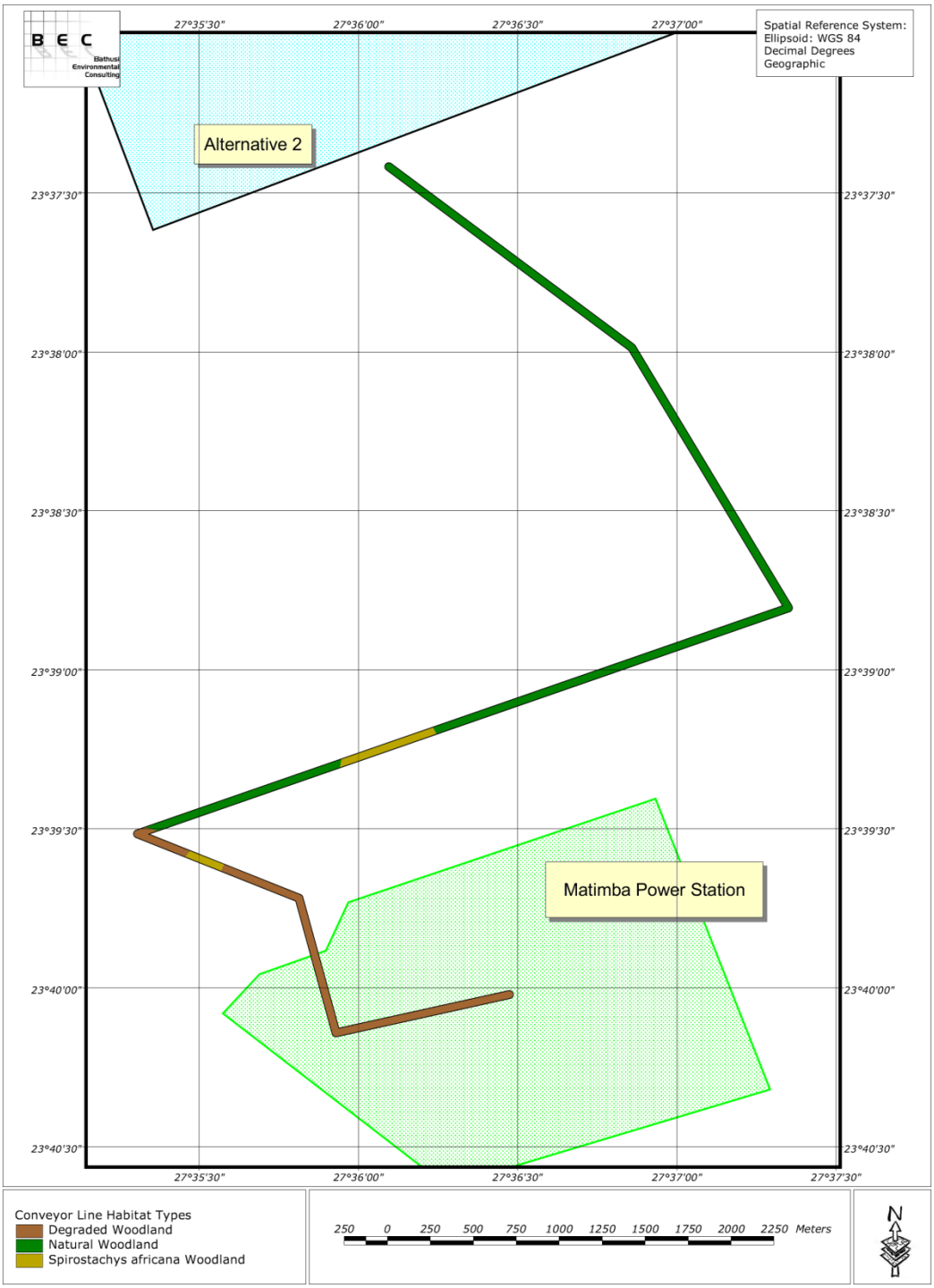



**Figure 25: Floristic habitat types of the proposed linear infrastructure route**

### 6.1.8.4 Fauna

Savannas of Limpopo have experienced recent impacts resulting from anthropogenic activities. The presence of minerals such as coal has led to significant transformation, degradation and fragmentation of the region's grasslands. It is therefore important to view the respective site alternatives on an ecologically relevant scale; consequently, all sensitive animal species (specific faunal groups) known from the Limpopo Province were included in this assessment. Detailed regional and scientific data on all faunal groups are lacking (notably for most of the invertebrate groups) and as a result only data sets on specific faunal groups allow for habitat sensitivity analyses based on the presence/ absence of sensitive faunal species (Red Data species) and their specific habitat requirements.

Animals known to be present in the ¼-degree grid 2327DA were considered potential inhabitants (all species known from the Limpopo Province were included in the assessment to limit the known effects of sampling bias).

During previous and on-going studies in the immediate vicinity of the site alternatives during the past years, a total of 332 animal species have been confirmed to occur around the alternatives and within the immediate surrounds (approximately an area of 100 km²). These include:

- 53 invertebrate species;
- 9 frog species;
- 20 reptile species;
- 204 bird species; and
- 46 mammals.

The diversity of animals recorded in the region included eighteen **Red Data species,** namely:

- Giant Bullfrog: *Pyxicephalus adspersus*
- Black Stork: *Ciconia nigra*
- Secretarybird: *Sagittarius serpentarius*
- White-backed Vulture: *Gyps africanus*
- Tawny Eagle: *Aquila rapax*
- Martial Eagle: *Polemaetus bellicosus*
- Lesser Kestrel: *Falco naumanni*
- Kori Bustard: *Ardeotis kori*
- Red-billed Oxpecker: *Buphagus erythrorhynchus*
- Bushveld Elephant Shrew: *Elephantulus intufi*
- Ground Pangolin: *Manis temminckii*
- Bushveld Gerbil: *Tatera leucogaster*
- Cheetah: *Acinonyx jubatus*
- Brown Hyena: *Parahyaena brunnea*
- Honey Badger: *Mellivora capensis*
- Southern Sable Antelope: *Hippotragus niger*
- Western Tsessebe: *Damaliscus lunatus*

The diversity of animals recorded include two **Alien and Invasive species**, namely:

- *Acridotheres tristis* (Common Myna); and
- *Equus asinus* (Donkey).

### 6.1.8.5 Faunal Habitat Types of Site Alternative 1 and 2

Faunal community structure and ecological diversity cannot be viewed in isolation without considering vegetation habitat diversity; therefore, the plant communities or macro-habitat types described in this

document (refer Section 6.1.8.2 and 6.1.8.3) are considered the main faunal habitats within SA1, SA2 and the linear infrastructure route.

- ***Transformed Habitats***

  Transformed habitats represent areas of an atypical nature - areas where the natural vegetation has been removed and replaced by various substitutes of either a sterile or an artificial nature. The Artificial Woodland Habitat is included in this category. These areas have little or no conservation value and it is highly unlikely that any threatened faunal taxa would persist in these areas (other than potentially passing through).

- **Wetland Faunal Habitats**

  Wetland habitats are characterised by areas of permanent or temporary surface water and vegetation associated with such areas. The wetland habitats include the *Nymphaea – Schoenoplectus* Impoundments Community (refer to Section 6.1.8.2).

  Wetlands often host a variety of sensitive and threatened faunal taxa; faunal wetland species are often particularly sensitive because of the pressures on the freshwater ecological systems of South Africa. Sensitive faunal wetland species considered likely to persist in SA1 ad SA2 include:

  - *Ciconia nigra* (Black Stork, Linnaeus, 1758); and
  - *Pyxicephalus adspersus* (Giant Bullfrog, Tschudi, 1838).

- **Natural Faunal Woodland Habitats**

  The natural (terrestrial) faunal woodland habitats of SA1 and SA2 include:

  - *Kyphocarpa angustifolia* – Eragrostis rigidior Woodland Community;
  - *Portulaca – Oldenlandia* Sheetrock Community; and
  - *Vernonia – Panicum maximum* Degraded Woodland Community.

Sensitive terrestrial faunal species that are regarded likely to persist within SA1 and SA2 and linear infrastructure route (not necessarily recorded during the field investigation) include:

- *Panthera pardus* (Linnaeus, 1758) – Leopard;
- *Aquila rapax* (Temminck, 1828) – Tawny Eagle;
- *Elephantulus intufi* (A. Smith, 1836) – Bushveld Elephant Shrew;
- *Tatera leucogaster* (Peters, 1852) – Bushveld Gerbil;
- *Buphagus erythrorhynchus* (Stanley, 1814) – Red-billed Oxpecker;
- *Falco biarmicus* (Temminck, 1825) – Lanner Falcon;
- *Mellivora capensis* (Schreber, 1776) – Honey Badger;
- *Parahyaena brunnea* (Thunberg, 1820) – Brown Hyena;
- *Sagittarius serpentarius* (J.F. Miller, 1779) – Secretarybird;
- *Acinonyx jubatus* (Schreber, 1775) – Cheetah;
- *Ardeotis kori (*Burchell, 1822) – Kori Bustard;
- *Falco naumanni* (Fleischer, 1818) – Lesser Kestrel;
- *Gyps africanus* (Salvadori, 1865) – White-backed Vulture;
- *Manis temminckii (*Smuts, 1832) – Ground Pangolin;
- *Polemaetus bellicosus* (Daudin, 1800) – Martial Eagle; and
- *Terathopius ecaudatus* (Daudin, 1800) – Bateleur.

#### 6.1.8.6 *Linear Infrastructure Route Faunal Habitat Types*

Faunal habitats are based on the floristic macro-habitat types, using an ecologically holistic approach and considering the important interaction between animals and their biotic and abiotic environment. Three faunal habitats have been identified for the area proposed for the linear infrastructure route:

- Degraded Woodland - is found wherever the natural woodland has been degraded because of the presence of existing infrastructure (overhead power lines and roads). This habitat type includes typical areas that have been affected by both long term and recent (or short term) anthropogenic activities.
- Natural Woodland – this habitat type does not include any unique habitat characteristics (such as those found on outcrops or in and near wetlands). It is therefore considered unlikely that any sensitive or threatened faunal species, assemblage or community will adversely (significantly) affected by the proposed linear infrastructure route.
- *Spirostachys africana* Woodland - species such as Giant Bullfrog (*Pyxicephalus adspersus*), Bubbling Kassina (*Kassina senegalensis*), Common Platanna (*Xenopus laevis*) and Southern Foam Nest Frog (*Chiromantis xerampelina*) is likely to utilise inundated conditions within the *Spirostachys africana* woodland faunal community for breeding purposes.

## 6.2 Social Environment

### 6.2.1 Social

SA1 and SA2 as well as the linear infrastructure route falls in the Waterberg District Municipality (DC 36), and within the jurisdiction of the Lephalale Local Municipality (LIM 362) of the Limpopo Province.

Lephalale Local Municipality has the following demographic characteristics:

- The population is approximately 115,765.
- 46% of residents of Lephalale are female and 54% are male.
- The largest number of people fall within the age groups 20-24 and 25-29 years.
- Black African is by far the majority population group (90.9%), followed by White (7.9%), Coloured (0.9%) and Indian/Asian (0.3%).
- The unemployment rate has decreased since 1996 from 29% to 23.4% in 2011.
- The average household size is 3.4 and the municipality has the highest number of households.
- 83.2% of people reside in formal dwellings, followed by 15.4% in informal dwellings and 1.4% in traditional dwellings.
- Majority of the residents have access to basic services i.e. portable water, sanitation and refuse removal.

Lephalale is defined by the Limpopo Growth and Development Strategy as a coal mining and petrochemical cluster. The area is currently experiencing growth driven by mining expansion and the construction of the Medupi Power Station. The local economy is dominated by the Grootegeluk coal mine (together with its beneficiation plants, is the biggest of its kind in the world) and the Matimba Power Station.

The three clusters that are most relevant to Lephalale are firstly coal and petrochemical, secondly red meat and thirdly, tourism.

Lephalale is also an important agricultural area, both in terms of animal and crop production. The main products produced are: cattle, game, vegetables, table grapes, citrus, cotton, tobacco, watermelon and paprika.

The Local Economic Development (LED) Strategy of Lephalale Municipality's Vision for 2025 is to:

- Increase power stations from one to five;
- Increase coal production from 16 million tons to more than 100 million tons per annum;

- Have a petrochemical industry established for 160 000 barrels per day;
- Diversify the local economy; and
- Double the population from 120 000 to 240 000.
- The following LED Interventions are recommended:
- Promote the coal and petrochemical cluster;
- Assist livestock farmers on communal land;
- Increase tourism services and expenditure;
- Support the informal economy; and
- Improve service delivery by the municipality.

### 6.2.2 Air Quality

#### *6.2.2.1 Identified Sensitive Receptors*

A sensitive receptor for the purposes of the current investigation can be defined as a person or place where involuntary exposure to pollutants released by the proposed ADF, can be expected to take place.

For the purposes of this study, areas of development such as residential, industries educational and recreational areas are identified as sensitive receptors. The receptors identified during the current study include:

- Lephalale Town (including Marapong and Onverwacht townships)
- Ubuntu Occupational Health Services
- Several guest houses
- Doctors practices
- Local airstrip
- Matimba Power Station
- Medupi Power Station
- Farm houses
- Game reserves

#### *6.2.2.2 Sources of Air Pollution*

Based on an aerial photo and site description of the area, the following sources of potential air pollution have been identified:

- Matimba Power Station
- Matimba ADF
- Medupi Power Station (currently under construction)
- Veld fires
- Domestic fuel burning at the surrounding township
- Vehicle entrainment
- Agriculture
- Mining Operations (Grootegeluk Colliery)

#### *6.2.2.3 Standards and Guidelines*

The main pollutant of concern which may pose a health risk to surrounding sensitive receptors and possible communities during the current investigation is particulate matter. An overview is provided of the available local regulations and standards (SANS), and then for comparison, international guidelines and standards prescribed for inhalable particulate and nuisance dust exposure, these include the World Bank (WB), European Union (EU), United Kingdom (UK), World Health Organisation (WHO), and the United States Environmental Protection Agency (USEPA).

### *a) Inhalable Particulates*

Particulate matter is a collective name for fine solid or liquid particles added to the atmosphere by processes at the earth's surface. Particulate matter includes dust, smoke, soot, pollen and soil particles.

Particulate matter (PM) has been linked to a range of serious respiratory and cardiovascular health problems. The key effects associated with exposure to ambient particulate matter include: premature mortality, aggravation of respiratory and cardiovascular disease, aggravated asthma, acute respiratory symptoms, chronic bronchitis, decreased lung function, and increased risk of myocardial infarction.

PM represents a broad class of chemically and physically diverse substances. Particles can be described by size, formation mechanism, origin, chemical composition, atmospheric behaviour and method of measurement. The concentration of particles in the air varies across space and time, and is related to the source of the particles and the transformations that occur in the atmosphere.

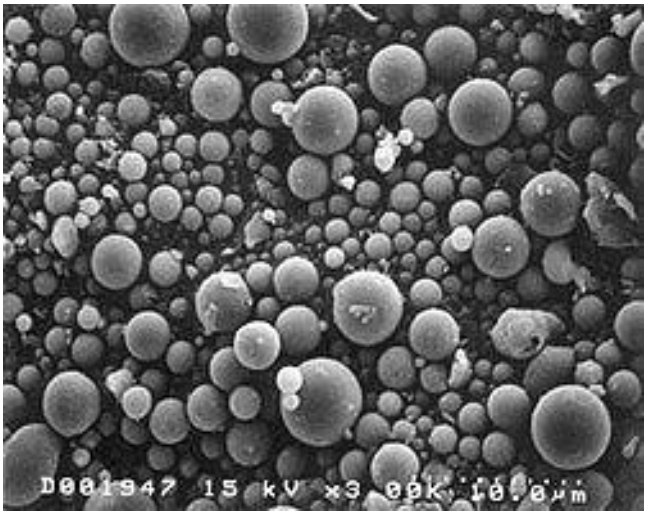



**Figure 26: Ash particle magnified x2000**

PM can be principally characterised as discrete particles spanning several orders of magnitude in size, with inhalable particles falling into the following general size fractions:

- PM2.5 also known as fine fraction particles (generally defined as those particles with an aerodynamic diameter of 2.5 microns or less);
- PM10 (generally defined as all particles equal to and less than 10 microns in aerodynamic diameter; particles larger than this are not generally deposited in the lung);
- PM10-2.5, also known as coarse fraction particles (generally defined as those particles with an aerodynamic diameter greater than 2.5 microns, but equal to or less than a nominal 10 microns); and
- Ultra fine particles generally defined as those less than 0.1 microns.

The National Air Quality Act (No. 39 of 2004) makes provision for the setting and formulation of National ambient air quality standards for substances or mixtures of substances which present a threat to health, well-being or the environment. On 24 December 2009, the Minister of Water and Environmental Affairs established National Ambient Air Quality Standards (GG No. 1210) referred to under Table 16 for Particulate Matter. These standards prescribe the allowable ambient concentrations of pollutants which are not to be exceeded during a specified time period in a defined area. If the air quality standards are exceeded, the ambient air quality is poor and the potential for health effects is greatest.

**Table 16: National standards for particulate matter**

| Pollutant | Averaging Period | Concentration (µg/m$^3$) | Frequency of Exceedance |
|---|---|---|---|
| **Particulate Matter PM10** | 24-hr average | 120<br>75 (from 2015) | 4 |
| | Annual average | 50<br>40 (from 2015) | 0 |

**with allowable frequencies of exceedance for immediate compliance*

Table 17 outlines the local and international (to allow for comparisons) health risk criteria used for the assessment of inhalable particulate matter (PM10). Guidelines and standards are provided for a 24-hour exposure and annual average exposure period respectively.

**Table 17: Available Local and International Standards for the evaluation of inhalable particulate matter (PM 10)**

| Origin | 24-Hour Exposure (µg/m$^3$) | Annual Average Exposure (µg/m$^3$) | Number of Exceedances Allowed per year |
|---|---|---|---|
| **RSA**[(1)] | 120[(1)] | 50[(1)] | 4 daily exceedances |
| **RSA**[(2)] | 75[(2)] | 40[(2)] | 0 daily exceedances |
| **Australia** | 50 | | 5 daily exceedances |
| **World Bank**[(3)] | 500 | 100 | NA |
| **EU**[(4)] | 50 | 20 | 7 daily exceedances |
| **US-EPA**[(5)] | 150 | 50[(6)] | 1 daily exceedance |
| **UK**[(7)] | 50 | 40 | 35 daily exceedances |
| **WHO**[(8) (9) (10)] | 50 | 20 | NA |

Notes:
(1) Standard laid out in the National Environment Management: Air Quality Act. No. 39 of 2004:
(2) Compliance by 1 January 2015
(3) World Bank Air Quality Standards summary obtainable at URL http://www.worldbank.org/html/fpd/em/power/standards/airqstd.stm#paq.
(4) European Union Air Quality Standards summary obtainable at URL http://europa.eu.int/smartapi/cgi/sga_doc?smartapi!celexplus!prod!DocNumber&lg=en&type_doc=Directive&an_doc=1999&nu_doc=30.
(5) United States Environmental Protection Agencies National Air quality Standards obtainable at URL http://www.epa.gov/air/criteria.html
(6) To attain this standard, the 3-year average of the weighted annual mean $PM_{10}$ concentration at each monitor within an area must not exceed 50 µg/m$^3$.
(7) United Kingdom Air Quality Standards and objectives obtainable at URL http://www.airquality.co.uk/archive/standards.php
(8) WHO = World Health Organisation
(9) Guidance on the concentrations at which increasing, and specified mortality responses due to PM are expected based on current scientific insights (WHO, 2005).
(10) Air quality guideline

### *b) Nuisance Dust*

Nuisance dust is known to result in the soiling of materials and has the potential to reduce visibility. Atmospheric particulates change the spectral transmission, thus diminishing visibility by scattering light. The scattering efficiency of such particulates is dependent upon the mass concentration and size distribution of the particulates. Various costs are associated with the loss of visibility, including: the need for artificial illumination and heating; delays, disruption and accidents involving traffic; vegetation growth reduction associated with reduced photosynthesis; and commercial losses associated with aesthetics. The soiling of buildings and materials due to dust frequently gives rise to damages and costs related to the increased need for washing, cleaning and repainting.

South Africa is one of the only countries with guideline limits for the evaluation of nuisance dust levels. A four banding system has traditionally been used which describes the dust deposition as resulting in a slight, moderate, heavy or very heavy nuisance impact. These criteria are summarised in Table 18.

**Table 18: Four band scale evaluation criteria for dust suppression**

| Level | Description | Amount |
|---|---|---|
| **Slight** | Barely visible to the naked eye | < 250 mg/m²/day |
| **Moderate** | Slightly visible to the naked eye | >250 mg/m²/day < 500 mg/m²/day |
| **Heavy** | Dustfall indicates a fine layer of dust on a surface | >500 mg/m²/day < 1200 mg/m²/day |
| **Very Heavy** | Easily visible should a surface not be cleaned for a few days | >1200 mg/m²/day |

The South African Department of Mineral Resources (DMR) use the 1200 mg/m²/day threshold level as an action level. In the event that on-site dustfall exceeds this threshold, the specific causes of high dustfall should be investigated and remedial steps taken. Local experience, gained from the assessment of impacts due to dust from mine tailings dams in Gauteng, has shown that complaints from the public will be activated by repeated dustfall in excess of ~2000 mg/m²/day.

The main limitation in using this type of classification system is that it is purely descriptive and does not provide an indication as to what action needs to be taken to remediate the problem. The South African Bureau of Standards in their SANS 1929:2005 publication, "Ambient air quality – limits for common pollutants", provides additional criteria which can be used for the evaluation of fallout dust deposition. A four banded scale has been provided, with target, action and alert thresholds indicated. Permissible margins of tolerances are outlined with possible exceptions noted.

**Table 19: Four band scale evaluation criteria for dust suppression**

| Band Number | Band Description | Dustfall Rate, D (mg/m²/day, 30-day average) |
|---|---|---|
| **1** | Residential | D < 600 |
| **2** | Industrial | 600 < D < 1200 |
| **3** | Action | 1200 < D < 2400 |
| **4** | Alert | 2400 < D |

**Table 20: Target, action and alert thresholds for dust deposition**

| Level | Dustfall rate, D (mg/m²/day, 30-day average) | Averaging Period | Permitted Frequency of Exceeding dustfall rate |
|---|---|---|---|
| **Target** | 300 | Annual | None |
| **Action residential** | 600 | 30 days | Three within any year no two sequential months |
| **Action industrial** | 1200 | 30 days | Three within any year not sequential months |
| **Alert threshold** | 2400 | 30 days | None. First incidence of dust fall rate being exceeded requires remediation and compulsory report to the relevant authorities. |

## 6.2.3 Visual

### *6.2.3.1 Landscape Structural Components, Topography, Visual Character, and Visual Absorption Capacity*

Topographically the area around the Onverwacht / Matimba Power station area is relatively flat, and extending into the area to the north and west. These landscape characteristics mark a change from the area to the south of the town of Lephalale where much more hilly and incised topography, forming part of the Waterberg foothills, exists. The area in which SA1 and SA2 and linear infrastructure route are located can thus be described as being very flat. Slopes on and around the two site alternatives are very gentle and in some places almost imperceptible. The ground typically slopes very gently down to localised low points drained by ephemeral drainage lines.

The nature of the topography has implications for views: due to the relatively flat terrain the topography typically does not restrict views to the surroundings, in particular when the viewer is located on a localised elevated position. However the flat nature of the terrain entails that micro-topographical features, in particular vegetation is highly effective in screening views from the viewer's location.

Vegetation cover is intrinsically related to land use; the natural vegetation of the area is woodland (Figure 27). The warm nature of the climate due to the latitudinal position of the site and generally sandy soils allows the climax vegetation type to develop as tall, relatively enclosed woodland, with a mix of deciduous and evergreen trees. The average height of the vegetation in its mature, undisturbed state is approximately 2 m to 4 m, and as described below this can have an important effect on restricting views.

**Figure 27: Typical woodland vegetation**

The land use around SA1 and SA2 as well as the linear infrastructure route is a mix of a number of components, including urban (commercial and residential), industrial, and livestock / game farming. The urban commercial and residential component is provided by the town of Lephalale and its 'satellite' Onverwacht. The wider area around the proposed development site displays a significant industrial component in the form of the Matimba Power Station complex, the Medupi Power Station (currently under construction), and the Grootegeluk Mine Complex which is currently expanding to the north and the west. In contrast to this developed component, the surrounds of the town (especially areas to the south-west, west and north) still contain areas in which livestock rearing and game farming occur. In these areas, the natural woodland has largely been retained. One does not have to move too far beyond the boundaries of the town to find areas that are non-industrial in character, rather being characterised by a rural or even natural visual environment. The

presence of woodland vegetation that is highly effective in screening views from the viewer's location within these areas of natural vegetation also tends to contribute to this perception of a more natural setting.

The visual character of SA1 is thus partly industrial and urban, and partly rural or natural for SA2. The visual character of the linear infrastructure route is partly industrial, urban and rural. The nature of the visual character affects the visual absorption capacity (VAC). The visual absorption capacity of an area / landscape refers to ability of that area / landscape to absorb development without noticeable intrusion or change to the visual character of the area. Visual absorption capacity can be measured on a scale from high (an area which has a high capacity to absorb new development) to low (an area in which a new development would be highly visible and would alter the visual character of the area). Visual absorption capacity is a function of a number of factors including topography (including slope and aspect) and the nature of land use and land cover (such as vegetation cover and height), and importantly the degree of human-induced transformation of the area. Urbanised or industrial areas typically have a high visual absorption capacity in the context of the type of development that is proposed, especially where industrial-type structures already occur. Conversely highly natural or rural areas with a low human footprint would have a very low VAC for the development of an industrial component.

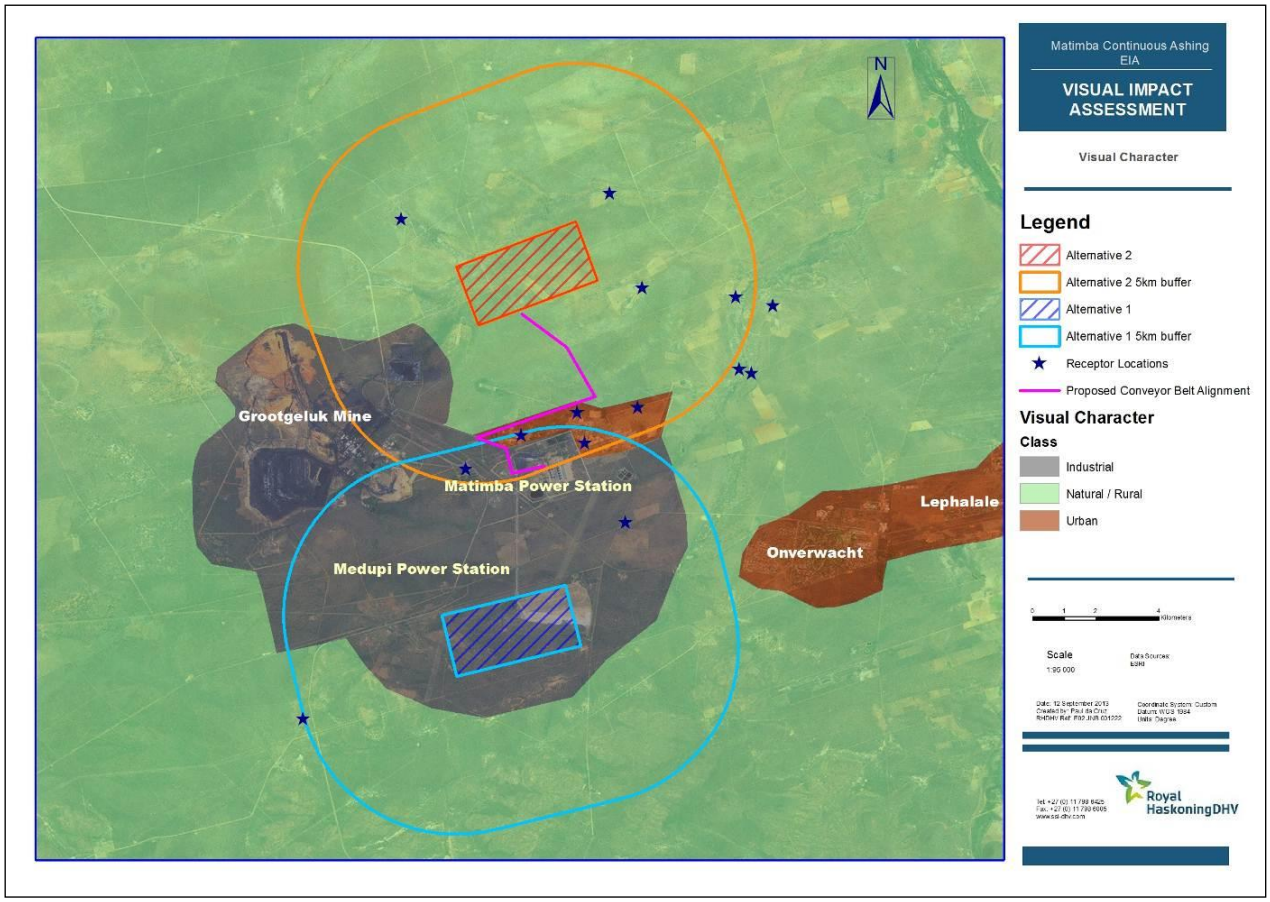



**Figure 28: Areas of differing visual character for Site Alternative 1, 2 and linear infrastructure route**

**Figure 29: View of the Matimba (right) and Medupi (left) Power Stations from Lephalale outskirts**

### *6.2.3.2 Location of Visual Receptors*

In order to identify receptor locations potentially affected by the proposed development, areas of human habitation within 5 km of each of the two development sites were identified. 5 km was selected as a reasonable radius, as beyond this distance the degree of visual exposure associated with the proposed development is likely to be too small to generate a visual impact. In the identification of receptor locations, all residential areas were included, with properties on the margins of such settlements being most likely to be exposed to views towards the proposed development (due especially to the flat nature of the terrain). Within the parts of the radial areas around the site alternatives which are not urban or industrial areas, homesteads and farmsteads, as well as commercial and non-commercial accommodation facilities where present were identified as receptor locations. Areas of potential future development were also considered. Properties on which visually sensitive activities such as hunting are being undertaken were also identified. Table 21, Figure 30 and Figure 31 lists and depicts the static receptor locations within the two radial areas that have been identified.

**Table 21: Static receptor locations within a 5 km radius of Site Alternative 1 and 2**

| Receptor Name | Receptor Type | Within 5km Radius of |
|---|---|---|
| **Manketti Reserve Manager's House** | Homestead | Site Alternative 2 |
| **Droogeheuvel Farmstead** | Farmstead | Site Alternative 2 |
| **Ganzepan Homestead** | Homestead | Site Alternative 2 |
| **Manketti Lodge** | Lodge | Site Alternatives 1 & 2 |
| **Marapong Contractors Village** | Contractor Accommodation | Site Alternatives 1 & 2 |
| **Zongesien Homestead 1** | Homestead | Site Alternative 2 |
| **Zongesien Homestead 2** | Homestead | Site Alternative 2 |
| **Kalkfontein Farmstead** | Farmstead | Site Alternative 2 |
| **Nel Family Homestead** | Homestead | Site Alternative 2 |
| **Eendracht Farmstead** | Farmstead | Site Alternative 1 |
| **Kuipersbult Farmstead** | Farmstead | Site Alternative 1 |
| **Marapong** | Residential Area | Site Alternatives 1 & 2 |

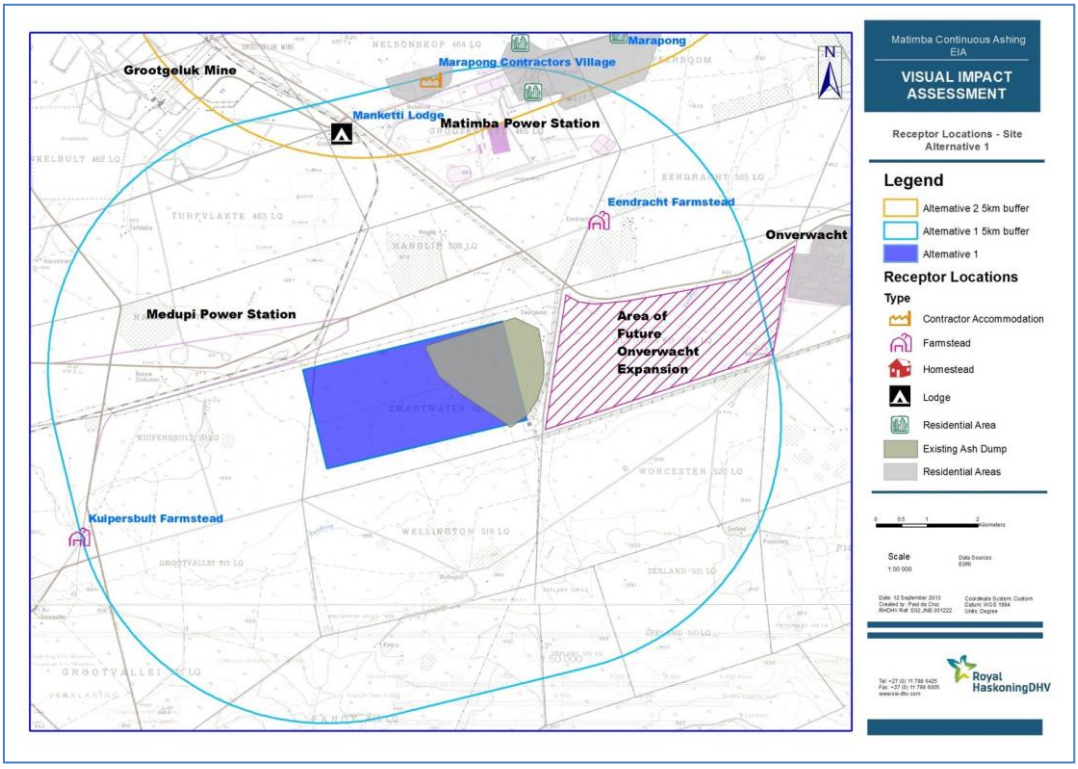



**Figure 30: Receptor locations surrounding Site Alternative 1**

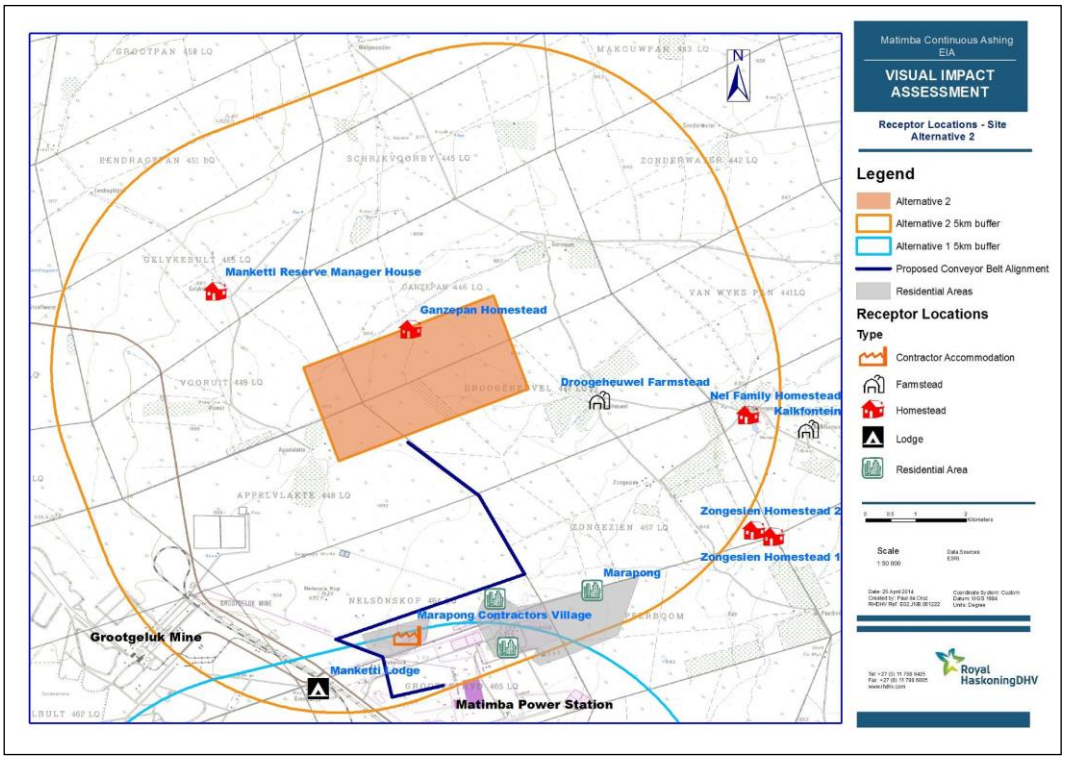



**Figure 31: Receptor locations surrounding Site Alternative 2 and linear infrastructure route**

### 6.2.4 Heritage

The cultural landscape qualities of the larger region essentially consist of a single component, which is a rural area in which the human occupation is made up of a pre-colonial (Stone Age and Iron Age) and a much later colonial (farmer) component.

As this is an environment that presents very little resources such as hills and outcrops for settling in, poor grazing and a lack of open water, the habitation of the region by humans has always been very low. It was only with the arrival of drilling rigs that below surface water could be accessed, that the population density increased.

#### *6.2.4.1 Pre-colonial Period*

Stone tools are known to occur in a low density on the banks of some of the rivers as well at the foot of outcrops and small hills. These mostly date to the Earlier Stone Age as well as to the Middle Stone Age and include typical points, blades and rectangular flakes. However, all these objects were found on the surface and are therefore out of their original context. As result, they are viewed to have low significance. Some rock art dating to the Later Stone Age occur in a number of shelters to the north-west of Lephalale.

Iron Age sites are only known to occur to the south, north and east of the general study area. These are linked to the Tswana and date in all probability to the period from 1600 and later.

On the koppie named Koorn Kop some interesting engravings of animal spoors, cupules and cut marks were identified on the southern face of the hill. In addition, on top of the hill a number of small stone walled sites occur. A few non-diagnostic stone flakes and potsherds occur in the shelter.

From ethnographic sources it is known that hills or promontories, for example in the Karoo, are important features to the San because they offer vantage points in an otherwise remarkably flat landscape from which the springbok may be watched. This is probably the purpose of the stone circles on top of Nelson's Kop, serving as lookout points. The fact that there is a big panel with a variety of engravings on it indicates that this is in all probability a site of potency, for the making of rain by the San and later Sotho-Tswana speaking people in the area.

#### *6.2.4.2 Colonial History*

The historic period starts of quite late in this part of the country. Probably one of the earliest published sources that refer to the area, in a generalised sense, is that of the explorer Thomas Baines who passed through the area during the early 1870s. Although for other sections of his travels he gives detailed descriptions of the local population, he does not comment on anybody in this particular area. Although his rendering of the various rivers and other topographical features are quite accurate for the time, he seems to imply that there were no communities settled here.

In the town of Lephalale (Ellisras) there is a cemetery containing the graves of some of the earliest white settlers in the area. The town of Ellisras was only laid out in December 1960, and was named after two of the pioneer families in the area, Ellis and Erasmus. In 2002, the name was changed to Lephalale. This latter name is taken from the Phalala River, which is derived from the Tswana verb 'to flow' or 'one which overflows'.

With reference to both site alternatives (SA1 and SA2), some information has been obtained about the different farms. It seems as if they were part of government land until the early part of the 20$^{th}$ century and most were only surveyed in the period 1909-1910. Drilling activities undertaken by the "Irrigation Department" in 1920, apparently revealed more than water; the presence of coal and oil bearing shale was established on the farms Grootegeluk and Hooikraal. This prompted an individual by the name of F.F. Pienaar to peg 50 claims on each of the farms Kringatspruit, Hooikraal, Grootegeluk and Enkelbult (Reference MM1713/20, 1920; Reference MM2827/20, 1920).

#### 6.2.4.3 *Farmsteads*

Farmsteads are complex features in the landscape, being made up of different yet interconnected elements. Typically these consist of a main house, gardens, outbuildings, sheds and barns, with some distance from the labourer housing and various cemeteries. In addition, roads and tracks, stock pens and wind mills complete the setup. An impact on one element therefore impacts on the whole.

#### 6.2.4.4 *Cemeteries*

Apart from the formal cemeteries that occur in municipal areas (towns or villages), a number of these, some quite informal, i.e. without fencing, are expected to occur sporadically all over, but probably in the vicinity of the various farmsteads. Many might also have been forgotten, making it very difficult to trace the descendants in a case where the graves are to be relocated.

Most of these cemeteries, irrespective of the fact that they are for land owners or farm labourers (with a few exceptions where they were integrated), are family orientated. They therefore, serve as important 'documents' linking people directly by name to the land.

#### 6.2.4.5 *Infrastructure and Industrial Heritage*

In many cases this aspect of heritage is left out of surveys, largely due to the fact that it is taken for granted. However, the land and its resources could not be accessed and exploited without the development of features such as roads, bridges, railway lines, electricity lines and telephone lines, as well as industries that exploit locally available resources.

### 6.2.5 Palaeontology

SA1 and 2 lie in the undifferentiated Permian and Triassic deposits, with very old rocks to the south and east of Lephalale. Both SA1 and SA2 most probably lie on the edge of the Ecca sediments or within the Ecca sediments with the Waterberg Group, Sandriviersberg and Mokalakwena formations, further south, however it is not clear from the literature where the boundary is. Imprints of fossil leaves from this area are mentioned by Johnson *et al.*[8] but no references are given. The palynology has been studied by MacRae (1988)[9] and correlated with that from the Pafuri Basin.

### 6.2.6 Land Use

The main existing land uses in relation to SA1, SA2 and the linear infrastructure route are:

- **Residential**
  - Town of Lephalale (Ellisras). The nearest section of the town namely Onverwacht Township lies approximately 4.5 km to the east of the existing ADF.
  - Marapong Township lies 650 m to the north-east of Matimba Power Station.
  - There are numerous farmhouses and farm labourer houses located near SA1 and SA2.

- **Educational**
  - There are several farm schools spread out around SA1 and SA2.
  - There are schools in Lephalale.

[8] Johnson, M.R., van Vuuren, C.J., Visser, J.N.J., Cole, D.I., Wickens, H.deV., Christie, A.D.M., Roberts, D.L., Brandl, G. (2006). Sedimentary rocks of the Karoo Supergroup. In: Johnson, M.R., Anhaeusser, C.R. and Thomas, R.J., (Eds). *The Geology of South Africa. Geological Society of South Africa, Johannesburg / Council for Geoscience.* Pretoria. Pp 461 – 499.

[9] MacRae, C.S. (1988). Palynostratigraphic correlation between the Lower Karoo sequence of the Waterberg and Pafuri coal-bearing basins and the Hammanskraal plant macrofossil locality, Republic of South Africa. Memoirs Geological Survey of South Africa 75: 1–217.

- **Industrial**
  - Matimba Power Station.
  - Medupi Power station (under construction).
  - Airfield.
  - There is a small industrial area just to the north of Onverwacht.
- **Mining**
  - The Grootegeluk Coal Mine, which provides Matimba Power Station and will provide the Medupi Power Station with coal, is located just to the west of Matimba Power Station.
- **Agriculture**
  - The main land use around SA1 and SA2 and its environs is cattle and game farming.
- **Tourism**
  - The Manketti Reserve is situated in the north.

### 6.2.7 Noise

The main sources of noise are from traffic on the main roads, Matimba Power Station, power station infrastructure remote from the facility (inclusive of the overland conveyor system and the activities at the ADF), Medupi Power Station (still under construction) and the Grootegeluk Coal Mine. These noise sources are significant contributors to a degraded noise climate.

The noise sensitive receptors include the existing residential areas, farm houses, farm labourer dwellings, schools, game farms and game lodges located around SA1, SA2 and the linear infrastructure route (Figure 32).

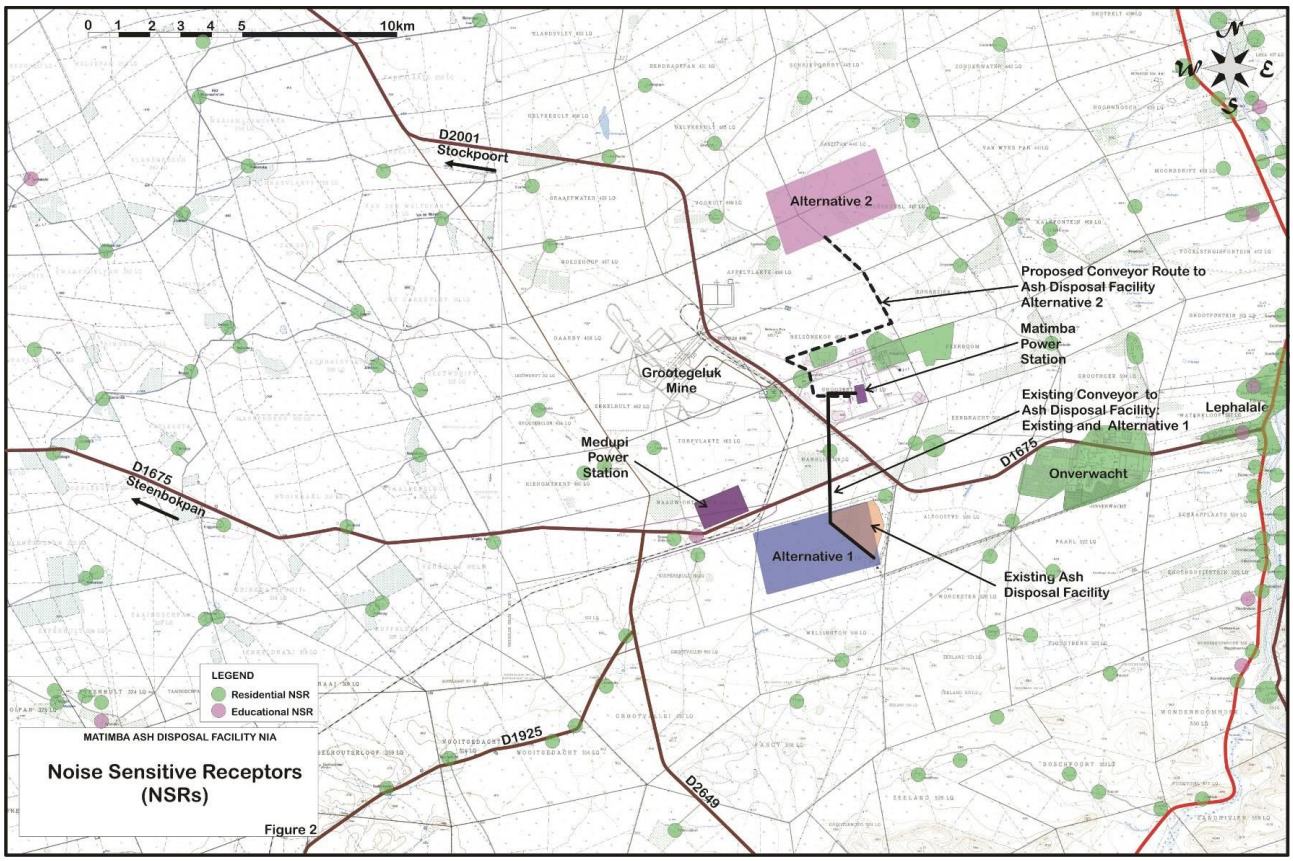



**Figure 32: Noise sensitive receptors in the vicinity Site Alternative 1, 2 and linear infrastructure route**

## 6.2.8 Traffic and Transportation

### *6.2.8.1 Roads*

There key roads servicing the area include:

i) Road D1675 is a surfaced road aligned in an east-west direction and linking Lephalale to Steenbokpan. It links from Road P84/1 (Route R510) in Lephalale to Road P16/2. The section of the road east of the intersection with Road D2001, namely the section through Onverwacht and Lephalale, is named Nelson Mandela Drive.

ii) Road D2001 is the main access to Matimba Power Station from Road D1675 (Nelson Mandela Drive). It is surfaced road on the section from its intersection with Road D1675 to Matimba Power Station and Grootegeluk Coal Mine. North of the coal mine it is a gravel road up to its intersection with Road P84/1 near the Stockpoort border post.

iii) Road D2649 is a gravel road that links from D1675 just east of Medupi Power Station to Road P84/1 (Route R510) approximately 20 km south of Lephalale.

### *6.2.8.2 Rail*

The only railway line in the area is aligned through the south-eastern sector of the site alternatives, linking from the Grootegeluk Coal Mine southwards to Thabazimbi. Its main use is the transport of coal from the coal mine. There are at present usually two trains per day.

# 7 PUBLIC PARTICIPATION

One of the general objectives of integrated environmental management laid down in Section 23(2)(d) of NEMA is to "*ensure adequate and appropriate opportunity for public participation in decisions that may affect the environment*".

## 7.1 Aims of the Public Participation Process

The primary aims of the Public Participation (PP) process are:

- to inform interested and affected parties (I&APs) and key stakeholders of progress on the proposed project and environmental studies;
- to ensure continuation of meaningful and timeous participation of I&APs;
- to provide assurance that identified issues and concerns of key stakeholders and I&APs with regards to the proposed development (i.e. focus on important issues) have been addressed;
- to promote transparency and an understanding of the project and its potential environmental (social and biophysical) impacts (both positive and negative);
- to provide information to be used for decision-making;
- to provide a structure for liaison and communication with I&APs and key stakeholders;
- to assist in identifying any other potential environmental (social and biophysical) impacts associated with the proposed development;
- to ensure inclusivity (the needs, interests and values of I&APs must be considered in the decision-making process);
- to focus on issues relevant to the project, and issues considered important by I&APs and key stakeholders; and
- to provide responses to I&AP queries.

## 7.2 Consultation with Competent Authorities

The competent authority and commenting authorities issuing decisions regarding the project as well as consultation to date are presented in below.

**Table 22: Competent and Commenting Authority associated with the Project**

| Authority | Role | Licence / Approval | Consultation to date |
|---|---|---|---|
| Department of Environmental Affairs (DEA) | Competent Authority for Integrated Licencing process | Integrated Environmental Authorisation | ▪ Submission and acceptance of integrated application form (**Appendix E**). Acknowledgement of application is in **Appendix E**.<br>▪ Submission and acceptance of the final Environmental Scoping Report (**Appendix E**).<br>▪ Submission of the draft EIAR and EMPr on 23 April 2015.<br>▪ Site visit held on 28 October 2015 with Masina Litsoane. |
| Limpopo Department of Economic Development, Environment and Tourism (LDEDET) | Commenting Authority for integrated Licencing process | (Comments on the documentation, no formal approval given) | ▪ Notification of the integrated waste and EIA process.<br>▪ Submission of the draft |

| Authority | Role | Licence / Approval | Consultation to date |
|---|---|---|---|
| | | | EIAR and EMPr on 23 April 2015. |
| Department of Water and Sanitation (DWS) | Competent Authority for Integrated Water Use Licence process | Water Use Licence | ▪ Pre-application meeting was held with the DWS – 04 December 2015. Minutes are attached as **Appendix E**.<br>▪ Submission of the draft EIAR and EMPr. |
| SAHRA | Authority for protection of South Africa's cultural heritage | Approval indicating that the application fulfils the requirements of the relevant heritage resources authority as described in Chapter II, Section 38(8) of the National Heritage Resources Act 25 of 1999 | ▪ Comments received on 23 May 2013, on the draft Environmental Scoping Report (**Appendix E**).<br>▪ Heritage Impact Assessment and PIA uploaded on the SAHRIS system on 01 April 2015 for comment.<br>▪ Final comment received on 20 July 2015 (**Appendix E**). |

## 7.3 Consultation with other Relevant Authorities and Key Stakeholders

Consultation with other relevant authorities and key stakeholders was undertaken via telephone, fax, email and letters in order to actively engage these stakeholders from the outset and to provide background information about the proposed project.

The following authorities and key stakeholders have been consulted with to date:

- National Government:
  - Department of Agriculture, Forestry and Fisheries

- Limpopo Provincial Government:
  - Department of Roads and Transport
  - Department of Public Works
  - Department of Mineral Resources
  - Department of Labour
  - Department of Agriculture
  - Department of Health and Social Development

- Local Government and other Stakeholders:
  - Lephalale Local Municipality
  - Waterberg District Municipality
  - Ward councillors
  - Neighbouring property owners/landowners
  - Environmental interest groups and NGOs (WEESA, Noed Family Trust, Ellisras & Hoornbosch Farmers' Union, Transvaal Agricultural Union, and Kudu Canyon & Waterberg Nature Conservancy)
  - Setateng Mmatladi Tribal Authority

## 7.4 Advertising

Advertisements on the availability of the draft EIAR and draft EMPr for public review and the public meetings were placed in the *Rise n Shine* and *Mogol Post* newspapers.

## 7.5 Identification of Interested and Affected Parties

I&APs and key stakeholders were identified during the ESS phase of the project. The identification of I&APs and key stakeholders continued in the EIA phase of the project as the PP process is a continuous process that runs throughout the duration of the EIA study.

## 7.6 I&AP Database

All I&AP information (including contact details), has been recorded within a database (**Appendix F**). This database has been updated on an on-going basis throughout the project, and acts as a record of the communication/involvement process.

## 7.7 Issues Trail

All issues, comments and concerns raised during the public participation process to date is included in **Appendix F**.

## 7.8 Public Review of the Draft Environmental Impact Assessment Report and Draft Environmental Management Programme

The draft EIAR and draft EMPr was made available for public review for a 30 day review period from **28 April** to **01 June 2015**. All I&APs registered on the proposed project's database were notified of the availability of the draft EIAR and draft EMPr and the report was also available in electronic format on the Royal HaskoningDHV's website (http://www.rhdhv.co.za/pages/services/environmental/current-projects.php). Hard copies of the report were made available for review at the following public places:

- Offices of Matimba Power Station (Nelson Mandela Drive, Lephalale)
- Lephalale Public Library (Lephalale Municipality Offices, corner Joe Slovo & Douwater Roads)
- Marapong Community Library (1456 Setlhora Street, Marapong)
- Manketti Lodge (Mogol Road, Lephalale)
- Office of Royal HaskoningDHV, 78 Kalkoen Street, Monument Park, Pretoria
- Royal HaskoningDHV website (http://www.rhdhv.co.za/pages/services/environmental/current-projects.php)

Hard copies of the reports were forwarded to:

- Department of Water and Sanitation
- Limpopo Department of Economic Development, Environment and Tourism (LDEDET)
- Lephalale Local Municipality
- Waterberg District Municipality
- Department of Mineral Resources

During the draft EIAR and draft EMPr review period, public meetings were held with the broader public and community members interested in the proposed project. The public meetings provided I&APs with the opportunity to be informed of the environmental findings as per the draft EIAR, the mitigation measures proposed and allowing them the opportunity to raise any issues / concerns on the project. The following public meetings were held (Table 23):

**Table 23: Meetings held for the project**

| Proposed Date & Time of Meeting | Proposed Venue |
|---|---|
| **Date: Thursday 21 May 2015 Time: 14h00 to 16h00** | Mogol Club |
| **Date: Thursday 21 May 2015 Time: 18h00 to 20h00** | Manketti Lodge |

The minutes of the meetings is provided in **Appendix F.**

## 7.9 Public and Authority Review of the Draft Environmental Impact Assessment Report

The draft EIAR was made available at public places for review and comment. A 30 calendar day period was allowed for this review process. The draft EIAR was also submitted to DEA and LDEDET simultaneously. A copy of report was submitted to the DWS, who had 30 calendar days to provide comments on the report.

An advertisement indicating the availability of the draft EIAR for public scrutiny was placed in the *Rise n Shine* and *Mogol Post* newspapers. I&APs registered on the project database (without email addresses) were notified of the availability of the report by written correspondence.

## 7.10 Registered I&AP and Authority Review of the Final Environmental Impact Assessment Report

In order to give effect to regulation 56 (2) of the EIA Regulations (2010), before submitting the final EIAR to the DEA, the registered I&APs were given access to, and an opportunity to comment on the final EIAR in writing within 30 days (as stipulated in the application acceptance letter from DEA). Only a soft copy of the report was made available on the Royal HaskoningDHV website (http://www.rhdhv.co.za/pages/services/environmental/current-projects.php). The final EIAR was available for registered I&AP review from 23 July – 12 August 2015.

This process ensures that all comments and issues raised by I&APs have been included.

## 7.11 Authority Review and Decision-making

After the final public review period, the final EIAR document will be submitted to DEA for review and decision-making.

The DEA has 60 days to accept or reject the report. If the EIAR is rejected, the report will either be referred to a specialist for review or be amended and resubmitted by the EAP. DEA have a further 45 days to grant or refuse authorisation of the application.

Should the DEA wish to administer the extension period of a further 60 days after the initial 60 days to accept or reject the report, a decision to grant or refuse authorisation must be provided 30 days after this extension period.

## 7.12 Announcement of Decision

On receipt of the Integrated Environmental Authorisation (IEA) for the project, I&APs registered on the project database will be informed, through letters and media advertisement, within 12 days of the acquisition.

# 8 SPECIALIST FINDINGS

## 8.1 Biophysical Environment

The findings and recommendations of the specialists and reports of specialised processes have been incorporated in this chapter. The following studies have been undertaken as part of this EIA process:

- Geology and Geotechnical (**Appendix G**)
- Geohydrology (**Appendix H**)
- Hydrology (**Appendix I**)
- Surface Water (Wetlands) (**Appendix J**)
- Soils and Agricultural Potential (**Appendix K**)
- Biodiversity (**Appendix L**)
- Social (**Appendix M**)
- Air Quality (**Appendix N**)
- Visual (**Appendix O**)
- Heritage and Palaeontology(**Appendix P**)
- Noise (**Appendix Q**)
- Traffic (**Appendix R**)

## 8.2 Geotechnical

The geotechnical assessment is a function of the geological assessment (Section 6.1.4) that has been conducted for the project (**Appendix G).**

### 8.2.1 Stability of the Existing Ash Disposal Facility (ADF)

The ADF at Matimba is being constructed by end dumping/tipping. End dumping is a controlled failure process where the ash is deposited forming a slope at/ or close to its angle of repose and the factor of safety is close to 1.0. The overall stability of the ADF is dependent on a number of factors such as:

- Topography of the ADF site;
- Method of construction;
- Geotechnical parameters of the ash;
- Geotechnical properties of the foundation materials;
- External forces acting on the disposal facility; and
- Rate of advance of the dump face.

Disposal facilities placed on flat ground are least likely to fail, and this is the case currently at Matimba. Analyses show that factors of safety begin to drop significantly above a ground surface inclination of 20 degrees, regardless of the strength parameters of either the waste or foundation material.

The geotechnical properties of the ash and the founding material are major factors in determining the overall stability of the ADF. Geotechnical testing of the fly ash itself was not conducted, however, it is anticipated that the ash material is cohesive to some degree with a silt and clay content of 80 to 95% and a Plasticity Index of 12 to 20. As such, failures are anticipated in the material itself and not the foundations, since foundations are on competent bedrock. Scouring of the fly ash material along the

disposal facility's edge surface and some surface/edge slides were noticed during the geotechnical investigation and is testament to this.

### 8.2.2 Foundations for the Linear Infrastructure Route to Site Alternative 2

The Aeolian sands encountered along the linear infrastructure route are considered to be generally loose in consistency, up to a depth of 3.0 m below existing ground level. As such, it is recommended that ground improvement be carried out if shallow foundations are proposed for this route.

### 8.2.3 Summary of Findings

The general geology of SA1 is characterised by Aeolian (wind-blown) sands of the Karoo Supergroup, which overlie conglomerate and sandstone bedrock of the Waterberg Group, Sandriviers Formation. The general geology of SA2 and linear infrastructure route is characterised by colluvial sandy soils and Aeolian (wind-blown) sands of the Karoo Supergroup, which overlie pedogenic soils (calcrete) and sandstone bedrock of the Ellisras Basin, Clarens Formation.

Both site alternatives are stable and suitable for the proposed development. No signs of inherent ground instability such as slip scars, tension cracks or sloughing of the mantle of transported/Aeolian soils were evident during the fieldwork.

The landform across SA1 is generally flat to very gently sloping i.e. disposal facilities placed on flat ground of competent soil/bedrock are least likely to fail. In contrast, SA2 slopes gently, with occasional small hills.

SA1 has a shallow depth to bedrock (i.e. 1.0 to 2.0 m below existing ground level) which would prove to be suitable/feasible for the ADF foundations as well as foundations for large building structures. In contrast, the depth to bedrock at SA2 is anticipated at 5.0 to 10.0 m below existing ground level and specialised foundation solutions e.g. piling, will likely be required for building structures with high foundation loads.

SA2 in contrast to SA1 is characterised by drainage lines where intermittent development of strong groundwater seepage is anticipated during the rainy season. The sudden occurrence of groundwater will likely increase the collapse potential of the sandy soils and cause embankment/foundation failures, thereby affecting the long term stability of the ADF.

Groundwater was not encountered across the study area (both SA1 and SA2) during the course of the field investigation. However, it is anticipated that a perched groundwater table will be encountered across both sites during high rainfall events, typically in the range 1.0 to 3.0 m below existing ground level. This perched water table will likely occur above the bedrock horizon in SA1 and above the calcrete horizon in SA2 and along the linear infrastructure route. Due cognisance of this water table will need to be taken into account during the construction phase and an allowance for de-watering of excavations would need to be considered, depending on the time of construction.

The Aeolian sands encountered along the linear infrastructure route are considered to be generally loose in consistency, up to a depth of 3.0 m below existing ground level. As such, it is recommended that ground improvement be carried out if shallow foundations are proposed for the route.

## 8.3 Geohydrology

A detailed geohydrological investigation for both site alternatives was conducted and the results are presented in the sections below.

### 8.3.1 Hydrocensus

A hydrocensus was conducted as part of the geohydrological investigation whereby properties within a ±2 km radius of both SA1 and SA2 were visited. During the visit, details including water use type, volumes, water levels and coordinates were obtained.

#### *8.3.1.1 Site Alternative 1*

Groundwater levels were measured in all boreholes which were accessible. A total of 16 boreholes were identified surrounding SA1 within a 2 km radius according to requirements of the DWS. The four new boreholes drilled as part of the geohydrological study in support of the integrated licencing for the continuous ashing project at Matimba formed part of the 16 boreholes identified during the SA1 hydrocensus.

Many of the boreholes identified during the hydrocensus were Matimba monitoring boreholes. Water levels were recorded in 11 boreholes ranged from 5.63 to 21.47 mbgl.

#### *8.3.1.2 Site Alternative 2*

Groundwater levels were measured in all boreholes which were accessible. In total, 16 boreholes were identified surrounding SA2 including the one new borehole drilled.

The water levels ranged from 17 mbgl to 23.94 mbgl. The water is used mostly for domestic purposes as well as stock watering.

### 8.3.2 Groundwater Levels and Flow Direction

The water levels collected during the hydrocensus and the borehole drilling on both sites were used to determine the groundwater levels for the site alternatives.

#### *8.3.2.1 Site Alternative 1*

The groundwater flow direction for SA1 is generally in an easterly direction (Figure 33) towards the Sandloop River. The flow direction contours were based on water levels collected from 11 different boreholes surrounding the site. The flow direction associated with the eastern portion of the current ash disposal area is somewhat different to the general easterly direction. This is most likely due to potential seepage occurring from the ADF resulting in shallower water levels immediately down-gradient of the existing ADF.

#### *8.3.2.2 Site Alternative 2*

The groundwater flow direction for SA2 is in an easterly direction (Figure 34). The flow direction contours were based on water levels collected from 8 different boreholes surrounding the site area.

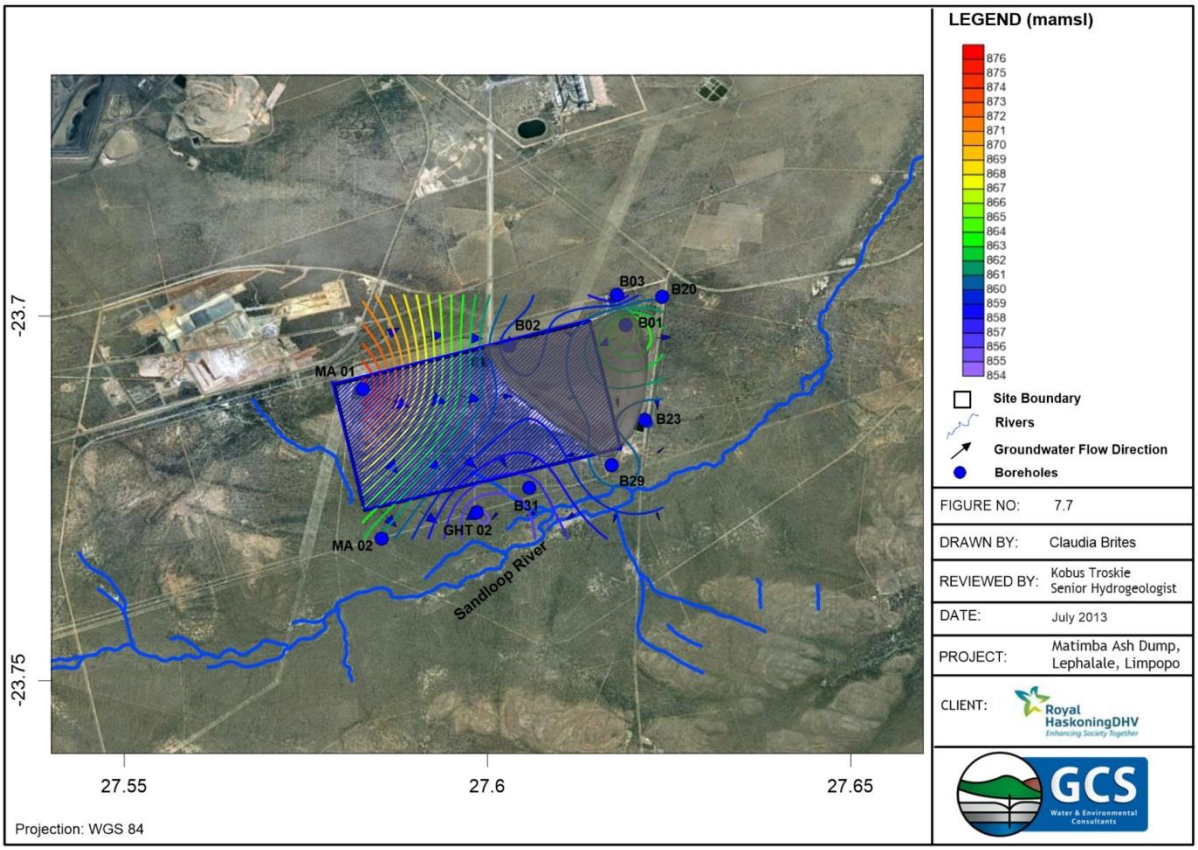



**Figure 33: Site Alternative 1 groundwater flow direction**

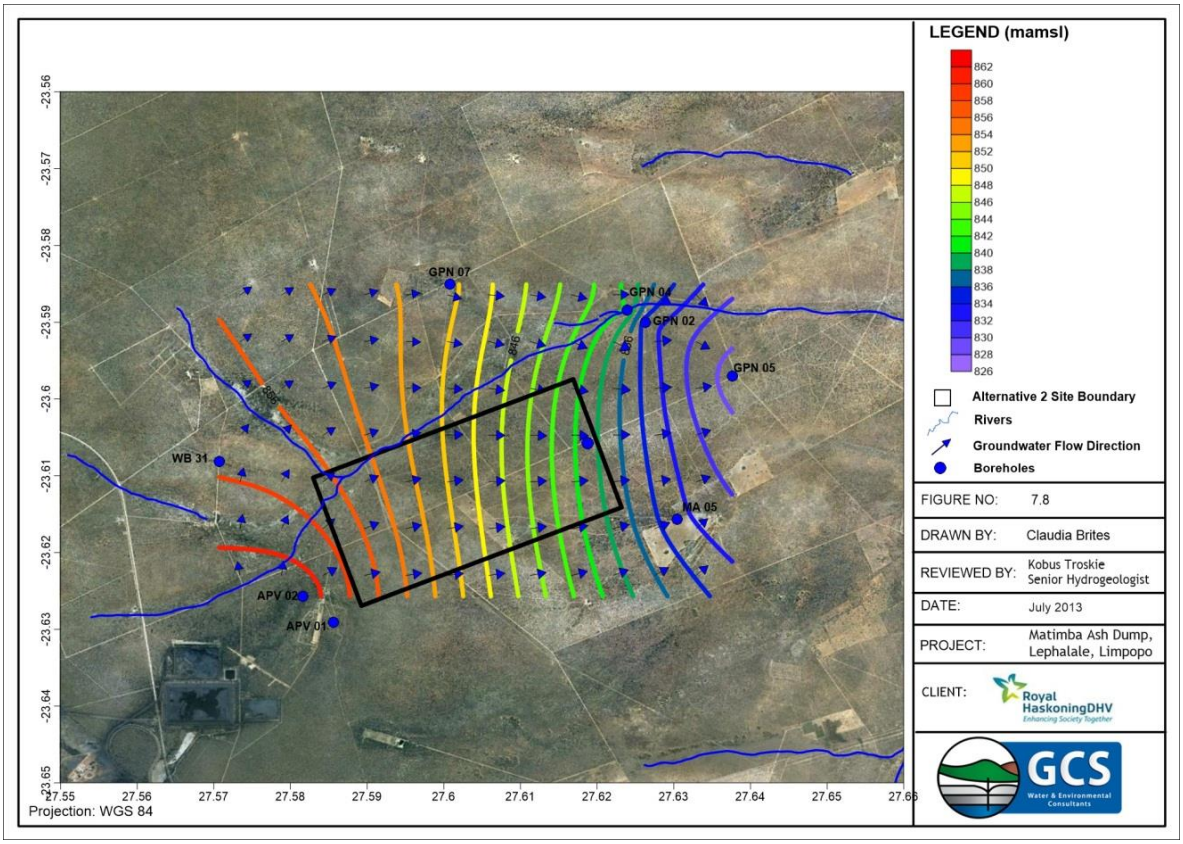



**Figure 34: Site Alternative 2 groundwater flow direction**

### 8.3.3 Aquifer Testing

The results of the aquifer testing were interpreted in order to provide a better understanding of the aquifer hydraulic characteristics of the geological formations and the calculation of travel times of pollutants and the risk of contamination.

#### *8.3.3.1 Site Alternative 1*

The results of the aquifer testing for the boreholes associated with SA1 are presented in Table 24. MA1 and MA2, the newly drilled boreholes were tested, MA3 and MA4 was drilled dry. The 12 other boreholes are hydrocensus boreholes which were not included in the scope of work to be tested.

**Table 24: Aquifer test results - Site Alternative 1**

| Borehole ID | Borehole SWL (mach) | Borehole Depth (m) | Pump Installation (mach) | Test (min) | Recovery Test (min) | Test Rate (l/s) | % Recovery | Transmissivity Theis Residual drawdown/recovery method ($m^2$/day) |
|---|---|---|---|---|---|---|---|---|
| **MA1** | 17.42 | 40 | 38 | 2.5 | 360 | 0.7 | 74% | 0.04 |
| **MA2** | 17.31 | 40 | 38 | 4 | 180 | 0.9 | 72% | 0.06 |

The aquifer test results are representative of a low yielding aquifer with transmissivity values ranging from 0.04 to 0.06 $m^2$/day.

#### 8.3.3.2 *Site Alternative 2*

The results of the aquifer testing for the boreholes associated with SA2 are presented in Table 25. The newly drilled boreholes MA5, APVO2 and GPN05 were tested. The remaining boreholes were hydrocensus boreholes which were equipped with pumps and could not be tested.

**Table 25: Aquifer test results - Site Alternative 2**

| Borehole ID | Borehole SWL (mach) | Borehole Depth (m) | Pump Installation (mach) | Test (min) | Recovery Test (min) | Test Rate (l/s) | % Recovery | Transmissivity Theis residual drawdown/recovery method ($m^2$/day) |
|---|---|---|---|---|---|---|---|---|
| **MA5** | 23.17 | 40 | 37 | 4 | 240 | 0.9 | 97% | 0.15 |
| **APV02** | 18.15 | 100 | 75 | 240 | 180 | 1.4 | 94% | 6.67 |
| **GPN05** | 23.28 | 40 | 38 | 10 | 400 | 0.9 | 99% | 0.1 |

The results indicate that boreholes MA5 and GPN05 were low yielding with short pumping periods and longer recovery periods. Borehole APV02 underwent a drawdown test of 240 minutes with a pumping rate of 1.4 l/s. The transmissivity in the three boreholes ranged from 0.1 to 6.67 $m^2$/day.

### 8.3.4 Groundwater Sampling

#### 8.3.4.1 *Site Alternative 1*

The field parameters measured in the site and hydrocensus boreholes of SA1 are presented below in Table 26 and include pH, temperature, EC and TDS.

Two newly drilled monitoring boreholes and 10 hydrocensus boreholes surrounding SA1 were sampled during the hydrocensus investigation. The other two newly drilled monitoring boreholes were dry.

**Table 26: Field parameters of site and hydrocensus boreholes – Site Alternative 1**

| Borehole | pH | Temperature (°C) | EC (mS/cm) | TDS (ppm) |
|---|---|---|---|---|
| **MA 01** | 6.98 | 25.1 | 25.4 | 231 |
| **MA 02** | 6.51 | 22.1 | 1870 | 4310 |
| **MA 03** | **Dry** | | | |
| **MA 04** | **Dry** | | | |
| **P02** | 6.79 | 23.5 | 395 | 2680 |
| **P29** | 6.21 | 21.8 | 1291 | 9110 |
| **P01** | 6.02 | 22 | 114.1 | 829 |
| **P21** | 6.59 | 19.1 | 825 | 390 |
| **P23** | 7.02 | 22.3 | 5440 | 3820 |
| **P03** | 6.62 | 20.7 | 45.9 | 314 |
| **P31** | 6.65 | 24.5 | 123.8 | 8650 |
| **P20** | 6.53 | 21.8 | 79.9 | 371 |
| **GHT 02** | 6.5 | 24.3 | 380 | 2840 |

| Borehole | pH | Temperature (°C) | EC (mS/cm) | TDS (ppm) |
|---|---|---|---|---|
| **HP 01** | 7.51 | 22.4 | 244 | 1250 |

### *8.3.4.2 Site Alternative 2*

The field parameters measured in the site and hydrocensus boreholes of SA2 are presented below in Table 27 and include pH, temperature, EC and TDS.

One newly drilled monitoring borehole and six hydrocensus boreholes surrounding SA2 were sampled during the hydrocensus investigation. This sampling method was deemed sufficient in terms of data as up- and down-gradient samples were collected. Some boreholes were located in close proximity to each other and therefore it was not necessary to sample all hydrocensus boreholes.

**Table 27: Field parameters of site and hydrocensus boreholes – Site Alternative 2**

| Borehole | pH | Temperature (°C) | EC (mS/cm) | TDS (ppm) |
|---|---|---|---|---|
| **MA 05** | 6.5 | 21.4 | 65.0 | 245 |
| **APV 02** | 6.14 | 18.6 | 834 | 2710 |
| **GPN05** | 6.41 | 21.7 | 71.5 | 524 |
| **NGA 096** | **Inaccessible** | | | |
| **DHL 123** | 6.46 | 25.6 | 57.3 | 276 |
| **GPN 07** | 6.97 | 23.3 | 95.3 | 655 |
| **APV 01** | 7.05 | 17 | 479 | 3330 |

### *8.3.4.3 Analysis of Water Samples*

The water qualities measured within all boreholes sampled were compared to the SANS (South African National Standard) 241-1:2011 Water quality standards for drinking water as well as the target values of the South African Water Quality Guidelines for Domestic Water Use (SAWQG) as published by the Department of Water Affairs (DWA) which is used as a guideline.

Background water quality is difficult to determine for SA1 as majority of the boreholes are located in close proximity to the existing ADF. MA1 was used for the pollution index assessment.

For SA2, there is no existing ADF, therefore background water quality is represented by all boreholes sampled. The difference in chemistry could be due to the geology.

- SA1 chemistry results of monitoring boreholes are presented in Table 28.

**Table 28: Site Alternative 1 chemistry results**

| Borehole | Location | Chemistry Results |
|---|---|---|
| **MA1** | This is a newly drilled borehole which was sited up-gradient of the current and ADF. | The chemistry indicated that TDS (Total Dissolved Solids), chloride and iron exceeded the DWA drinking guidelines. Manganese exceeded the SANS standard. Overall the water quality is generally good in comparison with the existing down-gradient monitoring boreholes.<br>This is the closest to background quality which is available, it is located up-gradient of the facility. However no information is available regarding the chemistry before the construction of the facility. |

| Borehole | Location | Chemistry Results |
|---|---|---|
| **MA2** | This is a newly drilled borehole drilled south west of the current and proposed ADF. | The chemistry results indicated several elevated constituents. This includes conductivity, TDS, chloride, fluoride, sulphate, calcium, potassium, sodium, manganese, magnesium and lead all which exceeded the SANS standards. The iron concentration exceeded the DWA guideline.<br>It does appear as though this borehole is contaminated as a result of the existing ADF. |

- SA1 chemistry results of hydrocensus boreholes are presented in Table 29.

**Table 29: Site Alternative 1 chemistry results of hydrocensus boreholes**

| Borehole | Location | Chemistry Results |
|---|---|---|
| **HP01** | Matimba monitoring borehole located on the northern perimeter of the ADF. The borehole is used for domestic and stock watering purposes. | Elevated constituents: conductivity, TDS, chloride, fluoride, calcium, sodium and magnesium all exceeded the SANS standards. The sulphate and manganese concentrations exceeded the DWA guideline. |
| **P02** | Matimba monitoring borehole located on the northern perimeter of the ADF. | Elevated constituents: conductivity, TDS, chloride, sulphate, calcium, sodium, manganese, magnesium and iron all exceeded the SANS standards. The ammonia and fluoride concentrations exceeded the DWA guideline. |
| **P03** | Matimba monitoring borehole located on the north-eastern corner of the ADF, an ash water collecting dam. | The quality of the water is good with only manganese exceeding the DWA guideline. |
| **P01** | Matimba monitoring borehole located on the north-eastern corner of the ADF. | Elevated constituents: conductivity, TDS, sulphate, aluminium, calcium, manganese, magnesium and arsenic which all exceeded the SANS standards. The sodium concentration exceeded the DWA guideline. The pH is also very low with a value of 3.5 which does not comply with the SANS standard. |
| **P20** | Matimba monitoring borehole located east of water return dams next to the fence and downstream of monitoring boreholes P05, P03, P12. | The quality of the water is good with only fluoride exceeding the SANS limits and conductivity, chloride, sodium, manganese and iron exceeding the DWA guideline. |
| **P21** | Matimba monitoring borehole located north-east of the ash stack next to the fence, downstream of ash stack, P05, P01, P03 and P12. | Elevated constituents: TDS, sulphate, calcium, manganese, magnesium and iron which all exceeded the SANS standards. The conductivity and sodium concentrations exceeded the DWA guideline. |
| **P23** | Matimba monitoring borehole located on the eastern perimeter of ADF & north-eastern corner of the eastern ash water collecting dam (P06). | Elevated constituents: conductivity, TDS, chloride, sulphate, calcium, sodium, manganese and magnesium which all exceeded the SANS standards. |
| **P29** | Matimba monitoring borehole located on the south-eastern corner, down-gradient of the ADF. | Elevated constituents: elevated conductivity, TDS, chloride, calcium, potassium, sodium, manganese, magnesium and iron which all exceeded the SANS standards. The ammonia and fluoride concentrations exceeded the DWA guideline. |
| **P31** | Matimba monitoring borehole located south and down-gradient of the ADF and boreholes P30 & P35. | Elevated constituents: TDS, chloride, fluoride, calcium, potassium, sodium, manganese, magnesium and iron which all exceeded the |

| Borehole | Location | Chemistry Results |
|---|---|---|
| | | SANS standards. The conductivity concentration exceeded the DWA guideline. |
| **GHT02** | New monitoring borehole drilled by GHT consultants at the same time this investigation was conducted. | Elevated constituents: conductivity, TDS, chloride, fluoride, calcium, sodium, manganese and magnesium which all exceeded the SANS standards. The sulphate concentration exceeded the DWA guideline. |

Overall, the general trend of the boreholes indicated similar parameters which generally exceeded the drinking water limits. Most of these parameters indicated very high concentrations. These problematic parameters as identified through the pollution index include: conductivity, TDS; chloride; sulphate; calcium; sodium; manganese and magnesium. Most of the boreholes indicated poor water quality with these parameters in high concentrations. This was with the exception of boreholes MA1 (newly drilled up-gradient), P03 and P20. The chemistry results of the remaining boreholes indicated the effect of the current ADF on the groundwater environment.

- SA2 chemistry results of monitoring boreholes are presented in Table 30.

**Table 30: Site Alternative 2 chemistry results of monitoring boreholes**

| Borehole | Location | Chemistry Results |
|---|---|---|
| **GPN05** | Down-gradient of the proposed ADF at SA2. An existing production borehole which was used as a monitoring borehole. | The water quality is good with the TDS, chloride and iron concentrations exceeding the DWA guideline. Manganese exceeded the SANS limits. |
| **APV02** | Up-gradient of the proposed ADF at SA2. An existing production borehole which was used as a monitoring borehole. | The water quality indicated concentrations exceeding of conductivity, TDS, chloride, sulphate, calcium, sodium, magnesium and iron all exceeded the SANS standards. |
| **MA5** | A newly drilled borehole located down-gradient of the proposed ADF. | The chemical analysis indicated conductivity, TDS, chloride, sodium and manganese, concentrations exceeded the DWA limits. Aluminium and iron exceeded the SANS limits. |

- SA2 chemistry results of hydrocensus boreholes in Table 31.

**Table 31: Site Alternative 2 chemistry results of hydrocensus boreholes**

| Borehole | Location | Chemistry Results |
|---|---|---|
| **APV01** | Hydrocensus boreholes identified during the investigation | The chemical analysis indicated conductivity, TDS, nitrate as N, sulphate, calcium, sodium and magnesium concentrations exceeded the SANS limits. Fluoride exceeded the DWA limits. |
| **NGA090** | | The quality of the water is good with only iron exceeding the DWA limits. |
| **GPN07** | | The chemical analysis indicated conductivity, TDS, ammonia, chloride, sodium and manganese concentrations exceeded the DWA limits. |

| Borehole | Location | Chemistry Results |
|---|---|---|
| **DHL123** | | The quality of the water is good with only fluoride and sodium exceeding the DWA limits. |

A comparison in the groundwater chemistry is also made between the boreholes surrounding SA1 and SA2. Although several boreholes associated with SA2 indicated elevated concentrations of parameters mentioned earlier which appear to be problematic, it is clear that the concentrations in general are much lower than those associated with boreholes surrounding SA1.

### 8.3.5 Ash Disposal Facility Leachate

Drawing on research that has been done in South Africa on the impacts of ash from coal-fired power stations on specifically groundwater the following conclusions can be made:

- The concentration of metals in the coal type determines the concentration of metals in the ash and therefore the leachate.
- Studies on South African sites show contamination of soils and groundwater directly under the ADF, with limited plume development and movement at well selected sites.
- Shallower water tables will develop as a mound under the disposal site, driving the groundwater flow in the direction of streams or other discharge points.
- Over the long term life of the ADF, the pH tends to decrease to around 7 and the mobilization of metals becomes problematic with low pH levels.
- Acid leaching will take place from the coal stockpiles (if not mitigated), increasing the overall potential for groundwater contamination.

Based on laboratory test results carried out on representative samples of the ash by Jeffares & Green (Pty) Ltd[10]. The samples were collected in February 2013 and underwent the following analysis:

**Table 32: Ash analysis**

| Test | Finding |
|---|---|
| Acid rain leach (ARL) procedure (ARLP) extraction | The only Contaminant of Concern (CoC) that exceeded the Acceptable Risk Level was hexavalent chromium (CrVI) but all other potential CoCs had a concentration lower than the respective ARL. |
| *Aqua regia* digestion | These results show elevated total concentrations of Ba in all the samples of ash, exceeding the TCT0 threshold level (total concentration thresholds for particular contaminants in a waste), while the total concentrations of all other potential CoCs were within acceptable levels. |
| Deionised water (1:20) extraction | The soluble Chromium (Cr) and Boron (B) concentrations in all three ash samples exceeded the LCT0 threshold.<br><br>The CrVI concentration in two of the ash samples exceeded the LCT0 threshold.<br><br>Leachable Molybdenum (Mo) concentration in the ash sampled from the new stockpile 1 exceeded the LCT0 threshold. |

[10] Classification done according to Minimum Requirements trilogy (DWAF, 1998) and draft Regulations (GNR 613 to 615, 2012). The draft Regulations (GNR 613 to 615, 2012) have since been promulgated in August 2013 and the trilogy of documents (GN 634-636, 2013) also referred to as the Waste Classification and Management Regulations (WCMR, 2013) now apply. The promulgation of the WCMR regulations deem the Minimum Requirements trilogy (DWAF, 1998) no longer relevant to waste classification.

### 8.3.6 Linear Infrastructure Route

During the sensitivity mapping study conducted during the Environmental Scoping Study, the following components were identified as sensitive areas: faults or lineaments and production boreholes. The linear infrastructure route to SA2 does not traverse/intersect any production boreholes but does traverse the Daarby fault. The route will traverse two faults (one the Daarby fault and another just north of the Daarby fault).

### 8.3.7 Potential Impacts

The ADF may have the following impacts on the groundwater environment as discussed in detail below.

#### *8.3.7.1 Construction Phase – Hydrocarbon Contamination*

During the construction phase, hydrocarbon contamination is possible due to the presence of oil containing machinery on site. Spillages may occur which may impact both the soil and groundwater environment.

#### *8.3.7.2 Operations and Closure Phases – Poor Quality Artificial Recharge from the Ash Disposal Facility*

The major potential impacts of ash disposal on groundwater resources are generally associated with changes in the pH of the water, the increase in salt content and the concentration of the potentially toxic trace elements. The most important factor in determining the resulting pollution impact of the ash is the way in which it is disposed.

During dry disposal, the ash still has a moisture content of up to 15% as water is added to suppress dust during transport and deposition.

Fly ash mainly consists of small, glassy hollow particles and contains all the natural elements, and in comparison with the parent material is enriched in trace elements. Studies show that trace elements are usually concentrated in the smaller ash particles. The ash is usually enriched in arsenic, boron, calcium, molybdenum, sulphur, selenium and strontium.

By understanding the chemistry of the ash, a better insight into its reactions with various other elements can be reached. The pH of the ash is normally elevated due to the abundance of calcium oxide. Calcium oxide usually constitutes about 8% of the ash and is of great importance in the forming of the pozzolanic layer. As stated above, another factor that plays an important role is the presence of water in the ash. If there is enough water to isolate the ash from the atmosphere (as is the case with wet disposal) the ash will not be able to react with the oxygen in the air and the pozzolanic layer will not be able to form.

Should the ash be wetted and dried cyclically, the ash will have time to react with the atmosphere. This will cause a reaction between calcium oxide and the carbon dioxide that will then lead to the crystallisation of calcium carbonate (limestone). Another reaction that occurs is that between calcium and sulphate that results in the crystallisation of gypsum. This is a process that takes place within the ADF.

These two minerals (calcium carbonate and gypsum) form the so-called pozzolanic layer, which is a layer of very low permeability. The layer can be expected to occur in the upper 0.5 m of the ash disposal infrastructure. It is thus evident that the formation of the pozzolanic layer is mostly confined where wetting and drying of ash occurs, during deposition in the wet process and near the surface on a dry ash pile.

Leaching from these ash disposal sites may occur. Leaching experiments (as mentioned above) show that the element composition of the leachate does not necessarily reflect that of the whole ash sample proportionally. This suggests that for some elements a correlation of leachate quality to whole ash properties cannot be made. The rate at which these elements will leach from the ash is dependent on:

- The form in which the element is present within the ash;
- The location of the element within the ash matrix; and
- Whether the element has been absorbed on to the ash particle surface.

Parts of the ash spheres are chemically stable in the environment and are resistant to weathering due to the alumino-silicate matrix. Any element present in this matrix will be less readily available for leaching. However, elements absorbed onto the surface of the ash spheres will be more readily leached. Un-combusted mineral material may account for the presence of high concentrations of certain elements in the whole ash analysis. Leachate generated from these ashes may however, not reflect the high concentrations because the extraneous material associated with the ash are not in a form that is susceptible to leaching.

Water contained in the ash material during deposition can leach constituents from the ADF and transport it to the surrounding environment. Additional water that is recharged from rainfall will supplement the interstitial water and contribute to the leaching of elements. The water that migrates through the facility can either seep out along the edge of the ADF and enter the surrounding environment as surface water, or migrate vertically to the bottom of the ADF and enter the underlying soil from where it can recharge and contaminate the aquifers.

The quality of the water seeping from the ADF is determined by performing leach and element enrichment testing. This includes a distilled water leachate test and acid-base accounting tests to determine the acid-neutralising and acid-generating capacity of the ash from which the net neutralising potential is calculated. The volume of water that will seep from the ADF in the long term will be affected by the recharge from rainfall.

#### *8.3.7.3 Operations Phase – Transportation of Ash*

During the operational phase, the loss of ash on the conveyor belt during the transportation from the power station to the ADF may have a detrimental effect on the soil and groundwater environment. In the event that this occurs, poor quality leachate may occur as a result of ash being deposited along the conveyor route.

### 8.3.8 Summary of Findings of the Geohydrological Assessment

A detailed hydrocensus was conducted as part of the geohydrological investigation whereby properties within a 2 km radius of SA1 and SA2 were visited. The water use for both site alternatives is mostly for domestic purposes as well as stock watering.

The groundwater flow direction for SA1 is generally in an easterly direction towards the Sandloop River. Aquifer testing was conducted which indicated relatively low transmissivities which ranged from 0.04 to 0.06 $m^2$/day.

The groundwater flow direction for SA2 is in an easterly direction. Aquifer testing was conducted which indicated transmissivities that ranged from 0.1 to 6.67 $m^2$/day.

A review of the chemistry of the Matimba Power Station monitoring boreholes sampled, indicated a general trend with similar parameters which generally exceeded the drinking water limits. Most of these parameters indicated very high concentrations. These problematic parameters as identified through the pollution index include the following: conductivity, TDS; chloride; sulphate; calcium;

sodium; manganese and magnesium. Majority of the boreholes indicated poor water quality with these parameters in high concentrations. This was with the exception of the newly drilled up-gradient boreholes MA1, P03 and P20. MA01 up-gradient, indicates good water quality as opposed to the down-gradient boreholes. The chemistry results of the remaining boreholes indicated the effect of the existing ADF on the groundwater environment.

A comparison in the groundwater chemistry was made between the boreholes surrounding SA1 and SA2. Although several boreholes associated with SA2 indicated elevated concentrations of parameters which appear to be problematic, it is clear that the concentrations in general are much lower than those associated with boreholes surrounding SA1.

With regards to the depth to water level, SA1 is slightly deeper when compared to SA2. SA1 is a further distance to intrusive lithologies in comparison to SA2. Furthermore, only 1 production borehole was identified in the 2 km radius of the SA1 compared to the 13 boreholes in use surrounding SA2.

The linear infrastructure route to SA2 will traverse two faults (one the Daarby fault and another just north of the Daarby fault). The presence of faults may potentially affect groundwater flow and provide preferential pathways for contamination.

During the operational phase, the loss of ash on the conveyor belt during the transportation from the power station to the ADF may have a detrimental effect on the soil and groundwater environment. In the event that this occurs, poor quality leachate may occur as a result of ash being deposited along the conveyor route.

## 8.4 Hydrology

### 8.4.1 Water Features Identified around Site Alternatives 1 and 2

Water infrastructure identified during the site visit include:

- ***Site Alternative 1***
  - Three existing, lined Pollution Control Dams (PCDs);
  - Stormwater channels and berms; and
  - A pan used by local wildlife for drinking water.

- ***Site Alternative 2***
  - An artificial pan used by local wildlife for drinking water.

### 8.4.2 Catchment Delineation, Characterization, and Properties

The general area is drained by the non-perennial Sandloop River, running from north to south. The catchment area of SA2 contains branches of a tributary of the Sandloop River and the catchment area of SA1 contains a very small tributary of the Sandloop River. An additional stream occurs to the west of SA1 which also drains toward the Sandloop River.

Catchment areas used for flood calculations were found to differ significantly from natural catchment areas derived solely from historical topographic maps. Local development has changed catchment boundaries and flow paths. Effective catchment areas that accounted for existing development were thus derived for each catchment. Table 33 shows a summary of the catchment areas.

**Table 33: Summary of catchment sizes**

| Sub-catchment | River | Site Area*(km²)* |
|---|---|---|
| **Natural Catchment 1** | Tributary of the Sandloop | 5.1 |
| **Natural Catchment 2** | Tributary of the Sandloop | 12.57 |
| **Natural Catchment 3** | Tributary of the Sandloop | 54.58 |
| **Effective catchment 1** | Tributary of the Sandloop | 0.83 |
| **Effective catchment 2** | Tributary of the Sandloop | 7.1 |
| **Effective catchment 3** | Tributary of the Sandloop | 52.51 |

The catchments can be seen in Figure 35. The catchments are rural and flat and comprise semi-permeable soils. The vegetation that makes up the area is mainly light bushveld with a combination of light grass and bare areas.

- ***Mean Annual Run-off (MAR)***

The Mean Annual Run-off (MAR) values for SA1 and SA2 are tabulated below. Table 34 also shows the percentages of MAR from the site boundary that make up the relevant quaternary catchment and Water Management Area.

**Table 34: Mean annual run-off for Site alternative 1 and 2**

| Natural Catchment | Correction Factor MAR | Basic MAR | % Quat. Catchment Area | % Water Management Area |
|---|---|---|---|---|
| **SA1** | 0.58 | 0.47 | 8 | 0.1562 |
| **SA2** | 0.40 | 0.32 | 5.52 | 0.1076 |

- ***Peak Flows***

Peak flows were been calculated based on the results of three methods: Rational; Alternative Rational and Standard Design Flood (SDF) Methods. The three methodologies were utilised to calculate and compare the peak flows for the 3 effective catchments for the 1:50 and 1:100 year return periods. The results of these calculations are tabulated in Table 35 below:

**Table 35: Peak flows as calculated using the three methods**

| Catchment Name | Method | | | | | |
|---|---|---|---|---|---|---|
| | Rational | | Alternative Rational | | SDF | |
| | 1:50 | 1:100 | 1:50 | 1:100 | 1:50 | 1:100 |
| | ($m^3/s$) | | | | | |
| **Catchment 1** | 4.03 | 7.73 | 5.13 | 7.12 | 8.51 | 7.12 |
| **Catchment 2** | 28.98 | 43.83 | 58.21 | 80.81 | 36.82 | 80.81 |
| **Catchment 3** | 336.83 | 524.76 | 249.79 | 346.77 | 395.92 | 506.96 |

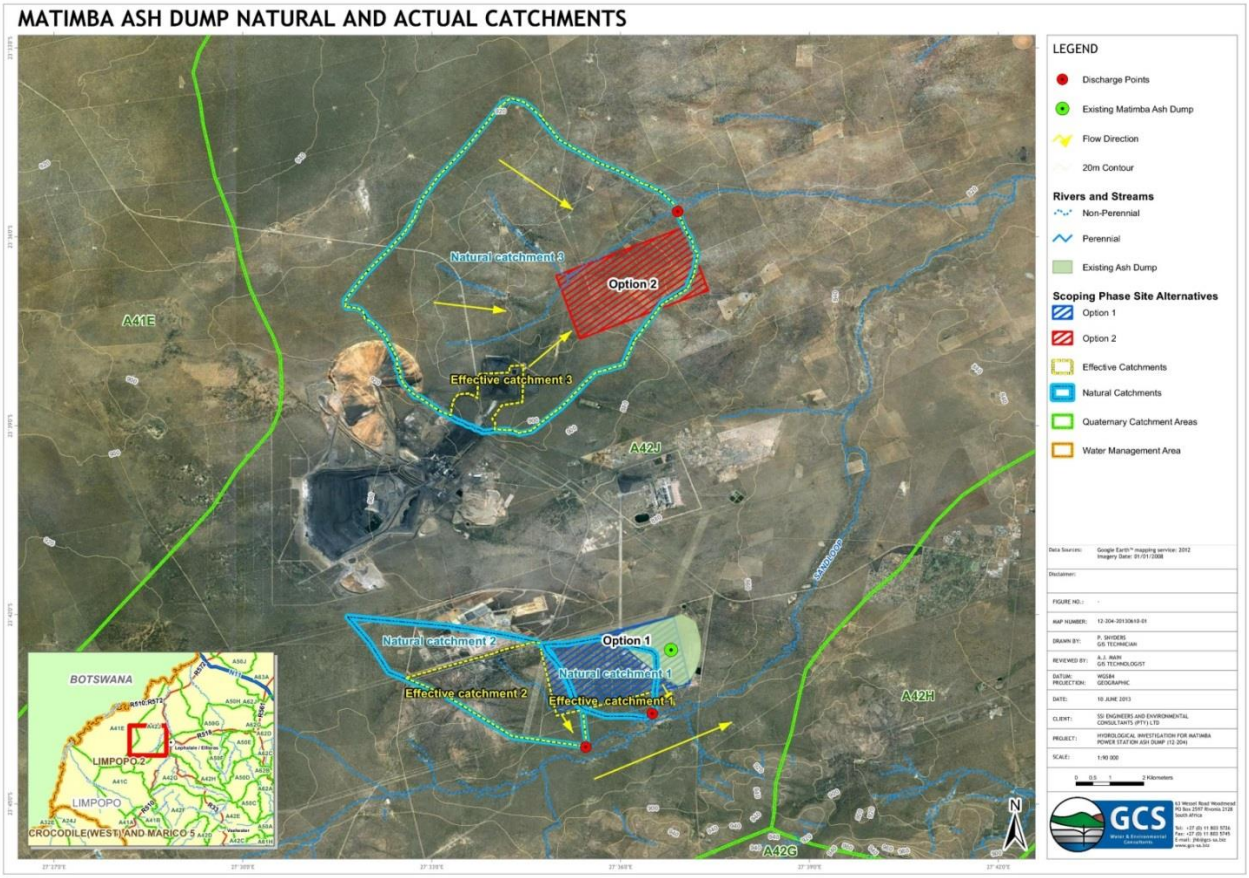



**Figure 35: Catchment areas for Site Alternative 1 and 2**

Of the methodologies used, the results obtained from the SDF method were chosen to represent the peak flows for catchment 3. This is because the SDF method is: the most conservative of these methods; specifically set up for South African conditions; and widely used and accepted within the hydrology industry.

The results using the Rational method were chosen for catchments 1 and 2, as this method is more appropriate to catchment areas of a smaller size. The following peak flows (Table 36) for each catchment were adopted for flood line analyses:

**Table 36: Adopted peak flows and associated method utilised**

| Catchment Name | 1:50 ($m^3/s$) | 1:100 ($m^3/s$) | Method |
|---|---|---|---|
| **Catchment 1** | 4.03 | 7.73 | Rational |
| **Catchment 2** | 28.98 | 43.83 | Rational |
| **Catchment 3** | 395.92 | 506.96 | Standard Design Flood |

### 8.4.3 Flood Lines

#### *8.4.3.1 Flood Line Characteristics*

Two watercourses were identified at SA1 and were labelled Rivers 1 and 2: these watercourses are tributaries of the Sandloop River. These watercourses were found to cross the site boundary, or pass within 100 m of the site, and are likely to influence development.

For the Sandloop River itself, floods would tend to flow randomly across a wide, poorly defined floodplain. The 1:100 year floods would be contained within this floodplain and a buffer zone was drawn that extended 100 m from the apparent edges of this floodplain. More detailed flood line analysis was not considered necessary. One watercourse was identified at SA2 and was labelled River 3. This watercourse is also a tributary of the Sandloop River and it intersects the site boundary. A flood line analysis was thus required for this tributary.

Flood characteristics are influenced by soils and by vegetation. For both site alternatives, the vast majority of the catchment area was dominated by sparse bushveld with well-established and hardy grass undergrowth. The local topography is flat and no defined watercourses were seen during the site visit. It seems likely that with each flood event that occurs, new and temporary flow-paths will develop that will be guided more by roads, fences, pathways and existing vegetation than by dominating topographical features.

The 1:50 and 1:100 year flood lines of the three analysed rivers mostly fall outside of the 100 m buffer zone. These flood lines could be exaggerated owing to data inaccuracy (cross sections using 20 m contours). Mostly overland flow is expected and consequent flood lines are extremely difficult to determine. A conservative approach would be to accept a wider floodplain for protection of the resource and to allow water to flow freely over a protected zone. A floodplain has been delineated that is likely to include any probable flow path for the design flood and a 100 m buffer zone around this floodplain has been drawn (Figure 36).

A 100 m buffer zone from the edge of this poorly-defined floodplain was drawn and accepted as the ultimate exclusion zone. Neither a floodplain, nor a flow path could be identified on the small headwater tributary on the northern side of SA1. 100 m buffer lines were thus drawn around the area in which the standard rivers coverage has identified this headwater tributary. Delineated and estimated areas are limited to areas where flooding could potentially impact on development, thus flood lines were not calculated over the whole extent of the rivers.

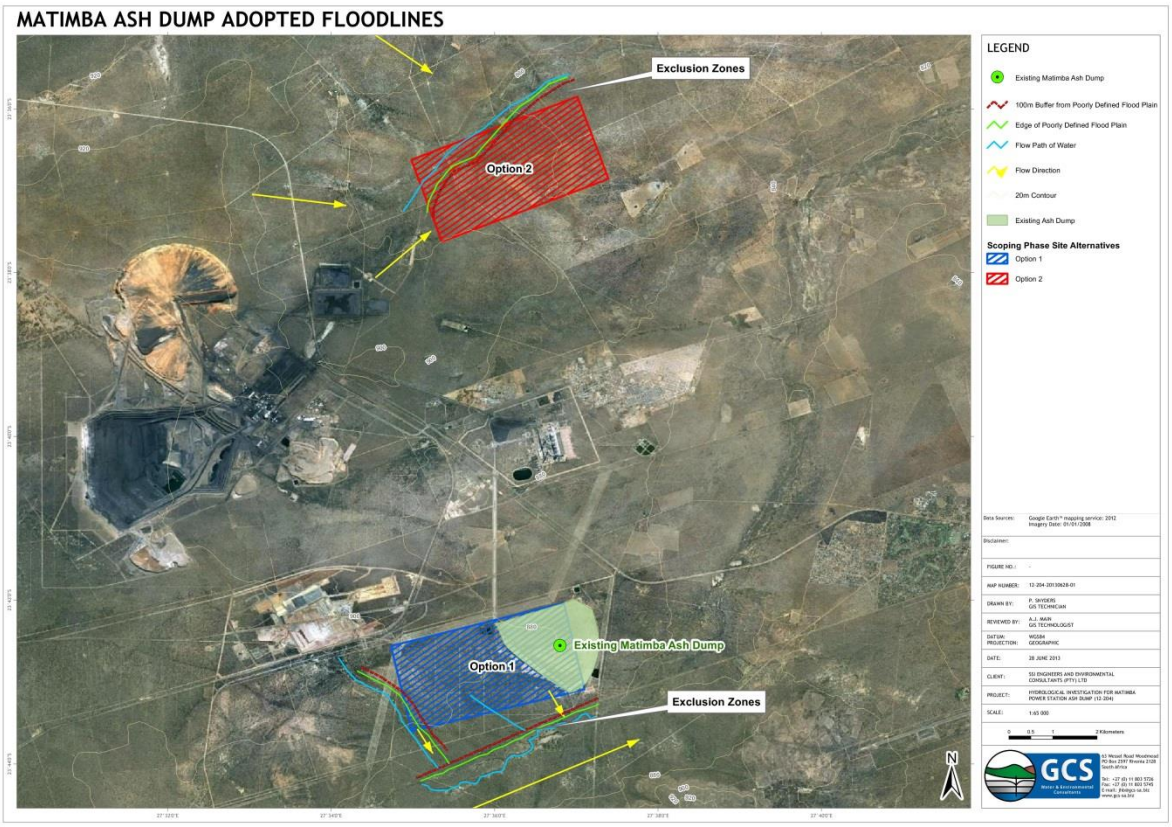



**Figure 36: Adopted flood lines**

### 8.4.4 Water Quality Assessment

Water quality evaluations were performed on 5 sampling points in the site area which are depicted in Figure 38. These are once-off samples that do not necessarily indicate average quality at the site.

The water sample chemistry results were compared to four different guidelines, namely:

- Department of Water Affairs (DWA) South African Water Quality Guidelines (SAWQG) Volume 1 for Domestic Use (1996a);
- DWA SAWQG Volume 5 for Livestock Watering (1996b);
- DWA SAWQG Volume 7 for Aquatic Ecosystems (1996c); and
- South African Bureau of Standards (SABS) SANS 241-1:2011 Drinking Water Standards.

The drinking water guidelines were used as they are the most comprehensive set of standards and provide for a worst case scenario where the water is unintentionally used for consumption by humans. Both the DWA and the SABS standards for drinking water were referred to in the analysis of the water quality.

The chemistry results compared to the aforementioned standards are presented in Table 6.14: Water Quality Results for March 2014 of the Hydrology Report (**Appendix I**).

From the chemistry results, MA SW3&4 (SA1) contained relatively more non-compliant parameters when compared to the other samples. The samples are compared in terms of a few primary parameters, as seen in Figure 37 below.

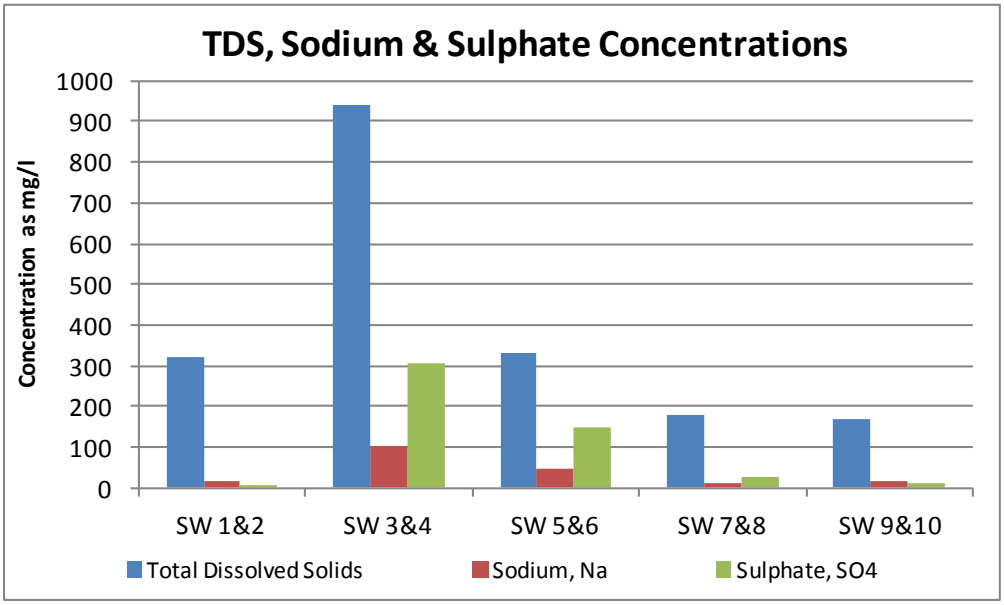



**Figure 37: TDS, Sodium and Sulphate concentrations**

The water chemistry results per sample site are further discussed below in terms of the samples taken from pans / dams and PCDs.

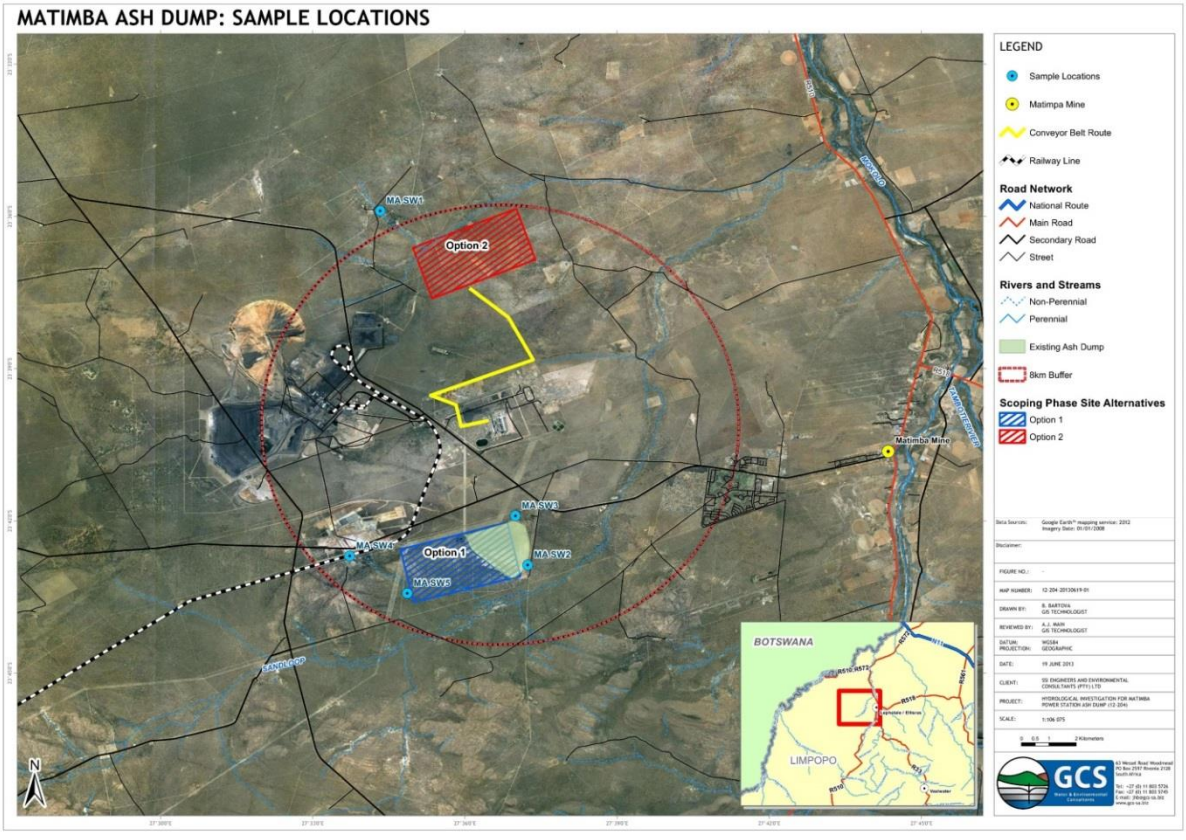



**Figure 38: Water sample collection site locations**

#### 8.4.4.1 Pan or Dam Water Samples

- **MA SW 1&2 (MA SW1 sampling point in Figure 38)**

This sample was taken from a man-made pan or small dam at sampling point MA SW 1. The pan is used by local wildlife for drinking water. The chemistry results indicated elevated metals at this site, namely:

- Aluminium (exceeded both the drinking water standards and the Aquatic Ecosystem standards);
- Manganese (exceeded the DWA Domestic Use and Aquatic Ecosystem standards); and
- Iron (exceeded both the drinking water standards and the Aquatic Ecosystem standards).

None of the concentrations of these parameters exceeded the Livestock Watering standard. According to the DWA standards for Domestic Use, there can be certain health effects associated with these elevated parameters, as seen in Table 37 below.

**Table 37: Health effects associated with parameters of concern (MA SW 1&2)**

| Parameter of concern | Health effect at concentration noted (DWA, 1996a) |
|---|---|
| **Aluminium (4.5 mg/ℓ)** | No acute health effects are expected except at very high concentrations although there may be long-term neurotoxic effects. This relationship has not been conclusively demonstrated. Severe aesthetic effects (discolouration) occur in the presence of iron or manganese. |
| **Manganese (0.35 mg/ℓ)** | Increasingly severe staining and taste problems. No health effects. |
| **Iron (2.8 mg/ℓ)** | Pronounced aesthetic effects (taste). Slight health effects expected in young children, and sensitive individuals. |

- **MA SW 7&8 (MA SW4 sampling point in Figure 38)**

This sample was taken from a dam between Matimba Power Station and the proposed Medupi Power Station at sampling point MA SW 7&8. The dam is possibly used by local wildlife for drinking water. The chemistry results indicated elevated:

- The water quality at the site was poor;
- aluminium exceeded all standards except DWA Livestock Water;
- iron exceeded the DWA Domestic Use standard only;
- Electrical conductivity (EC), calcium (Ca), magnesium (Mg) and manganese (Mn) exceeded the DWA SAWQG target values for domestic use;
- Total dissolved solids (TDS) exceeded the DWA SAWQG target values for livestock;
- Sulphate ($SO_4$) and fluoride (F) exceeded the SANS 241:2011 limit; and
- The elevated constituents noted at the point indicate potential contamination from the Power Station activities and infrastructure (e.g. ADF run-off can result in elevated EC, TDS and $SO_4$).

None of the concentrations of these parameters exceeded the Livestock Watering standard. According to the DWA standards for Domestic Use there can be certain health effects associated with these elevated parameters, as shown in Table 38.

**Table 38: Health effects associated with parameters of concern (MA SW 7&8)**

| Parameter of concern | Health effect at concentration noted (DWA, 1996a) |
|---|---|
| **Fluoride (1.5 mg/ ℓ)** | Slight mottling of dental enamel may occur in sensitive individuals. No other health effects are expected. |
| **Aluminium (0.31 mg/ℓ)** | No effects on health are expected. Noticeable adverse aesthetic effects (colour) occur when aluminium is present in association with iron or manganese. |
| **Iron (0.18 mg/ℓ)** | Very slight effects on taste and marginal other aesthetic effects. No health effects are expected. |

- **MA SW 9&10 (MA SW5 sampling point in Figure 38)**

This sample was taken from sampling point MA SW 9&10; a pan at the ash disposal site at the Matimba Power Station. The pan is used by local wildlife for drinking water. The chemistry results indicated elevated:

- Fluoride (exceeded all standards except DWA Livestock Water); and
- Aluminium (exceeded the DWA Aquatic Ecosystems standards only).

None of the concentrations of these parameters exceeded the Livestock Watering standard. According to the DWA standards for Domestic Use there can be certain health effects associated with these elevated parameters see Table 39.

**Table 39: Health effects associated with parameters of concern (MA SW 9&10)**

| Parameter of concern | Health effect at concentration noted (DWA, 1996a) |
|---|---|
| **Fluoride (1.9 mg/ ℓ)** | Mottling and tooth damage will probably be noticeable in most continuous users of the water. No other health effects occur. |
| **Aluminium (0.31 mg/ℓ)** | No effects on health are expected. Noticeable adverse aesthetic effects (colour) occur when aluminium is present in association with iron or manganese. |

#### *8.4.4.2 PCD Water Samples*

- **MA SW 3&4 (MA SW2 sampling point in Figure 38)**

This sample was taken from PCD 1 at sampling point MA SW 3&4 and as such is expected to be contaminated and not comply with the standards provided.

The chemistry results indicated the following parameters exceeded the DWA Domestic Use limits: conductivity, total dissolved solids, calcium, sodium, sulphate, and fluoride. Furthermore, the fluoride concentration also exceeded the DWA Aquatic Ecosystem limit. However, all of the parameters analysed were compliant with SANS 241-1:2011 drinking water and DWA Livestock Watering standards. As this is a PCD, this water is unlikely to be used for drinking by either animals or humans.

- **MA SW 5&6 (MA SW3 sampling point in Figure 38)**

This sample was taken from PCD 2 at sampling point MA SW576 and as such is expected to be contaminated and not comply with the standards provided.

The chemistry results indicated elevated:

- The water quality was generally poor, with a pH of 3.4 (acidic);

- pH, sulphate ($SO_4$) and manganese (Mn) exceeded the SANS 241:2011 limit, which is indicative of contamination from mining-related activities; and
- Electrical conductivity (EC), total dissolved solids (TDS), calcium (Ca), aluminium (Al) and iron (Fe) all exceeded the DWA SAWQG target values for domestic use.
- Calcium (exceeded the DWA Domestic Use standard);
- Fluoride (exceeded all standards except DWA Livestock Water); and
- Aluminium (exceeded all standards except DWA Livestock Water).

The water quality of this sample is relatively more polluted when compared to the other samples but as this is a PCD, this is not unexpected. Additionally, as this is a PCD, this water is unlikely to be used for drinking by either animals or humans.

#### *8.4.4.3 Geochemical Diagrams*

Samples MA SW 3&4 and MA SW 5&6 plot in the top right-hand side of the Piper diagram and indicate a relativity higher proportion of sulphate compared to the other samples. These waters can be classified as sodium-sulphate water types. This is expected since these samples are from the two PCDs.

The remaining samples from the pans/dams plotted towards the centre and slightly to the left of the Piper diagram. These samples indicated less impacted waters with calcium/magnesium-water types.

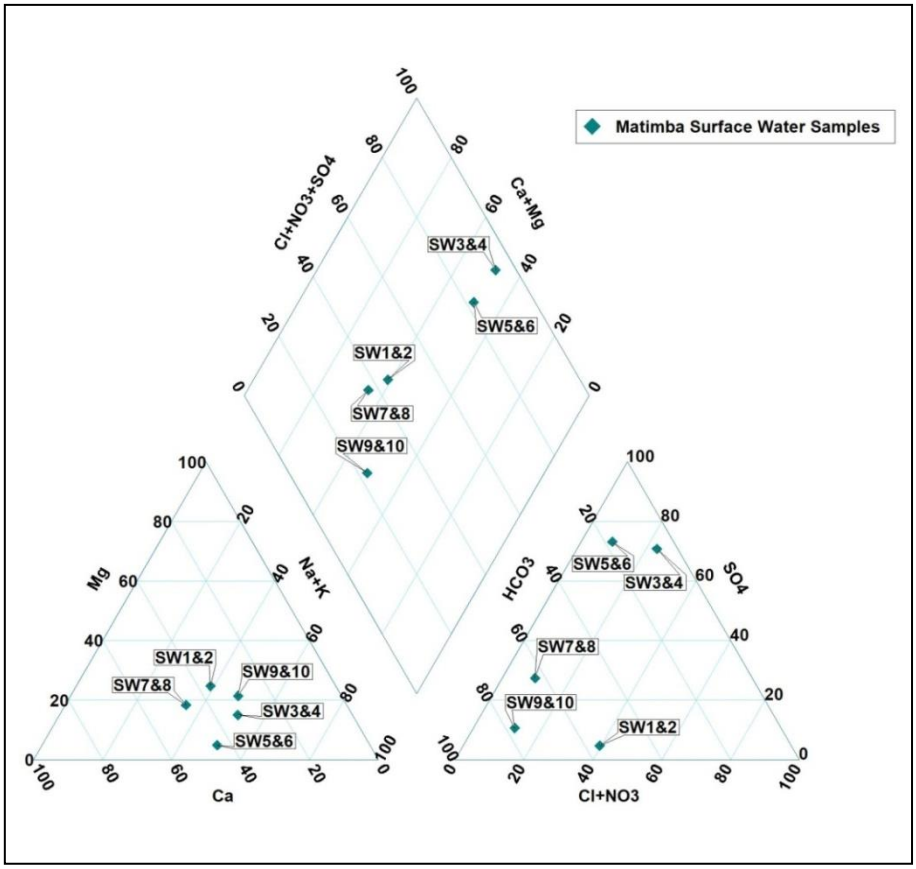



**Figure 39: Piper diagram of surface water samples**

Figure 39 shows that all of the samples plotted within the calcium sulphate water type sector of the diagram and showed impacts due to mining activities, with the exception of MA SW1 which plotted in the sodium chloride water type sector of the diagram and showed signs of being brackish.

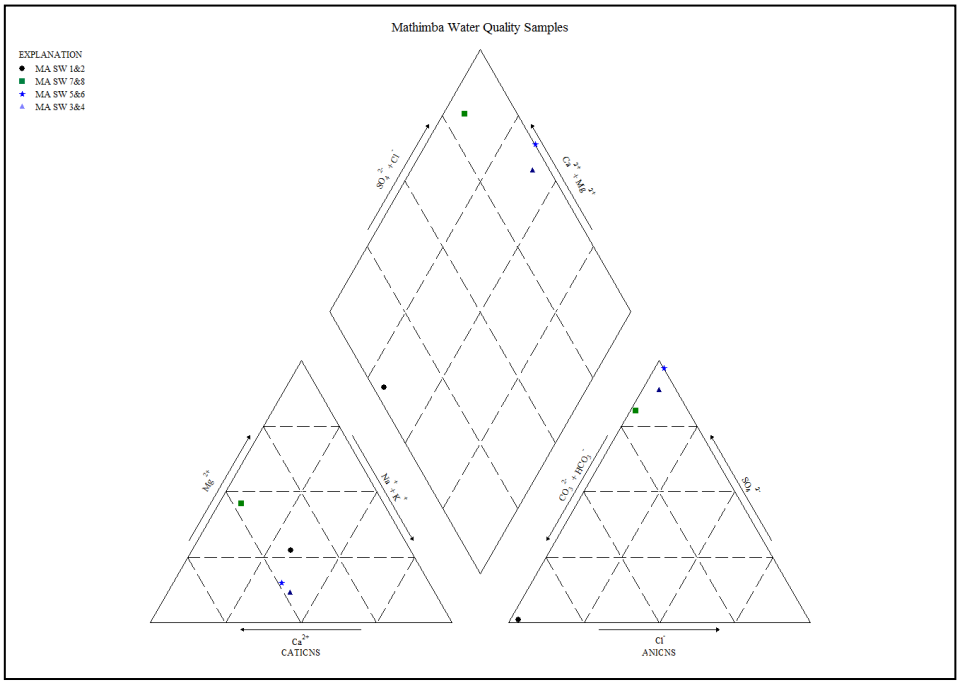



**Figure 40: Piper diagram for surface water samples**

## 8.4.5 Summary of Findings of the Water and Ash Quality Assessments

### *8.4.5.1 Water Quality Findings*

The dam / pan water samples highlighted that fluoride and metal levels were elevated. These dams are utilised by wildlife in the area for drinking water and none of the parameters analysed exceeded the Livestock Watering guidelines. Samples MA SW1&2, however, contained elevated aluminium levels and it is recommended that this is addressed as this may be dangerous for the livestock that drink from the pan over time.

In terms of the PCD samples, PCD 1 was more contaminated than PCD 2. However, these dams are not expected to be compliant with drinking water or Livestock Watering standards and thus, should be contained and access controlled. It is recommended that the PCDs be in line with all Water Use Licence (WUL) requirements in terms of size, free-board levels, water quality and monitoring requirements, including but not limited to groundwater and toxicity testing. PCDs should meet the minimum conditions of the Best Practice Guidelines A4: Pollution Control Dams[11] and Government Notice 704 of the National Water Act (No 36 of 1998). The results from a once-off sampling event cannot be used to make a conclusive statement about the water quality. However, from this analysis, the water sampled from the dams/pans is fit for Livestock Watering and the PCD water should be contained.

[11] Department of Water Affairs (DWA). (2007). *Best Practice Guidelines A4: Pollution Control Dams*. Pretoria: DWA.

#### 8.4.5.2 *Ash Quality Findings*

The nutrient status results indicate that both samples primarily comprised of calcium, magnesium and potassium in terms of mg/l.

The aqueous extraction results show that the samples indicated high concentrations of sulphate, calcium and magnesium in the leachate. Calcium and magnesium are not of concern; however the elevated sulphate will have a negative impact on the receiving environment. The aqueous extraction analysis for both samples indicated that run-off from these samples would not be suitable for the environment, domestic use or livestock watering.

The results from a once-off sampling event cannot be used to make a conclusive statement about the ADF. However, from this analysis, the run-off from the ash dump poses a potential pollution threat and should therefore be contained in a dirty water system as part of an overall Stormwater Management Plan (SWMP).

#### 8.4.5.3 *Conceptual Stormwater Management Plan*

Any SWMP in South Africa must comply with GN 704 of the National Water Act (No 36 of 1998), Regulation 77 and other relevant legislation.

The conceptual SWMP has been produced for SA1, SA2 and the proposed linear infrastructure route. This proposed development differs slightly from normal processes, in that full plans for two potential sites and a proposed linear infrastructure route were developed.

- **Site Alternative 1 SWMP**
  - **Separation of Clean and Dirty Water Systems**

    The site constitutes an extension of the existing ADF. Water tends to drain naturally away from the site. Overland flood flows in the extreme south-west corner of the proposed site, must be diverted away from the ADF area. Upstream slopes are so flat that a 1 m high earth berm along the western boundary of the proposed disposal facility area would effectively divert flood water. It is unlikely that this simplified diversion would result in any local erosion of soils.

    The entire ADF site should be regarded as a dirty water area. Run-off from the site could, however, be easily captured in a down-slope drain system and removed to a PCD. A single, large PCD is available to the south of the existing ADF. The layout of recommended stormwater management measures is detailed in Figure 41.

  - **Containment of Dirty Water**

    Run-off and drainage from spoil heaps will be considered dirty water and, as such, this water must be captured on site and contained in a PCD. Assuming that the entire site was covered by a layer of fly ash between 20 and 30 m deep, it is likely that 50% of the expected 430 mm per annum rainfall would penetrate the spoil heaps and report to toe drains (approximately 1.5 million cubic meters per annum). Some seepage water is, however, likely to enter the groundwater. In practice, ash spoil heaps are covered with top-soil and rehabilitated on an on-going basis. As spoil heaps extend to new areas, older areas need to be covered and rehabilitated.

    Assuming an average surface area of 8 ha this equates to a required PCD storage capacity, for a dam that spills on average only once in 50 years, of 203 600 $m^3$. It is suggested that the main toe drain indicated on the PCD storage capacity above should be capable of conveying a peak flow rate of 0.88 $m^3/s$.

- **Site Alternative 2 SWMP**

  - **Separation of Clean and Dirty Water Systems**

  This site alternative lies more on a hill-slope with run-off from above the site that would need to be diverted away. A long clean-water drain can be constructed that captures this run-off and conveys clean water run-off to a south-eastern discharge point. A down-slope toe-drain would be required to collect dirty water run-off and convey this to a PCD.

  The entire ADF site should be regarded as a dirty water area. Run-off from the site could, however, be easily captured in a down-slope drain system and removed to a PCD. A single, large PCD is recommended to the north of the ADF site and below all likely spoil heaps. The layout of recommended stormwater management measures is detailed in Figure 42 below.

  - **Containment of Dirty Water**

  The ADF area should be considered as a dirty water area, and is treated in much the same way as the SA1, described above.

  For the purpose of this study, a 100 m buffer zone was drawn to indicate areas that seem to be safe from flooding. This exercise excludes large sections of the proposed site towards the northern and western boundaries of the site. This reduced would lead to a reduced PCD of approximately 180 000 $m^3$ capacity. Toe drains would be long and would be designed to accommodate peak flow rates in the order of 0.75 $m^3/s$.

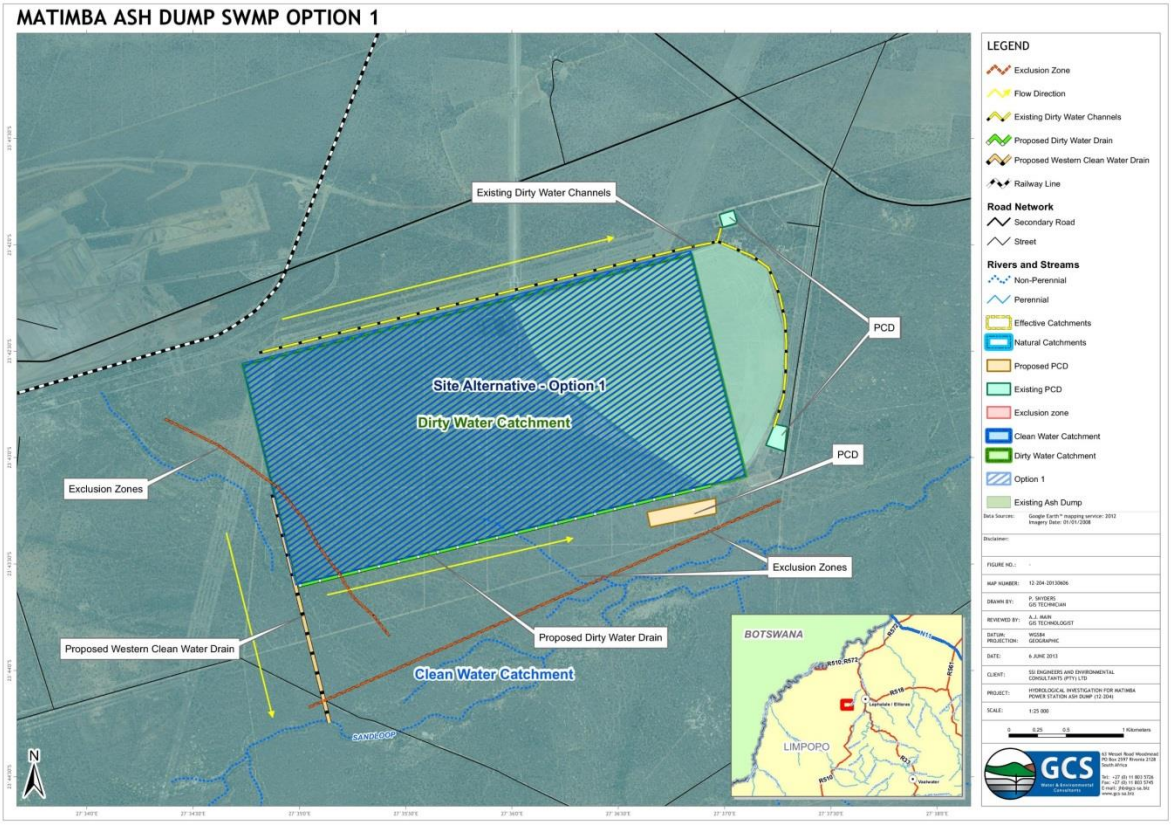



**Figure 41: Site Alternative 1 conceptual stormwater management measures**

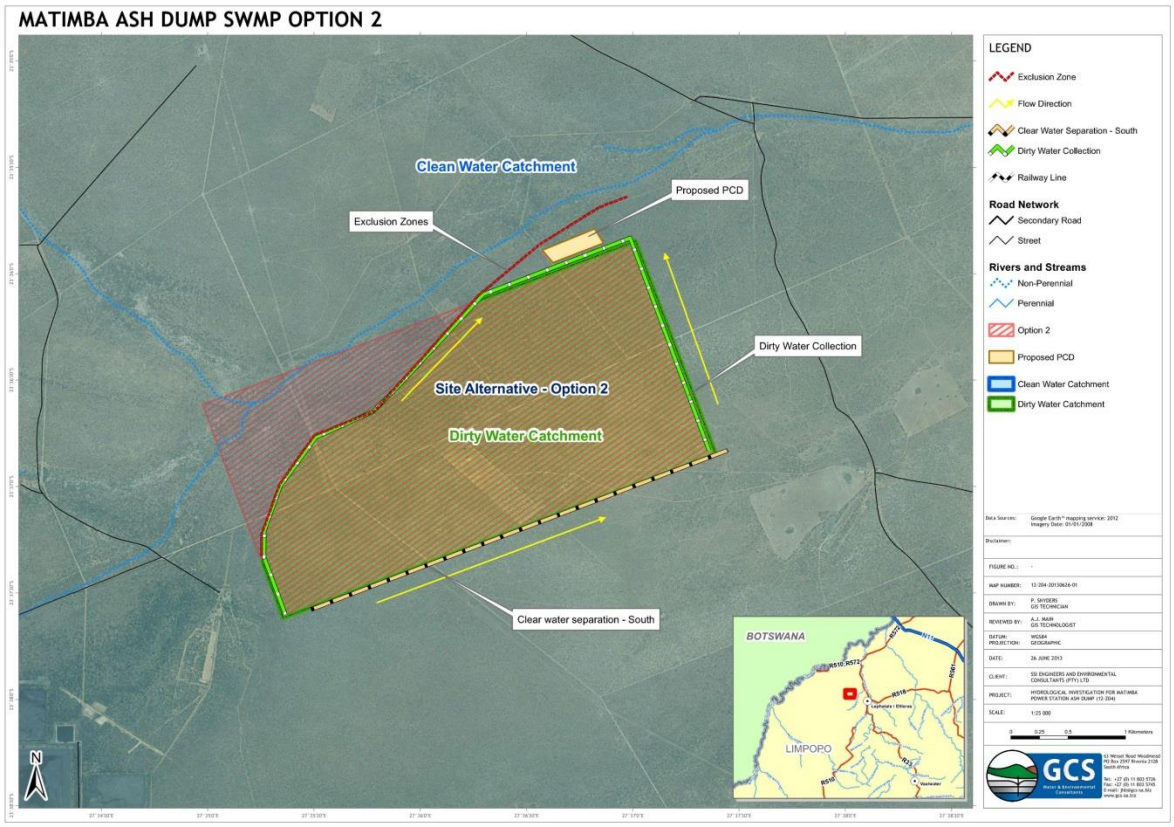



**Figure 42: Site Alternative 2 conceptual stormwater management measures**

- **Linear Infrastructure Route**

The entire linear infrastructure route area was defined as a dirty catchment. The Applicant has stated that there will be a road situated next to the belt with the length, width and area the same as the linear infrastructure route. The road was considered to be a clean area as it would be used to maintain the linear infrastructure route.

- **Proposed Stormwater Management Measures**

  The stormwater management measures suggested for the linear infrastructure route are a berm and a drain located next to the linear infrastructure route as shown in Figure 43.

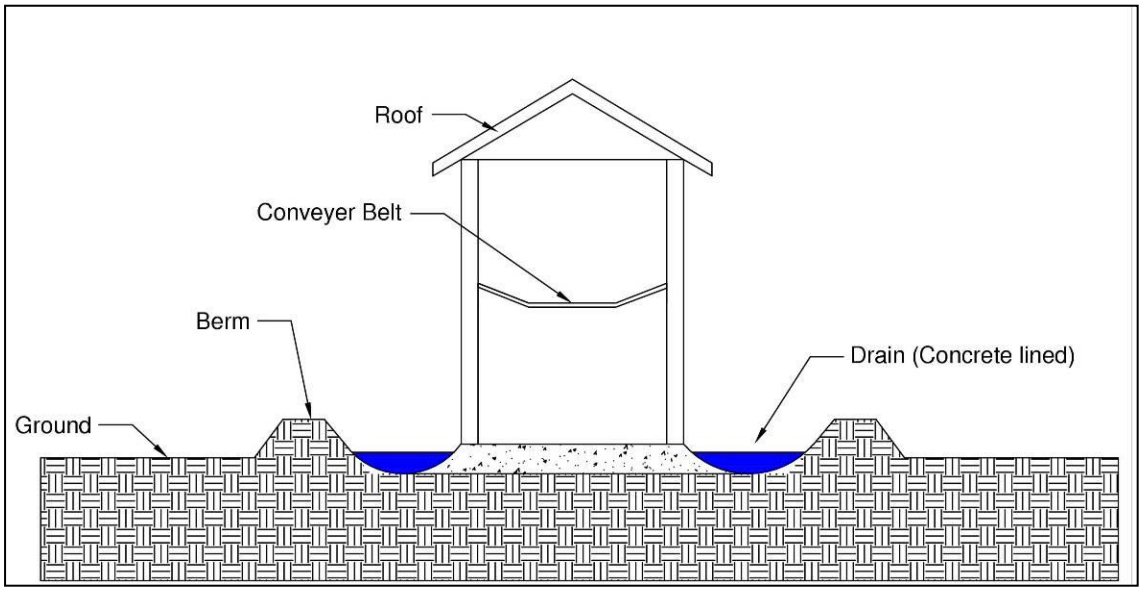



**Figure 43: Stormwater measurements for the linear infrastructure route**

Rainfall that falls on the roof will mix with the dust generated by the linear infrastructure route and this water will be contained by the berms and transported to the sumps placed along the route. Sumps A, B and C were placed at the lowest elevation point of the route. The areas contributing run-off to these sumps can be seen in Table 40. Water that accumulates in these sumps must be pumped to the nearest PCD. A culvert is suggested under Sump B to navigate clean water from the above catchment under the belt and back into the environment. This will ensure that clean water does not mix with the dirty water.

**Table 40: Area contributing run-off to the sumps**

| Sump | Area ($km^2$) |
|---|---|
| **A** | 0.012 |
| **B** | 0.030 |
| **C** | 0.0044 |

The elevation profile of the linear infrastructure route can be seen in the left hand side top corner of Figure 44.

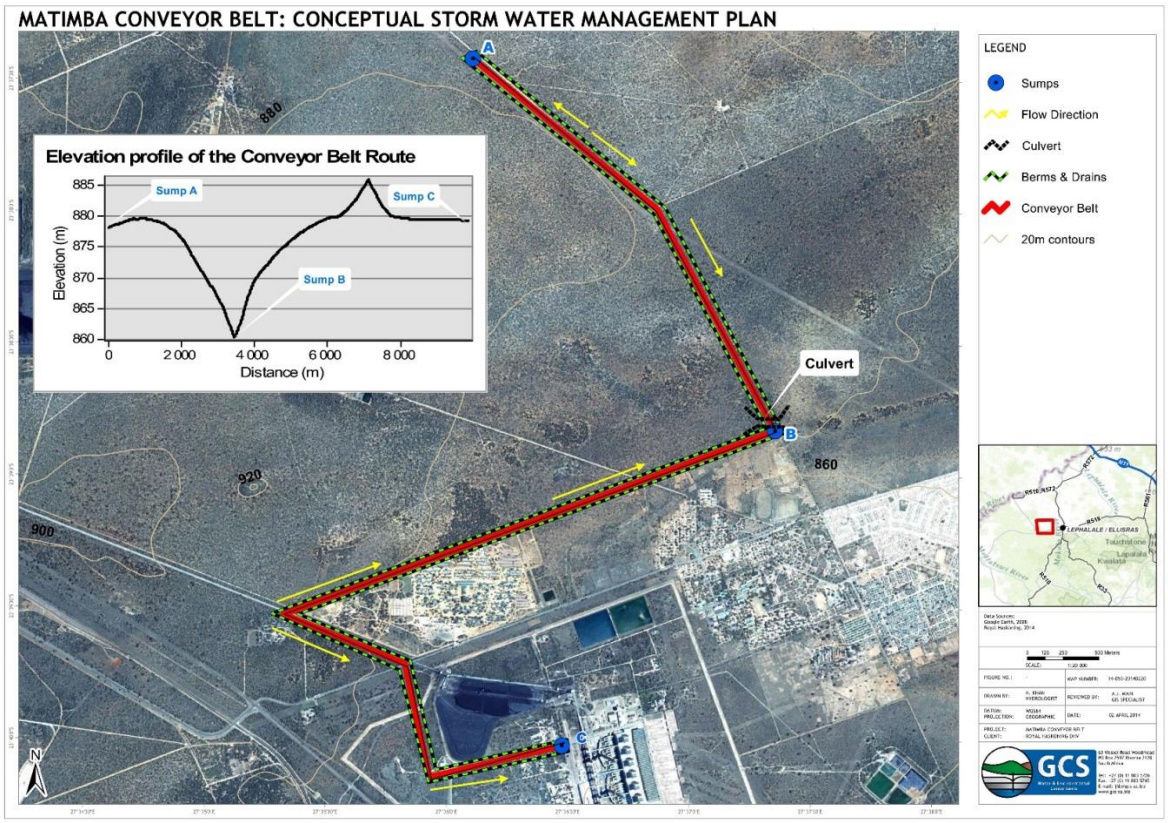



**Figure 44: Conceptual stormwater management plan for the linear infrastructure route**

# 8.5 Surface Water (Wetlands)

## 8.5.1 Characteristics of Watercourses and their Riparian Zones

### *8.5.1.1 Site Alternative 1*

Two ephemeral drainage features were identified in the south-western part of SA1. The Sandloop River runs to the south of the current ADF, and two small tributaries are indicated as draining south from SA1 (the Zwartwater property) towards the Sandloop River on the 1:50 000 scale topographical maps. However, one of these drainage lines is shown to 'disappear' before reaching the river.

The more easterly drainage line, as indicated on the 1:50 000 topographical maps, does not appear as a distinctive drainage feature on colour aerial photo imagery. This was confirmed in the field where analysis at two points in the field did not reveal any distinct morphological or vegetative features indicating the presence of a drainage line. No channel or evidence of any flow or depressions was noted, only a very slightly perceptible low point within the terrain. Importantly the vegetation did not display any difference in structure and composition to the surrounding woodland. As a confirmatory measure the soils were sampled in this low point; soils revealed a brown Orthic A horizon underlain by a yellow-brown apedal B horizon (typical of the wider Clovelly soil form), with no signs of any hydromorphism in the form of gleying that would suggest lateral movement of water within the upper part of the soil profile. It was thus concluded that there was no drainage feature at this point, rather a localised low point in the flat terrain.

The WULA will however still include a Section 21 c and i application for this ‘drainage line’.

**Figure 45: Alluvial material with a very indistinct area of flow**

The drainage line as indicated in the south-western corner of the site displayed more distinct hydromorphological characteristics that identified it as a watercourse, albeit without an incised channel or other very distinctive morphological features. The primary hydromorphological feature noted was a very shallow channel (more akin to a very shallow depression) or open area of sandy, alluvially transported sediment as is commonly encountered within ephemeral drainage systems (Figure 45). In one location along the reach a small depression or wallow was encountered. This area consisted of highly gleyed clayey soils that displayed hydromorphic characteristics in terms of the reduced matrix and the presence of small iron mottles. It is thus clear that this small localised area of clayey soils is seasonally inundated (it was dry at the time of the assessment), with sufficient periods of inundation to enable the development of hydromorphic soils, albeit in a very localised area.

The ‘channel bed’ was typically 3 – 5 m in width and was flanked by thick vegetation, comprising mainly of shrubs and some trees, forming a thicket-like cover. At a certain point just outside of the development site the drainage line had been dammed. The channel immediately downstream of the dam was most pronounced with the presence of cobbles in the channel bed and evidence of flow-deposited wrack on the margins of the channel (Figure 46).

**Figure 46: Channel with alluvial material and flow wrack downstream of the dam**

This drainage line drains an area to the north-west with the large Medupi Power Station construction site located within the head of its catchment (Figure 47 and Figure 48). In this context it is not certain whether stormwater run-off from the developed site would be discharged into this drainage line (if this were to occur the discharge of stormwater and its subsequent drainage down this system would be likely to have an important hydromorphological impact on this drainage system which would be likely to have a concomitant impact on the riparian habitat). Upstream of the site this drainage line is intersected by a number of parallel-running power line servitudes within which all of the woody riparian vegetation has been cleared, thus constituting an impact on it.

In a natural context (without taking the presence of the Medupi Power Station into account), this drainage system has a relatively small catchment with a resultant relatively minor degree of surface water run-off, as demonstrated by the highly indistinct channel profile and riparian vegetation. Analysis of aerial photography after the site visit revealed numerous 'channels' within the area that would be encompassed by this drainage feature (refer to Figure 48). It thus appears as if drainage in the very flat context of this part of the study area is spatially spread over a wider area, thus possibly accounting for the un-incised nature of the drainage features and absence of a single channel that would carry overland flow.

In the context of the VEGRAI[12] template, the atypical morphological cross-sectional profile of this riparian zone makes it difficult to assign zones. The narrow 'channels' could arguably comprise the marginal zone of the riparian corridor, even though they would be inundated for short periods of time. Under this scenario, unlike the classical cross-section of a riparian corridor, a series of alternating

[12] Riparian assessment zone classification done as per the VEGRAI (Riparian Vegetation Response Assessment Index) methodology where riparian zones are divided up into 3 vegetation zones i.e. marginal, lower and upper zones. This vegetation zone classification is based upon: periodicity of hydrological influence; marked changes in lateral elevation or moisture gradients; changes in geomorphic structure and changed in plant species distribution or community composition along lateral gradients. In spite of these zones being vegetative, they are also distinguished based on a combination of other factors including geomorphic structure and elevation along with vegetation.

marginal zones with intervening lower zones would be present. However if differing degrees of hydrological activation across this riparian corridor are examined, a case could be made that the marginal zone is absent, and that the 'channels' comprise lower zones and intervening areas of the riparian corridor the upper zone. This altered template appears to best describe the hydro-vegetative profile of this riparian corridor.

Riparian vegetation was noted to consist mostly of low shrubs forming a dense thicket. Due to the presence of the dense coverage of woody vegetation, grass was limited within the understorey. The most common shrub species encountered along the drainage line included *Dichrostachys cinerea*, *Pterocarpus rotundifolius, Acacia nigrescens, Ziziphus mucronata,* and *Grewia flava.* In a few areas, taller *Spirostachys africana* trees formed small groves. Riparian vegetation flanking the small dam took the form of larger trees, but this greater structural growth reflects the impoundment of water within the dam, rather than a natural state. Under the VEGRAI classification of riparian reference state, this reference state for the riparian corridor of this drainage line falls within the category of shrub-dominated state. No alien invasive vegetation was noted within the riparian zone of this drainage line, thus reflecting a 100% abundance of indigenous vegetation within this reach. In spite of the presence of these linear unvegetated areas, coverage by the shrubby vegetation within the riparian corridor was noted to be almost complete.

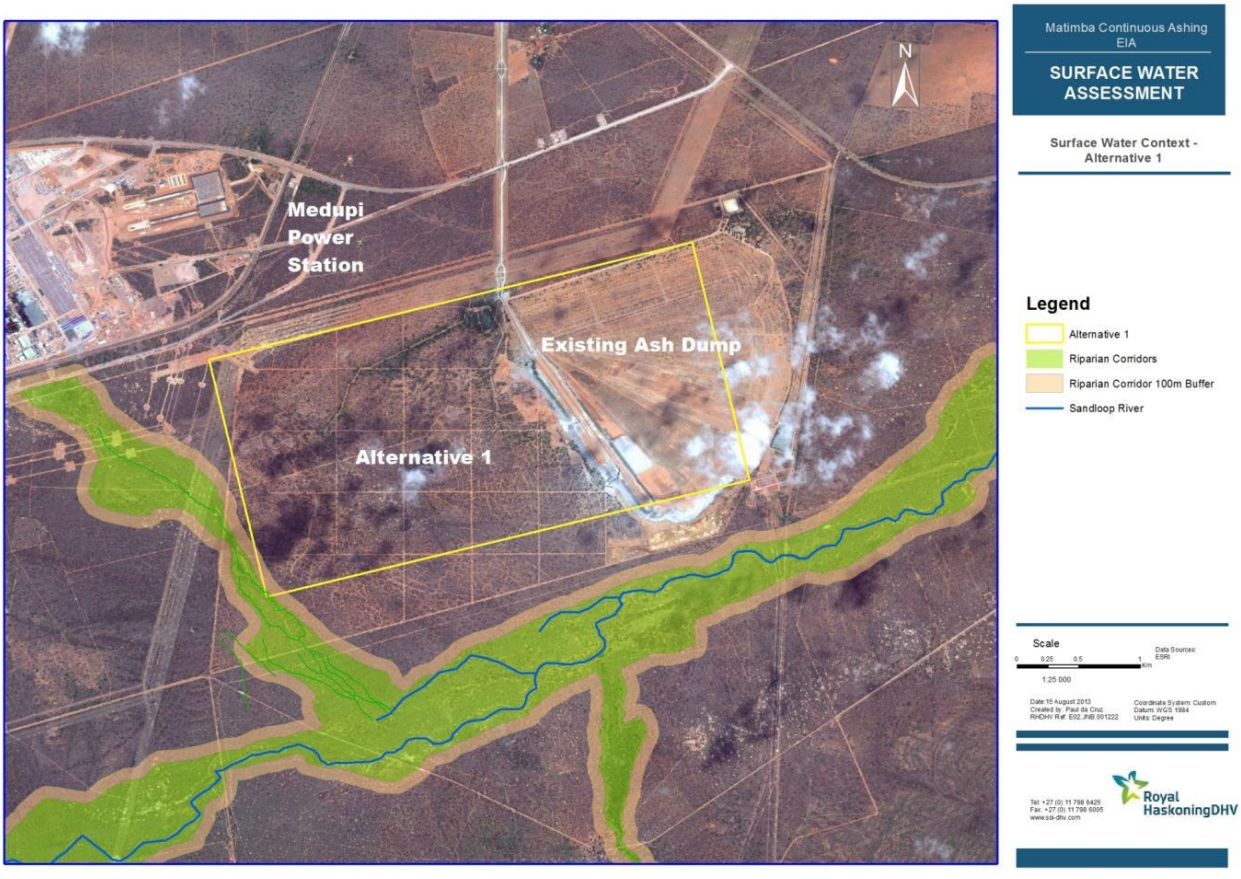



**Figure 47: Layout of Site Alternative 1 and riparian corridors and associated buffers**


**Figure 48: Riparian corridors and associated buffers on Site Alternative 1**

### *8.5.1.2 Site Alternative 2*

Surface water drainage on SA2 takes the form of two ephemeral drainage lines that converge to form a single eastward-flowing drainage line the north-western corner of the site; one that drains from the Vooruit property to the west, and another that drains from the north in the vicinity of the Manketti Nature Reserve Office on the Gelykebult property. These 2 ephemeral drainage lines converge in the north-western part of the site, flowing north-eastwards off the site and parallel to it in a north-easterly direction towards the Sandloop River.

The part of the site on which the drainage lines are located is characterised by very gentle slopes. The ground slopes up very gently to the north, with the drainage lines being located in very wide and extremely shallow valley bottoms. Like the drainage lines on SA1, there are no distinctly incised channels, and surface water drainage occurs over a wider area. The drainage line emanating from the north displays evidence of a very shallow ‘channel’ for a short stretch where the slope steepens slightly, but this is not more than a very shallow depression within the context of the wider open area. Other than this area there is no evidence of channelled flow on the site. The presence of riparian vegetation of a different structure to that of the surrounding bushveld, however, indicates the presence of greater moisture availability, and it is thus likely that a large part of the hydrological regime within these two ephemeral drainage lines is comprised of groundwater flow at very shallow depths along the drainage lines. Overland flow does occur within these two systems, albeit diffuse flow across a wider area. Evidence of the presence of episodic flow within the system is provided by pan-like depressions located within both of the drainage lines that are not only likely to be fed by

rainwater but by overland flow within the wider area. At the time of the field assessment (early autumn), these were noted to be water-filled and are likely to be filled by overland flow emanating from the upstream portion of the drainage line.

In terms of the hydromorphology and riparian zone classification of these two drainage systems, it is difficult to assign a marginal zone within them, other than within the two pan-like depressions encountered, in which typical marginal vegetation was noted to occur. Thus apart from the localised area of the two depressions, the riparian area is likely to be comprised mostly of what can be termed the upper zone due to an ephemeral degree of hydrological activation, with a narrow lower zone occurring along more distinct flow lines and within parts of the western drainage line in which taller vegetation and a more luxuriant grassy understorey is present.

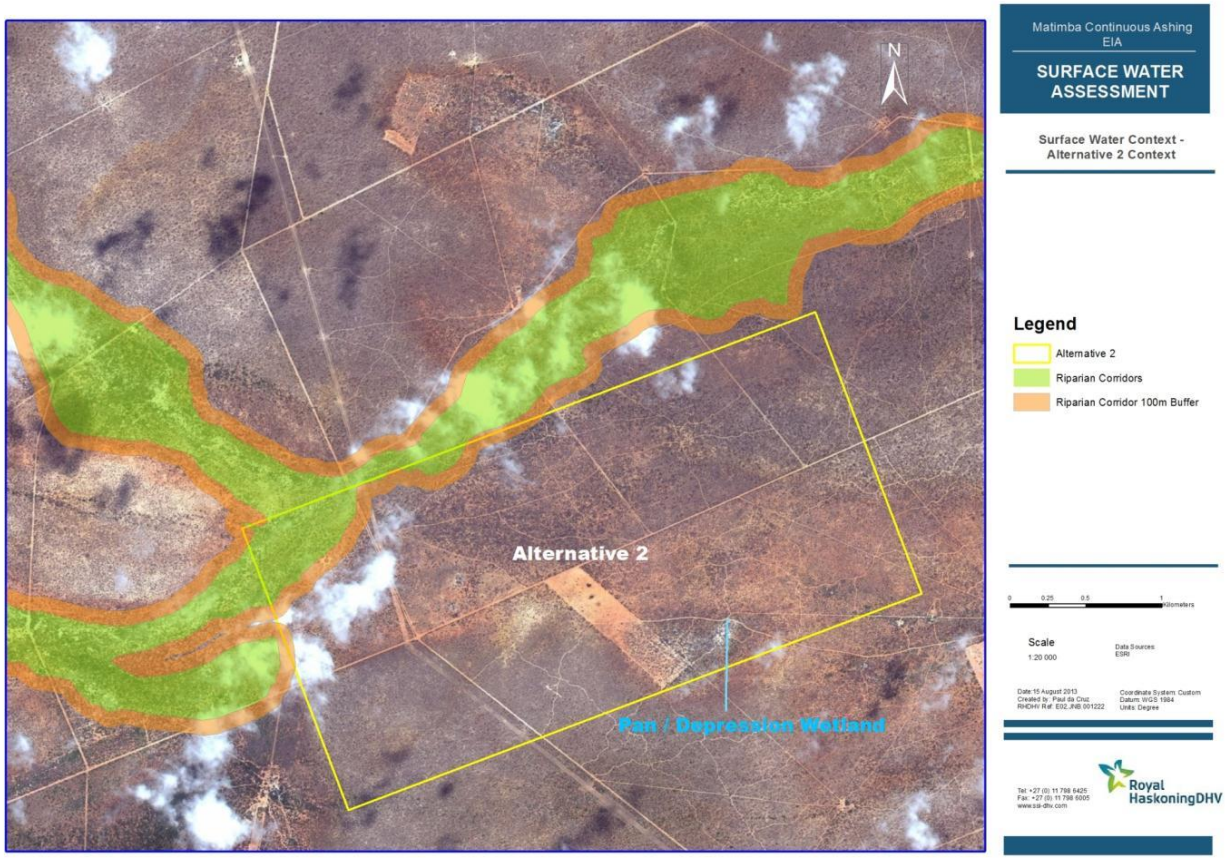



**Figure 49: Layout of Site Alternative 2 and riparian corridors and associated buffers**

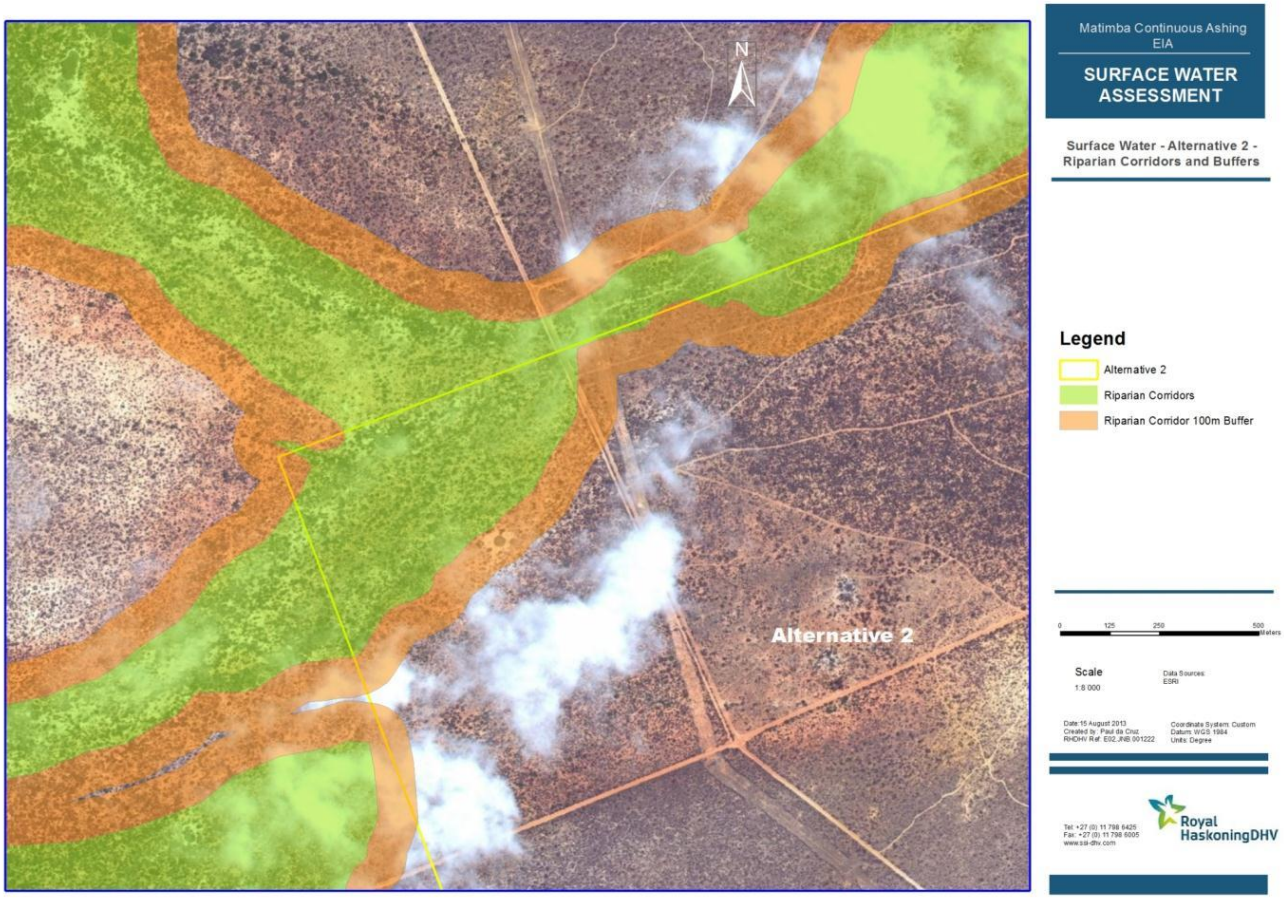



**Figure 50: Riparian corridors and associated buffers on Site Alternative 2**

The riparian areas differed in vegetation composition across the site. At the point on the site where the two drainage lines converge, riparian vegetation was noted to comprise mainly of shrubs including *Euclea divinorum, Acacia melifera, Dichrostachys cinerea, Combretum hereroense, Grewia monticola,* and a few *Combretum imberbe* tree specimens. The riparian corridor within this area was characterised by a partial woody cover with a grassy substrate. In places, the shrubs were noted to be taller, reflecting increased moisture availability. In areas of white bleached soils (showing affinities with sodic areas), the tree / shrub species *Boscia foetida ss. Rehmaniana, Acacia nilotica* and some *Acacia robusta* were noted, with the dominant species being *Acacia mellifera.* Coverage of vegetation varied across these sodic areas with a relatively dense coverage of *Acacia mellifera* close to the pan-like depression within the northern drainage line, contrasting with a very sparse vegetation cover in the area to the north of the pan. *Acacia karroo* was noted in the transitional area between the riparian corridor (including the sodic areas) and non-riparian areas.

Vegetatively, the main difference between the two drainage lines was that tall trees were only encountered along a stretch of the western drainage line. In this part of the site, the riparian corridor was very distinct and differed markedly from the surrounding non-riparian woodland. Along the western drainage line close to the western boundary of the site, a linear arrangement of tall indigenous trees species was noted (Figure 51). These species included large specimens of *Combretum imberbe* as well as *Ziziphus mucronata, Combretum hereroense, Acacia erubescens* and *Peltophorum africanum*. The understorey of this area comprised of shrubs and a luxuriant grass cover

(comprising mainly of the species *Panicum maximum*) indicating a high degree of moisture availability. A small water-filled depression was located within this stretch. The width of this riparian corridor is approximately 30 – 40 m in width. Coverage by woody vegetation was not complete, being about 50% as viewed aerially. Interestingly the taller trees did not extend along the entire reach of the western drainage line assessed on the site, and this distinct riparian corridor 'dissipated' downstream (closer to the confluence within the northern drainage line).

**Figure 51: Tall trees and shrubs within the riparian corridor along the western drainage line**

Analysis of the riparian aerial photography (Figure 52) reveals a widened riparian zone (as characterised by the presence of larger trees) in the areas where the two drainage lines meet, reflecting a wider area of increased moisture availability.

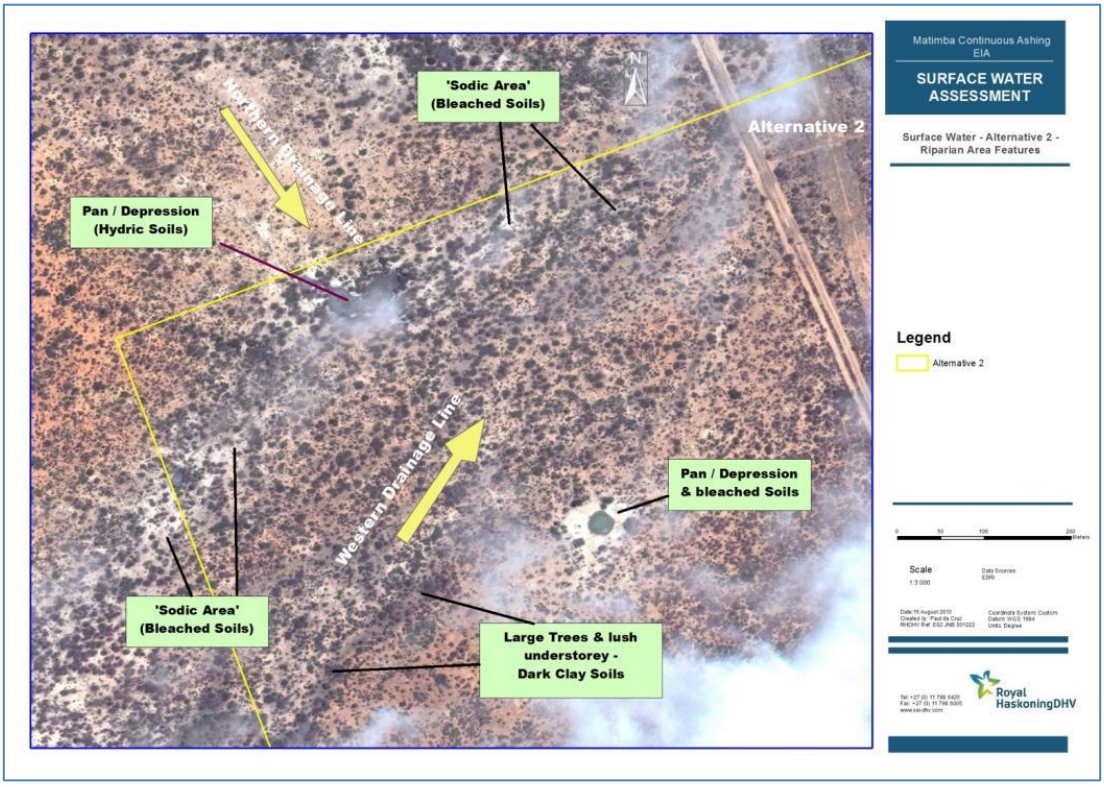



**Figure 52: Colour aerial image of Site Alternative 2 showing the location of riparian features**

The northern drainage line did not display any such linear growths of distinctively larger trees, rather a more shrub-dominated woody component dominated by *Acacia mellifera*. Nonetheless *Combretum imberbe* and *Ziziphus mucronata* trees, as well as *Carissa bispinosa, Euclea crispa and Gymnosporia senegalensis* shrubs were found to occur around the larger pan-like depression. This drainage line displayed larger areas of sodic soils which were noted to display a very sparse coverage of both woody vegetation and the lower substrate as described above. Analysis of colour aerial photographs indicates the presence of two linear zones of larger and denser shrubs across a wider riparian zone across the northern drainage line (refer to Figure 52). The intervening area was very sparsely vegetated with large patches of bleached soils (believed to be sodic in character as discussed below). In the overall context of the site, the vegetative reference state for these ephemeral drainage lines is shrub-dominated, with trees only occurring in certain parts and shrubs being the dominant growth form. Coverage varies as described above from a dense coverage along part of the western drainage line to a much sparser coverage. For SA1, no invasive alien vegetation was noted, thus reflecting a 100% abundance of indigenous vegetation.

There is a distinct change in vegetation away from the riparian corridor in terms of a number of factors:

a) **Vegetation composition** - in the area immediately outside of the riparian corridor only *Acacia melifera* and *Grewias* are encountered, while the sandy upland slopes were characterised by two dominant species – *Combretum apiculatum* and *Terminalia sericea.*

b) **Cover** - a much lower density of vegetation with *Acacia melifera* more sparsely distributed, with a very sparse grassy substrate, comprising mostly of *Aristida spp.* grass.

c) **Structure** - woody vegetation comprising of shrubs rather than trees (reflecting the decreased availability of moisture).

As described above, 'typical' marginal vegetation only occurred in very limited parts of the riparian zone on the margins of within the two pan-like depressions. This was comprised predominantly of the grass *Eragrostis inamoena* as well as the obligate wetland grass species; *Arundinella nepalensis* in flooded areas (Figure 53). This species is listed as a facultative wetland species in the context of the eastern seaboard on South Africa, but in this much more arid context is highly likely to be an obligate hydrophyte. The presence of this hydrophyte in these locations corresponds with the confirmed presence of hydric soils.

**Figure 53: Pan-like depression on the northern drainage line with *Arundinella nepalensis* marginal vegetation**

It was noted that the riparian corridor does not contain excessive erosion, in spite of the presence of sodic areas (the presence of these may be a reflection of the former cattle ranching on this property through which artificial water points were placed within these riparian zones, thus arguably resulting in accelerated erosion). The riparian area is thus assessed to be in a natural state, a state which represents the reference state for this area and this type of riparian zone associated with an ephemeral drainage line. The potential impact of the proposed development in terms of potential transformation of the site would thus be significant in this context.

#### *8.5.1.3 Watercourse North of Marapong (in close proximity to the Linear Infrastructure Route)*

A tributary of the Sandloop rises to the north of the Marapong Township (Figure 55) relatively close to the proposed alignment of the linear infrastructure route to SA2, and thus this watercourse was investigated to determine whether it extended to the alignment of the proposed linear infrastructure route. The watercourse was noted to rise to the east of the proposed linear infrastructure route, and the surface water feature becomes visible at a low point in the otherwise flat or very gently sloping terrain. A small depression characterised by the presence of shallow standing water was located at the head of the watercourse (Figure 54). This depressional area was investigated for the presence of hydric soils, which were found to exist in the form of gleyed clays with the presence of extensive iron mottling. The vegetation in the depression consisted predominantly of the grass species *Echinochloa holubii* (a grass species typical of watercourses and naturally moist areas in the more arid parts of southern Africa) and a *Sesbania* species shrub within the depression. Downstream of this depression, the watercourse extended eastwards in the form of a poorly defined channel characterised by some

bare patches of soil and stands of *Bothriochloa insculpta* grass (a species that can also occur in wet areas), and consisting of a series of similar downstream depressional areas. Upslope (west) of the uppermost depression, no visible surface water characteristics were present; although the area was characterised by grassy as opposed to shrub-dominated vegetation, there was no evidence of hydric soils (soils sampled were sandy, well drained in character) or any physical drainage features.

**Figure 54: Head of the watercourse north of Marapong**

This watercourse did not display a wooded riparian corridor as displayed by the other watercourses on and around the nearby sites, rather being characterised by grassy vegetation with a different species composition in the watercourse to the immediately adjacent areas that were characterised by the presence of grasses and low shrubs. Analysis of the site and of satellite imagery for the site reveals that a strip of trees runs parallel to the northern side of the watercourse in this area, but at a distance (approx. 50 m) away from it. The site assessment revealed that gently sloping area moving north of and away from the watercourse graded from grass-dominated vegetation in the uppermost depression and ensuing channel to an area of low shrubs (mainly *Dichrostachys cinerea*) and to a belt of taller trees with the tree species being mainly *Acacia erioloba*. This belt of trees was too far removed from the watercourse to be riparian in nature, and appeared to be related more to the presence of sandy soils as opposed to the clayey soils in the watercourse.

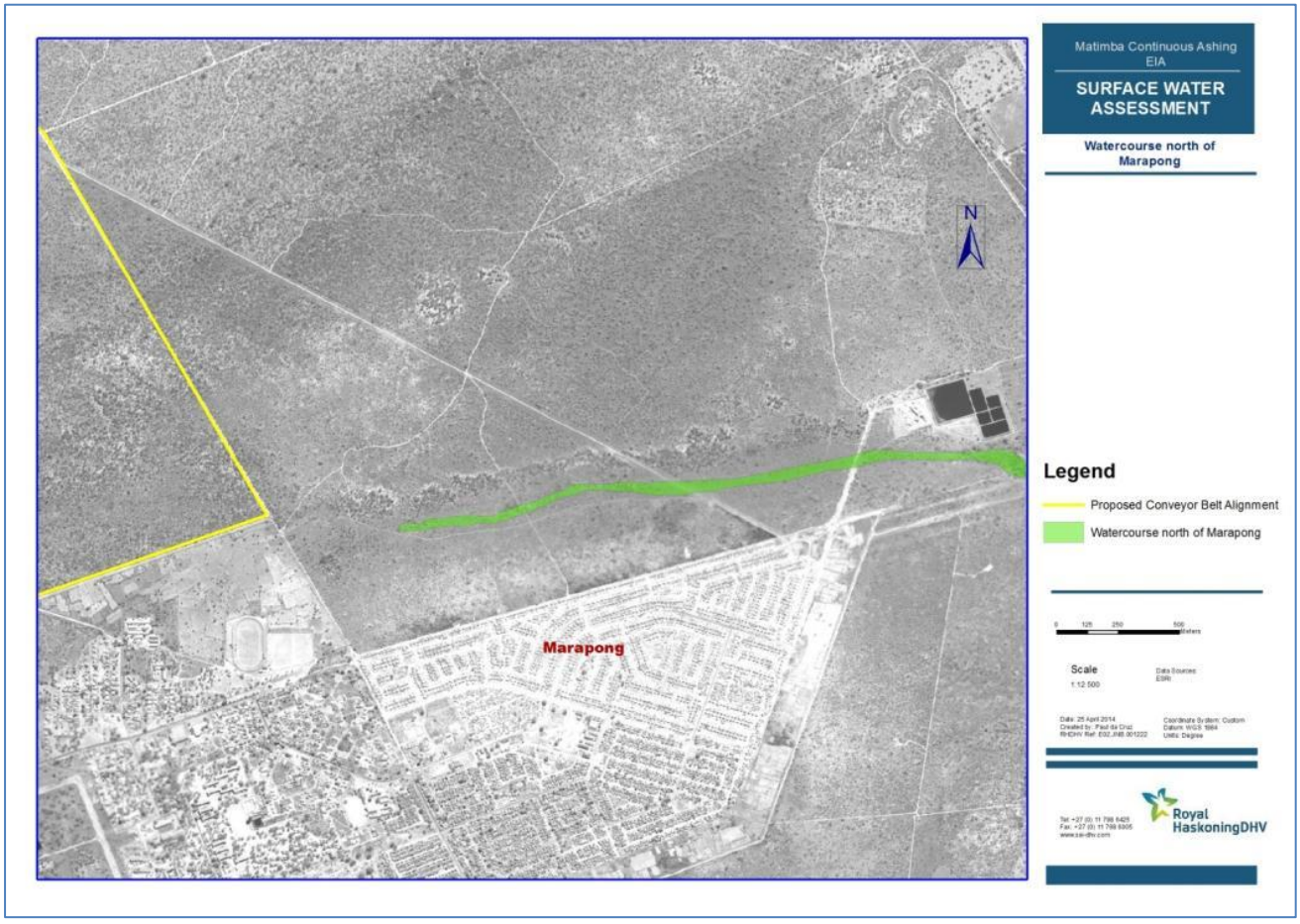



**Figure 55: Watercourse north of Marapong, in relation to the proposed linear infrastructure route**

Soils were noted to change within the riparian corridor, as opposed to the surrounding non-riparian woodland areas in terms of colour (hue) and physical characteristics. Soils within the surrounding woodland were noted to be highly sandy with a light orange hue. Conversely soils within the riparian corridor were noted to be more clayey in character and a dark grey to brown colouration, with alternating areas of more bleached white soils in places.

This pattern is present on the site, with a clear zone of bleached white soils occurring between the riparian zone of the western drainage line (Figure 56) and the edge of the footslopes to the north.

**Figure 56: Sodic area on the periphery of the riparian corridor of the western drainage line**

### 8.5.2 Implications of Surface Water Features and Riparian Zone occurrence for the Proposed Development

As described above, surface water features occur on both sites, with ephemeral drainage lines and their associated riparian zones being the primary surface water-related feature. It should be noted that a small pan-like depression wetland very similar to the largest water-filled depression on SA2 was encountered in the south-eastern part of the SA2. This pan was not connected to any linear drainage feature and is believed to be fully endorheic. It was very small in spatial extent and like the larger depression on the northern drainage line displayed *Arundinella nepalensis* as the primary marginal vegetation species.

**Figure 57: Small pan-depression on the south-eastern part of Site Alternative 2**

On both sites the surface water features are located on the periphery of the site, thus making it relatively easy to develop the majority of the site while at the same time avoiding physically impacting the surface water features.

The watercourse located to the north of Marapong is located relatively close to the alignment of the proposed linear infrastructure route linking the Matimba Power Station with SA2, but the route would not cross this feature, as the head of the watercourse is located to the east of the proposed route alignment.

### 8.5.3 Potential Impacts

#### *8.5.3.1 Potential Loss of Riparian and Wetland Habitat*

There would be a number of aspects to the impact associated with transformation of certain reaches of the drainage lines on each site. Firstly the development would cause the loss of riparian habitat in the affected reach, thus adversely affecting the resource quality of the affected surface water feature. All vegetation within the affected part of the riparian corridor(s) would be destroyed through removal prior to being covered in ash. This would result in the loss of habitat for fauna inhabiting these riparian zones. Thus the ecosystem services offered by the riparian zone in terms of providing habitat for fauna and by performing an ecological linkage between natural areas would be severely affected.

Importantly, in spite of the ephemeral nature of the hydrological regimes of the drainage lines, the hydrology of the drainage line(s) would be altered and adversely affected as it is likely that alternative flow conduits for surface water flow along the drainage systems would be engineered. Any functionality currently performed by the riparian zones relating to the retardation / pooling of water draining along the system would be lost, and the channelisation of flow into reaches of the drainage system downstream of the affected reach could introduce erosion and scouring which are not part of the natural hydrological regime of these drainage systems.

On an ecological level at the localised scale of the Manketti Nature Reserve (in the context of SA2), important habitat (in terms of food sources and cover) and water sources for much of the fauna (including ecologically and economically important mega fauna) within the reserve would be lost. It is recognised that if such impacts were to occur, they would occur on a localised scale. Nonetheless they would constitute a direct impact on a water resource, which would need to be licenced under the National Water Act.

#### *8.5.3.2 Stormwater-Related Impacts*

The development could be associated with discharge of stormwater of the ADF into the drainage lines on the respective sites. This could be an impact that materialises even if the riparian zones are not physically destroyed by the ADF. Stormwater run-off will be generated of the ADF. Rainfall as well as water used for dust suppression would infiltrate the ADF and manifest as seepage at the edges of the facility, thus forming a discharge that would enter the surrounding environment, along with stormwater run-off, of the surface of the facility. Depending on where this stormwater run-off is discharged and whether it is discharged into adjacent riparian areas is important in determining the potential impact of stormwater from the facility on the riparian corridors.

Increased volumes of surface water discharge into riparian areas could alter their hydrology. If the stormwater discharge is concentrated to one or a few point-specific discharges, this could result in channelisation of flow within the affected riparian area and the possible development of gulley erosion, particularly in the context of the occurrence of highly erosive duplex soils that were noted to occur on SA2 (as indicated by the presence of sodic areas). This could in turn result in loss of riparian habitat, as the current hydrological regime of primarily diffuse overland flow into and within the riparian corridor could be altered to one or more channelled flow. This could have has spin-off effects in changing the vegetative composition of the riparian zone through alteration of sub-surface moisture availability.

Stormwater discharge could also carry potential pollutants into the riparian corridor, as well as silt. These pollutants could equally adversely affect the resource quality of the surface water system. The nature of leachate from the ADF is explored below.

In the context of the above worst case scenario impacts, it should be noted that the existing ADF has a stormwater drainage system that captures stormwater flow from the rehabilitated sections of the ADF into drains at the foot of the facility that feed stormwater into lined pollution control dams.

#### *8.5.3.3 Groundwater-Related Impacts*

As described above, subterranean hydrological inputs are believed to be an important factor in the occurrence of riparian vegetation on the site. Surface water hydrology on the site is not clearly defined in hydromorphological terms and there is no evidence of a classical fluvial regime with water inputs to the riparian zone emanating from an active channel. Surface water flows take the form of diffuse overland flow. It appears likely that riparian vegetation on the site draws on subterranean water (shallow groundwater) to a significant degree. It should be noted however that no surface water discharges (springs or seeps) were noted, thus groundwater inputs do not contribute to surface water flow in the system.

In this context, impacts of the proposed development on groundwater could adversely affect surface water features by potentially affecting the health of the riparian corridor. Experience relating to existing ADFs and groundwater flows in South Africa indicates that shallow water tables will develop as a mound under the disposal site, driving the groundwater flow in the direction of streams or other discharge points[13]; this suggests that shallow groundwater may be forced towards the ephemeral drainage lines on / adjacent to the site. The geohydrological report has concluded that groundwater flow direction on SA1 is generally southwards / south-eastwards (mimicking the topography) towards the valley bottom of the Sandloop River. In the context of SA2, groundwater flow also roughly mimics topography, being eastward flowing in the direction of the Mokolo River valley bottom. In the context of SA1, the drainage line just to the west of the site would thus theoretically not be down-gradient of groundwater flows. In the context of SA2, the drainage lines in the north-western corner of the site would not be down-gradient of the ADF, but the downstream reaches of the drainage line to the north of the site could be. Nonetheless the report lists the non-perennial rivers on and adjacent to both sites as sensitive receptors[14].

According to the geohydrological report water contained in the ash material during deposition can leach constituents from the ADF and transport it to the surrounding environment. The water that migrates through the facility can be discharged at the edge of the ADF and enter the surrounding environment as surface water, or migrate vertically to the bottom of the ADF and enter the underlying soil from where it can recharge and contaminate the aquifers[15]. If not mitigated (through lining of the facility), leachate could enter groundwater receptors, thereby polluting existing groundwater resources. The exact nature of interaction between riparian vegetation within the ephemeral drainage lines on the sites and groundwater is not known, however groundwater with decreased pH (increased acid content) could adversely affect riparian vegetation causing a die-off of this vegetation.

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[13] GCS. (2013). *Hydrogeological Desktop Study: Continuous Ash Disposal Facility for the Matimba Power Station*. Johannesburg: GCS.
[14] *Ibid* Footnote 13.
[15] *Ibid* Footnote 13.

#### 8.5.3.4 Other Related Impacts

***Construction Phase:***

The general construction of the expanded ashing facility and associated infrastructure could be associated with other generic construction-related impacts on the riparian zones on the respective sites that are detailed below. The most important of these potential impacts relate to:

- A lack of / poor stormwater controls being put in place on the construction site. This may result in the creation of run-off containing pollutants such as cement and oils being transported by stormwater run-off into the adjacent riparian corridors.
- The dumping of construction material, including fill or excavated material into, or close to surface water features that may then be washed into these features.
- Spills of hazardous materials, especially oils and other hydrocarbons that may be washed into, or infiltrate nearby surface water features.
- The conducting of certain construction-related activities (such as cement batching) too close to surface water features or without the implementation of certain controls that may lead to the direct or indirect pollution of the surface water feature.
- The lack of provision of ablutions that may lead to the conducting of 'informal ablutions' within or close to a surface water feature that may lead to its pollution by faecal contaminants.
- The interaction of untrained construction workers with wetlands and water resources, which could result in the washing if equipment in rivers, for example.

***Operations Phase:***

- Transformation / clearing of riparian corridors as part of the ashing activities would have a significant impact on the hydrology, morphology and resource quality of the affected drainage lines.
- Stormwater from the ashing area could enter riparian areas and transport pollutants into the surface water features.

***Decommissioning Phase:***

- Improper rehabilitation of the ADF could result in erosion of the deposited ash and its transport through stormwater into adjacent riparian zones, thus causing pollution.

### 8.5.4 Summary of the Surface Water Assessment Findings

Both sites contain surface water features, however the drainage line on SA1 traverses a much smaller part of the site than the two drainage lines that converge within the north-western corner of SA2. The drainage line on SA1 is also much narrower and contains less pronounced riparian vegetation. Looking slightly further than the drainage lines traversing the sites, the upper catchment of the drainage line that traverses SA1 is located close to the western boundary of the site, and the Sandloop River is located to the south of the site, about 650 – 850 m to the south. In the context of SA2, the drainage line downstream of the confluence of the northern and western drainage lines in the north-western part of the site runs parallel to the northern part of the site, being located between 100 m – 500 m away from the northern boundary. The distance of the Sandloop River away from SA1 is believed to be sufficient to ensure that the Sandloop would not be directly affected by surface water inflows from the site. In contrast the closer location of SA2 to the downstream reach of the drainage line after it leaves the site entails that this downstream reach could be adversely affected through stormwater discharge or polluted groundwater inputs in spite of not being located on the actual development site.

The riparian corridors on SA2 have been assessed to be in a very natural state and close to reference state, being surrounded by a catchment in natural condition (falling within a nature reserve and game farm to the east). While the drainage line that bisects a small area of SA1 was assessed to be in a natural condition, with its immediate catchment comprising of natural woodland vegetation, the wider setting is important. The upper-most part of the catchment of this drainage line is currently undergoing development and thus transformation as part of the development of the Medupi Power Station. Accordingly it is possible that stormwater discharges of the Medupi site may be channelled into this drainage line, potentially affecting its hydrology. Immediately upstream of the area assessed a number of power line servitudes traverse the riparian corridor and accordingly the riparian habitat has been transformed as part of the clearing of the servitudes. Perhaps most importantly, SA1 is located immediately adjacent to the existing Matimba ADF, and in the context of consolidating impacts the expansion of the ADF onto the remainder of the Zwartwater property (SA1) would be preferable to the creation of impacts in area that is currently relatively un-impacted by industrial development (SA2).

## 8.6 Soils and Agriculture Potential

### 8.6.1 Soils

#### *8.6.1.1 Site Alternative 1*

The soils on SA1 can be grouped into three groups namely: dominantly Clovelly, stony Clovelly and Valsrivier and Oakleaf soils.

**(i) Clovelly**

The dominant soil form in this area is the Clovelly (orthic A horizon / yellow-brown apedal B horizon / unspecified material – usually weathering rock) form but soils with localised signs of wetness in the form of bleaching and mottling may occur. Under these circumstances soils of the Pinedene (*orthic A horizon / yellow-brown apedal B horizon / unspecified material with signs of wetness*) and Avalon (*orthic A horizon / yellow-brown apedal B horizon / soft plinthic B horizon*) forms may be present. A few localised patches (of limited geographical extent) with soils of higher clay content and structure occur within this area (addressed under the Valsrivier / Oakleaf description) - Figure 58.

**Figure 58: Exposed profile of the Clovelly soil form**

**(ii) Stony Clovelly**

This soil has essentially the same characteristics as the one described above with the exception that the profiles contain large amounts of pebbles (Figure 59 and Figure 60) and are often intercepted at the surface by conglomerate rock outcrops (Figure 60 and Figure 61).

**Figure 59: Copious amounts of pebbles on the surface**

**Figure 60: Copious amounts of pebbles on the surface with the occasional rock outcrop**

**Figure 61: Distinct rock outcrops**

**(iii) Valsrivier / Oakleaf**

These areas are characterised by slight depressions in the landscape (Figure 62) and exhibit a distinct increase in clay content and degree of structure development as compared to the areas with the sandier Clovelly soils. These areas are dominated by soils of the Valsrivier (*orthic A horizon / pedocutanic B horizon / unconsolidated material without signs of wetness*) and Oakleaf (*orthic A horizon / neocutanic B horizon / unspecified material*) forms (Figure 63). The classification of the Oakleaf form rests primarily on the presence of a distinctly bleached A horizon and cutanic character in the B horizon but with poorly expressed structural character in this B horizon. These areas are indicative of potential surface concentrations of water with a consequent

accumulation of clay in the subsoils. These soils however do not exhibit any signs of reduction as required by the wetland delineation guidelines[16], for classifying these areas as wetlands.

**Figure 62: Depression in the landscape with structured and high clay content soils**

[16] Department of Water Affairs and Forestry (DWAF). (2005). *A Practical field procedure for identification and delineation of wetlands and riparian areas, Final Draft.* Pretoria: DWAF.

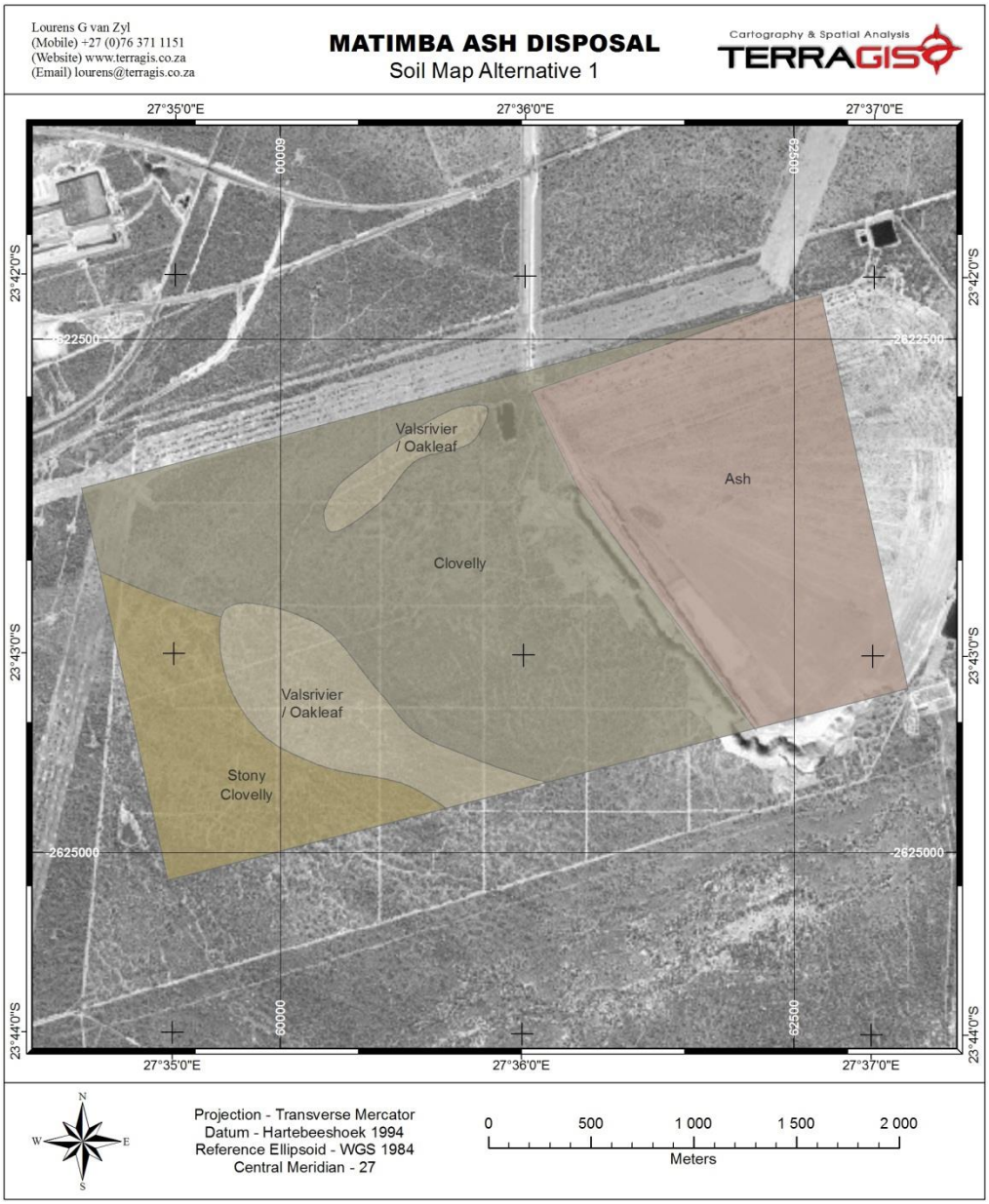


**Figure 63: Soil map of Site Alternative 1**

### *8.6.1.2 Site Alternative 2*

The soils on SA2 can be grouped into three groups namely: Clovelly, Fernwood and Valsrivier (Figure 67).

**(i) Clovelly**

The dominant soil form in this area is the Clovelly (orthic A horizon / yellow-brown apedal B horizon / unspecified material – usually weathering rock) form that is deep and of sandy texture (Figure 64). There is a degree of variation in this area as redder hues are also encountered but these are subdominant.

**Figure 64: Auger profile of a deep sandy Covelly soil form**

### (ii) Fernwood

Distinct areas occur where the soils are bleached sandy soils of the Fernwood (orthic A horizon / E horizon) form. These areas are not indicative of wetland conditions as often associated with E horizons in the wetland delineation guidelines[17].

**Figure 65: Auger profile of a deep sandy Fernwood with a degree of yellowing in the subsoil**

### (iii) Valsrivier

Soils associated with depressions in the landscape are predominantly of the Valsrivier on the survey site. These are underlain by lime rich horizons at depth. Although these soils do not conform to the definition of wetland soils they are indicative of areas with increased water ingress as expressed in bleached A horizons, higher clay content and the presence of lime at depth (Figure 66).

[17] *Ibid* Footnote 16.

**Figure 66: Addition of HCl (10 % solution) to subsoil lime and effervescence confirming the presence of carbonates**


**Figure 67: Soil map of Site Alternative 2**

### 8.6.1.3 *Linear Infrastructure Route*

The soils encountered along the linear infrastructure route can be grouped into two groups namely Clovelly and Fernwood (Figure 67). These soils have been discussed in preceding sections and the same applies for the conveyor route.

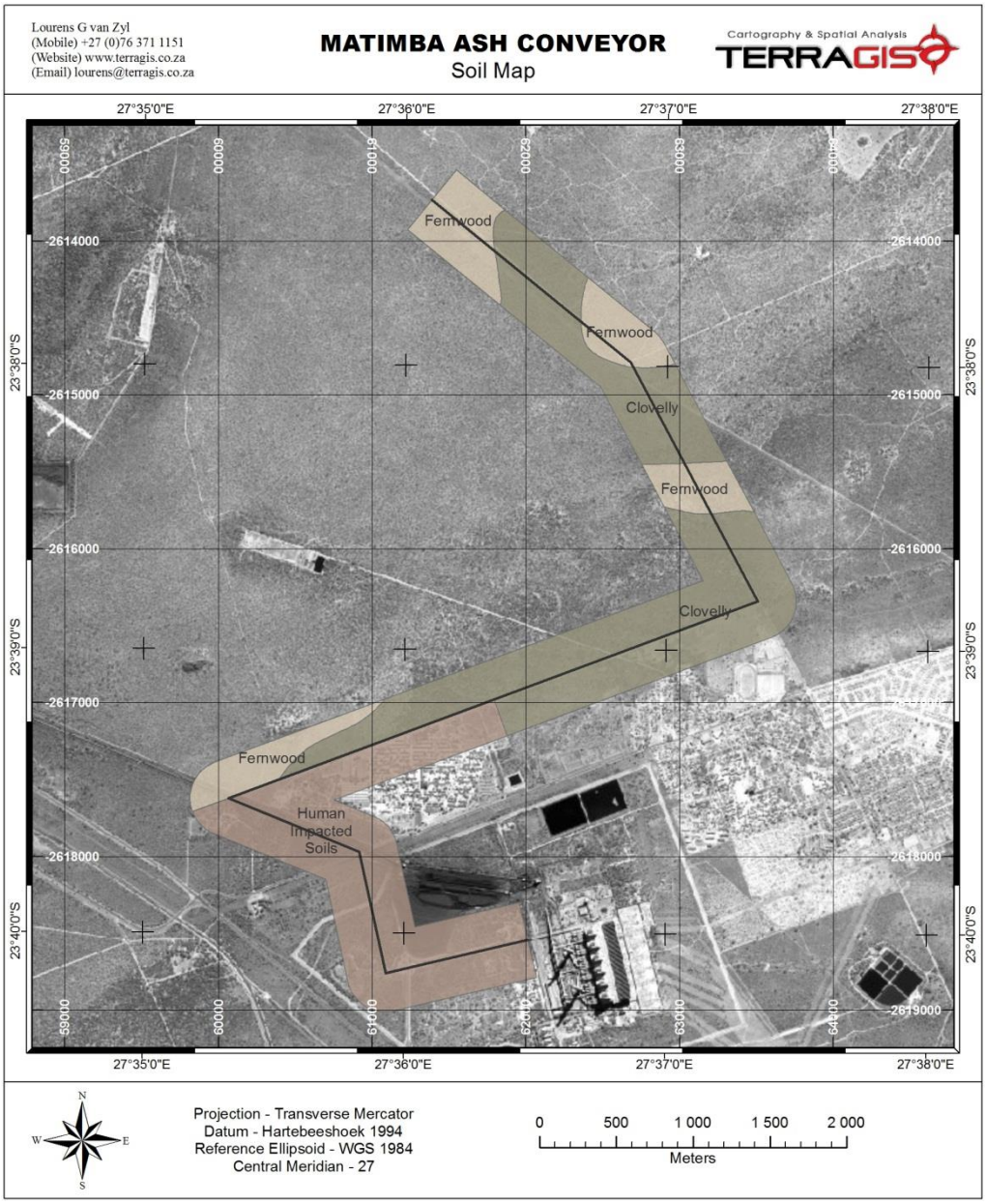


**Figure 68: Soil map of the linear infrastructure route**

## 8.6.2 Land use/Capability

The interpretation of the Google Earth image yielded that SA1 has two land uses namely extensive grazing (dominant) and an anthropogenic land use (ash disposal) adjacent to the proposed site. SA2 is exclusively extensively grazed. The linear infrastructure route traverses areas with similar land use as SA2. The land capability of the sites mimic the land use and is classified as “grazing”. From the

satellite imagery it appears that there are a number of linear depressions on SA1. From previous experience and extensive ground-truthing in the general area it is clear that these features on satellite images do not necessarily constitute wet areas. Rather, these areas represent potential depositional environments in a semi-arid climate and they are therefore probably indicative of areas with an increased incidence of bleaching or structure formation in the soils.

### 8.6.3 Agricultural Potential

The agricultural potential of the two site alternatives as well as the linear infrastructure route are determined by two factors namely the:

- Deep sandy soils (adequate for deep rooting and water storage); and
- Erratic rainfall and high evapo-transpiration potential.

The deep soils can be used for crop production purposes as is done in a subsistence manner near the urban developments close to the power station. This is subsistence crop production and yields are restricted due to poor fertilisation practices as well as the erratic rainfall. In this sense the area is not considered to be of high or prime agricultural potential as there is a distinct risk for crop failures for every 5 to 7 years out of every 10.

### 8.6.4 Wetland Distribution

During the investigation distinct depressions were identified on SA2 and the Topographic Wetness Index (TWI) confirms (Figure 69) that these are areas where surface water will accumulate and flow following distinct rainfall events. The soils indicate no signs of wetness or perched water within the depth that could be augured (1.2 m). It is therefore, concluded that these areas do not constitute wetlands or even potential wetland zones but rather indicate ephemeral watercourses due to the flat topography.

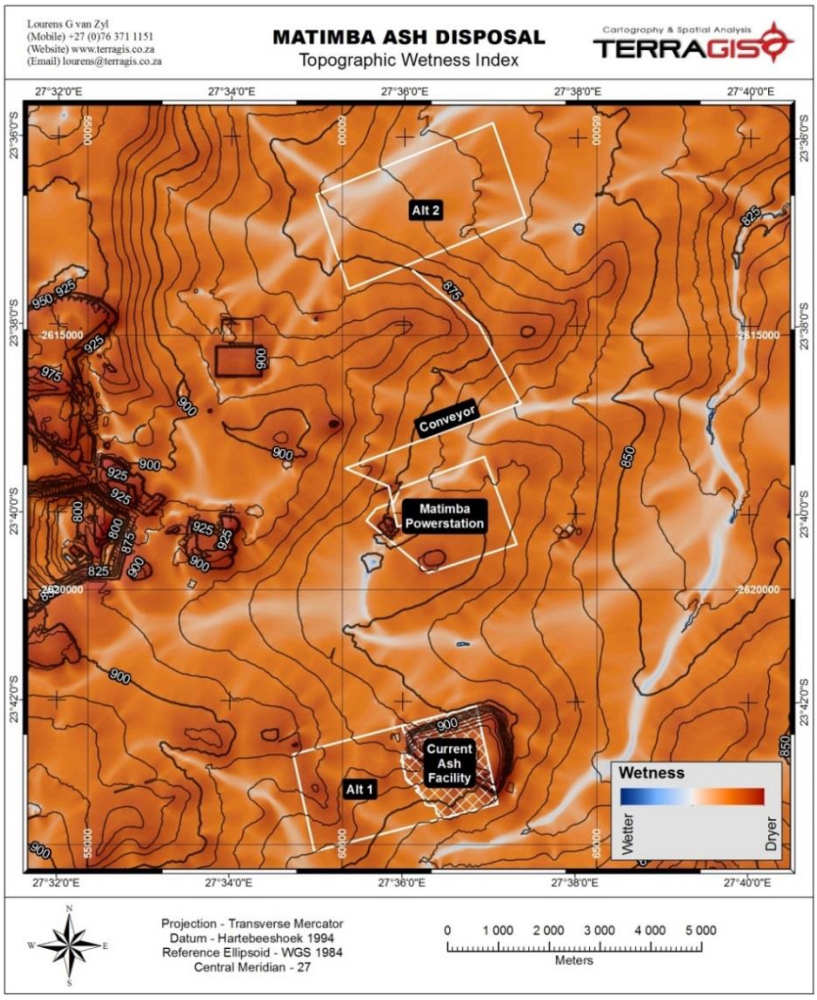


**Figure 69: Topographic wetness index (TWI) of the two site alternatives**

## 8.6.5 Potential Impacts

The potential activities on site and the anticipated forms of soil degradation/impact are presented in Table 41. Soil degradation can be divided into the following classes and subclasses:

- Physical degradation
  - Compaction
  - Surface crusting
  - Erosion
  - Structural degradation/hardsetting
- Chemical degradation
  - Eutrophication (Nitrogen; Phosphorus)
  - Soil organic carbon losses or alteration
  - Trace element and heavy metal pollution
  - Acidification
  - Salinisation and sodification
  - Nutrient mining

**Table 41: List of activities and their associated forms of soil degradation**

| Activity | Form of Degradation / Impact |
|---|---|
| **Construction Phase** | |
| Construction of ADF | Physical degradation (surface) |
| Construction of buildings and other infrastructure | Physical degradation (compound) |
| Construction of roads | Physical degradation (compound) |
| Construction of conveyor | Physical degradation (compound) |
| **Construction and Operational Phase** | |
| Vehicle operation on site | Physical and chemical degradation (hydrocarbon spills) |
| Dust generation | Physical degradation |
| Continuous disposal of ash | Physical degradation (surface) |
| **Closure Phase** | |
| Vehicle operation on site | Physical and chemical degradation (hydrocarbon spills) |
| Dust generation | Physical degradation |
| Rehabilitation of disturbed areas | No additional degradation |

### 8.6.6 Summary of the Soil and Agricultural Potential Study Findings

For SA1, impacts related to ash transport and disposal have already been largely incurred. From a soil classification and mapping perspective SA2 poses larger risks as it has a much more pronounced drainage feature (north-western edge) that is linked to areas outside of the survey site.

The linear infrastructure route suffers from very similar restrictions to SA2. Additionally, the route has very distinct sharp corners. It is assumed that during detailed design, the route would be altered in areas where sharp corners are situated that would result in more land being taken up for infrastructure to accommodate the change in direction.

The proposed continuous ADF (either SA1 or SA2) will not have large impacts on the current land use of the broader area. This is mainly due to the low agricultural potential, dominant soils and climatic constraints for the sites. The main aspect that will have to be managed on the sites is dust generation during the construction and operation process. Soil erosion poses a limited risk due to the level nature of the terrain.

## 8.7 Biodiversity - Flora

### 8.7.1 Floristic Sensitivity of the Study Area

Botanical sensitivity values are presented in Table 42. These estimations are used to ascribe a sensitivity index value to units of the respective variations (as indicated in Section 6.1.8.1) and illustrated in Figure 70 and Figure 71. Habitat sensitivity is categorised as follows:

- **Low:**

  No natural habitat remaining, this category is represented by developed/ transformed areas, nodal and linear infrastructure, areas of agriculture or cultivation, areas where exotic species dominate exclusively, mining land (particularly surface mining), etc.

- **Medium to Low:**

  Areas where the natural habitat has been degraded, with the important distinction that the vegetation has not been decimated and a measure of the original vegetation remain, albeit dominated by secondary climax species.

- **Medium:**

  Indigenous natural habitat with a high diversity, but characterised by moderate to high levels of degradation, fragmentation and habitat isolation. Also includes areas where flora species of conservation importance could potentially occur, but habitat is regarded marginal.

- **Medium to High:**

  Indigenous natural vegetation with areas that are characterised by a high/ moderate-high intrinsic floristic diversity; areas characterised by moderate to low levels of habitat fragmentation and isolation; low to moderate levels of habitat transformation and a moderate to high ability to respond to disturbance factors.

- **High:**

  Indigenous natural vegetation with a combination of the following attributes - the presence of plant species of conservation importance, particularly threatened categories; areas where 'threatened' plants are known to occur, or habitat that is highly suitable for the presence of these species; habitat types that are protected by national or provincial legislation and areas that have an intrinsic high floristic diversity.

**Table 42: Floristic sensitivity estimations for the respective habitat types**

| Criteria | RD species | Landscape sensitivity | Status | Species diversity | Functionality / fragmentation | Total | Sensitivity Index | Sensitivity Category |
|---|---|---|---|---|---|---|---|---|
| **Community** | **Criteria Ranking** | | | | | | | |
| **Artificial Woodland Habitat** | 3 | 2 | 3 | 3 | 3 | 88 | 28% | Medium-Low |
| ***Kyphocarpa angustifolia* – *Eragrostis rigidior* Woodland** | 6 | 8 | 9 | 9 | 9 | 250 | 78% | Medium-High |
| ***Nymphaea* – *Schoenoplectus* Impoundments** | 4 | 10 | 8 | 8 | 10 | 238 | 74% | Medium-High |
| ***Portulaca* – *Oldenlandia* Sheetrock** | 4 | 9 | 8 | 9 | 8 | 229 | 72% | Medium-High |
| ***Vernonia* species - *Panicum*** | 5 | 6 | 5 | 5 | 7 | 174 | 54% | Medium |

| Criteria | RD species | Landscape sensitivity | Status | Species diversity | Functionality / fragmentation | Total | Sensitivity Index | Sensitivity Category |
|---|---|---|---|---|---|---|---|---|
| ***maximum*** **Degraded Woodland** | | | | | | | | |

**Table 43: Comparative extent of habitat types within each of the site alternatives[18]**

| Habitat | *Site Alternative 1* | | *Site Alternative 2* | |
|---|---|---|---|---|
| | ***Extent*** | ***( %)*** | ***Extent*** | ***(%)*** |
| *Acacia mellifera - Acacia tortilis* Alluvial Plains Variation | -- | -- ^ | 86.5 ha | 11.8 % |
| *Acacia nigrescens - Melhania forbesii* Woodland Variation | 432.2 | 85.0 % | -- | -- |
| Artificial woodland habitat | -- | -- | 25.0 ha | 3.4 % |
| *Brachiaria nigropedata* Impoundment Variation | -- | -- | 1.5 ha | 0.2 % |
| *Croton gratissimus - Sclerocarya birrea* Gravel Plains Variation | 66.2 | 13.0 % | -- | -- |
| *Portulaca - Oldenlandia* Sheetrock Community | 2.5 ha | 0.5 % | -- | -- |
| *Stipagrostis uniplumis - Eragrostis pallens* Sandveld Variation | -- | -- | 620.4 | 84.6 % |
| *Typha capensis* Impoundment Variation | 7.4 ha | 1.5 % | -- | -- |

**Table 44: Comparative floristic sensitivities for each of the site alternatives[19]**

| ***Floristic Sensitivities*** | ***Site Alternative 1*** | ***Site Alternative 2*** |
|---|---|---|
| High | 0.0 % | 0.0 % |
| Medium-High | 100.0 % | 0.2 % |
| Medium | 0.0 % | 96.4 % |
| Medium-Low | 0.0 % | 3.4 % |
| Low | 0.0 % | 0.0 % |

The suitability of the respective sites for the proposed activity is strongly determined by the sensitivity and status of floristic habitat types that characterise these areas. Additional factors taken into consideration is the connectivity of the respective sites to adjacent and surrounding natural habitat as well as existing impacts within and adjacent to the sites, including required and existing transportation infrastructure.

Typically, natural vegetation of the respective sites, as well as the immediate surrounds, are strongly determined by the savannah character of the region. A dominant woody layer and a diverse herbaceous stratum are evident on both site alternatives. Protected trees were recorded throughout both site alternatives and this was therefore not used as a specific point of reference in terms of the suitability of either of the sites. However, visual observations indicate that the number of protected trees within SA1 is higher than in SA2.

Habitat diversity is an important attribute that affects the suitability of the sites. SA2 was found to contain largely homogenous woodland vegetation, while SA1 exhibits more localised variations in terms of biophysical habitat conditions as well as the associated floristic types. Similarly local degradation patterns resulting from utilisation influences the status of the vegetation significantly. The vegetation of SA1 was found to be largely pristine; hence, a medium-high floristic sensitivity was attributed to all the variations and communities of this alternative. In contrast, high utilisation factors

[18] Note: for the comparative assessments, the Artificial habitat (ADF) of SA1 was not included in the calculations.
[19] Note: for the comparative assessments, the Artificial habitat (ADF) of SA1 was not included in the calculations.

affected the status of vegetation of SA2 adversely and the vegetation exhibit largely attributes of medium sensitivity.

#### *8.7.1.1 Site Alternative 1*

Floristic communities and variations of this area are pristine and representative of the regional vegetation type. Calculated diversity indices confirm this natural status. A high connectivity to adjacent pristine savannah habitat is noted to the south. Additionally, riparian woodlands located to the south of this alternative are regarded sensitive. It is possible, although unlikely, that these sensitive habitat types could be affected adversely by the extension of the existing ashing facility. The loss of natural (pristine) habitat from this site by the development of the ashing facility is regarded significant, more so than for SA2. A medium-high floristic sensitivity is therefore, estimated for all natural vegetation of this site (Figure 70).

#### *8.7.1.2 Site Alternative 2*

Habitat of this unit is regarded slightly degraded due to persistent high grazing. In particular, the herbaceous layer exhibits a species composition that includes dominant weeds and indicator species of poor habitat conditions. Habitat diversity within this area is also lower compared to SA1 and the loss of habitat from this site is therefore not regarded as significant (Figure 70). Ecological connectivity of this site is good; being surrounded by natural woodland habitat. However, visual observations indicate that similar poor habitat conditions prevail in surrounding areas. Importantly though, no existing infrastructure is available for the transportation of ash to this area, implying that an additional conveyor system needs to be constructed. This will result in increased habitat fragmentation on a local scale.

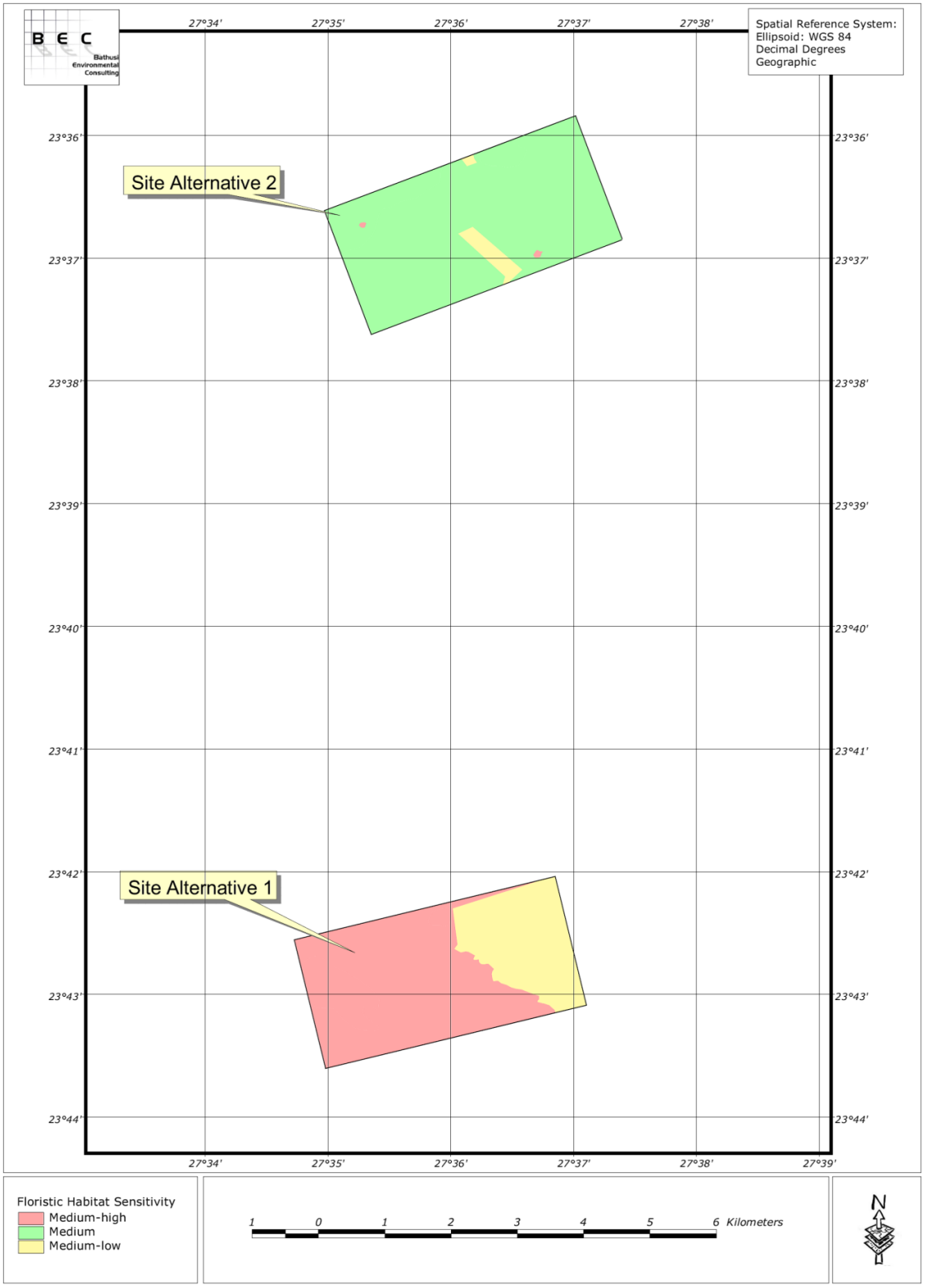


**Figure 70: Floristic sensitivity of the site alternatives**

#### 8.7.1.3 Linear Infrastructure Route

Natural woodland communities and variations within the proposed linear infrastructure route between Matimba Power Station and the proposed SA2 exhibit the typical floristic composition, physiognomy and inherent sensitivities encountered on a local and regional scale. Natural woodland varies considerably on a local and regional scale; this is mostly attributed to soil conditions and the prevalence of mesic environs as little topographical heterogeneity can be noted. Slight degradation resulted from surrounding land uses and developments as well as persistent high grazing. The largest extent of the proposed linear infrastructure route exhibit floristic attributes of a moderate sensitivity, mostly attributed to the characteristic presence of protected trees.

While the presence of protected trees within natural woodland is a typical characteristic of the natural woodland on a regional scale, a particularly high density of *Spirostachys africana* within a portion of the proposed linear infrastructure route was recognised; these areas are visually recognisable from aerial imagery. A medium-high floristic sensitivity was ascribed to these portions. Impacts within these areas are therefore considered significant because of the exceptional density of protected trees and realignment is strongly recommended in order to avoid these areas in their entirety.

The proposed realignment should follow the existing Grootegeluk – Matimba conveyor line and divert eastwards towards SA2 immediately south of Grootegeluk Mine. All woodland habitat types of medium-high floristic sensitivity will be avoided by this recommended alignment and potential and likely impacts are likely to by significantly lower. Deviation from the existing Grootegeluk – Matimba conveyor line must take place as far north as possible in order avoid the Nelsonskop feature as this represents a particularly significant topographical and environmentally sensitive feature. Figure 71 below depicts the recommended proposed deviation of the proposed linear infrastructure route.

During the review of the draft EIAR, Exxaro Coal, indicated that the proposed realignment of the linear infrastructure route is not feasible due to the following reasons: the route will cause fragmentation of the Nelsonskop farm area that is currently being managed as a Game Reserve and Biosphere as part of the Exxaro Land Management Area known as Manketti and this recommended route will go through an area currently earmarked for the Superfines Facility of Exxaro Grootegeluk which is in the pre-feasibility stage.

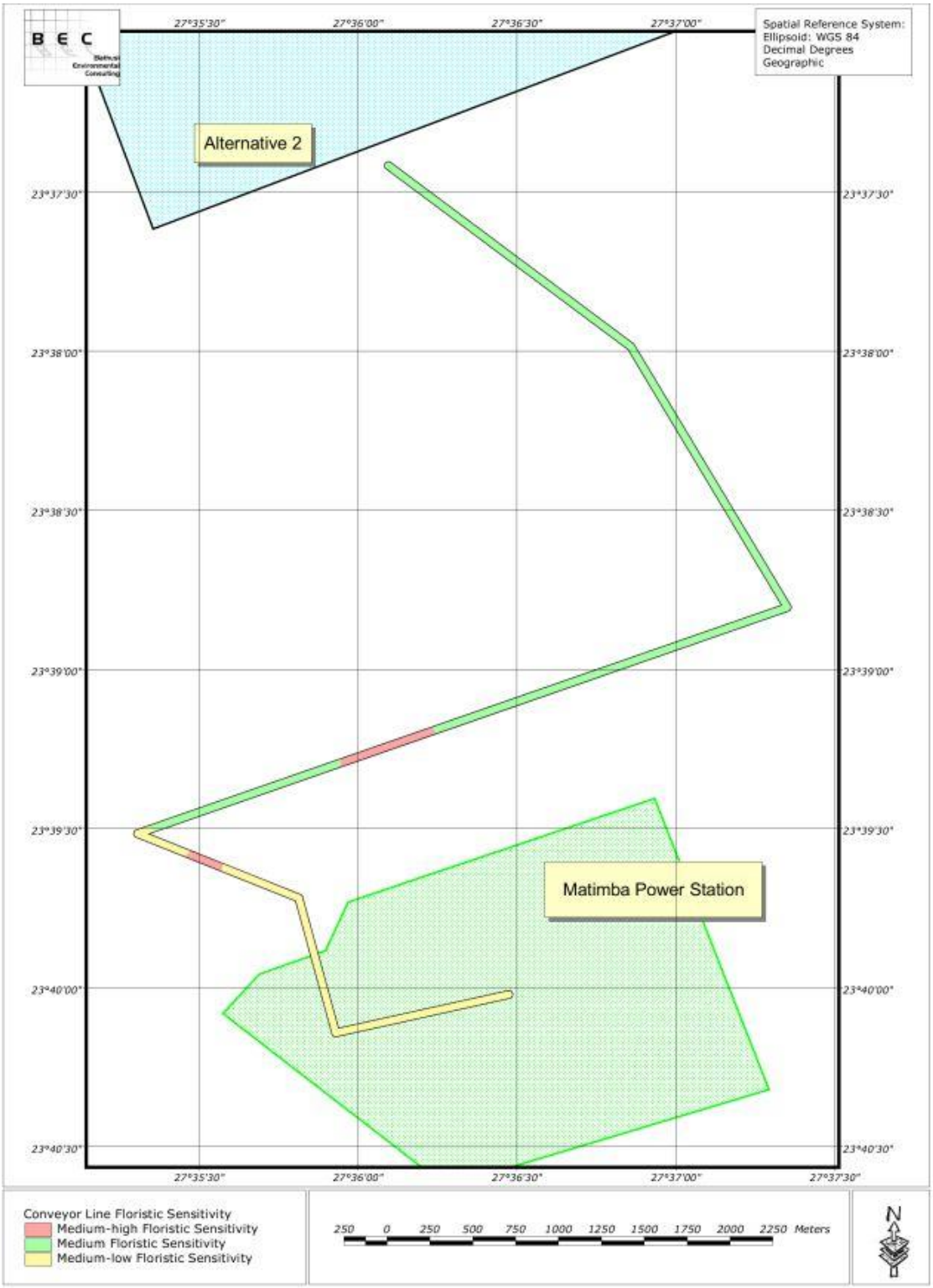


**Figure 71: Floristic sensitivity of the proposed linear infrastructure route**

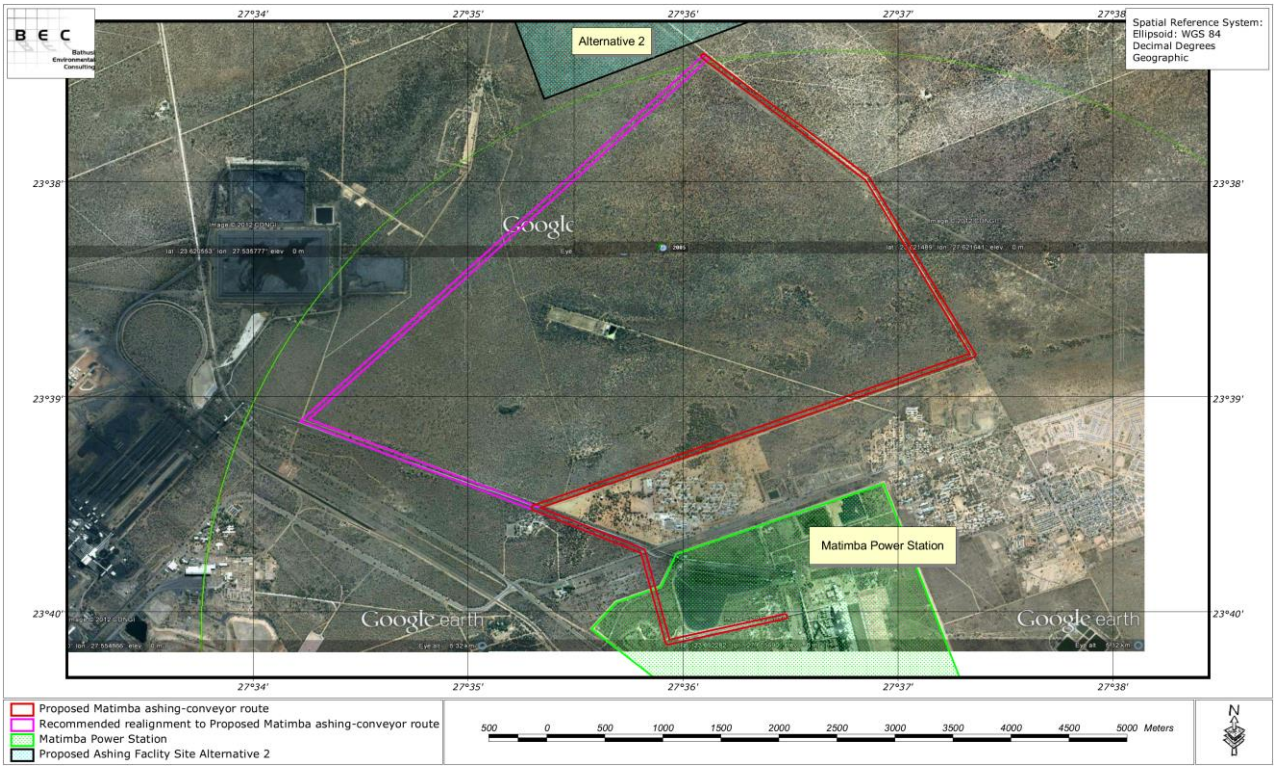


**Figure 72: Recommended realignment of the linear infrastructure route (purple)**

# 8.8 Biodiversity - Fauna

## 8.8.1 Faunal Habitat Sensitivity Assessment

The study area was investigated and the faunal sensitivity of respective habitat types assessed in terms of the following biodiversity attributes (refer to Table 45):

- Habitat status (ST): level of habitat transformation and degradation vs. pristine faunal habitat;
- Habitat diversity (DV): the number of different faunal habitat types (both on micro- and macro-scale) found within the proposed site and bordering areas;
- Habitat linkage (LN): the degree to which the faunal habitat of the proposed site is linked to other natural areas enabling movement of animals to and from the habitat found on site;
- Red Data species (RD): the degree to which suitable habitat for the Red Data species likely to be found in the study area (larger study area) is located on each site; and
- Sensitive faunal habitat (SE): the relative presence of faunal sensitive habitat type elements such as surface rock associated with outcrops and hills as well as wetland elements.

**Table 45: Faunal sensitivities for the respective habitat types**

| Unit | Habitat Type | S | D | L | R | S | Averag | Category |
|---|---|---|---|---|---|---|---|---|
| **Transforme** | Artificial woodland | 2 | 2 | 3 | 1 | 1 | 18% | Low |
| **Wetland** | *Nymphaea - Schoenoplectus* | 5 | 7 | 7 | 6 | 6 | 62% | Medium- |
| **Woodland** | *Kyphocarpa - Eragrostis* woodland | 8 | 8 | 7 | 7 | 7 | 74% | Medium- |
| | *Portulaca - Oldenlandia* sheetrock | 9 | 7 | 8 | 7 | 9 | 80% | High |
| | *Vernonia - Panicum* degraded woodland | 6 | 5 | 7 | 5 | 5 | 56% | Medium |

Faunal habitat sensitivities of the habitat types are illustrated in Figure 73 and Figure 74 below.

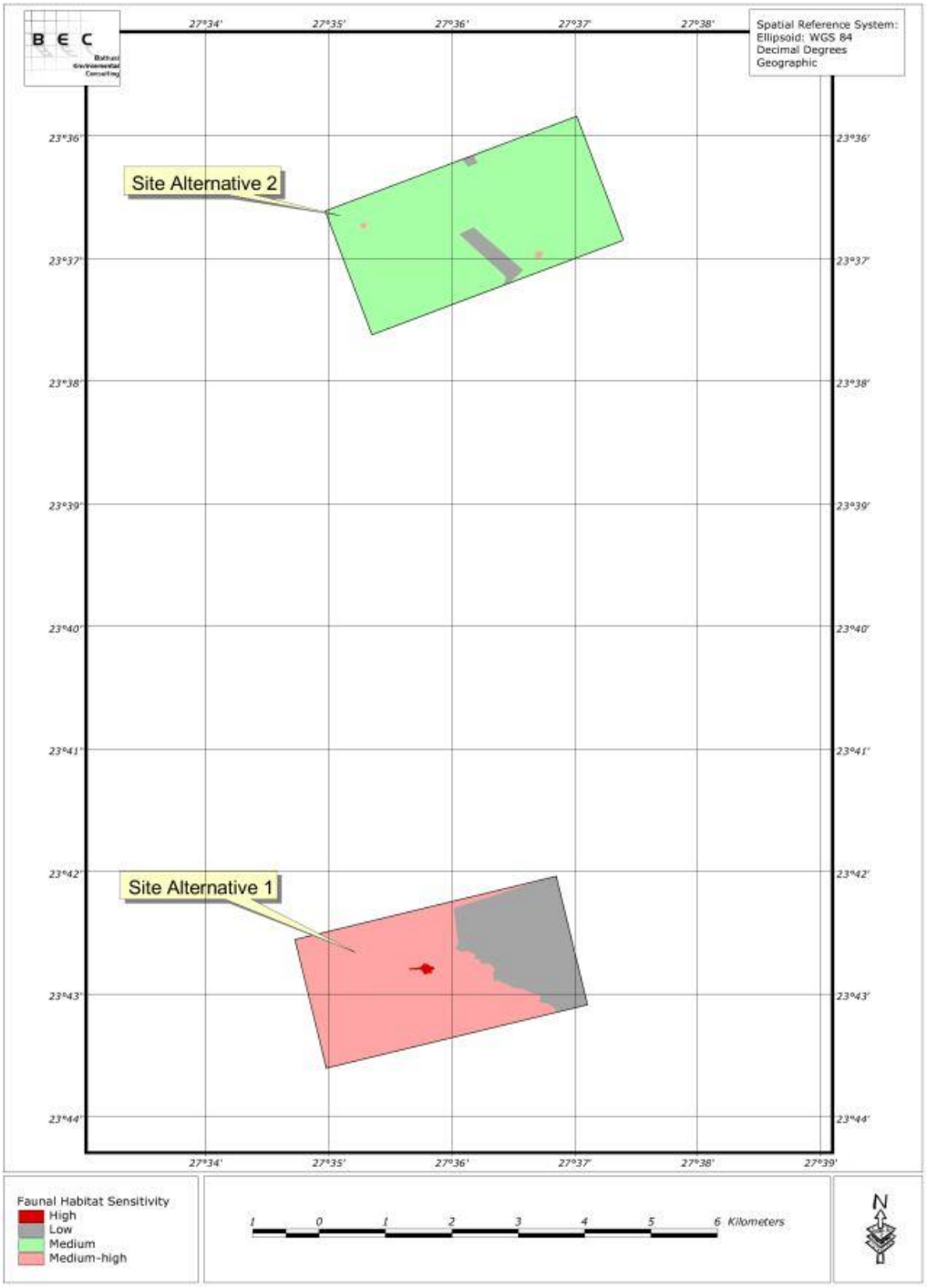


**Figure 73: Faunal sensitivity of the site alternatives**

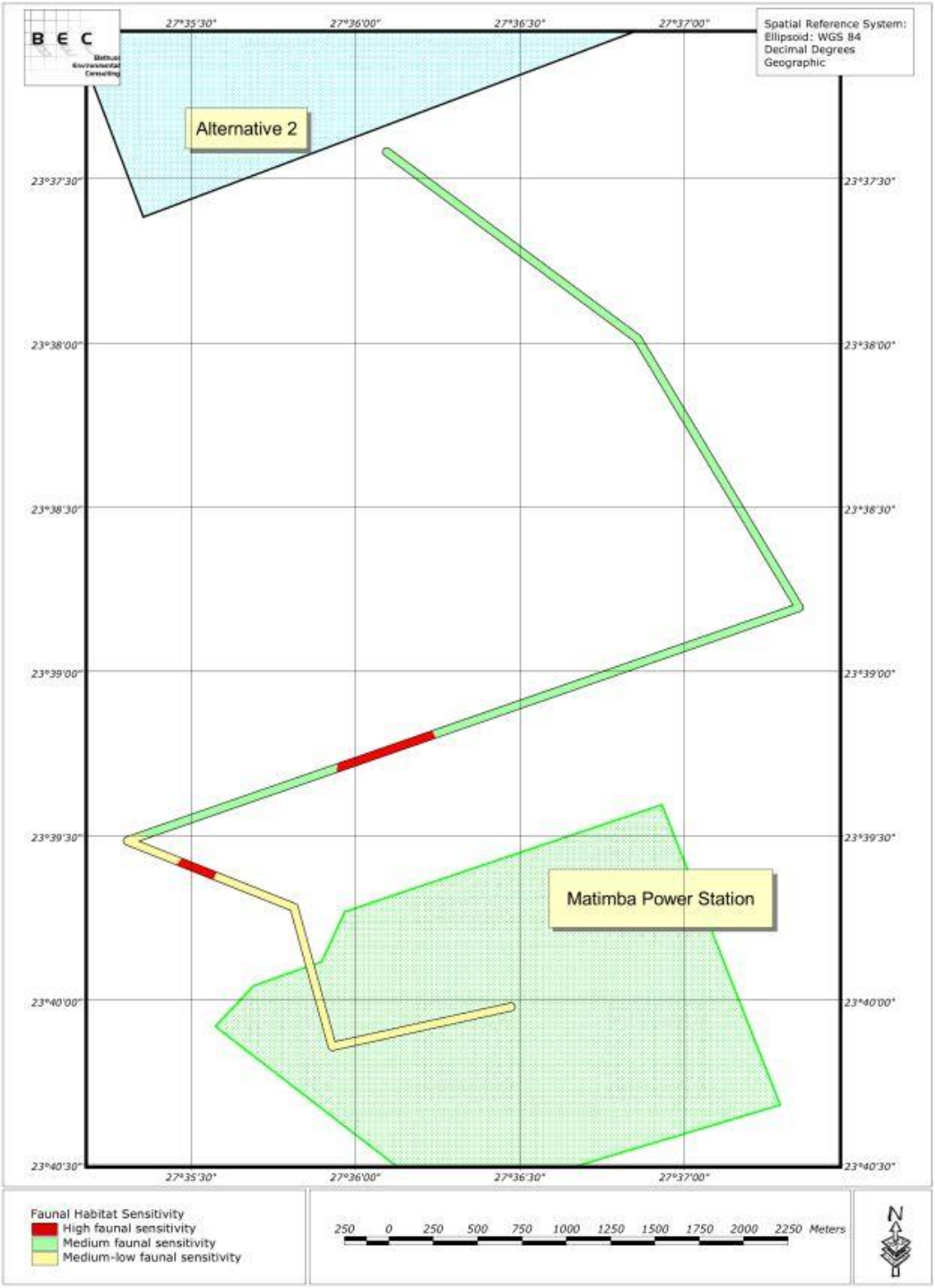


**Figure 74: Faunal sensitivity of the linear infrastructure route**

The study areas (SA1 and 2) are characterised by (largely) untransformed Sweet Limpopo Bushveld faunal habitat. Although some transformation is evident on the two sites investigated as well as (extensively) in the region of the study area, most of the original faunal habitat of the study area is still ecologically intact. The presence of 98 animal species in the study area (confirmed during the April 2013 field investigation) attests to the untransformed nature of the faunal habitats. The ecological functionality, integrity, faunal biodiversity and general sensitivity of the study area is underlined by the

confirmed presence of three Red Data species in the study area as well as the confirmed presence of eighteen Red Data species in the immediate vicinity.

The region in which the study area is located has been significantly altered (the presence of Grootegeluk opencast coal mine, Matimba and Medupi (under construction) power stations and associated infrastructure) and continues to experience very high land use change pressures. Consequently, the general sensitivities of faunal habitats and faunal communities of the region in which the study area is located, increases almost on a daily basis.

Within the scope of a single EIA related biodiversity assessment, cumulative impacts for a specific region are very difficult to identify, quantify and assess. These difficulties are especially relevant to the region of the study areas relevant to the continuous ashing project proposed for the Matimba Power Station because of the extensive faunal habitat loss and fragmentation in the immediate vicinity of the study area. Additionally, the habitat loss (and fragmentation) thresholds of the sensitive faunal inhabitants of the study area region (eighteen Red Data species confirmed) are mostly unknown and warrant caution.

#### *8.8.1.1 Site Alternative 1*

SA1 is located next to the existing ashing facility. The eastern third of the study area is characterised by artificial faunal woodland habitat (low faunal sensitivity). The remaining (approximately) two thirds of SA1 include *Kyphocarpa angustifolia – Eragrostis rigidior* Woodland (medium-high faunal sensitivity), *Nymphaea – Schoenoplectus* impoundments (medium-high faunal sensitivity) and *Portulaca – Oldenlandia* sheetrock faunal habitat (high faunal sensitivity). Higher habitat diversity is associated with this site alternative; while the status of the habitat is also in a better condition.

Sixty-four animal species were recorded in SA1, including the Red Data species i.e. eagle and hyaena.

#### *8.8.1.2 Site Alternative 2*

SA2 is situated north-east of the Grootegeluk opencast coal mine. Most of the study area (Site Alternative 2) is characterised by *Vernonia – Panicum maximum* degraded woodland faunal habitat (medium faunal sensitivity). Some areas of artificial woodland habitat (low faunal sensitivity) is evident, also two small *Nymphaea – Schoenoplectus* impoundments (medium-high faunal sensitivity). SA2 does not include any faunal habitat fragments of high faunal sensitivity. Low habitat diversity and variability is associated with SA2, hence a moderate faunal sensitivity is ascribed to this option.

Sixty-five animal species were confirmed to be present in SA2, including the Red Data species i.e. leopard and hyaena.

#### *8.8.1.3 Linear Infrastructure Route*

Based on the faunal habitat status, diversity, ecological connectivity, Red Data hosting ability and inherent sensitivity, different faunal sensitivities are assigned to the three macro habitat types of the proposed linear infrastructure route (Figure 74). Degraded and Natural Woodland habitats are not deemed particularly sensitive and it is regarded unlikely that any animal species, assemblage or community of conservation importance will be adversely affected by the construction and operation of the proposed linear infrastructure route. However, the *Spirostachys africana* Woodland faunal habitat type exhibit unique and sensitive faunal habitat within the general arid landscape of the region. This faunal habitat is therefore deemed sensitive and not suitable for the construction and operation of a linear infrastructure route. It is strongly recommended that it is excluded by means of a realignment of the proposed line towards the north (Figure 72).

### 8.8.2 Potential Impacts

No impacts were identified that could lead to a beneficial impact on the ecological environment of either of the site alternatives since the proposed development is largely destructive, involving the alteration or degradation of habitat that is currently in a climax (natural) status.

Impacts associated with the proposed development clearly falls within three categories, namely:

- Direct, immediate and highly significant impacts, also of a permanent nature;
- Indirect, referred and moderate significant impacts; and
- Cumulative, permanent and highly significant impacts.

#### *8.8.2.1 Impacts on Flora Species of Conservation Importance (including suitable habitat)*

Development activities frequently result in the destruction of:

- Individual conservation important species;
- Communities of conservation important species;
- Areas where conservation important species are known to occur (historically recorded); or
- Areas that are considered particularly suitable for these species (potentially present, but not previously recorded due to poor floristic sampling records).

Red Data species are particularly sensitive to changes in their environment, being adapted to a narrow range of specific habitat requirements. Changes in habitat conditions resulting from human-related activities is one of the greatest reasons for these species being in danger of extinction. Surface transformation/ degradation activities within habitat types that are occupied by flora species of conservation importance will ultimately result in significant impacts on these species and their population dynamics. Effects of this impact are usually permanent.
The presence of abundant plants of conservation importance, particularly protected trees, was established during the brief survey period. Habitat throughout both site alternatives is furthermore suitable for a number of other taxa that were not recorded during the survey.

#### *8.8.2.2 Impacts on Fauna Species of Conservation Importance (including suitable habitat)*

Due to the fact that animals are mostly mobile and are ultimately able to migrate away from impacts, developments rarely affect them directly. However, significant impacts result from losses and degradation of suitable habitat that is available to them. This represents a significant direct impact on these animals. Additional aspects that will be affected include migration patterns and suitable habitat for breeding and foraging purposes. Habitat requirements and preferences of conservation important species are much stricter than for common or generalist species and a higher conservation obligation is placed on these areas. Even slight changes to habitat in which these species persist are therefore likely to have significant effects on the presence and status of these taxa within the immediate region.

The presence of conservation important fauna species within- as well as near to the proposed development areas was established during the survey period. Considering the brief period over which the survey was conducted, and taking cognisance of the habitat status and availability, the likelihood that other conservation important species would occur in the immediate region is regarded high.

#### *8.8.2.3 Impacts on Sensitive or Protected Habitat Types (including loss and degradation)*

Extensive areas of natural habitat will be adversely affected by direct impacts resulting from construction and operational phases of the ashing activity. Particular reference is made to the loss of habitat resulting from surface clearing activities, the construction of infrastructure and contamination

of natural habitat through the leaching of chemicals into the groundwater and surface water and generation of huge amounts of dust and spillages. Also of importance is the loss of habitat that is not necessarily considered suitable for Red Data species, but where high endemic species richness is likely to be recorded. Natural woodland habitat that is in an optimal condition is regarded sensitive, particularly in view of the presence of several conservation important plant and animal taxa that were recorded within these areas during the survey period.

#### *8.8.2.4 Displacement of Fauna Species, Human-Animal Conflicts and Interactions*

The presence of personnel within the development area during construction and operational phases will inevitably result in contact with animals. Evidence from nearby developments indicates that numerous encounters with dangerous animals (such as snakes, scorpions and spiders) can reasonably be expected. Encounters with dangerous mammals are less likely, but still possible. In addition, the presence of domestic dogs and cats is generally associated with humans. These animals are frequently accountable for killing of natural fauna. It is also regarded moderately likely that the natural faunal component might be attracted to the artificial habitat that is created by the development. The establishment of human abodes generally result in the presence of foraging rodents, which is likely to attract smaller predators, raptors, owls, and snakes. The lack of understanding from personnel frequently results in the unnecessary killing of these animals.

#### *8.8.2.5 Cumulative Impacts on Conservation Obligations and Targets (including National and Regional)*

The conservation importance of vegetation types is based on the conservation status ascribed to regional vegetation types[20] and because impacts that result in irreversible transformation of natural habitat are regarded significant. The current conservation status is based on regional information relating to the status and availability of remaining natural habitat. The vegetation of the region (Limpopo Sweet Bushveld) is included in the 'Least Threatened' category.

However, recent developments that have taken place subsequent to the compilation of the VEGMAP database have resulted in further decimation of natural woodland in the region, contributing to a cumulative impact. Ultimately, the current estimation of conservation level is therefore likely to be an underrepresentation of the conservation requirements that need to be applied to these vegetation types.

#### *8.8.2.6 Impacts on Ecological Connectivity and Ecosystem Functioning*

The larger region is characterised by moderate to low transformation levels. This is reflected in the site alternatives and immediate surrounds. Therefore, the ecological connectivity that natural habitat provides within this regional setting of habitat fragmentation and isolation, is particularly important in the effective functioning of the regional and local ecological processes. It is therefore reasonable to assume that the animals that utilise these habitat types migrate extensively across the region for various reasons. Foraging, available water, food sources, breeding patterns and seasonal climate changes include some of the more obvious explanations for migration of animals. In order to ensure the persistence of animals within this system on a local and regional scale, it is critical that the basic characteristics of the system, such as a natural species composition, physiognomy, aquatic principles, contributions from surrounding habitat types, etc. are preserved. This is also particularly relevant for plant species of conservation consideration that could potentially occupy the area.

[20] Mucina, L. and Rutherford, M.C. (2006). The vegetation of South Africa, Lesotho and Swaziland. *Strelitzia 19*. Pretoria: South African National Biodiversity Institute.

In the study area, while most of the larger mammal species (ungulates) are restricted in their movement by fences, small and medium sized animals (that include predators) burrowing species, small mammals, invertebrate species, reptiles, amphibians, etc. utilise all available natural habitat as either corridors, 'stepping stones' or habitat. Loss of current migration routes or connectivity areas ('stepping stones') within the site alternatives will likely affect the migration pattern of some species on larger scale. Particular reference is made to the disruption of migration patterns of flightless animals.

#### *8.8.2.7 Indirect Impacts on Surrounding Habitat*

Surrounding areas and species/ communities present in the direct vicinity of the site alternatives and linear infrastructure route will likely be affected adversely by indirect impacts resulting from construction and operational activities. These indirect impacts also include adverse effects on any processes or factors that maintain ecosystem health and character, including the following:

- Disruption of nutrient-flow dynamics;
- Introduction of chemicals into the ground- and surface water through leaching;
- Impedance of movement of material or water;
- Habitat fragmentation;
- Changes to abiotic environmental conditions;
- Changes to disturbance regimes, e.g. increased or decreased incidence of fire;
- Changes to successional processes;
- Effects on pollinators; and
- Increased invasion by plants and animals not endemic to the area.

These impacts lead to initial, incremental or augmentation of existing types of environmental degradation, including impacts on the air, soil and water present within available habitat. Pollution of these elements might not always be immediately visible or readily quantifiable, but incremental or fractional increases might rise to levels where biological attributes could be affected adversely on a local or regional scale. In most cases, these effects are not bound and are dispersed, or diluted over an area that is much larger than the actual footprint of the causal factor. The nature of the operation is such that pollution and degradation of the surrounding areas could reasonably be expected. These effects are evident from existing activities in the immediate surrounds.

These impacts lead to a reduction in the resilience of peripheral ecological communities and ecosystems or loss or changes in ecosystem function.

#### *8.8.2.8 Cumulative Increase in Local and Regional Fragmentation / Isolation of Habitat*

The loss of natural habitat, even small fragments, implies that endemic biodiversity have permanently lost that opportunity to occupy that space, effectively meaning that a higher premium is placed on available food, water and habitat resources in the immediate surrounds. This, in some instances, might imply that the viable population of plants in a region will decrease proportionally with the loss of habitat, eventually decreasing beyond a viable population size.

The danger in this type of cumulative impact is that effects are not known or are not visible with immediate effect and normally when these effects become visible, they are usually beyond repair. Impacts on linear areas of natural habitat affect the migratory success of animals in particular. The general region is characterised by moderate to low levels of transformation and habitat fragmentation.

### 8.8.3 Summary of Biodiversity Assessment Findings

Destruction of habitat as well as the accompanying loss of common and, more importantly, conservation important species, will lead to site-specific and local (5 -10 km) effects on biodiversity. Activities that cause these impacts are most significant during the site preparation and construction phases when vegetation is removed, soils stripped and the site prepared for the operational phase. The loss of species and habitat during this phase of the project is significant and impossible to mitigate against. It is important to understand that effects of these initial activities on the natural environment are irreversible.

Subsequent to the site preparation phase, actual construction and operational activities are expected to result in indirect and referred impacts on the surrounding biological and ecological environment.

Cumulative impacts of the project and impacts on the ecological and biological environment during and subsequent to decommissioning of the project will result in significant and lasting impacts on the ecological environment. The immediate area as well as the larger region is characterised by moderate levels of habitat loss and fragmentation. Cumulative impacts of habitat destruction and the associated loss of species are regarded severe on a local and regional scale. Ample evidence of anthropogenic encroachment is present in the immediate surrounds and is causing widespread, uncontrolled and irreversible impacts on the natural savannahs of this region.

The known and potential presence of conservation important plant and animal taxa in a specific area normally dictates the suitability of a site for a development. In this particular case, conservation important taxa are known to persist, or are highly likely to persist, on both site alternatives. The importance of this aspect was definitely not discarded and the recommendation of SA2 as the (slightly) preferred option is partly based on the lowest potential for conservation important taxa to persist within this area. The suitability of SA2 is slightly challenged by the need for a conveyor (linear infrastructure route) connection to the source of the ash. Such linear infrastructure will undoubtedly increase local and regional habitat fragmentation levels, impact adversely on movement and migration corridors as well as crossing and effects on sensitive species and habitat types.

Furthermore, while numerous protected trees occur throughout the greater region, parts of the proposed linear infrastructure route are characterised by an exceptional density of the Protected Trees *Spirostachys africana* and significant impacts on this species are expected. This impact can only be ameliorated with a recommended realignment of the proposed linear infrastructure route. This realignment of the proposed conveyor route therefore represents the most significant mitigation measures for this aspect of the proposed development. However, the realignment is not supported by Exxaro Coal for the reasons listed in Section 8.8.1.3.

## 8.9 Social Environment

Social impacts are rarely known with certainty during the early stages of a project. However, in the case of the proposed continuous ADF for the Matimba Power Station, it will be easier to predict impacts, as an ADF already exists. Therefore, the environmental factors which may have an effect on social impacts remain the same. Impacts have thus already occurred under the same circumstances.

Figure 75 below shows the communities, farms, and businesses within the study area and will be potentially impacted by the ADF for Matimba Power Station.

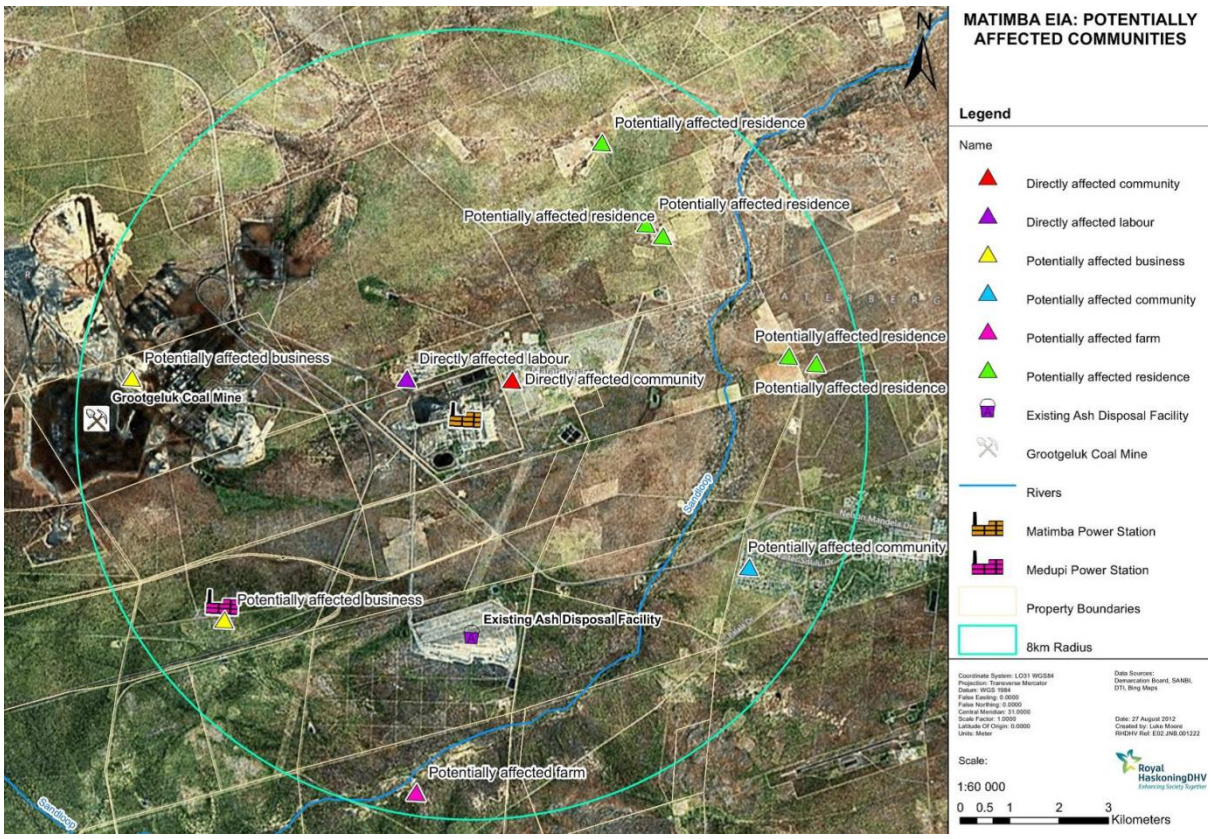


**Figure 75: Potentially affected communities**

## 8.9.1 Potential Impacts

### *8.9.1.1 Impact on Health due to Air Quality*

Prolonged exposure to airborne ash (coal fly ash) could have health impacts on neighbouring communities, including those living on farms and in Marapong and Lephalale, and employees at Matimba Power Station as well as local businesses within the area.

The combustion of coal leads to the formation of fine particles (particulate matter), which can remain in the air for weeks. According to the specialist Air Quality Report for this project, particulate matter can be linked to a range of serious respiratory and cardiovascular health problems, including premature mortality, aggravation of respiratory and cardiovascular disease, aggravated asthma, acute respiratory symptoms, chronic bronchitis, decreased lung function, and increased risk of myocardial infarction[21].

Various households and Marapong fall within the 8 km radius as depicted in Figure 75. The residential area Marapong is located directly north of the power station itself. The prevailing winds blow from a north-easterly direction and none of the residential areas are directly in the path of prevailing winds. Therefore residences have limited risk exposure to fly ash and particulate matter.

[21] United States Environmental Protection Agency. (USEPA). (1996). *Air Quality Criteria for Particulate Matter (Final Report, April 1996)*. Washington: USEPA, EPA 600/P-95/001.

The health of employees on site and members of surrounding communities can be affected by dust generated during construction activities of infrastructure such as conveyors and access roads. This will, however, be temporary and limited to the construction phase.

#### *8.9.1.2 Impact on Health due to Water Contamination*

The Sandloop River is located within the study area. Water contamination of the Sandloop River can occur either through stormwater run-off or seepage; this could affect water users downstream of the facility and negatively affect their health. However, the extent of surface water use by communities in the area is expected to be minimal, as the communities surrounding the facility (Marapong and Lephalale) are fully serviced by the municipality.

Seepage is mainly caused by the irrigation of the ash to suppress dust creation. The amount of seepage infiltration into groundwater resources will largely depend on the site geology and on the presence or absence of liners at the base of the facility prior to operation. According to the Geohydrological study, groundwater monitoring is conducted and the reports have shown that several parameters exceeded the limit in some of the boreholes, including Electrical Conductivity, sodium, chloride, sulphate, manganese and iron. The non-compliance of the water quality standards within the boreholes may be as a result of the seepage from the ADF.

Boreholes located further away from the existing ADF indicated a better water quality and therefore, it is likely that the potential contaminant plume associated with the ADF is localised.

#### *8.9.1.3 Impact on Health due to Consumption of Contaminated Food*

Air and water pollution, generated by the ADF, can have negative impacts on the health of domestic animals, livestock and game located within the study area. Pollutants can also enter the food chain via roots and fodder plants that are consumed by humans and livestock alike. This can lead to the food chain being contaminated, which in turn would lead to human health being affected through the consumption of contaminated meat or fresh produce.

#### *8.9.1.4 Impacts due to Changes in Land-Use*

Current land uses of surrounding areas that could be impacted on are the residential areas of Marapong and Lephalale, game farms, livestock farming and crop production. Through the proposed development, the current land-uses would increase and may result in a loss of livelihoods and income of local residences.

#### *8.9.1.5 Reduced Visibility due to Dust*

Dust generation will mainly be the result of construction activities related to conveyor lines, access roads, other associated infrastructure (such as site office, workshop, contractors yard, water supply lines and stormwater control dams and channels) and the disposal facility itself, but can also be as a result of wind storms. Dust generation will result in a reduced visibility in the study area.

Reduced visibility due to dust could result in vehicle and pedestrian accidents and traffic delays and disruption. However, this is not likely as Lephalale is not an area with high wind speeds, as reported in the Air Quality Assessment. Dust as a result of construction activities will also be of a temporary nature and limited to the construction phase.

#### *8.9.1.6 Financial Impacts*

Apart from financial losses that surrounding landowners or users may incur due to a change in land-use, dust and fly ash can also have financial implications due to the following:

- The need to install additional and/or artificial lighting due to reduced visibility;

- Commercial losses due to aesthetics;
- Increased maintenance and repairing costs for buildings;
- Impacts on sensitive industries in the area, such as bakeries;
- Decrease in property values; and
- Reduced growth of crops, due to altered soil composition.

#### *8.9.1.7 Noise*

The current sources of noise in the area are traffic, Matimba Power Station and its infrastructure, Medupi Power Station (which is still under construction) and Grootegeluk Coal Mine. Noise related to activities at the ADF include the conveyor belt transporting the ash from the power station to the disposal facility and operations at the facility, such as the dumping and spreading of the ash, as well as rehabilitation activities.

Noise during construction could be high, but would be temporary. Households and sensitive receptors within 1.4 km from the site would particularly be affected.

During operation of the ADF, households and sensitive receptors that fall within 1 km of the site would be exposed to noise levels that are higher than the ideal levels, 50 dBA during daytime and 40 dBA during night-time. According to the Noise Impact Assessment, noise levels within 500 m of the ashing operations are predicted to be 53.9 dBA and within 1 km, 46.9 dBA.

#### *8.9.1.8 Increase in Traffic Volumes*

An increase in traffic can lead to an increase in road accidents and congestion. The Traffic Impact Assessment found that the Matimba Power Station and the existing ADF do not generate notable operational traffic. The majority of users of the main road are employees of the power station and the Grootegeluk Mine.

During the construction phase additional traffic will be generated from construction activities such as the delivery of construction materials and equipment. Traffic during operation will be minimal, as ash is transported by conveyor belt and not by road.

#### *8.9.1.9 Employment Opportunities Created*

Matimba Power Station employs approximately 750 people. A limited number of employment opportunities will be created due to the proposed development. Ashing is also not labour intensive. If ashing activities cease, the operations at the power plant will be affected which may result in significant job losses.

#### *8.9.1.10 Tourism*

There are a number of game farms and lodges in the area where hunting takes place and which contributes to tourism in the area. The extent is unknown, but it is not expected to be considerable.

#### *8.9.1.11 Supply in Electricity*

Matimba Power Station supplies electricity to the country's grid. Should the plant not be able to dispose of ash, operations will cease which will have a negative impact on the country's electricity supply, which is already under pressure. This will in turn have negative impacts on regional and national businesses, living conditions and economic growth.

#### 8.9.1.12 Migration

The ADF is expected to only employ a limited number of staff for the construction and expansion of the facility. Therefore it is anticipated that only a limited number of migrants seeking employment will move in to the area.

#### 8.9.1.13 Visual Impacts / Aesthetic Quality

Residents within the study area will be visually and aesthetically impacted by the ADF as it will disrupt the natural aesthetical value. However concurrent rehabilitation will limit the extent and significance of the impact.

#### 8.9.1.14 Impact on Business in the Area

There are both formal and informal businesses present in the study area, especially in Lephalale and Marapong. Fly ash could impact on these businesses. Existing businesses could be affected by the need to increase maintenance and repairs due to fly ash and dust, as well as experiencing losses due to decreased aesthetic value, depending on the nature of the business. However, as stated previously, ash disposal sites that are used to capacity are rehabilitated immediately and if dust suppression measures are implemented successfully it should not have a significant impact on existing businesses in the area.

#### 8.9.1.15 HIV/AIDS

“Mainstreaming of HIV/AIDS, STIs and TB through the Environmental Impact Assessment (EIA) process” has been identified as an action to be implemented by all 10 Environmental Competent Authorities (National Department and the nine Provincial Departments), in terms of the National Strategic Plan 2012-2016, which commenced in 2012.

Inclusion of HIV/AIDS issues in the EIA process will be compulsory only for large infrastructure development projects, specifically the *State of the Nation Address 2012 Prioritised Development Projects* and other projects that form part of the *Projects of the Presidential Infrastructure Coordinating Commission* (*PICC*). Therefore it does not apply to the ADF, as very few (if any at all) employment opportunities will be created as a result of the project and therefore, no workforce will be affected. There are also no specific aspects related to this project that will result in a risk of increased spread of the diseases, such as a long-term change in the labour force in the area or migration of workers.

## 8.9.2 Summary of the Social Impact Assessment Findings

The following key social findings (Table 46) have been identified for SA1, SA2 and the linear infrastructure route.

**Table 46: Key social assessment findings**

| Impact | Site Alternative 1 | Site Alternative 2 | Linear Infrastructure Route | Phase |
|---|---|---|---|---|
| **Impact on Human Health due to Air Quality** | SA1 is located on land that is zoned "Industrial" and in the vicinity of other potentially disturbing features, such as the Grootegeluk Coal Mine and the two power stations (Matimba and Medupi). The current conveyor belt carrying the ash to the existing disposal site would continue as is, should the existing site be expanded, as proposed. Therefore residences of communities will have a limited risk expose to fly ash and particulate matter. | There are some homesteads, including labourer accommodation, on the four farms that constitute SA2 which may be exposed to airborne ash and coal fine particles. There is a risk that these communities will have health and respiratory issues due to pollutant exposure. | The proposed linear infrastructure route would run adjacent to the residential area of Marapong, or even through it, should the residential area expand, as has been the case in recent years when the area has experienced rapid growth. Therefore, the community of Marapong will be exposed to fly ash and particulate matter which will negatively affect the health of the community. | Construction and Operational Phases |
| **Impact on Human Health due to Water Contamination** | Surface and ground water contamination can occur either through stormwater run-off or seepage; this could affect water users downstream of the facility and negatively affect their health. | | | Construction and Operational Phases |
| **Impact on Health due to the Consumption of Contaminated Food** | Air and water pollution, generated by the ADF, can enter the food chain through absorption or consumption. This can lead to the food chain being contaminated, which in turn would lead to human health being affected through the consumption of contaminated meat or fresh produce. | | | Construction and Operational Phases |
| **Impacts in Changes to Land-Use** | It is uncertain whether concurrently rehabilitated land will be suitable for grazing and whether the presence of the ADF may lead to the permanent sterilisation of soil. However, according to the Agriculture Potential study the proposed activity will not impact on cultivated areas as the land is owned by Eskom. In addition, the agricultural potential of the area has been found to be low. Should agricultural activities, including game farming, be affected, it could lead to a loss of income to | There are currently two game farms located on SA2 which will be affected and land use changes will occur. Income generation will cease which will significantly affect the livelihoods of the game farmers.<br><br>This impact will be long term however will ultimately not be permanent, as the used ash disposal sites are rehabilitated and will therefore no longer pose a threat to communities residing in the vicinity in the future. | Land-use changes will occur along the linear infrastructure route. Two of the three farms through which the linear infrastructure route would traverse, are owned by Exxaro Coal. These farms (Nelsonskop 464 LQ and Appelvlakte 448 LQ) currently are game farmers, although it is understood that hunting no longer takes place on these sections and it is not utilised for any tourism related activities. The third farm, Grootestryd 465 LQ, has three owners for the various portions namely | Pre-Construction, Construction and Operational Phases |

| Impact | Site Alternative 1 | Site Alternative 2 | Linear Infrastructure Route | Phase |
|---|---|---|---|---|
| | farmers and landowners. | | Eskom, Exxaro and the Lephalale Local Municipality. The Matimba Power Station and the residential area of Marapong are located on Farm Grootestryd 465 LQ.<br><br>The proposed linear infrastructure route would change current land uses which would have significant impacts on livelihoods and incomes of residences and farmers.<br><br>Expansion potential of the residential area of Marapong might become limited due to its proximity to the proposed linear infrastructure route. | |
| **Reduced Visibility due to Dust** | Dust generation will occur during the construction phase and will reduce visibility which may lead to increased traffic and pedestrian accidents. | | The proposed linear infrastructure route will run adjacent to the residential area of Marapong. Marapong's close proximity to the linear infrastructure route, as well as the fact that Marapong is located downwind from SA2, could reduce the visibility of the residents of Marapong due to dust generation during the construction phase. | Construction Phase |
| **Financial Impacts** | Financial losses will occur due to changes in land-use. An increase in financial expenditure for local residences and farmers will occur due to the potential generation of fly ash and dust. | | | Construction Phase |
| **Noise** | Noise during construction could be high, but would be temporary. Households and sensitive receptors within 1.4 km from the site would particularly be affected.<br><br>During operation of the ADF, households and sensitive receptors that fall within 1 km of the site would be exposed to noise levels that are higher than the ideal levels, 50dBA during daytime and 40 dBA during night-time. | | | Construction and Operational Phases |
| **Increased in Traffic Volumes** | During the construction phase additional traffic will be generated from construction activities such as the delivery of construction materials and equipment; this impact will be short-term. Traffic during operation will be minimal, as ash is transport by conveyor belt and not by road. | | | Construction and Operational Phases |
| **Employment Opportunities Created** | By extending the ADF on SA1, it is not anticipated that a significant number of employment opportunities will be created, as such a facility is already in operation | A limited number of jobs will be created due to the proposed development. Ashing also does not require a large labour force. | | Construction and Operational Phases |

| Impact | Site Alternative 1 | Site Alternative 2 | Linear Infrastructure Route | Phase |
|---|---|---|---|---|
| | and rehabilitation occurs as soon as its maximum capacity has been reached.<br><br>Ashing also does not require a large labour force.<br><br>If ashing activities cease, the operations at the power plant will be affected which may result in significant job losses. | | | |
| **Tourism** | Currently no tourism is practiced on SA1. Therefore there are no associated tourism impacts. | The farms that constitute SA2 are game farms and it has been confirmed that tourists visit these farms to hunt game. Hunting activities will cease if SA2 is approved, however there are several other game farms in the area that will still be able to accommodate hunters. Therefore it is not anticipated that the activity will have a significant impact on tourism in the general area. | Hunting as a tourism activity is not practiced along the linear infrastructure route. | Pre-Construction Phase |
| **Supply in Electricity** | Should the plant not be able to dispose of ash, operations will cease which will have a negative impact on the country's electricity supply, which is already under pressure. This will in turn have negative impacts on regional and national businesses, living conditions and economic growth. | | | Operational Phase |
| **Migration** | As the creation of employment opportunities will not be significant, there will be limited (if any) migration of work force if site alternative one is approved for the extension of the current ADF. | Should SA2 be approved a minimal number of temporary employment opportunities would be created for the construction of the disposal facility and the linear infrastructure route. Migration of work force will occur however to a limited extent. | | Construction Phase |
| **Visual Impacts / Aesthetic Quality** | It will be impossible to avoid any visual impact by extending the ADF at SA1. However, the significance of potential visual impacts will depend on whether the extended ADF will be visible from areas where it previously has not been visible, especially where tourism activities such as hunting have been occurring. | SA2 and the associated linear infrastructure route consists of game farms and should the proposed ADF be located on this site, it will heavily impact on the visual characteristics of the site, which currently is natural and unspoilt bushveld. | | Construction and Operational Phases |

| Impact | Site Alternative 1 | Site Alternative 2 | Linear Infrastructure Route | Phase |
|---|---|---|---|---|
| | There is however a strong existing industrial element in the surrounding area of SA1, consisting of Matimba Power Station, Medupi Power Station, Grootegeluk Coal Mine and Matimba's existing ADF. | | | |
| **Impacts on Businesses in the Area** | Fly ash could impact on these businesses, especially sensitive receptors. Existing businesses could be affected by the need to increase maintenance and repairs due to fly ash and dust, as well as experiencing losses due to decreased aesthetic value, depending on the nature of the business. | | The new linear infrastructure route would be located adjacent to Marapong. Due to Marapong's close proximity to the proposed linear infrastructure route, businesses in Marapong would be more at risk to fly ash and dust, than with the existing conveyor belt of SA1. | Construction and Operational Phases |
| **HIV/AIDS** | There are also no specific aspects related to this project that will result in a risk of increased spread of the diseases, such as a long-term change in the labour force in the area or migration of workers. | | | Construction and Operational Phases |

# 8.10 Air Quality

This section outlines the potential impacts associated with the expansion/continuation of the existing ADF (SA1) and the establishment of a new ADF (SA2). To clearly detail the potential impacts in ambient ground level concentrations, only operational emissions are included in the final model runs. The construction and decommissioning phases of the operation can only qualitatively be addressed due to the variability and unpredictable nature of the construction operations on site.

## 8.10.1 Potential Impacts

### *8.10.1.1 Construction Phase*

During the construction phase it is expected that, the main sources of impact will be associated with the construction of infrastructure such as roads, pollution control dams, stormwater channels etc. These predicted impacts cannot be directly quantified, primarily due to the lack of detailed information related to scheduling and positioning of construction related activities. Instead a qualitative description of the impacts has been provided and this involves the identification of possible sources of emissions and the provision of details related to their impacts.

Construction is commonly of a temporary nature with a definite beginning and end. Construction usually consists of a series of different operations, each with its own duration and potential for dust generation. Dust emission will vary from day to day depending on the phase of construction, the level of activity, and the prevailing meteorological conditions[22].

The following possible sources of fugitive dust have been identified as activities which could potentially generate dust during construction operations at the site:

[22] United States Environmental Protection Agency. (USEPA). (1996). *Air Quality Criteria for Particulate Matter (Final Report, April 1996)*. Washington: USEPA, EPA 600/P-95/001.

- Construction of the proposed linear infrastructure route;
- Grading of unpaved roads; and
- Ash disposal site preparation.

Access roads are typically constructed by the removal of overlying topsoil, whereby the exposed surface is graded to provide a smooth compacted surface for vehicles to drive on. Material removed is often stored in temporary piles close to the road edge, which allows for easy access once the road is no longer in use, whereby the material stored in these piles can be re-covered for rehabilitation purposes. Often however, these unused haul roads are left as is in the event that sections of them could be reused at a later stage.

As with the clearing and grading for access roads, the proposed linear infrastructure route requires clearing and grading for construction to be undertaken. This clearing is usually undertaken along the entire route leaving exposed soils vulnerable to wind erosion, as well as acting as a temporary roadway for vehicles.

A large amount of dust emissions are generated by vehicle traffic over these temporary unpaved roads[23]. Substantial secondary emissions may be emitted from material moved out from the construction/clearing area during grading and deposited adjacent to roads[24]. Passing traffic can thus re-suspend the deposited material.

The following components of the environment may be impacted upon during the construction phase:

- Ambient air quality;
- Local residents and neighbouring communities;
- Employees;
- The aesthetic environment; and
- Possibly fauna and flora.

The impact on air quality and air pollution of fugitive dust is dependent on the quantity and drift potential of the dust particles[25]. Large particles settle out near the source causing a local nuisance problem. Fine particles can be dispersed over much greater distances. Fugitive dust may have significant adverse impacts such as reduced visibility, soiling of buildings and materials, reduced growth and production in vegetation and may affect sensitive areas and aesthetics. Fugitive dust can also adversely affect human health. It is important to note that impacts will be of a temporary nature, only occurring during the construction period.

#### *8.10.1.2 Operational Phase*

Dispersion modelling simulations were undertaken using the US-EPA approved Aermod Dispersion Model to determine the potential air quality impacts associated with the expansion of the existing ADF on SA1 or the establishment of a new facility on SA. These impacts are reflected as isopleths plots below.

The isopleth plots reflect the gridded contours with zones of impact at various distances from the contributing sources. The patterns generated by the contours are representative of the maximum predicted ground level concentrations for the averaging period being represented. These predicted concentrations are for unmitigated conditions (i.e. worst case scenario) and therefore with proper dust management, it is expected that these results will decrease.

A maximum daily average PM10 concentration of 203 µg/m$^3$ is predicted for SA1 which exceeds the current National daily average standard of 120 µg/m³ (Figure 76). However, this is still within the site

[23] United States Environmental Protection Agency. (USEPA). (1996). *Air Quality Criteria for Particulate Matter (Final Report, April 1996)*. Washington: USEPA, EPA 600/P-95/001.
[24] *Ibid* Footnote 23
[25] *Ibid* Footnote 23.

boundary, and therefore with mitigation is unlikely to have an impact on the surrounding receptors. An annual average concentration of 58 µg/m$^3$ is predicted, which exceeds the current National annual average standard of 50 µg/m$^3$.

A maximum predicted daily average PM10 concentration of 161 µg/m$^3$ for SA2, (including the conveyor) exceeds the current National daily average standard of 120 µg/m³ (Figure 77). Due to the location of this site, and it being a new location for the ADF, there is the potential for the particulate matter to impact on the nearby Grootegeluk Coal Mine. The annual averaging concentration for this site is 71 µg/m$^3$, which is above the current National annual average standard of 50 µg/m$^3$.

Individually, the conveyor system will produce 7.23 µg/m³ and 1.47 µg/m³ of particulate matter for daily and annual averaging periods respectively. This will result in a very small (2.3%) addition to the overall particulate loading of the receiving environment.

Cumulative impacts on the Matimba Power Station and Grootegeluk Coal Mine have also been assessed, using information provided by Eskom, and US-EPA emission factors, with a maximum daily average of 305 µg/m³ predicted for SA1 and 315 µg/m³ predicted for SA2. An annual average of 97 µg/m³, and 104 µg/m³ was predicted for SA1 and SA2, respectively.

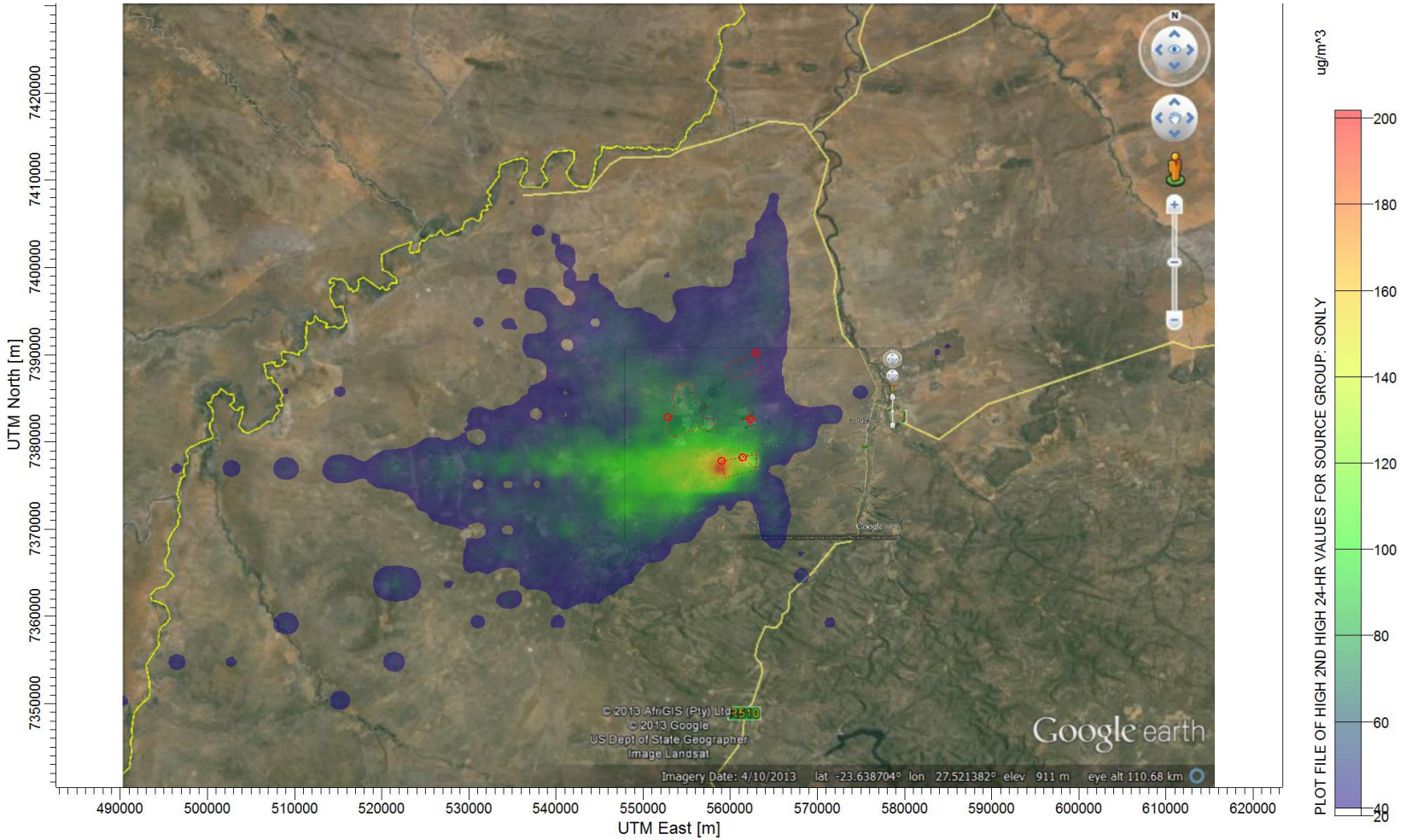


**Figure 76: Daily average PM10 concentrations at Site Alternative 1**

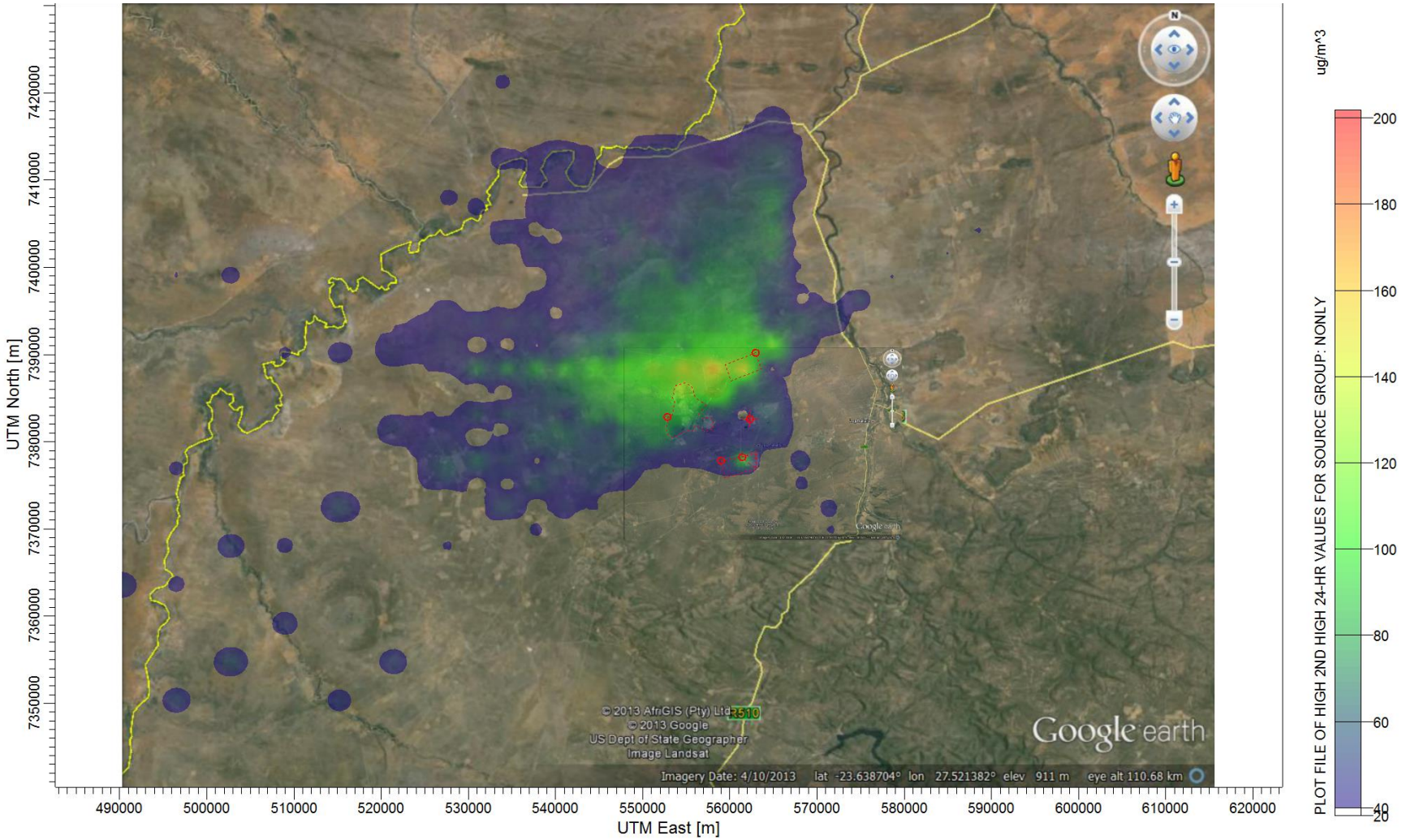


**Figure 77: Daily average PM10 concentrations at Site Alternative 2 including linear infrastructure route**

#### 8.10.1.3 Decommissioning Phase

Possible sources of fugitive dust emission during the closure and post-closure phase include:

- Smoothing of stockpiles by bulldozer;
- Grading of sites;
- Transport and dumping of overburden for filling;
- Infrastructure demolition;
- Infrastructure rubble piling;
- Transport and dumping of building rubble;
- Transport and dumping of topsoil; and
- Preparation of soil for re-vegetation – ploughing and addition of fertiliser, compost etc.

Exposed soil is often prone to erosion by water. The erodability of soil depends on the amount of rainfall and its intensity, soil type and structure, slope of the terrain and the amount of vegetation cover[26]. Re-vegetation of exposed areas for long-term dust and water erosion control is commonly used and is the most cost-effective option. Plant roots bind the soil, and vegetation cover breaks the impact of falling raindrops, thus preventing wind and water erosion.

### 8.10.2 Summary of Air Quality Impact Assessment Findings

Based on the predicted model results, SA1 has higher predicted daily particulate matter concentrations, for off-site (environmental) impacts, annually and cumulatively this site produces lower concentrations than SA2. Long-term exposure is the main concern for dust and particulate matter exposure, and therefore a lower annual concentration is preferred to a lower daily concentration. Furthermore, potential emissions would be generated from the construction and operation of a second linear infrastructure route compared to SA1 that would be able to utilise the existing conveyor system.

## 8.11 Visual

It is important to understand how the ADF will appear if either expanded at its current location SA1) or if a new one is constructed. In this context the current visual profile of the existing ADF is examined, and thus the likely visual impacts associated with the ADF at a new location (SA2) are able to be explored.

### 8.11.1 Profile of the Existing ADF

Like any ADF, the Matimba ADF on the Zwartwater Property is a large man-made feature. Importantly in a visual context certain parts of the ADF have been rehabilitated, i.e. those parts of the facility where the first ashing activities occurred. The northern and eastern sides of the ADF have been vegetated, but the western face is not rehabilitated as ashing continues to extend the ADF to the west. The differentiation of the ADF in terms of a rehabilitated aspect as well as an active face is important in a visual context as these are associated with different degrees of visual intrusion and thus visual impact.

The rehabilitation of the ADF has given it a relatively natural appearance when viewed from the east. When viewed from the Matimba and Medupi access road heading westwards out of Onverwacht, one

[26] Brady, N.C. (1974). Organic matter of mineral soils. In: Buckman, H. O. and Brady N. C. (ed.). *The nature and properties of soils*. Macmillan Publishing Co., New York, p. 137-163.

gets the impression of natural rising ground, such as a hill. Viewed in this way, the ADF may not even be discerned as an unnatural feature by people who are not aware of its existence. Viewed from the north (Figure 78), the ADF is more discernible as an unnatural feature due to its tabular shape and flat top, however the presence of trees and other vegetation cover on its sides provide it with some form of natural character. The presence of vegetation on the ADF assists greatly in lowering the visual intrusion factor associated with it, in particular in a context of the presence of patches of residual natural woodland in the immediately adjacent area, allowing it to be less intrusive than if it was not vegetated in this way.

**Figure 78: ADF as viewed from the north**

Viewed from the south and west (Figure 79) the active face of the ADF and the conveyor belt are visible and are prominent, providing a visual focal point in the landscape, contrasting with the surrounding natural vegetation. The prominence of the ADF was noted to be enhanced by ash being blown off the active face of the facility during windy weather, creating a 'trail' of dust off the face. The pale grey colour of the ash on the active face contrasts with the surrounding vegetation and is more visible than the rehabilitated parts of the facility. The visual intrusiveness of the ADF as viewed from the south is heightened by the presence of an 'active' non-rehabilitated face across much of the southern side of the ADF.

**Figure 79: Southern face of the ADF as viewed from a high point to the south**

### 8.11.2 Key Observation Locations

Due to access limitations, not all sensitive receptor locations have been able to be assessed using the visual contract methodology. As a result a number of key observation locations have been selected to represent the typical views towards the ADF from a representative set of locations.

The list below indicates the following key observation locations for which the visual contrast rating has been undertaken:

- Manketti Reserve Manager's House;
- Droogeheuvel Farmstead; and
- Marapong (northern edge of Marapong).

It is important to note that the Ganzepan Homestead has not been assessed as the household and its immediate environs (farm compound) fall within the footprint of the ADF if it was developed on SA2, therefore in practical terms it is likely that the farmstead would cease to be used as a homestead, thus ceasing to be a sensitive receptor location.

A number of other receptor locations were considered for assessment using the visual contrast rating methodology however, at these locations the proposed facility would not be visible due to factors such as the presence of vegetation that would prevent the ADF from being able to be viewed from that location. Table 47 below lists these locations and the reason for the ADF not being able to be viewed. It should be noted that no visual impact would be created by the proposed ADF at these particular locations.

**Table 47: Receptor Locations which would not be able to View the ADF**

| Receptor Location | Reasons for proposed ADF not able to be viewed |
|---|---|
| **Manketti Lodge** | ▪ The lodge is located very close to the Matimba Power Station and the massive structures of the power station are prominent and were able to be viewed through the flanking trees. The presence of the power station in the immediate vicinity engenders the immediate vicinity with a strong industrial component to its visual character.<br>▪ Tall trees flank the lodge immediately adjacent on the northern and north-eastern side, thus blocking any potential views to the facility SA2. Intervening vegetation between the lodge location and the proposed ADF site (to the north-east of the lodge) would also be likely to screen the facility from view. |
| **Nel Family Homestead** | ▪ The house is surrounded on its western, southern and northern side by dense vegetation that precludes any views towards the proposed ADF.<br>▪ In addition the homestead is located close to the valley bottom of the Sandloop River, and its topographical location close to a valley bottom would hinder any potential views to the proposed facility. |
| **Eendracht Farmstead** | ▪ The existing ADF cannot be viewed from the farmstead due to intervening trees in the area between the farmstead and the Matimba / Medupi access road. Thus any extension to the existing facility will not be able to be viewed.<br>▪ The farmstead is also located very close to the Matimba Power Station, thus there is a strong industrial component to its visual character. |

It should be noted that no receptor locations that fall within the 5 km radius of SA1 have been rated using the visual contrast rating methodology. This is due to the absence of receptors located close to the ADF site and the screening effect of vegetation between the ADF and more distant receptor locations.

#### *8.11.2.1 Tolerance Levels relating to Degree of Acceptable Change*

The study area has a mixed visual character, with the hub of the town and the power stations having an urban / industrial visual character with some natural aspects and the outlying areas having a more natural visual character. In this context of differing visual and aesthetic qualities and differing degrees of change to a natural visual baseline there are likely to be differing tolerance levels to change within the landscape. In the parts of the study area that have retained their natural characteristics, the nature of certain types of land use practiced and the likely value placed in the natural characteristics of such a landscape entail that emphasis would thus likely to be on preserving the natural character of the landscape, in which human objects have spatially limited and non-intensive visual characteristics and prominence.

Accordingly, the associated objective would be to create as little visual change and contrast to the landscape as possible, by limiting the degree of visual intrusion caused by a development such as the proposed ADF. Put in another way, the objective would be to only allow development that did not degrade the visual context. In areas with a much more visually altered baseline (i.e. the dominant presence of industrial infrastructure of massive scale and extent), the tolerance level for further development and visual change of the landscape is likely to be much higher. The degree of visual intrusion created by the proposed ADF is thus important in these differing visual contexts. Accordingly the following visual objectives, and thus tolerance levels have been identified for the differing areas of visual character (Table 48):

**Table 48: Visual change objective and tolerance level for the study area**

| Landscape Context | Visual Change Objective | Tolerance Level |
|---|---|---|
| **Rural environment – largely natural landscapes** | Maintain the natural character as far as possible and limit intrusion of large-scale human structural features | Low degree of change in visual contrast permitted |
| **Urban / Industrial environment** | Allow developments similar in visual character to existing infrastructure, clustering infrastructure where possible | Medium degree or no change in visual contrast (from urban-industrial baseline) permitted |

The above visual change objectives are a very important component of the visual contrast assessment, and the tolerance levels allow a judgement to be made of whether the degree of visual contrast created by the proposed development (and thus the likely degree intrusion of the development) is acceptable in terms of its visual setting.

#### *8.11.2.2 Discussion and Implications for Visual Impact*

- **Site Alternative 1**

Fewer static receptor locations exist within the 5 km radius of SA1. The Eendracht farmstead is shielded from viewing the existing ADF by intervening woodland vegetation. The Kuipersbult farmstead is likely to also be shielded from viewing the facility by intervening bushveld vegetation on the property to the east. Similarly woodland vegetation between the Manketti Lodge and the ADF entails that there is no view of the existing facility from this location. In the case of the southern parts of Marapong the enormous bulk of the Matimba Power Station shields the ADF from view.

To the east of the existing ADF, the Onverwacht Township is likely to expand to the west of its current boundary onto the Altoostyd property that lies immediately to the east. It is not certain whether a buffer of natural vegetation (that currently covers the Altoostyd site) will be maintained on its western edge. However, as this would be a new development, the existing ADF would form part of the baseline visual

environment. In addition, the eastern face of the ADF (the face that would be viewed by the new settlement) is already rehabilitated with vegetation, and thus this extension of the township would not be subject to any visual impacts associated with the expansion of the ashing facility to the west of the existing ADF.

The Wellington property located immediately to the south of the existing ADF is undeveloped and may be utilised for hunting, but this has not been confirmed. Thus, the visual sensitivity of hunting activities may apply here too however, an important factor is that the existing ADF forms part of the current visual baseline and views to the north from the property (where not screened by vegetation) are currently dominated by the active face of the ADF and the southern side which has not yet been fully rehabilitated. The screening of the ADF by vegetation on this property is an important factor, as not many parts of the property are likely to be exposed to views of the ADF. In this context, it is likely that the expansion of the ADF to the west would be unlikely to be perceived as a significant visual impact.

- **Site Alternative 2**

Two receptor locations (Droogeheuvel Farmstead and the Ganzepan Homestead) would be subject to a potential high degree of visual impact due to the visual contrast created by the proposed ADF and due to its high degree of visibility within the view from these locations. In the case of the Ganzepan Homestead, the immediate proximity of the ADF to the receptor location would entail that the visual environment in the surrounding area would be drastically altered through the development of a massive new structure across the arc of the southern horizon that due to its height would be completely visually dominant[27]. In the case of the Droogeheuvel Farmstead, the presence of a large area that has been cleared of the natural woodland vegetation immediately adjacent to the farmstead would allow the ADF to be highly visible in the north-western arc of view from the farmstead.

It is likely that unless the Ganzepan and Droogeheuvel properties in their entirety are purchased as part of the development of the ashing facility on SA2 (in which case these would cease to exist as privately owned receptor locations, instead being owned by Eskom), the development of the ADF on SA2 would cause significant and irreversible visual impacts at these two locations. Capital expenditure in the development of both homesteads is evident, and although they do occur in a wider context of a significant presence of industrial infrastructure, both locations are currently largely natural in visual context. The development of the ADF in close proximity to these locations is likely to represent an anachronism, altering the visual environment and sense of place of the two locations, and arguably in so doing diminishing the attractiveness of these locations as places of residence or as hunting accommodation. As such it is important to note that the visual impacts at these locations would be very difficult, if not impossible to mitigate or reduce to acceptable levels.

For the other receptors locations within the 5 km radius of SA2, a number of factors entail that these locations would not be subject to significant visual impacts. A combination of the distance of the receptor locations away from the ADF site and vegetation or other structures that would shield the receptor location from views of the facility entail that the degree of visual contrast likely to be created by the facility would be minimal and thus there would be negligible visual intrusion associated with the ADF at these static locations.

[27] In reality, the receptor location may be purchased as part of the purchase of land for the ADF, and would thus cease to be privately owned, being either used as part of a new ashing facility, or being destroyed to make way for the facility . However an assumption cannot be made regarding whether this would be the case, as this may not be acceptable to the current owners, and as such a 'worst case' scenario has been investigated.

Away from the static locations, the land uses on the properties surrounding SA2 need to be examined to determine sensitivity to visual intrusion associated with the ADF. The Gelykebult, Vooruit and Appelvlakte properties are all owned by Exxaro Coal and are run as the Manketti Nature Reserve. Although hunting (bow hunting) has previously been undertaken on the property, hunting no longer occurs, but there is a possibility that it would be conducted in the future (Marius Fuls, *pers. comm*.). The presence of certain mega-herbivore species and a wide variety of general game on the property lends the reserve to be developed to offer certain eco-tourism activities such as game viewing or guided walks. Hunting has previously been undertaken on the Droogeheuvel property (Louis Grobler, *pers. comm*.), with accommodation for hunters having been established. Although currently not taking place on the farm, hunting could be a viable land use activity on the property in the future. The status of hunting on the Ganzepan property is not known, however the presence of electrified game fences on its boundary suggests that the property is stocked with game and that commercial hunting is likely to occur.

It can be debated whether hunting is an activity that is visually sensitive. Hunting does not depend on aesthetics as such, however in a context of commercial hunting activities, value is placed on the aesthetic appeal and 'the sense of place' of the area in which hunting takes place, especially as hunting is marketed to overseas clients as an 'African bush experience'. The presence of visibly intrusive and noisy industrial infrastructure would thus likely be perceived as detracting from, or degrading the 'bush hunting experience', especially in a context where hunting guests are accommodated on the property. The proximity of the proposed SA2 to the above mentioned properties on which hunting is / may be practiced in the future is a significant factor. Much of the area of these properties is located closer to this site than the static receptor locations, and thus the ADF would be more visually prominent and thus visually intrusive (although the tall woodland vegetation will continue to perform an effective screening location). The potential for hunting (and potential future eco-tourism-related activities on the Manketti Reserve) to be subjected to visual impacts associated with the ADF on SA2 exists.

## 8.11.3 Potential Impacts

### *8.11.3.1 Potential Visual Impacts associated with the Different Development Scenarios*

- **Expansion of the existing facility**
  Expansion of the existing activity would be likely to constitute an extension of the existing visual status quo, although due to the recently proposed height expansion (piggy-backing) of the existing ash dump, the visual profile of the ADF would change. The disposal of ash is proposed to continue on the active western face into the currently undeveloped areas on the remainder of the site, with the ash dump growing laterally in a westward direction. However in order to accommodate the required airspace required at the ADF, the height of the current ADF would be increased with ash being disposed on top of the current crest of the ash dump. This would steadily raise the total height of the facility and would make it increasingly visible as a large object in the landscape.

  In order to compare the area of visual intrusion of the proposed facility as compared to the existing facility, a viewshed (i.e. area in which an object is visible) has been generated for the existing ADF, and a viewshed has been generated for the proposed facility at its maximum height when fully developed – i.e. 90 m. The viewsheds are indicated in Figure 80 and Figure 81. It is important to note that these viewsheds represent the area from which at least a portion of the ash dump / ADF is (would be) visible and does not represent the area from which the entire extent of the facility would be visible.

  Analysis of Figure 80 and Figure 81 below indicate that the existing ADF is visible from a wide area within its radius. Most of the receptors to the north of the existing facility are located within the

viewshed of the facility. The proposed facility at SA1 would be visible from a wider area in the radius of the facility. Effectively as the existing facility is already visible from a wide area in the surrounds of the existing facility, the degree of change of area (extent) of visibility is not very marked. However the major difference will be in terms of the likely extent of the facility that will be visible from the surrounding area, with a greater degree of the full 'body' of the extended facility being visible from the surrounds. Screening features within the landscape such as existing structures and vegetation in particular will screen the expended (heightened) facility or parts of it from view at the receptor locations.

As importantly as the increased visual profile of the facility, the relative degree of visual intrusion of the expanded facility needs to be considered based on the altered appearance of the feature. It should be noted that as cells within the ash disposal facility are completed the sides and crest of the completed cells, as well as those parts of the ash disposal facility that are extending into the undeveloped part of the site (falling behind the active face) would be rehabilitated, providing an increasing portion of the dump with a more 'natural' appearance. Over the operational lifespan of the dump, it would be elongated (westwards) as viewed from the south and the north, but a portion of it would also be raised.

The active face would extend closer to any receptors to the west, but the combination of a very low density of receptors in this area and the screening function of natural vegetation would be likely to entail that this is not a factor. The part of the surrounding area that would arguably be subject to the greatest degree of impact would be from the property to the south, the Wellington 519 LQ property. At the end of its operational lifespan the ash dump would extend the full east-west extent on the Wellington property, and would be prominent if viewed from cleared areas or areas of greater relief on the property. It is important to note that the gradual rehabilitation of the ash dump (especially if the dump was designed and landscaped to have a more natural appearance) would reduce the visual intrusion factor of the ADF, and the greatest visual intrusion factor would be during the operational period of the dump.

It is important to note that the conveyor belt that transports ash from the Matimba Power Station to the ash dump would not be likely to be moved, rather extended into the new ashing area and thus there will be no new visual impact associated with this feature.

In summary it is important to note that the further expansion of the ash dump on the current site would constitute a consolidation of existing visual impacts associated with the current dump, and importantly would not constitute a new visual impact.

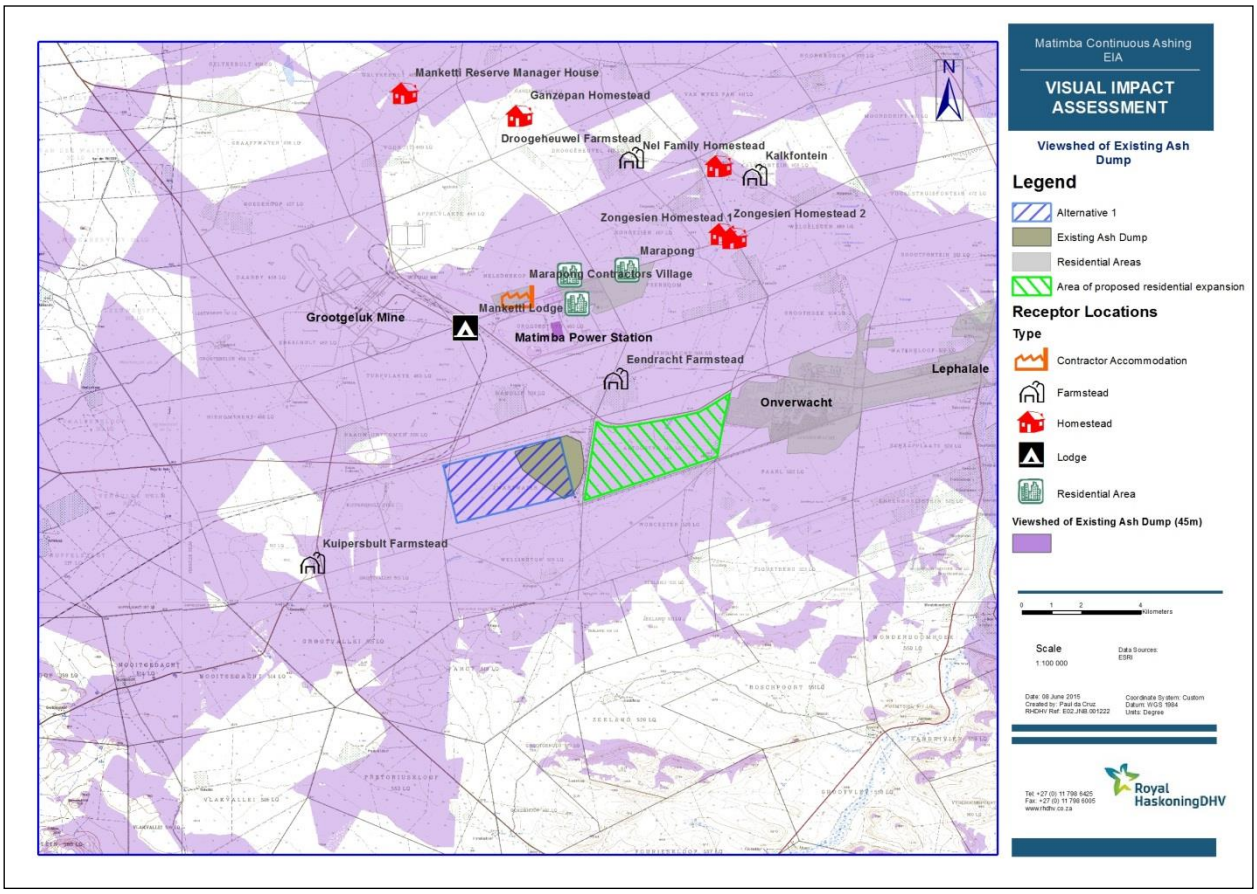


**Figure 80: Viewshed of the existing ADF**

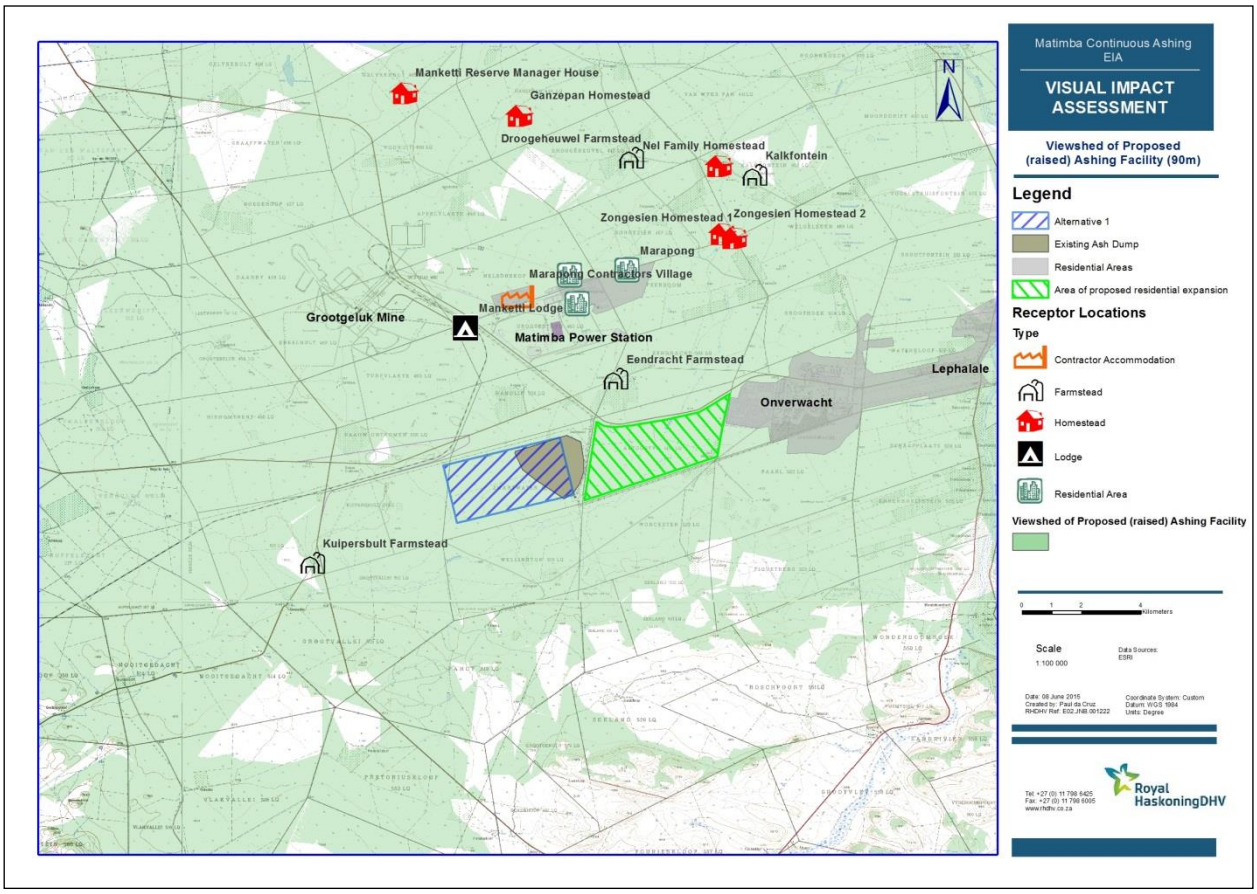


**Figure 81: Viewshed of the proposed ADF at SA1 at full development height (90 m above average ground level)**

- **Creation of a new facility**

  If the continuous ashing was developed on SA2, a completely new ADF would need to be developed. This would be in the context of the SA2, on which there is no existing infrastructure except for an existing power line and farming infrastructure such as fencing. The site and its surrounds are highly natural in character, although it is located not too distant (approx. 2 km) from the Grootegeluk Mine.

  The creation of a new facility would involve the clearing of vegetation to form a base onto which the ash would be deposited. It should be noted that all vegetation in portions of the footprint of the ADF will be cleared prior to the ashing operations commencing in order to install the lining under the ADF. A portion of the area will be cleared to cater for 3 – 4 conveyor shifts. Once the ADF becomes operational, an ash dump, of a maximum height of 85 m from ground level would form on the site. The height of this facility and the grey colour of the ash would make it highly visible in the context of the existing natural surroundings. This ADF would create a visual contrast as explained below.

  In addition to the ADF, equipment associated with the ashing would be brought to the site, which would be visible at the height of the top of the ADF. A conveyor belt transporting ash from the Matimba Power Station to the ADF would also be constructed, as explored below. This conveyor belt would be raised above the ground.

The infrastructure associated with the new ADF (if developed on the new site) would be similar to that associated with the existing facility and would include:

- Conveyors,
- Stacker and Spreader machines,
- Mobile equipment,
- Pollution control dams,
- Stormwater channels and berms, and
- Gravel road access roads.

Due to screening effect of the bushveld vegetation surrounding the new facility, certain of this infrastructure located at ground level, such as pollution control dams and local access roads will be unlikely to be visually prominent or even visible from surrounding receptor locations. The infrastructure used for ash disposal that would be located on top of the developing ADF would be more visually prominent as part of the ADF itself.

Rehabilitation of the new facility would occur in a similar way to the existing facility, and thus parts of the ADF on which ashing has been completed would be rehabilitated while ash disposal was proceeding in other parts of the footprint. As no information has been provided as to the part of the site or the part of the ADF footprint on which ashing would commence, it is not possible to determine the direction in which ash disposal would proceed and which aspect of the ADF would be rehabilitated first.

The Droogeheuvel Farmstead would be subject to a potential high degree of visual impact due to the visual contrast created by the proposed ADF and due to its high degree of visibility within the view from this location. In the case of the Ganzepan Homestead, a high degree of contrast would have been likely to have been created due to the immediate proximity of the ash dump to the receptor location, but in practical terms it is expected that this receptor location would cease to be an inhabited homestead. In the case of the Droogeheuvel Farmstead, the presence of a large area that has been cleared of the natural woodland vegetation immediately adjacent to the farmstead would allow the ash dump to be highly visible in the north-western arc of view from the farmstead.

#### *8.11.3.2 Visual Impact associated with the Development of a New Linear Infrastructure Route to Site Alternative 2*

An existing conveyor belt that currently transports ash from the Matimba Power Station to the existing ashing facility would continue to be used for such a purpose if SA1 was chosen as the site for the further ashing. However as SA2 is a greenfields site, a new road and conveyor belt (linear infrastructure route) would have to be developed in order to transport ash from the Matimba Power Station to the new ashing facility.

The conveyor belt will be raised above the ground, and as such would be a visually prominent structure, due to its height and linear nature. The proposed alignment of the linear infrastructure to SA2 in relation to differing areas of visual character and in relation to the receptor locations in the vicinity of the site is indicated in Figure 82 . The southern-most part of the alignment of the linear infrastructure route to the north of the power station would traverse areas of industrial and urban visual character respectively. The linear infrastructure route would run in close proximity to the receptor locations of the Marapong Contractors Village and the north-western parts of Marapong. In spite of the close proximity of the linear infrastructure route to these locations, their location very close to the Matimba Power Station and the associated alteration of the visual character from a natural base to an urban area in a wider industrial setting entails that these locations are highly unlikely to be sensitive to the development of further

infrastructure on their northern boundary, and the development of the linear infrastructure route in these areas is unlikely to be perceived to be a visual intrusion in this visual context.

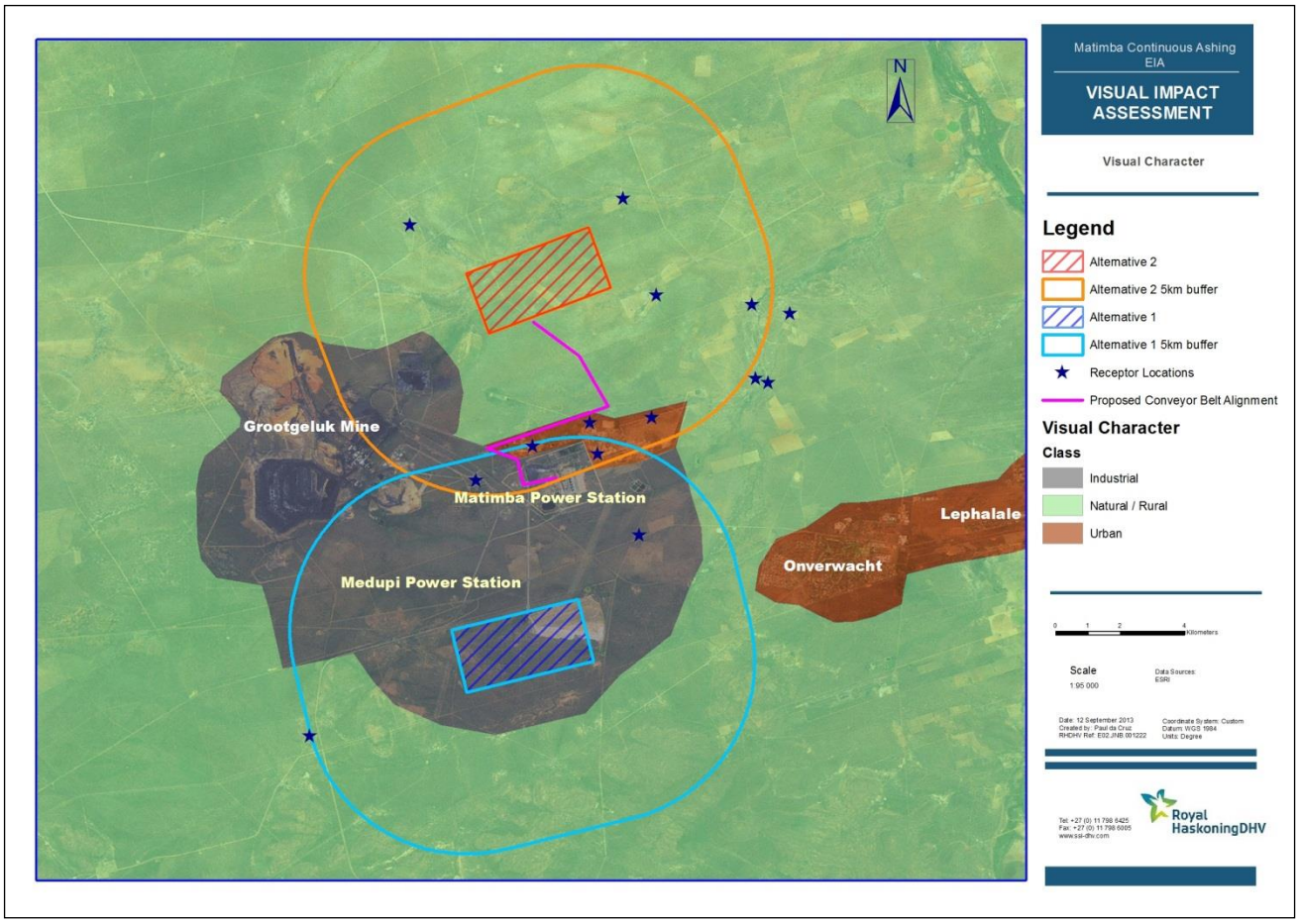


**Figure 82: Areas of differing visual character in the study area**

To the north of Marapong, the linear infrastructure route would run along a cadastral boundary between the Nelsonskop and Zongezien properties and between the Appelvlakte and Droogeheuvel properties to the north, and in so doing would traverse an area of more natural visual character. It is important to note, however, that there are no stationary receptor locations located in close proximity to the proposed alignment of the linear infrastructure route in this area. The closest stationary receptor in this area, the Droogehewel Farmstead, would be located over a 3 km distance from the alignment, and as such would be unlikely to be visually affected. The ash facility would be developed between the Ganzepan Homestead and the linear infrastructure route and as such the linear infrastructure route would not be visible from that receptor location. The linear infrastructure route would run in proximity to areas of the above-mentioned properties on which hunting is practiced (or on which hunting could be practiced in the future), and may constitute a visual intrusion in this context. However the linear infrastructure route would be aligned along the boundary of the properties, not bisecting any of them. Additionally it would be constructed along with the new ashing facility, and although the ashing facility would initially be limited in extent, it would over time become more visually prominent than the linear infrastructure route, resulting in the transformation of the visual environment in the surrounds of the ashing facility.

### 8.11.4 Summary of the Visual Assessment Findings

SA2 would be developed on a greenfields site, while the development of SA1 entails the expansion of an existing feature. SA2 would thus be associated with a new visual intrusion in an area that is currently subject to a much lesser degree of visual impact. Furthermore, SA2 site is located in an area with a natural visual character, whereas SA1 is located in the middle of an industrial hub. Thus visual impacts associated with SA2 would be much more significant in the context of the setting, and would be much more likely to be perceived as a significant visual impact due to this natural setting.

Due to the existing and ongoing presence of rehabilitation of the existing ADF, rehabilitation of the parts of the ADF on which ashing has been completed will be able to continue immediately at the onset of the 'continuous' ashing. This contrasts with the SA2, where presumably a relatively large amount of ash would need to be deposited before the first rehabilitation efforts would be able to commence.

The linear infrastructure route would represent a smaller component of the visual change in the surrounds of the ashing facility as resultant from the development of the ashing facility on SA2 that would in practice extend the industrial hub northwards to the surrounds of the site. The linear infrastructure route would thus not be associated with a stand-alone visual impact, but would be a component of the larger scale visual change in the wider area associated with the potential development of the ashing facility on the SA2.

## 8.12 Heritage

### 8.12.1 Site Alternative 1

No sites, features or objects dating to the Stone Age and Iron Age were identified within the site. A small two roomed structure in a bad state of repair occurs on SA1. The roof and all the fittings have been removed. Even some of the bricks have been taken out, possibly for recycling. This makes it difficult to date the site. Broken bottles, metal cans, pieces of wire, etc. have been found around the structure. From this it is deduced that the structure served either as accommodation for a labourer overseeing the farm and/or as a store room for farming equipment (Figure 83).

**Figure 83: The remains of the old house structure**

### 8.12.2 Site Alternative 2

No sites, features or objects dating to the Stone Age and Iron Age were identified within the site. The remains of a small house structure was demolished in approximately 1999. According to Mr Mokau who

has been living in this house before it was demolished also indicated that there were grave(s) in the vicinity of the house. It was only marked with stones and did not have any inscriptions. The last time it was seen, it was covered by a tree that had fallen over it. During the site visit, it could not be located. A second farm worker, who claimed to have last seen it, could also not locate it. This site would be located just outside the proposed development area of SA2. However, it is indicated as a red flag area which should be avoided.

**Figure 84: Remains of the old house structure**

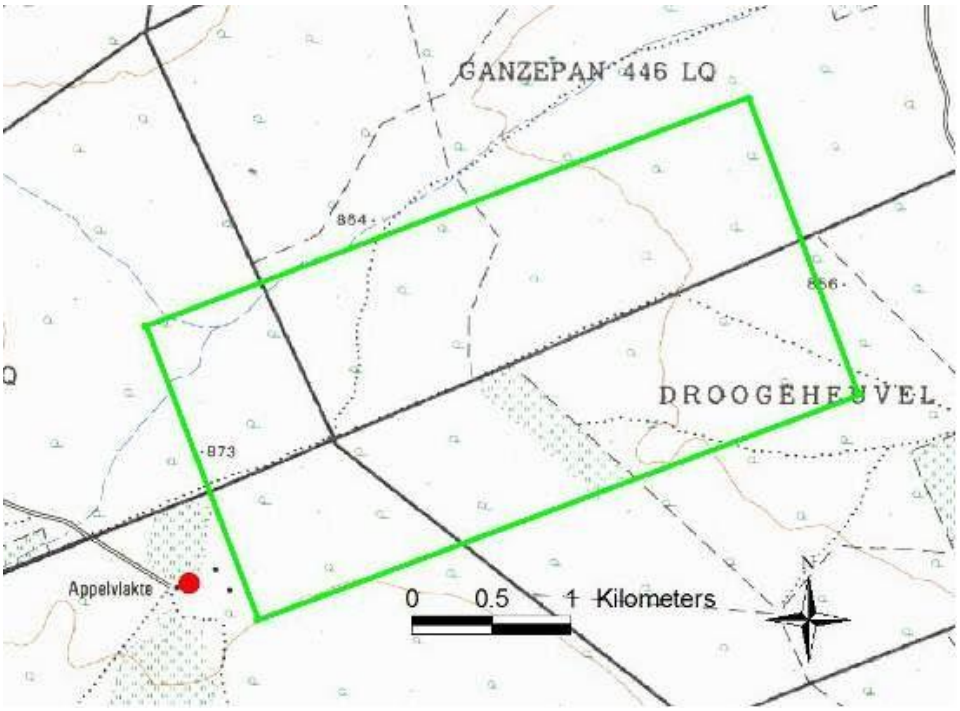

**Figure 85: Site Alternative 2 with the proposed small house structure (indicated in a red circle) outside the proposed site**

### 8.12.3 Linear Infrastructure Route

No sites, features or objects dating to the Stone Age and Iron Age or Historic Period were identified within the route.

## 8.13 Palaeontology

### 8.13.1 Site Alternative 1

No rocks and no fossils were found during the site visit. Based on drill cores and information from engineering personnel at the Matimba Power Station, the existing ADF is not constructed over coal deposits.

### 8.13.2 Site Alternative 2 and Linear Infrastructure Route

No fossils were found on the farm Vooruit 449LQ, Applevlakte 448LQ; Droogeheuvel 447LQ, Ganzepan 446LQ or Nelsonskop 445LQ. There were no rocks, no rocky outcrops, shale or sandstones, only deep loose sand which is not suitable for the preservation of fossils.

## 8.14 Noise

### 8.14.1 Baseline Noise Climate

The baseline situation with respect to the noise climates in the study area and the changes up to the present date (2013) was found to be as follows:

i) The areas relatively far from the main roads, Matimba Power Station, the Medupi Power Station construction activities and the Grootegeluk Coal Mine are generally very quiet. Most of the area has a typical rural noise climate.
ii) The main sources of noise in the area are from traffic on the main roads, Matimba Power Station, power station infrastructure remote from the facility (inclusive of the overland conveyor system and the activities at the ADF), Medupi Power Station (still under construction) and Grootegeluk Coal Mine. These noise sources are significant contributors to a degraded noise climate.
iii) With regards to traffic noise from Nelson Mandela Drive, existing residences in the residential areas of Lephalale (Ellisras) and Onverwacht, up to approximately a 500 m offset from the road, are impacted (night-time conditions). In these areas the noise levels exceed acceptable suburban residential living conditions as specified in SANS 10103. Ideally the ambient noise level should not exceed 50 dBA during the daytime period (06h00 to 22h00) and 40 dBA during the night-time period (22h00 to 06h00).
iv) Ambient noise levels due to traffic in the areas along Steenbokpan Road (D1675) are not high and the impact is not significant.
v) Noise levels from Matimba Power Station adversely affect the daytime noise climate at any residences in the surrounding area for up to a distance of 3000 m around the facility based on the rural standards that need to be applied for this area. At night the radius of impact increases to approximately 6500 m.
vi) At present, the Medupi Power Station is under construction. The predicted noise footprint when the power station is commissioned is estimated to adversely affect the daytime noise climate at any

residences in the surrounding area for up to a distance of 4700 m around the facility based on the rural standards that need to be applied for this area. At night the radius of impact increases to approximately 9500 m. There will be cumulative effects between the noise from the Matimba and Medupi Power Stations that will enlarge the individual noise footprints of these two sources of noise.

vii) There are also noise sources from Matimba Power Station equipment at locations remote from the power station as well as other isolated (or infrequent) noise sources such as:

- The coal overland conveyor from the Grootegeluk Coal Mine to the power station
- The overland conveyor belt transporting the ash residue from Matimba power station to the ADF.
- Operations at the ADF that include the dumping and spreading of the ash, and the rehabilitation of the dump. The 35 dBA noise contour of the ADF operations is presently positioned at an offset of 3250 m from the dump.
- The sewage works serving the power station, which is located 3 km to the north of the power station.

viii) The noise profile of Grootegeluk Coal Mine, which is a major source of noise in the area (Figure 86).

ix) The outer limit of influence (negative impact) of the Matimba Power Station, the Medupi Power Station (once commissioned) and the Grootegeluk Colliery Complex is the combined (not cumulative) 35 dBA contour of these sources of noise.

x) An intermittent source of noise is the coal haul trains on the railway line from the colliery to Thabazimbi. There are at present two trains per day.

xi)

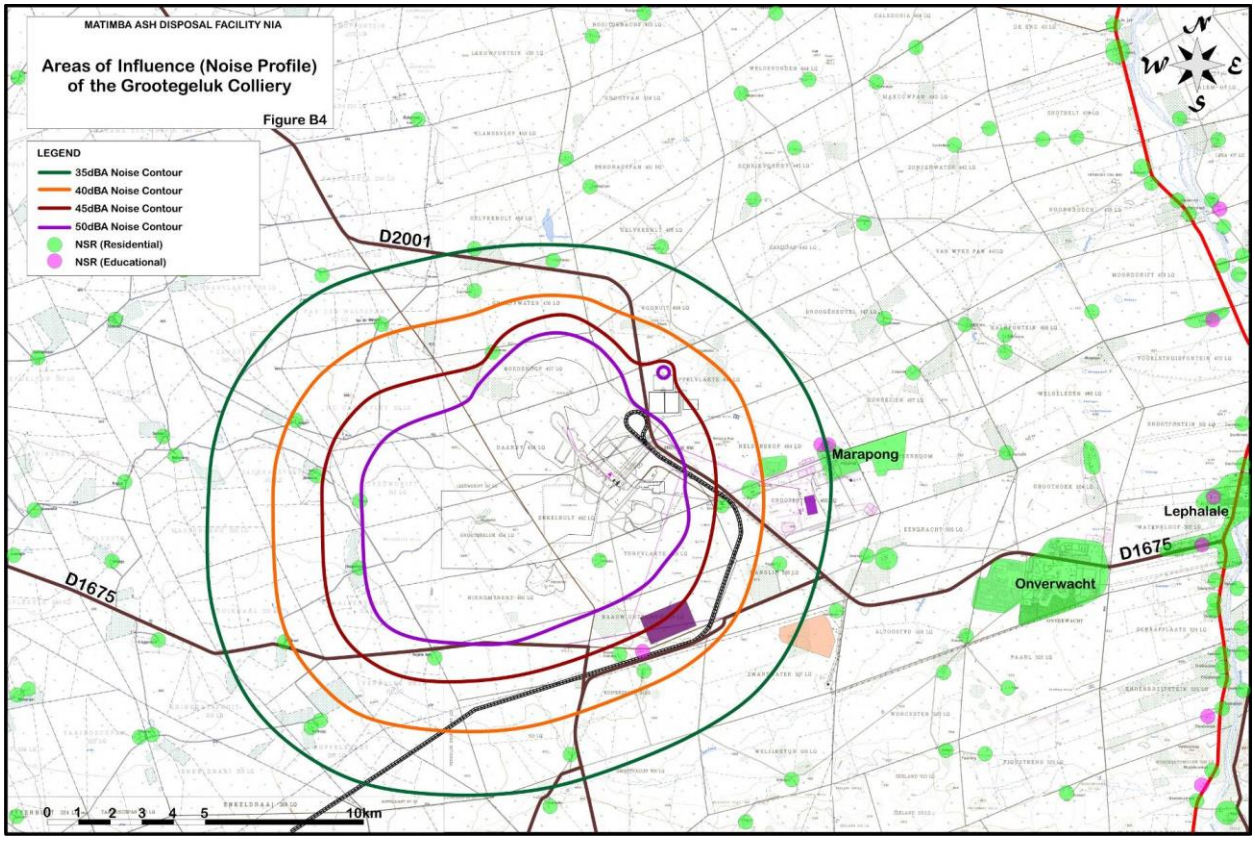


**Figure 86: Noise profile of the Grootegeluk Colliery**

## 8.14.2 Potential Impacts

### *8.14.2.1 Pre-Construction Phase*

Activities during the planning and design phase that normally have possible noise impact implications are those related to field surveys (such as investigation of founding conditions for large plant/equipment). As these activities are usually of short duration and take place during the day, generally they are unlikely to cause any major noise disturbance or nuisance in adjacent areas.

### *8.14.2.2 Construction Phase*

The potential noise climate was established in general for the construction of the infrastructure for transporting the ash, namely the overland conveyor system and the return water system. Construction site offices and lay down/storage areas are planned for on site. Although not all the layout details have been finalised, general concepts have been used in the noise impact evaluation. These are adequate to provide a sound basis for the analysis of typical noise conditions and impacts that are likely to prevail on the project.

The general nature of the noise impacts from the construction sites is predicted to be as follows:

i) Source noise levels from many of the construction activities will be high. Noise levels from all work areas will vary constantly and in many instances significantly over short periods during any day working period.

ii) Working on a worst case scenario basis, it is estimated that the ambient noise level from general construction activities could negatively affect noise sensitive sites within a distance of 1400 m of the construction site. Note that this is the offset of the 45 dBA noise contour from the construction as referred to in Table 49 below.

iii) Night-time construction could have a significant impact on noise sensitive sites within a radius of 3000 m of the construction site.

iv) There are some short-term noises that may, at times, be heard beyond the indicated positions of the respective 35 dBA contours, for example blasting. There are likely to be some significant noise nuisance effects from these intermittent loud noises on some people living in the area.

v) It has been estimated that the construction activities will on average generate about 240 vehicle trips (two way trips) daily. The main percentage of the trips will be concentrated in the morning and evening peak periods. In general, the construction traffic will have a relatively minor effect on the noise climate alongside the main external roads in the area. Because of the character of the traffic (namely heavy vehicles), there is likely to be some noise nuisance factor with the passing of each vehicle at noise sensitive receptors along the access routes.

vi) There are a number of noise sensitive receptors in the vicinity of the two alternative development sites that are likely to be affected by construction noise. The nature of the impact will be related to more to noise nuisance (annoyance) than to noise disturbance.

The general nature of the noise impacts from road construction (access roads) activities is predicted to be as follows:

i) The level and character of the construction noise will be highly variable as different activities with different plant/equipment take place at different times, over different periods, in different combinations, in different sequences and on different parts of the construction site.

ii) As no specific construction details or possible locations of major ancillary activity sites are available at this stage, the anticipated noise from various types of construction activities cannot be calculated accurately. In general at this stage, it can be said that the typical noise levels of construction equipment at a distance of 15 m lie in the range of 75 dBA to 100 dBA (Table 49). Based on data from similar "linear" construction sites, a one-hour equivalent noise level of between 75 dBA and 78 dBA at a point 50 m from the construction would be typical for the earthmoving phase.

iii) There are noise sensitive receptors in the vicinity of the two development sites that are likely to be affected by noise from the road construction.

It should be noted that higher ambient noise levels than recommended in SANS 10103 are normally accepted at the noise sensitive receptors as being reasonable during the construction period, provided that the very noisy construction activities (refer to Table 49) are limited to the daytime and that the contractor takes reasonable measures to limit noise from the work site. Note that it has been assumed that construction will generally take place from 06h00 to 18h00 with no activities (or at least no noisy construction activities) at night. From the details presently available, it appears that the construction noise impact is not likely to be severe if good noise management procedures are applied on site and various mitigation measures implemented.

**Table 49: Typical noise levels generated by construction equipment**

| Plant/Equipment | Typical Operational Noise Level at Given Offset (dBA) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 5 m | 10 m | 25 m | 50 m | 100 m | 250 m | 500 m | 1000 m |
| **Air compressor** | 91 | 85 | 77 | 71 | 65 | 57 | 51 | 46 |
| **Compactor** | 92 | 86 | 78 | 72 | 66 | 58 | 52 | 46 |
| **Concrete mixer** | 95 | 89 | 81 | 75 | 69 | 61 | 55 | 49 |
| **Concrete vibrator** | 86 | 80 | 72 | 66 | 60 | 52 | 46 | 40 |
| **Mobile Conveyor belt** | 77 | 71 | 63 | 57 | 51 | 43 | 37 | 32 |
| **Crusher (aggregate)** | 90 | 84 | 76 | 70 | 64 | 56 | 50 | 44 |
| **Crane (mobile)** | 93 | 87 | 79 | 73 | 67 | 59 | 53 | 47 |
| **Dozer** | 95 | 89 | 81 | 75 | 69 | 61 | 55 | 49 |
| **Loader** | 95 | 89 | 81 | 75 | 69 | 61 | 55 | 49 |
| **Mechanical shovel** | 98 | 92 | 84 | 78 | 72 | 64 | 58 | 52 |
| **Pile driver** | 110 | 104 | 97 | 91 | 85 | 77 | 71 | 65 |
| **Pump** | 86 | 80 | 72 | 66 | 60 | 52 | 46 | 40 |
| **Pneumatic breaker** | 98 | 92 | 84 | 78 | 72 | 64 | 58 | 52 |
| **Rock drill** | 108 | 102 | 94 | 88 | 82 | 74 | 68 | 62 |
| **Roller** | 84 | 78 | 70 | 64 | 58 | 50 | 44 | 38 |
| **Trucks** | 87 | 81 | 73 | 67 | 64 | 60 | 57 | 54 |

**Table 50: Predicted ambient noise levels at given offsets from some specific construction activities**

| Equipment | Sound pressure level at given offset(dBA) | | | | | |
|---|---|---|---|---|---|---|
| | 500 m | 1000 m | 1500 m | 2000m | 2500 m | 3000 m |
| **Concrete Batching Plant** | 53.6 | 46.0 | 41.1 | 37.5 | 34.7 | 32.3 |
| **Concreting Operations** | 57.2 | 49.1 | 43.9 | 40.1 | 37.1 | 34.6 |

#### *8.14.2.3 Operational Phase*

The main sources of background noise in the area will continue to be from:

- Traffic on the main roads.
- Medupi Power Station.
- Matimba Power Station.
- Grootegeluk Coal Mine.
- Linear infrastructure such as overland conveyors.
- General farming activities (not a major source of noise).

In general, it is not anticipated that the noise levels from these existing sources will increase significantly in the future, with the exception of road traffic noise and Medupi Power Station which is to be commissioned in 2015.

The noise generated by the new ADF and its ancillary works (including the proposed linear infrastructure route) will be added to the noise climate prevailing in the area. All the calculated noise profiles as shown in Figure 87 (for both site alternatives).

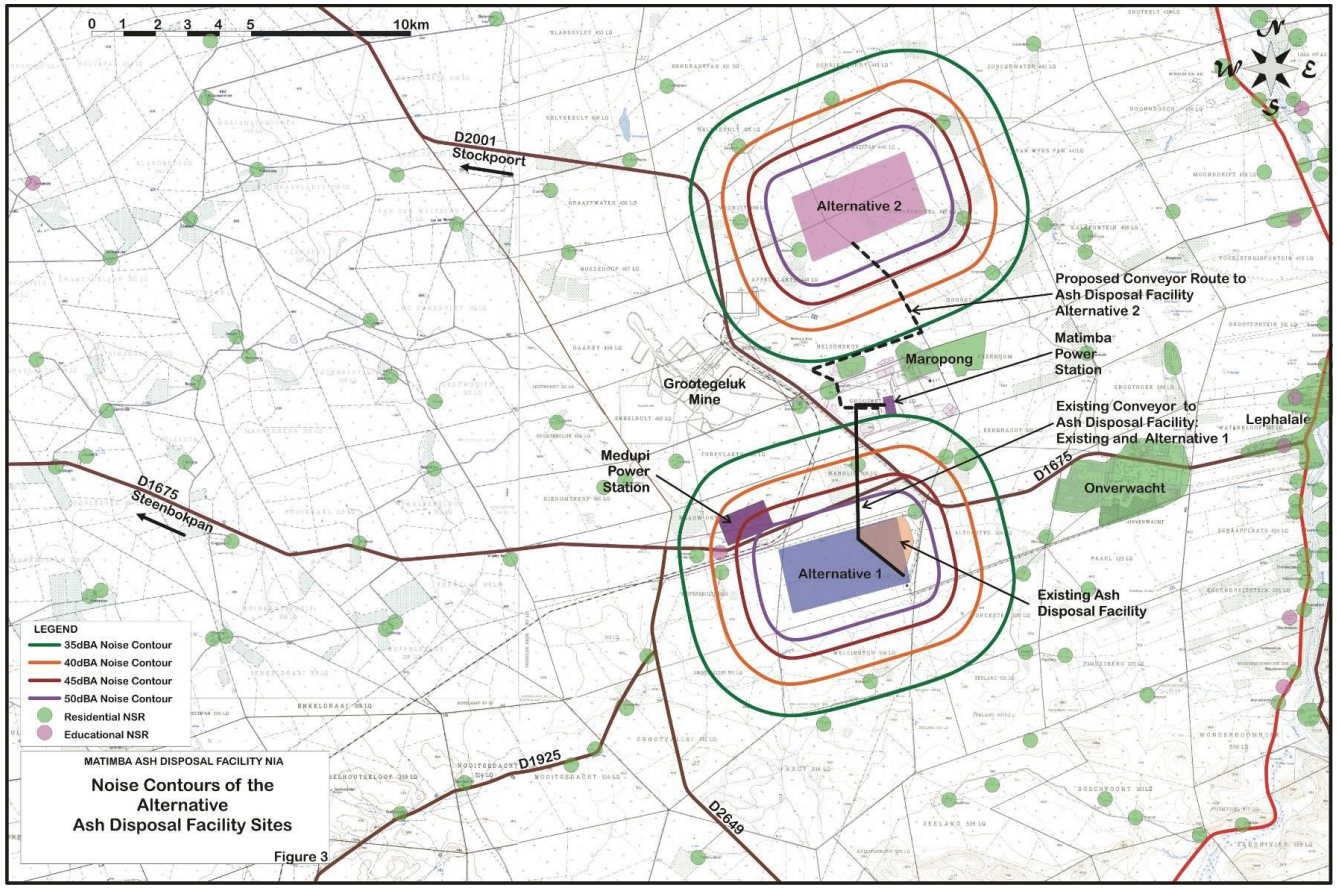


**Figure 87: Noise contours of the ADF site alternatives**

- **Ash Disposal Operations**

The ADF construction operations will not extend at one time over the whole site area, but the area will be worked incrementally. This will mean that there will not be a static noise footprint from the facility. As well as moving in plan, the noise levels from the respective sections being worked will also vary as the height of the disposal increases. As the height of the disposal increases, the overall noise footprint will increase, but at the same time, the noise sensitive sites closer to the disposal will be shielded from the noise. This is due to the shielding effect of the sides of the ash disposal.

The noise footprint shown in Figure 87 is for the operations over the full period that the ADF will be worked. It is the total noise envelope covering the noise generated by the entire facility for all situations over the full operational phase of the ADF. It indicates the worst situation that could occur at any specific receiver point. It is for this reason as well as the very conservative (i.e. worst meteorological conditions, hard ground, no barriers, etc.) approach to the analysis that the cumulative effects with any of the other noise zones of the ADF are not plotted. If problems are anticipated at any one noise sensitive site then a more detailed analysis of that specific site will need to be undertaken.

Noise from the ADF process is virtually continuous. The main sources of noise from the process will be from the following plant/equipment (refer also to Figure 87 and Table 51):

- Excavators, Front-end loaders and dozers;
- Compactor;
- Spreader; and
- Conveyor Drive house.

**Table 51: Predicted ambient noise conditions from operations at the Matimba Power Station proposed ADF[28]**

| Time Period | Sound pressure level at given offset (dBA) | | | | | | |
|---|---|---|---|---|---|---|---|
| | 500 m | 1000 m | 1500 m | 2000 m | 2500 m | 3000 m | 3500 m |
| Daytime $L_{Req,d}$ (06h00-22h00) | 53.9 | 46.9 | 42.5 | 39.3 | 36.6 | 34.4 | 32.4 |
| Night $L_{Req,n}$ (22h00-06h00) | 53.9 | 46.9 | 42.5 | 39.3 | 36.6 | 34.4 | 32.4 |

- **Transportation of Ash**

The ash will be transported by overland conveyor from the power station to the relevant facility. The noise profile of a conveyor drive house is given in Table 52, and that of an intermediate section (between drive houses) is given in Table 53. The existing overland conveyor to SA1 is an existing facility and as such is part of the existing noise climate. The planned linear infrastructure route to SA2 will introduce a new source of noise into the area.

[28] Unmitigated.

**Table 52: Predicted ambient noise conditions from overland conveyor system drive house[29]**

| Time Period | Sound pressure level at given offset (dBA) | | | | |
|---|---|---|---|---|---|
| | 500 m | 700 m | 1000 m | 1500 m | 2000 m |
| Daytime (06h00 – 22h00) $L_{Req,d}$ | 48.3 | 45.0 | 41.4 | 37.0 | 33.6 |
| Night-time (22h00 – 06h00) $L_{Req,n}$ | 48.3 | 45.0 | 41.4 | 37.0 | 33.6 |

**Table 53: Predicted ambient noise conditions from the overland conveyor belt (between drive houses)[30]**

| Time Period | Sound pressure level at given offset (dBA) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 10 m | 20 m | 30 m | 40 m | 50 m | 100 m | 150 m | 200 m |
| Daytime (06h00 – 22h00) $L_{Req,d}$ | 60.1 | 54.1 | 50.5 | 48.0 | 46.0 | 39.9 | 36.2 | 33.6 |
| Night-time (22h00 – 06h00) $L_{Req,n}$ | 60.1 | 54.1 | 50.5 | 48.0 | 46.0 | 39.9 | 36.2 | 33.6 |

- **Pollution Control Dams**

A pollution control dam (PCD) is one of the components of the ADF operation. Seepage water from the ADF is stored in a dam and is pumped back to various parts of the site for dust suppression. The main source of virtually continuous noise from the PCD complex will be from the pumps. The noise footprint of the pump station is relatively small when compared to the noise generated by the stacking of the ash piles (Table 54); that is the pump station 35 dBA footprint is contained within the 45 dBA footprint of the ADF. For the underground return pipeline, no noise will be generated above surface.

**Table 54: Predicted ambient noise conditions from pumps at the Matimba Power Station ADF (pollution control dams)[31]**

| Time Period | Sound pressure level at given offset (dBA) | | | | | | |
|---|---|---|---|---|---|---|---|
| | 100 m | 200 m | 300 m | 400 m | 500 m | 550 m | 600 m |
| Daytime $L_{Req,d}$ (06h00-22h00) | 51.4 | 45.0 | 41.1 | 38.3 | 36.1 | 35.0 | 34.2 |
| Night $L_{Req,n}$ (22h00-06h00) | 51.4 | 45.0 | 41.1 | 38.3 | 36.1 | 35.0 | 34.2 |

[29] Unmitigated.
[30] Unmitigated.
[31] Unmitigated.

#### 8.14.2.4 Decommissioning Phase

The situation will be similar to aspects that occur in the construction phase. The dismantling of the conveyor systems and re-vegetation of the disposal facility will require the use of similar equipment as those during construction.

### 8.14.3 Summary of the Noise Assessment Findings

The development of a new ADF will not introduce a major noise impact factor into the area, SA1 being less affected than SA2. SA1 will have no significant impact on the area as the existing noise climate is already degraded by the noise from the Power Stations (Matimba and Medupi) and the Grootegeluk Mine. A portion of the 35 dBA noise contour of SA2 falls partly outside the existing noise footprint of the Matimba Power Station, Medupi Power Station and Grootegeluk Coal Mine Complex and will therefore extend the existing 35 dBA baseline noise contour 3250 m to the north of SA2. Refer to Figure 88.

The proposed linear infrastructure route to SA2 will not affect the overall noise footprint as indicated in Figure 88. It should, however, be noted that part of the linear infrastructure route just west of the Matimba power station runs parallel to two other existing conveyor lines for a short distance and thus there will be cumulative effects on the Babcock residential area, but these should not exceed 3 dBA.

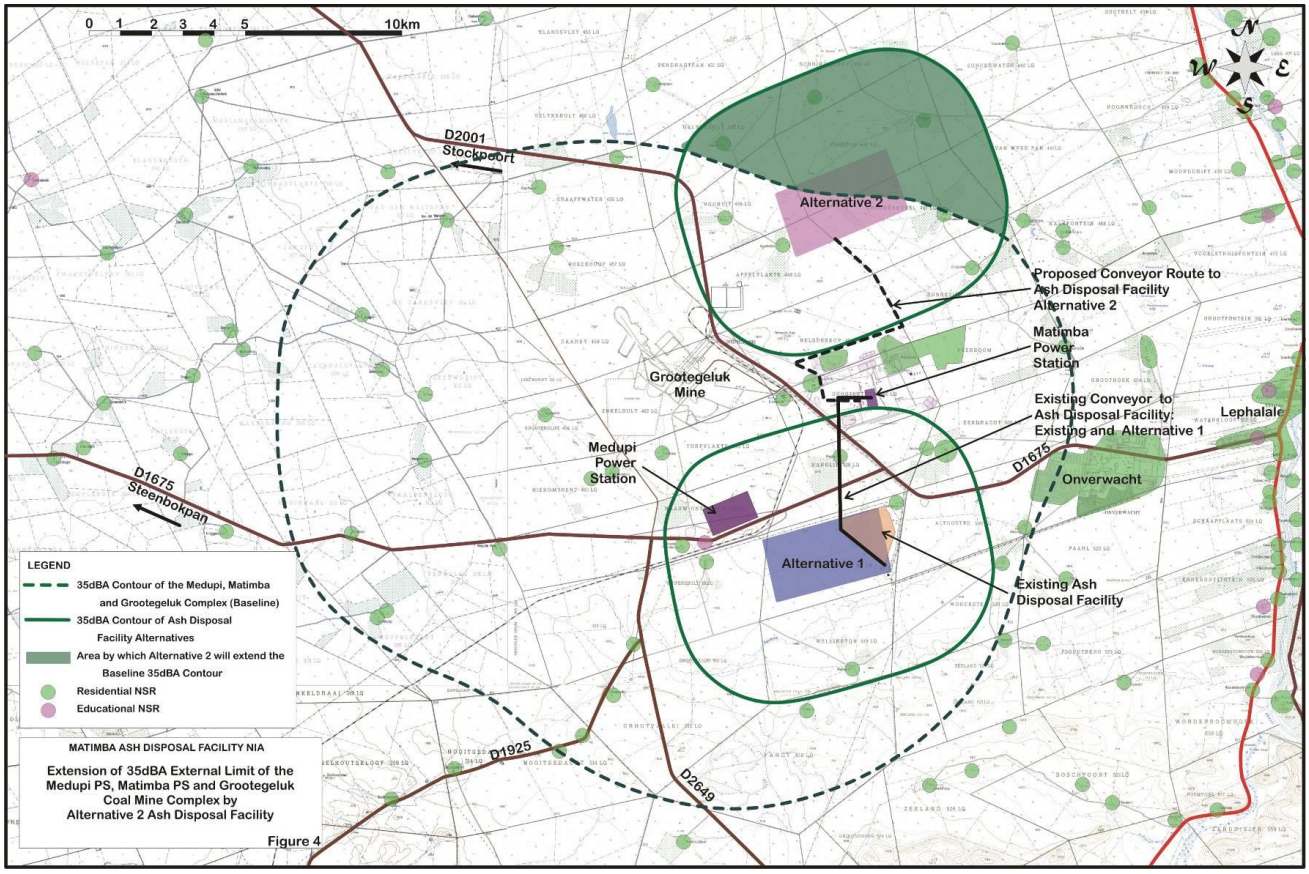


**Figure 88: Extension of the external limit of the Medupi PS, Matimba PS and Grootegeluk Coal Mine Complex by Site Alternative 2**

# 8.15 Traffic and Transportation

## 8.15.1 Current Site Operations

There are three main areas or sites for transport of coal from the Grootegeluk Coal Mine to the Matimba Power Station and then transporting of the fly ash to the existing ADF. The transport of coal from the mine to the power station is via an overland conveyor. As the coal arrives at the power station, the load is divided via two conveyors, one to the stockpile or via another conveyor directly to the control bin. From the control bin the coal is transported, again via conveyors, to the silos and boilers. From the boilers the fly ash is transported by overland conveyors to the ashing site.

## 8.15.2 Existing Road Network

The existing main access to the existing ADF is from Nelson Mandela Drive (D1675). Road D1675 can be classified as a paved Class 2 Rural Two-lane Highway with a speed limit of 80 km/h without shoulders on either side of the road. At the time of the assessment, construction was being carried out on Road D1675 to upgrade it to a four lane road with two lanes per direction. The project is being funded by Exxaro Coal (Pty) Ltd and Eskom Holdings SOC Ltd.

## 8.15.3 Access to Existing Ashing Facility

The existing main access to the ADF is from Nelson Mandela Drive (D1675). The access is located 2.8 km southeast from the Matimba Power Station access and 1.1 km southeast from the Medupi Power Station turn-off. It intersects with road D1675. This is a priority controlled intersection with STOP control at the access road and priority on Road D1675. The access road to the ashing facility is a gravel road with a level crossing from road D1675.

## 8.15.4 Classified (Light and Heavy) Vehicle Counts

A manual traffic survey was carried out on 23 August 2012 at the intersection of Nelson Mandela (D1675) drive and Walter Sisulu Lane as the majority of employees are commuting from Lephalale and Onverwacht. Directional counts on Road D1675 near the access to the site were also conducted.

No turning movement counts were conducted at the site access / road D1675 intersection as it was observed during the site visit that no vehicles made use of the access. It was confirmed during the site visit that the road is mainly used by official vehicles, mostly two vehicles a day, which is negligibly low. The morning and afternoon peak hours were between 06:15 – 07:15 and 16:30 – 17:30 respectively (Figure 89 and Figure 90).

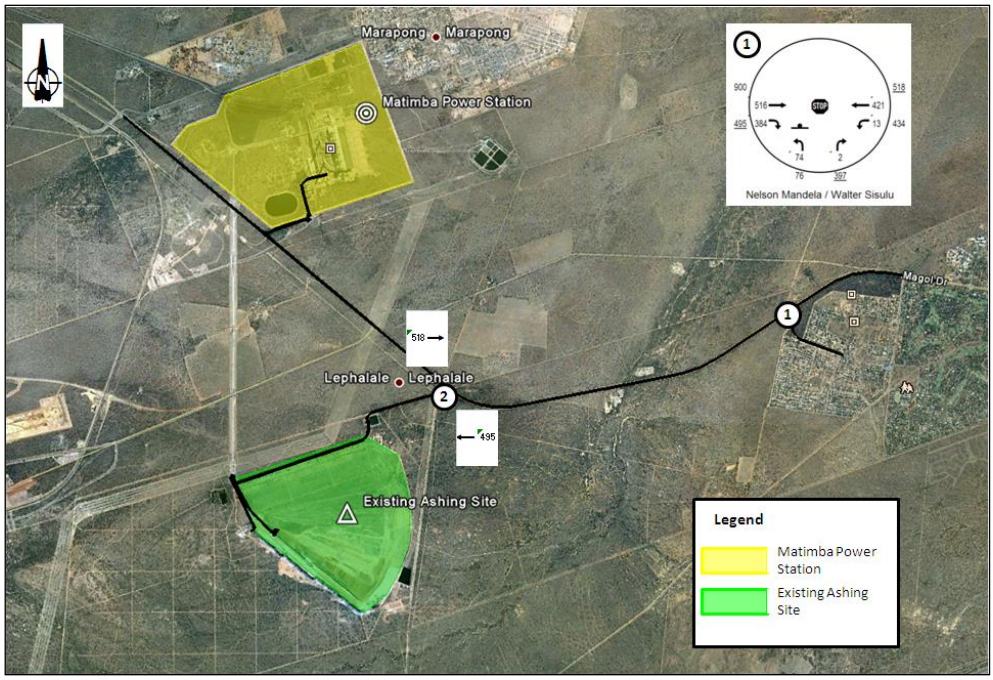


**Figure 89: Total AM peak hour traffic volumes (2012)**

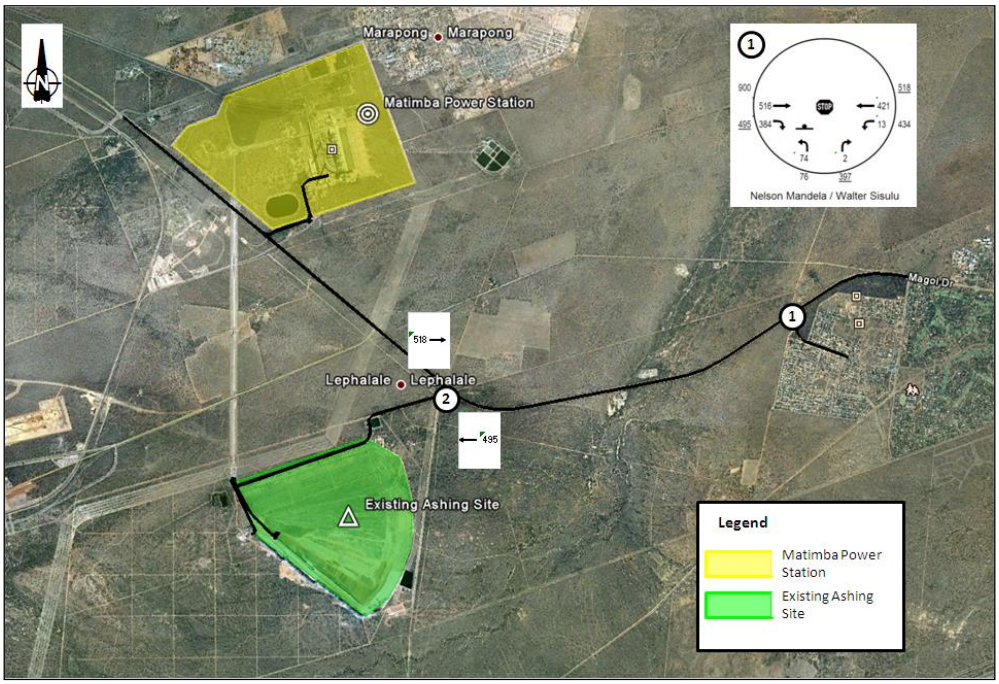


**Figure 90: Total PM peak hour traffic volumes (2012)**

Although the traffic survey was conducted during the construction and upgrading of Road D1675, the counts were compared to previous studies' results conducted in the area and was found to be reasonable.

### 8.15.5 Additional Informative Vehicle Counts

Additional informative link counts were conducted on 09 May 2013 at the possible new access road position to SA2 on Road D2001.

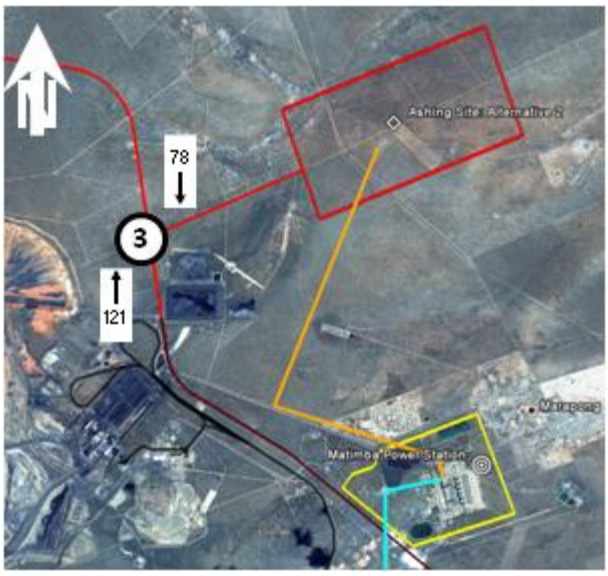


**Figure 91: AM peak hour traffic volumes**


**Figure 92: PM peak hour traffic volumes**

As shown in Figure 91 and Figure 92, Road D2001 carries approximately 200 and 210 vehicles per hour (vph) during the morning and afternoon peak hours respectively.

### 8.15.6 Travel Time Survey

Based on the scoping process a travel time survey was also conducted to determine the current speed that vehicles are travelling on Road D1675.

The speed (distance / time) profile for the morning peak is shown in Figure 93.

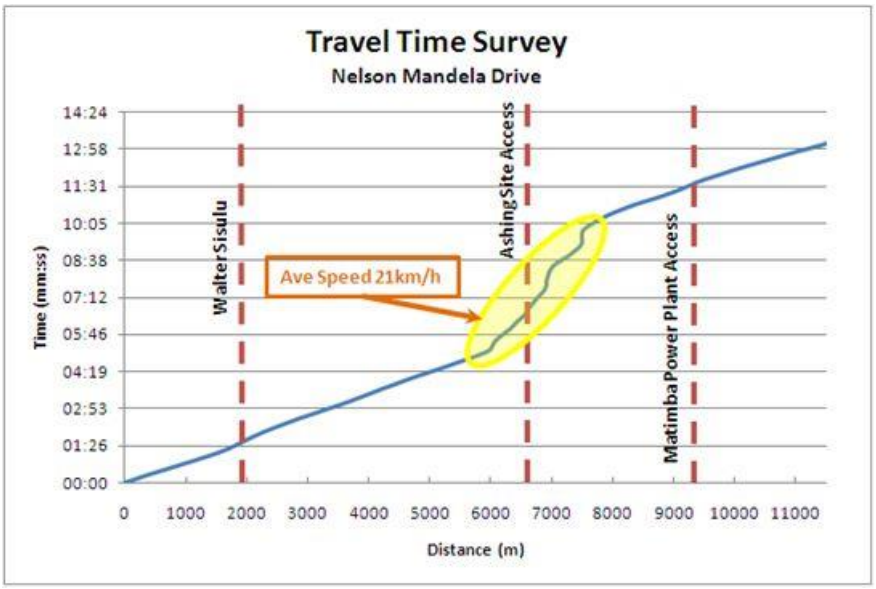


**Figure 93: Travel Time Survey**

At the time of conducting the travel time survey, the road works hindered the progression along Road D1675 between KM 6 and KM 8 and only an average speed of 21 km/h could be achieved.

With the completion of the road works, an average speed of more than 70 km/h will be achievable during peak hours.

## 8.15.7 Traffic Analysis

The analysis of the road sections were done by following the processes stipulated in the Highway Capacity Manual (HCM) for two lane highways.

Level of Service (LOS) is a quality measure describing operational conditions within a traffic stream, generally in terms of such service measures as speed, travel time, freedom to manoeuvre, traffic interruptions, and comfort and convenience. Six LOS are defined where letters designate each level, from A to F. LOS A represents the best operating conditions and LOS F the worst. Most design or planning efforts typically use service flow rates at LOS C or D to ensure an acceptable service for facility users.

### *8.15.7.1 Status Quo, Two-lane Highway*

The road section of D1675 analysed, is classified as Class 2 two-lane highway. The LOS for this road type is defined only in terms of percent time-spend-following as described in the Highway Capacity Manual (HCM).

**Table 55: LOS calculation for existing two-lane road**

| AM PEAK HOUR | | PM PEAK HOUR | |
|---|---|---|---|
| **Description** | **Value** | **Description** | **Value** |
| **AM peak hour 2-way Volume** | 1417 | PM peak hour 2-way Volume | 1013 |
| **AM Directional Split** | 86:14<br>WB:EB | PM Directional Split | 10:90<br>WB:EB |
| **AM Peak hour factor** | 0.97 | PM Peak hour factor | 0.90 |

| AM PEAK HOUR | | PM PEAK HOUR | |
|---|---|---|---|
| **Description** | **Value** | **Description** | **Value** |
| **AM % heavy vehicles** | 18% | PM % heavy vehicles | 10% |
| **AM Two-way flow rate, vp (pc/h)** | 1461 | PM Two-way flow rate, vp (pc/h) | 1137 |
| **AM vp*highest directional split proportion2 (pc/h)** | 1256 | PM vp*highest directional split proportion2 (pc/h) | 1023 |
| **Grade adjustment factor** | 1* | Grade adjustment factor | 1* |
| **Passenger-car equivalent for heavy vehicles** | 1* | Passenger-car equivalent for heavy vehicles | 1* |
| **Heavy-vehicles adjustment factor** | 1* | Heavy-vehicles adjustment factor | 1* |
| **% No Passing zones** | 80% | % No Passing zones | 80% |
| **Access points/km** | 1 | Access points/km | 1 |
| **Base percent time spent following, BPTSF (%) BPTSF = (1-e-0.000879vp)** | 72.3% | Base percent time spent following, BPTSF (%) BPTSF = (1-e-0.000879vp) | 63.2% |
| **Adj. For directional distribution and no-passing zone, fd/np (%)** | 9.7* | Adj. For directional distribution and no-passing zone, fd/np (%) | 14.2* |
| **Percent time spent following, PTSF (%) PTSF= BTSF + fd/np** | 82% | Percent time spent following, PTSF (%) PTSF= BTSF + fd/np | 77.4% |
| **LOS** | **E** | **LOS** | **D** |

#### *8.15.7.2 Future Conditions*

As mentioned previously Road D1675 is currently being upgraded to a four lane road with two lanes per direction. The projected LOS for the four lane road after construction is LOS B for the westbound direction and LOS A for the eastbound direction during the morning peak hour. For the afternoon peak hour, it will be LOS A for both the westbound and eastbound directions.

- **Possible New Access to Site Alternative 2**

As stated previously, north of the Grootegeluk Coal Mine, Road D2001 is a gravel road up to its intersection with Road P84/1 near the Stockpoort border post. It is assumed that road D2001 will be upgraded to a paved road if SA2 is used for the continuous ADF.

Access to the SA2 will be from Road D2001. The SIDRA capacity analysis software was used to determine the operational capacity of the D2001 / Access intersections.

For both the morning and afternoon peak hours, the intersection will operate at very good Level of Service, i.e. LOS A.

Although not required from a capacity point of view, it is recommended that a short right-turn lane from Road D2001 into the Access road be provided, as schematically shown in Figure 94. This is to ensure that a turning vehicle will not hinder through traffic on Road D2001.

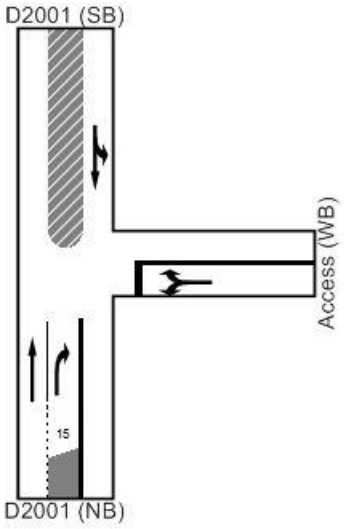


**Figure 94: Proposed Intersection Layout (if Site Alternative 2 is used)**

- **Alignment of Linear Infrastructure Route**

Based on the alignment of the linear infrastructure route, Road D2816 and gravel access road to Nelsonskop 464 LQ will have to be crossed by the system. Due to the fact that construction vehicles might drive under or next to the conveyor, especially during maintenance periods, it is recommended that a clearance height of 5.2 m be provided. This is to eliminate the possibility of a heavy vehicle colliding into the conveyor system.

### 8.15.8 Summary of the Traffic Impact Assessment Findings

The continuous ADF on the two site alternatives will have a very small, if any, impact on the existing road network. However, during the construction phase, SA2 will have a greater impact on the road network than that of SA1 which is only an expansion of the existing site.

# 9 POTENTIAL IMPACTS

## 9.1 Methodology

The potential environmental impacts associated with the project will be evaluated according to its nature, extent, duration, intensity, probability and significance of the impacts, whereby:

**Table 56: Environmental criteria to be rated**

| Environmental Criteria | Description |
|---|---|
| **Nature** | A brief written statement of the environmental aspect being impacted upon by a particular action or activity |
| **Extent** | The area over which the impact will be expressed. Typically, the severity and significance of an impact have different scales and as such bracketing ranges are often required. This is often useful during the detailed assessment phase of a project in terms of further defining the determined significance or intensity of an impact. For example, high at a local scale, but low at a regional scale |
| **Duration** | Indicates what the lifetime of the impact will be |
| **Intensity** | Describes whether an impact is destructive or benign |
| **Probability** | Describes the likelihood of an impact actually occurring |
| **Cumulative** | In relation to an activity, means the impact of an activity that in itself may not be significant but may become significant when added to the existing and potential impacts eventuating from similar or diverse activities or undertakings in the area |

Table 57: Rating criteria

| CRITERIA | DESCRIPTION | | | |
|---|---|---|---|---|
| EXTENT | **National (4)**<br>The whole of South Africa | **Regional (3)**<br>Provincial and parts of neighbouring provinces | **Local (2)**<br>Within a radius of 2 km of the construction site | **Site (1)**<br>Within the construction site |
| DURATION | **Permanent (4)**<br>Mitigation either by man or natural process will not occur in such a way or in such a time span that the impact can be considered transient | **Long-term (3)**<br>The impact will continue or last for the entire operational life of the development, but will be mitigated by direct human action or by natural processes thereafter. The only class of impact which will be non-transitory | **Medium-term (2)**<br>The impact will last for the period of the construction phase, where after it will be entirely negated | **Short-term (1)**<br>The impact will either disappear with mitigation or will be mitigated through natural process in a span shorter than the construction phase |
| INTENSITY | **Very High (4)**<br>Natural, cultural and social functions and processes are altered to extent that they permanently cease | **High (3)**<br>Natural, cultural and social functions and processes are altered to extent that they temporarily cease | **Moderate (2)**<br>Affected environment is altered, but natural, cultural and social functions and processes continue albeit in a modified way | **Low (1)**<br>Impact affects the environment in such a way that natural, cultural and social functions and processes are not affected |
| PROBABILTY OF OCCURANCE | **Definite (4)**<br>Permanent impact will certainly occur | **Highly Probable (3)**<br>Most likely that permanent impact will occur | **Possible (2)**<br>The permanent impact may occur | **Improbable (1)**<br>Likelihood of permanent impact materialising is very low |

Significance is determined through a synthesis of impact characteristics. Significance is an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required. The total number of points scored for each impact indicates the level of significance of the impact.

**Table 58: Significance rating of classified impacts**

| Class | | Description |
|---|---|---|
| + | Any value | Any positive / beneficial "impact", i.e. where no harm will occur due to the activity being undertaken |
| – | Low impact (4 – 6 points) | A low impact has no permanent impact of significance. Mitigation measures are feasible and are readily instituted as part of a standing design, construction or operating procedure. |
| | Medium impact (7 – 9 points) | Mitigation is possible with additional design and construction inputs. |
| | High impact (10 – 12 points) | The design of the site may be affected. Mitigation and possible remediation are needed during the construction and/or operational phases. The effects of the impact may affect the broader environment. |
| | Very high impact (13 – 16 points) | Permanent and important impacts. The design of the site may be affected. Intensive remediation is needed during construction and/or operational phases. Any activity which results in a "very high impact" is likely to be a fatal flaw. |
| Status | | Denotes the perceived effect of the impact on the affected area. |
| Positive (+) | | Beneficial impact. |
| Negative (-) | | Deleterious or adverse impact. |
| Neutral (/) | | Impact is neither beneficial nor adverse. |

The suitability and feasibility of all proposed mitigation measures will be included in the assessment of significant impacts. This will be achieved through the comparison of the significance of the impact before and after the proposed mitigation measure is implemented. Mitigation measures identified as necessary will be included in an EMPr.

The subsequent sections will provide a description of the potential impacts as identified by the specialists, EAP and through the public participation process as well as the assessment according the criteria described in Table 57 and Table 58.

It should be noted, that for some specialist assessments, the potential impacts were applicable to both site alternatives and linear infrastructure route. These impact tables were not repeated. Where applicable, decommissioning and cumulative impacts have been included and assessed.

## 9.2 Geology

**Table 59: Site Alternative 1, 2 and linear infrastructure route geological impacts**

| Phase | Aspect and Impact | Mitigation | Extent | Duration | Intensity | Probability | Significance (E+D+I+P) | |
|---|---|---|---|---|---|---|---|---|
| **Construction** | **Aspect:**<br>Earthworks and construction of infrastructure.<br><br>**Impact:**<br>Site instability due to inadequate drainage. | **Without** | -1 | -4 | -3 | -3 | -11 | **High** |
| | | **With** | -1 | -4 | -2 | -1 | -8 | **Medium** |
| | | **Mitigation measures:**<br>• It is recommended that earthworks be carried out along the guidelines given in SANS 1200 (current version).<br>• Where necessary, subsoil drains must also be provided particularly if fills are constructed over water logged/marshy areas and drainage courses.<br>• Earthworks and drainage measures should be designed in such a way as to prevent ponding of, or high concentrations of, stormwater or groundwater anywhere on the sites.<br>• It is important to allow for regular on-site inspections and evaluations by an experienced professions (e.g. engineering geologist/geotechnical engineer) so that stability problems can be timeously identified and remedied.<br>• The terrace should be shaped to a gradient to prevent water ponding on the surface and should be graded to direct water away from the fill edges and foundations.<br>• Trenches excavated in sandy material will require lateral support, as will trenches excavated in areas with strong groundwater seepage.<br>• Trenches deeper than 1.5 m below existing ground level should be shored in any event, particularly if left open for significant periods.<br>• It is recommended that lateral support be used in all situations where shallow groundwater is encountered and that regular inspections of the trenches are carried out in order to detect potentially unstable sidewall conditions during the construction phase.<br>• The Aeolian sands encountered along the linear infrastructure route are considered to be generally loose in consistency, up to a depth of 3.0 m below existing ground level. As such, it is recommended that ground improvement be carried out if shallow foundations are proposed for this route (refer to the EMPr – **Appendix S**). | | | | | |

| Phase | Aspect and Impact | Mitigation | Extent | Duration | Intensity | Probability | Significance (E+D+I+P) | |
|---|---|---|---|---|---|---|---|---|
| **Operations** | **Aspect:**<br>Continuous ashing.<br><br>**Impact:**<br>Movement and slope failure. | **Without** | -1 | -3 | -3 | -2 | -9 | **Medium** |
| | | **With** | -1 | -3 | -1 | -1 | -6 | **Low** |
| | | **Mitigation measures:**<br>• The ADF should be monitored on a regular basis for possible movement and slope failure. The amount of movement that is likely to occur before failure determines the sensitivity of the monitoring equipment required. Movement varies with the type of material disposed, the disposal facility height and the location at which monitoring will be done. Taking into consideration that scouring and surface/edge slides were noticed along the existing ADF crest, it is recommended that movement monitoring be focused in this area.<br>– Current monitoring techniques should include one or more of the following:<br>– On-site inspections and surveying;<br>– Photogrammetry;<br>– Extensometers;<br>– Inclinometers;<br>– Acoustic Emission;<br>– Laser Beacon; and<br>– Settlement Cells. | | | | | | |

## 9.3 Geohydrology

**Table 60: Site Alternative 1, 2 and linear infrastructure route geohydrology impacts**

| Phase | Aspect and Impact | Mitigation | Extent | Duration | Intensity | Probability | Significance (E+D+I+P) | |
|---|---|---|---|---|---|---|---|---|
| **Construction** | **Aspect:**<br>Spillage of fuels, lubricants and other chemicals.<br><br>**Impact:**<br>Hydrocarbon contamination | **Without** | -2 | -3 | -2 | -2 | -9 | **Medium** |
| | | **With** | -2 | 3 | -2 | -2 | -9 | **Medium** |
| | | **Mitigation measures:**<br>• Secondary containment for all fuel stored on site.<br>• Accurate oil records must be kept. | | | | | | |

| Phase | Aspect and Impact | Mitigation | Extent | Duration | Intensity | Probability | Significance (E+D+I+P) | |
|---|---|---|---|---|---|---|---|---|
| | associated with heavy machinery on site. | • Ensure clean up protocols are in place and followed. | | | | | | |
| **Operations** | **Aspect:**<br>Poor quality artificial recharge from the ADF.<br><br>**Impact:**<br>Groundwater contamination. | **Without** | -2 | -3 | -3 | -3 | -11 | **High** |
| | | **With** | -2 | -2 | -2 | -2 | -8 | **Medium** |
| | | **Mitigation measures:**<br>• Lining of the greenfields portion of the ADF as per the recommendations of the Technical Engineering Report (**Appendix C**) where it is proposed that the Compacted Clay Liner (CCL) is substituted with a Geosynthetic Clay Liner (GCL) of equivalent or better performance.<br>• Implementation of groundwater monitoring programme:<br>– A Groundwater Management Plan is required to ensure that the ADF does not impact negatively on groundwater levels and quality to unacceptable levels. To ensure that the groundwater environment is protected, monitoring of water quality and levels is required on an on-going basis. Both sites, namely, SA1 and SA2 have sufficient amounts of monitoring boreholes surrounding the site, located both up-gradient and down-gradient. It is imperative that these boreholes are monitored on a regular basis.<br>– For SA1, there are monitoring boreholes which are located on the footprint of the site. It is important that if SA1 is selected as the site for the ADF that any borehole located on the site footprint is backfilled using a cement – bentonite slurry so as to prevent direct migration of potentially poor quality water into the aquifers. This is also applicable to the areas of the site where an exemption application will be lodged for disposal to take place on an unlined surface.<br>– The following boreholes are currently being monitored by GHT Consulting: P01, P03, P02, P31, P29, P23 and P20. Boreholes GHT01 and GHT 2 are newly drilled boreholes by GHT Consulting. MA01 and MA02 are newly drilled boreholes by GCS. Borehole HP01 is a production borehole used for garden irrigation and stock watering. All these boreholes should be included in the proposed monitoring plan for SA1. Boreholes MA1 and HP01 can be monitored bi-annually whereas the remainder of boreholes should be monitored quarterly.<br>– Boreholes APV02, APV01, WB31, MA05, DHL123, DHL05, DHL07, DHL08, GPN07, GPN06, GPN01, GPN05, GPN04, GPN03, GPN02 are all boreholes located around SA2. Boreholes APV02, GPN05 and MA05 which were included in the geohydrology investigation should be monitored on a quarterly basis. Additionally, boreholes NGA090, GPN07 and DHL08 located at a further distance from the proposed site should be monitored on a quarterly basis.<br>• If the monitoring data indicates the need for corrective action, the magnitude of the impact must be | | | | | | |

| Phase | Aspect and Impact | Mitigation | Extent | Duration | Intensity | Probability | Significance (E+D+I+P) | |
|---|---|---|---|---|---|---|---|---|
| | | assessed by an appropriately qualified and experienced specialist and the necessary measures put forward based on the magnitude of the impact. | | | | | | |
| | **Aspect:**<br>Loss of ash during conveyor belt transportation.<br><br>**Impact:**<br>Groundwater contamination. | **Without** | -1 | -3 | -2 | -2 | -8 | **Medium** |
| | | **With** | -1 | -3 | -2 | -2 | -8 | **Medium** |
| | | **Mitigation measures:**<br>• Regular inspections of the linear infrastructure route along sensitive areas mapped (fault areas) in order to visibly identify any areas where ash has been deposited on the soil. Ash must then be removed and transported to the ADF. | | | | | | |
| **Decommissioning** | **Aspect:**<br>Poor quality artificial recharge from the ADF.<br><br>**Impact:**<br>Groundwater contamination. | **Without** | -2 | -3 | -3 | -3 | -11 | **High** |
| | | **With** | -2 | -2 | -2 | -2 | -8 | **Medium** |
| | | **Mitigation measures:**<br>• Lining of the greenfields portion of the ADF as per the recommendations of the Technical Engineering Report (**Appendix C**) where it is proposed that the Compacted Clay Liner (CCL) is substituted with a Geosynthetic Clay Liner (GCL) of equivalent or better performance.<br>• Implementation of groundwater monitoring programme. If the monitoring data indicates the need for corrective action, the magnitude of the impact must be assessed by an appropriately qualified and experienced specialist and the necessary measures put forward based on the magnitude of the impact. | | | | | | |

## 9.4 Hydrology

**Table 61: Site Alternative 1 and 2 hydrological impacts**

| Phase | Aspect and Impact | Mitigation | Extent | Duration | Intensity | Probability | Significance (E+D+I+P) | |
|---|---|---|---|---|---|---|---|---|
| Construction | **Aspect:** Separation of clean and dirty water areas.<br><br>**Impact:** Clean water run-off from areas outside the dirty water footprint area of the ADF could flow into this area and potentially become polluted. | **Without** | -3 | -4 | -3 | -4 | -14 | **Very High** |
| | | **With** | -3 | -3 | -2 | -2 | -10 | **High** |
| | | **Mitigation measures:**<br>• Divert all clean water resources away from dirty water areas.<br>• Adequate stormwater management around the site to comply with GN 704. For SA1, the entire ADF should be regarded as a dirty water area. Run-off from the site could be easily captured in a down-slope drain system and removed to a PCD. A single, large PCD is available to the south of the existing ADF. For SA2, entire ADF should be regarded as a dirty water area. Run-off from the site could, be easily captured in a down-slope drain system and removed to a PCD. A single, large PCD is recommended to the north of the dump site and below all likely spoil heaps.<br>• The stormwater management measures suggested for the conveyor belt system are a berm and a drain located next to the belt. The drains are placed to stop clean water from entering the dirty water system and vice versa. Rainfall that falls on the roof will mix with the dust generated by the conveyor belt and this water will be contained by the berms and transported to the sumps placed along the route. Water that accumulates in these sumps must be pumped to the nearest PCD. | | | | | | |
| | **Aspect:** Seepage to surface water resources from the ADF.<br><br>**Impact:** Contamination of surface water. | **Without** | -4 | -4 | -2 | -4 | -14 | **Very High** |
| | | **With** | -3 | -4 | -1 | -2 | -10 | **High** |
| | | **Mitigation measures:**<br>• Lining of the greenfields portion of the ADF as per the recommendations of the Technical Engineering Report (**Appendix C**) where it is proposed that the Compacted Clay Liner (CCL) is substituted with a Geosynthetic Clay Liner (GCL) of equivalent or better performance.<br>• Adequate stormwater management around the site to comply with GN 704. For SA1, the entire ADF should be regarded as a dirty water area. Run-off from the site could be easily captured in a down-slope drain system and removed to a PCD. A single, large PCD is available to the south of the existing ADF. For SA2, entire ADF should be regarded as a dirty water area. Run-off from the site could, be easily captured in a down-slope drain | | | | | | |

| Phase | Aspect and Impact | Mitigation | Extent | Duration | Intensity | Probability | Significance (E+D+I+P) | |
|---|---|---|---|---|---|---|---|---|
| | | system and removed to a PCD. A single, large PCD is recommended to the north of the dump site and below all likely spoil heaps. | | | | | | |
| | **Aspect:** Vegetation and topsoil cleared from building sites and roadways.<br><br>**Impact:** Obstruction of natural drainage resulting in the diversion of clean water into dirty water areas, waterlogging of adjacent areas or pollution of water resources. | **Without** | -4 | -4 | -3 | -4 | -15 | **Very High** |
| | | **With** | -3 | -3 | -2 | -2 | -10 | **High** |
| | | **Mitigation measures:**<br>• Place all removed / excavated vegetation and topsoil in demarcated overburden stockpile areas to prevent obstruction of natural drainage paths. | | | | | | |
| | **Aspect:** Soil disturbance during soil turning.<br><br>**Impact:** Siltation of the surface water resource. | **Without** | -1 | -2 | -2 | -4 | -9 | **Medium** |
| | | **With** | -1 | -1 | -2 | -2 | -6 | **Low** |
| | | **Mitigation measures:**<br>• Divert all clean water resources away from dirty water areas prior to construction and compact the base of working areas. | | | | | | |
| | **Aspect:** Construction of ADF slopes.<br><br>**Impact:** Slopes could significantly contribute to erosion and siltation. | **Without** | -2 | -4 | -2 | -4 | -12 | **High** |
| | | **With** | -1 | -3 | -2 | -3 | -9 | **Medium** |
| | | **Mitigation measures:**<br>• It is recommended that cover material be placed on side slopes to achieve a slope of 1V:3H or flatter as the ash dump extends vertically, thereby achieving progressive capping.<br>• Erosion of slopes shall be repaired as soon as practicably possible after they have occurred. | | | | | | |

| Phase | Aspect and Impact | Mitigation | Extent | Duration | Intensity | Probability | Significance (E+D+I+P) | |
|---|---|---|---|---|---|---|---|---|
| | **Aspect:**<br>Builders' rubble, packaging and other waste generated in the construction process.<br><br>**Impact:**<br>Contamination of surface water resources. | **Without** | -3 | -3 | -3 | -3 | -12 | **High** |
| | | **With** | -2 | -1 | -2 | -2 | -7 | **Medium** |
| | | **Mitigation measures:**<br>• An adequate number of general waste receptacles, including bins must be arranged around the site to collect all domestic refuse, and to minimise littering.<br>• Bins should be clearly marked and lined for efficient control and safe disposal of waste.<br>• A fenced area must be allocated for waste sorting and disposal on the site.<br>• General waste produced on site is to be collected in skips for disposal at the Matimba Power Station. Hazardous waste is not to be mixed or combined with general waste.<br>• Under no circumstances is waste to be burnt or buried on site.<br>• Waste bins should be cleaned out on a regular basis to prevent any windblown waste and/or visual disturbance.<br>• All general waste must be removed from the site at regular intervals and disposed of in suitable waste receptacle.<br>• Hazardous waste is to be disposed at a Permitted Hazardous Waste Landfill Site. The ECO must have as part of his/her records the waste manifest for each batch based disposal.<br>• Hazardous waste bins must be clearly marked, stored in a contained area (or have a drip tray) and covered (either stored under a roof or the top of the container must be covered with a lid).<br>• A hazardous waste disposal certificate must be obtained from the waste removal company as evidence of correct disposal.<br>• In the case of a spill of hydrocarbons, chemicals or bituminous, the spill should be contained and cleaned up and the material together with any contaminated soil collected and bioremediated. | | | | | | |
| | **Aspect:**<br>Fuel and / or toxic material spills.<br><br>**Impact:**<br>Pollution of local water resources. | **Without** | -4 | -3 | -2 | -4 | -13 | **Very High** |
| | | **With** | -3 | -3 | -2 | -1 | -9 | **Medium** |
| | | **Mitigation measures:**<br>• Appropriate design of facilities to handle fuels and toxic waste. Chemical storage areas to be bunded so that if a spill occurs the chemical will be contained.<br>• Ensure that all spills are immediately cleaned up. | | | | | | |

| Phase | Aspect and Impact | Mitigation | Extent | Duration | Intensity | Probability | Significance (E+D+I+P) | |
|---|---|---|---|---|---|---|---|---|
| | **Aspect:** Seepage to surface water resources from waste disposal areas.<br><br>**Impact:** Pollution of local water resources. | **Without** | -1 | -3 | -3 | -3 | -10 | **High** |
| | | **With** | -1 | -2 | -2 | -2 | -7 | **Medium** |
| | | **Mitigation measures:**<br>• Design drains to capture and transport water to PCDs.<br>• A monitoring programme is recommended at the ADF in terms of Best Practice Guidelines G3: Water Monitoring Systems[32], in order to detect any potential contamination as early as possible. The monitoring programme will assist with overall water management at the site and should be amended according to on-site operations and licencing conditions (Environmental Authorisation and WUL), monthly sampling up- and down-stream of relevant rivers and pans within the study site and bi-annual sampling up- and down-stream of relevant rivers and pans in the greater area. It is further recommended that sample site MASW1 is monitored at least biannually as livestock are likely to continue drinking from this pan. | | | | | | |
| | **Aspect:** Workshops and washbays.<br><br>**Impact:** Run-off could be contaminated with hydrocarbons. | **Without** | -2 | -3 | -1 | -4 | -10 | **High** |
| | | **With** | -2 | -3 | -2 | -1 | -8 | **Medium** |
| | | **Mitigation measures:**<br>• Contain run-off and remove hydrocarbons with an oil trap. | | | | | | |
| | **Aspect:** Wash water entering pollution control dams.<br><br>**Impact:** Wash water contains heavy silt loads which could settle in pollution | **Without** | -2 | -3 | -2 | -3 | -10 | **High** |
| | | **With** | -2 | -3 | -2 | -1 | -8 | **Medium** |
| | | **Mitigation measures:**<br>• Provide a silt trap to contain and allow the removal of sediments. | | | | | | |

[32] Department of Water Affairs (DWA). (2006). *Best Practice Guidelines for Water Resources Protection in the South African Mining Industry. BPG G3. Water Monitoring Systems.* Pretoria: DWA.

| Phase | Aspect and Impact | Mitigation | Extent | Duration | Intensity | Probability | Significance (E+D+I+P) | |
|---|---|---|---|---|---|---|---|---|
| | control dams and reduce storage capacity. | | | | | | | |
| **Operations** | **Aspect:**<br>Large quantities of run-off and seepage from the ADF will exceed storage capacities and spill into the environment.<br><br>**Impact:**<br>Pollution of local water resources. | **Without** | -4 | -4 | -2 | -4 | -14 | **Very High** |
| | | **With** | -3 | -3 | -1 | -1 | -8 | **Medium** |
| | | **Mitigation measures:**<br>• Sizing of pollution control dams – designed to accepted standards and norms.<br>• Adequate stormwater management around the site to comply with GN 704. For SA1, the entire ADF should be regarded as a dirty water area. Run-off from the site could be easily captured in a down-slope drain system and removed to a PCD. A single, large PCD is available to the south of the existing ADF. For SA2, the entire ADF should be regarded as a dirty water area. Run-off from the site could, be easily captured in a down-slope drain system and removed to a PCD. A single, large PCD is recommended to the north of the dump site and below all likely spoil heaps.<br>• A monitoring programme is recommended at the ADF in terms of Best Practice Guidelines G3: Water Monitoring Systems[33], in order to detect any potential contamination as early as possible. The monitoring programme will assist with overall water management at the site and should be amended according to on-site operations and licencing conditions (Environmental Authorisation and WUL), monthly sampling up- and down-stream of relevant rivers and pans within the study site and bi-annual sampling up- and down-stream of relevant rivers and pans in the greater area. It is further recommended that sample site MASW1 is monitored at least biannually as livestock are likely to continue drinking from this pan. | | | | | | |
| **Decommissioning** | **Aspect:**<br>Rubble and waste from site.<br><br>**Impact:**<br>Pollution of local water resources. | **Without** | -2 | -4 | -2 | -3 | -11 | **High** |
| | | **With** | -2 | -4 | -2 | -1 | -9 | **Medium** |
| | | **Mitigation measures:**<br>• Waste that is not removed from site should be spread, covered and suitably rehabilitated. | | | | | | |
| | **Aspect:** | **Without** | -3 | -4 | -3 | -4 | -14 | **Very High** |

[33] Department of Water Affairs (DWA). (2006). *Best Practice Guidelines for Water Resources Protection in the South African Mining Industry. BPG G3. Water Monitoring Systems.* Pretoria: DWA.

| Phase | Aspect and Impact | Mitigation | Extent | Duration | Intensity | Probability | Significance (E+D+I+P) | |
|---|---|---|---|---|---|---|---|---|
| | Run-off and drainage from stockpiles and ADF.<br><br>**Impact:**<br>Continue to yield polluted water. | **With** | -3 | -4 | -1 | -2 | -10 | **High** |
| | | **Mitigation measures:**<br>• Stockpiles are spread and surfaces rehabilitated.<br>• Drains and PCDs are maintained.<br>• Polluted water transferred to the PCDs. | | | | | | |
| | **Aspect:**<br>Drainage and seepage from ADF.<br><br>**Impact:**<br>Continued flows of polluted water. | **Without** | -2 | -4 | -3 | -4 | -13 | **Very High** |
| | | **With** | -2 | -4 | -1 | -1 | -8 | **Medium** |
| | | **Mitigation measures:**<br>• The PCDs or treatment works that safely contains or treats water continues to function. | | | | | | |

## 9.5 Surface Water (Wetlands)

**Table 62: Site Alternative 1 and 2 surface water impacts**

| Phase | Aspect and Impact | Mitigation | Extent | Duration | Intensity | Probability | Significance (E+D+I+P) | |
|---|---|---|---|---|---|---|---|---|
| **Construction** | **Aspect:**<br>• Irresponsible construction practices.<br>• Temporary road accesses across riparian corridors.<br><br>**Impact:**<br>• Pollution of surface water features (e.g. faecal contamination, or pollution of surface water through | **Without** | -2 | -2 | -2 | -2 | -8 | **Medium** |
| | | **With** | -1 | -2 | -1 | -2 | -6 | **Low** |
| | | **Mitigation measures:**<br>• Construction to be guided by Eskom guidelines for construction.<br>• Construction to be monitored by an ECO according to the stipulations of the EMPr.<br>• No batching or chemical / fuel storage areas to be located within any surface water feature or associated buffer.<br>• A construction stormwater management plan to be devised to prevent silt and polluted water ingress into surface water features. | | | | | | |

| Phase | Aspect and Impact | Mitigation | Extent | Duration | Intensity | Probability | Significance (E+D+I+P) | |
|---|---|---|---|---|---|---|---|---|
| | hydrocarbons).<br>• Hydrological and morphological impacts (erosion, channel morphology changes, undercutting of riparian areas, etc.) and degrade the resource quality of the riparian corridor. | • No temporary construction accesses to be constructed through any surface water feature and no machinery to enter any surface water feature or buffer. | | | | | | |
| **Operations** | **Aspect:**<br>Transformation / clearing of riparian corridors as part of the ashing activities.<br><br>**Impact:**<br>Hydrological, morphological and resource quality impacts of the affected drainage lines. | **Without** | -2 | -3 | -3 | -2 | -10 | **High** |
| | | **With** | | | | | | **No impact** |
| | | **Mitigation measures:**<br>• No riparian zones or associated buffer areas must form part of the footprint of the ADF.<br>• The presence of a buffer beyond the edge of the riparian zone will protect the riparian corridor from direct impacts. | | | | | | |
| | **Aspect:**<br>Polluted stormwater run-off.<br><br>**Impact:**<br>Stormwater from the ashing area could enter riparian areas and transport pollutants into the surface water features. | **Without** | -2 | -3 | -2 | -2 | -9 | **Medium** |
| | | **With** | -1 | -1 | -2 | -1 | -5 | **Low** |
| | | **Mitigation measures:**<br>• Stormwater control to be included in the design of the rehabilitated ADF.<br>• Temporary stormwater control must be incorporated into the active ashing area.<br>• Buffers (100 m beyond the edge of the riparian zone) around riparian corridors to be strictly enforced. | | | | | | |
| **Decommissioning** | **Aspect:**<br>Improper rehabilitation of the ADF.<br><br>**Impact:** | **Without** | -2 | -2 | -2 | -2 | -8 | **Medium** |
| | | **With** | -1 | -2 | -1 | -2 | -6 | **Low** |
| | | **Mitigation measures:** | | | | | | |

| Phase | Aspect and Impact | Mitigation | Extent | Duration | Intensity | Probability | Significance (E+D+I+P) |
|---|---|---|---|---|---|---|---|
| | Erosion of the deposited ash and its transport through stormwater into adjacent riparian zones, thus causing pollution. | • Decommissioning to be guided by Eskom guidelines for construction / decommissioning.<br>• Final rehabilitation of the ADF to be monitored by an ECO according to the stipulations of the EMPr.<br>• No temporary accesses to be constructed through any surface water feature and no machinery to enter any riparian corridor. | | | | | |
| **Cumulative** | Cumulative loss of riparian habitat due to transformation of the riparian areas could result in a cumulative impact on the wider surface water feature. This is particularly relevant in the case of the drainage line on SA1 where there are a number of existing impacts on the drainage line and associated riparian corridor.<br><br>Refer to activity / phase specific mitigation measures above. | | | | | | |

## 9.6 Soils and Agricultural Potential

**Table 63: Site Alternative 1, 2 and linear infrastructure route soils and agricultural potential impacts**

| Phase | Aspect and Impact | Mitigation | Extent | Duration | Intensity | Probability | Significance (E+D+I+P) | |
|---|---|---|---|---|---|---|---|---|
| **Construction** | **Aspect:**<br>Construction of the ADF, buildings, roads, conveyor and ancillary infrastructure.<br><br>**Impact:**<br>Impact on soils, land capability and agricultural potential. | **Without** | -1 | -4 | -1 | -4 | -10 | **High** |
| | | **With** | | | | | | |
| | | **Mitigation measures:**<br>• None possible. Limit footprint to the immediate development area. | | | | | | |
| | **Aspect:**<br>Vehicle operation on site. | **Without** | -1 | -2 | -1 | -3 | -7 | **Medium** |
| | | **With** | -1 | -1 | -1 | -2 | -5 | **Low** |

| Phase | Aspect and Impact | Mitigation | Extent | Duration | Intensity | Probability | Significance (E+D+I+P) | |
|---|---|---|---|---|---|---|---|---|
| | **Impact:**<br>Spillage of lubricants and petroleum products. | **Mitigation measures:**<br>• Vehicles and machinery to be properly maintained to keep oil and diesel leaks in check.<br>• Depending on the nature and extent of the spill, contaminated soil to be excavated / treated on-site. | | | | | | |
| | **Aspect:**<br>Vehicle operation on site.<br><br>**Impact:**<br>Dust generation. | **Without** | -2 | -3 | -1 | -3 | -9 | **Medium** |
| | | **With** | -1 | -2 | -1 | -2 | -6 | **Low** |
| | | **Mitigation measures:**<br>• Limit vehicle movement to absolute minimum or construct proper roads for access.<br>• Limit vehicle movement on unpaved areas and vehicle speeds should be restricted on site.<br>• Dust must be suppressed on the construction site and during the transportation of material during dry periods by the regular application of water. Water used for this purpose must be used in quantities that will not result in the generation of run-off. | | | | | | |
| **Operations** | **Aspect:**<br>Continuous ashing.<br><br>**Impact:**<br>Impact on soils, land capability and agricultural potential. | **Without** | -2 | -3 | -1 | -3 | -9 | **Medium** |
| | | **With** | | | | | | |
| | | **Mitigation measures:**<br>• None possible. Limit footprint to the immediate development area. | | | | | | |
| **Decommissioning** | **Refer to construction phase aspects and impacts.** | **Mitigation measures:**<br>• Refer to construction phase mitigation measures. | | | | | | |

## 9.7 Biodiversity

**Table 64: Site Alternative 1 biodiversity impacts**

| Phase | Aspect and Impact | Mitigation | Extent | Duration | Intensity | Probability | Significance (E+D+I+P) | |
|---|---|---|---|---|---|---|---|---|
| **Construction** | **Aspect:**<br>Construction activities.<br><br>**Impact:**<br>Impacts on flora species of conservation importance (including habitat suitable for these species). | **Without** | -4 | -4 | -3 | -4 | -15 | **Very High** |
| | | **With** | -4 | -4 | -3 | -4 | -15 | **Very High** |
| | | **Mitigation measures:**<br>• The loss of sensitive habitat within SA1 is unavoidable and impossible to mitigate against. Spatial and temporal impacts will therefore be unavoidable, permanent and irreversible. The recommendation is therefore to implement an added value biodiversity enhancement strategy, of which the major objective would be to improve biodiversity conservation and management on a local and regional scale. Eskom will access the Limpopo Conservation Plan to align current land management practices of the of the Eskom owned Grootvallei Game Reserve with 'conservation added value projects', for the purposes of enhancing and securing biodiversity of the region through stewardship.<br>• The details of such a plan should form part of a subsequent phase, subjected to the approval by authorities, i.e. a post authorisation requirement.<br>• Prevent contamination of natural habitat and nearby wetlands from any source of pollution<br>• Provide an adequate buffer between areas of development and surrounding natural habitat.<br>• Demarcate construction areas by semi-permanent means/ material, in order to control movement of personnel, vehicles, providing boundaries for construction and operational sites<br>• No painting or marking of rocks or vegetation to identify locality or other information shall be allowed, as it will disfigure the natural setting. Marking shall be done by steel stakes with tags, if required.<br>• Provide demarcated fire-safe zones, facilities and suitable fire control measures.<br>• A road management plan should be compiled prior to the commencement of construction activities.<br>• Access is to be established by vehicles passing over the same track on natural ground. Multiple tracks are not permitted.<br>• Dust control on all roads should be prioritised.<br>• Conduct a protected species survey. Results of this survey will guide permitting requirements for the removal of protected trees from the selected property.<br>• The Applicant must immediately take steps to remove alien vegetation. | | | | | | |

| Phase | Aspect and Impact | Mitigation | Extent | Duration | Intensity | Probability | Significance (E+D+I+P) | |
|---|---|---|---|---|---|---|---|---|
| | | • The size of areas subjected to land clearance will be kept to a minimum.<br>• Only areas as instructed by the Site Manager must be cleared and grubbed.<br>• Cleared vegetation and debris that has not been utilised will be collected and disposed of to a suitable waste disposal site. It must not be burned on site.<br>• All vegetation not required to be removed will be protected against damage.<br>• Removal of vegetation/ plants shall be avoided until such time as soil stripping is required and similarly exposed surfaces must be re-vegetated or stabilised as soon as is practically possible.<br>• Remove and store topsoil separately in areas where excavation/ degradation takes place. Removal of topsoil should be done to a depth of at least 1 m.<br>• Stored topsoil will be free of deleterious matter such as large roots, stones, refuse, stiff or heavy clay and noxious weeds, which would adversely affect its suitability for planting.<br>• No spoil material will be dumped outside the defined site.<br>• Disturbance of vegetation must be limited to areas of construction.<br>• The removal or picking of any protected or unprotected plants shall not be permitted and no horticultural specimens (even within the demarcated working area) shall be removed, damaged or tampered with unless agreed to by the ECO. | | | | | | |
| | **Aspect:**<br>Construction activities.<br><br>**Impact:**<br>Impacts on fauna species of conservation importance (including habitat suitable for these species). | **Without** | -4 | -4 | -3 | -4 | -15 | **Very High** |
| | | **With** | -3 | -4 | -2 | -3 | -12 | **High** |
| | | **Mitigation measures:**<br>• Refer to mitigation measures above. | | | | | | |
| | **Aspect:**<br>Construction activities.<br><br>**Impact:**<br>Impacts on unique or protected habitat types (including loss and | **Without** | -3 | -4 | -4 | -3 | -14 | **Very High** |
| | | **With** | -3 | -4 | -4 | -3 | -14 | **Very High** |
| | | **Mitigation measures:**<br>• Refer to mitigation measures above. | | | | | | |

| Phase | Aspect and Impact | Mitigation | Extent | Duration | Intensity | Probability | Significance (E+D+I+P) | |
|---|---|---|---|---|---|---|---|---|
| | degradation). | | | | | | | |
| | **Aspect:**<br>Construction activities.<br><br>**Impact:**<br>Loss of sensitive/ natural habitat types (including plant diversity and abundance). | **Without** | -2 | -4 | -3 | -3 | -12 | **High** |
| | | **With** | -2 | -4 | -3 | -3 | -12 | **High** |
| | | **Mitigation measures:**<br>• Refer to mitigation measures above. | | | | | | |
| | **Aspect:**<br>Construction activities.<br><br>**Impact:**<br>Displacement of fauna species, human-animal conflicts and interactions (including diversity and abundance). | **Without** | -3 | -4 | -3 | -4 | -14 | **Very High** |
| | | **With** | -3 | -3 | -3 | -3 | -12 | **High** |
| | | **Mitigation measures:**<br>• Refer to mitigation measures above. | | | | | | |
| | **Aspect:**<br>Construction activities.<br><br>**Impact:**<br>Impacts on ecological connectivity and ecosystem functioning. | **Without** | -3 | -4 | -3 | -4 | -14 | **Very High** |
| | | **With** | -2 | -3 | -2 | -2 | -9 | **Medium** |
| | | **Mitigation measures:**<br>• Refer to mitigation measures above. | | | | | | |
| | **Aspect:**<br>Construction activities.<br><br>**Impact:**<br>Indirect impacts on surrounding habitat. | **Without** | -2 | -3 | -3 | -4 | -12 | **High** |
| | | **With** | -2 | -3 | -2 | -2 | -9 | **Medium** |
| | | **Mitigation Measures**<br>• Refer to mitigation measures above. | | | | | | |

| Phase | Aspect and Impact | Mitigation | Extent | Duration | Intensity | Probability | Significance (E+D+I+P) | |
|---|---|---|---|---|---|---|---|---|
| **Operations** | **Aspect:**<br>Continuous ashing.<br><br>**Impact:**<br>Impacts on flora species of conservation importance (including habitat suitable for these species). | **Without** | -4 | -4 | -3 | -2 | -13 | **Very High** |
| | | **With** | -1 | -2 | -2 | -1 | -6 | **Low** |
| | | **Mitigation measures:**<br>• Compile and implement a biodiversity monitoring programme, the aim of which should be ensuring long-term success of rehabilitation and prevention of environmental degradation. Biodiversity monitoring should be conducted at least once a year in order to assess the status of natural habitat and effects of the development on the natural environment.<br>• The Project team should compile a Fire Management Plan (FMP) and Contractors directed by the ECO will submit a FMP. This combined Project FMP shall be approved by local Fire Protection Association, and shall include inter alia aspects such as relevant training, equipment on site, prevention, response, rehabilitation and compliance to the National Veld and Forest Fire Act, Act No. 101 of 1998.<br>• No open fires allowed on site.<br>• Use of branches of trees, shrubs or any vegetation for fire making purposes is strictly prohibited.<br>• Monitoring the potential spread of declared weeds and invasive alien vegetation to neighbouring land and vice versa and protecting the agricultural resources and soil conservation works are regulated by the NEM: Biodiversity Act (Act 10 of 2004) and Regulations must be addressed on a continual basis, through an alien vegetation control and monitoring programme.<br>• The removal or picking of any protected or unprotected plants shall not be permitted and no horticultural specimens (even within the demarcated working area) shall be removed, damaged or tampered with unless agreed to by the ECO. | | | | | | |
| | **Aspect:**<br>Continuous ashing.<br><br>**Impact:**<br>Impacts on fauna species of conservation importance (including habitat suitable for these species). | **Without** | -4 | -4 | -3 | -2 | -13 | **Very High** |
| | | **With** | -1 | -2 | -2 | -1 | -6 | **Low** |
| | | **Mitigation measures:**<br>• Refer to mitigation measures above. | | | | | | |
| | **Aspect:** | **Without** | -2 | -4 | -3 | -2 | -11 | **High** |

| Phase | Aspect and Impact | Mitigation | Extent | Duration | Intensity | Probability | Significance (E+D+I+P) | |
|---|---|---|---|---|---|---|---|---|
| | Continuous ashing.<br><br>**Impact:**<br>Impacts on unique or protected habitat types (including loss and degradation). | **With** | -1 | -2 | -2 | -1 | -6 | **Low** |
| | | **Mitigation measures:**<br>• Refer to mitigation measures above. | | | | | | |
| | **Aspect:**<br>Continuous ashing.<br><br>**Impact:**<br>Loss of sensitive/ natural habitat types (including plant diversity and abundance). | **Without** | -1 | -3 | -2 | -2 | -8 | **Medium** |
| | | **With** | -1 | -3 | -2 | -1 | -7 | **Medium** |
| | | **Mitigation measures:**<br>• Refer to mitigation measures above. | | | | | | |
| | **Aspect:**<br>Continuous ashing.<br><br>**Impact:**<br>Displacement of fauna species, human-animal conflicts and interactions (including diversity and abundance). | **Without** | -2 | -4 | -2 | -3 | -11 | **High** |
| | | **With** | -2 | -3 | -2 | -2 | -9 | **Medium** |
| | | **Mitigation measures:**<br>• Refer to mitigation measures above. | | | | | | |
| | **Aspect:**<br>Continuous ashing.<br><br>**Impact:**<br>Impacts on ecological connectivity and ecosystem functioning. | **Without** | -3 | -4 | -2 | -4 | -13 | **Very High** |
| | | **With** | -3 | -3 | -2 | -3 | -11 | **High** |
| | | **Mitigation measures:**<br>• Refer to mitigation measures above. | | | | | | |
| | **Aspect:** | **Without** | -2 | -3 | -2 | -4 | -11 | **High** |

| Phase | Aspect and Impact | Mitigation | Extent | Duration | Intensity | Probability | Significance (E+D+I+P) | |
|---|---|---|---|---|---|---|---|---|
| | Continuous ashing.<br><br>**Impact:**<br>Indirect impacts on surrounding habitat. | **With** | -2 | -3 | -2 | -3 | -10 | **High** |
| | | **Mitigation measures:**<br>• Refer to mitigation measures above. | | | | | | |
| **Decommissioning** | **Aspect:**<br>Decommissioning.<br><br>**Impact:**<br>Impacts on flora species of conservation importance (including habitat suitable for these species). | **Without** | -2 | -3 | -2 | -2 | -9 | **Medium** |
| | | **With** | -2 | -2 | -2 | -1 | -7 | **Medium** |
| | | **Mitigation measures:**<br>• Implement a biodiversity monitoring programme that should be conducted at least twice per year.<br>• Ensure proper surface restoration and re-sloping in order to prevent erosion, taking cognisance of local contours and landscaping.<br>• Exposed areas with slopes less than 1:3 should be rehabilitated with a grass mix that blends in with the surrounding vegetation.<br>• The grass mix should consist of indigenous grasses adapted to the local environmental conditions.<br>• Re-vegetated areas should be fenced to prevent damage by grazing animals.<br>• Re-vegetated areas showing inadequate surface coverage (less than 30% within eight months after re-vegetation) should be prepared and re-vegetated from scratch.<br>• Damage to re-vegetated areas should be repaired promptly.<br>• Exotic weeds and invaders that might establish on the re-vegetated areas should be controlled to allow the grasses to properly establish. | | | | | | |
| | **Aspect:**<br>Decommissioning.<br><br>**Impact:**<br>Impacts on fauna species of conservation importance (including habitat suitable for these species). | **Without** | -2 | -3 | -2 | -2 | -9 | **Medium** |
| | | **With** | -2 | -2 | -1 | -1 | -6 | **Low** |
| | | **Mitigation measures:**<br>• Refer to mitigation measures above. | | | | | | |
| | **Aspect:** | **Without** | -2 | -2 | -2 | -2 | -8 | **Medium** |

| Phase | Aspect and Impact | Mitigation | Extent | Duration | Intensity | Probability | Significance (E+D+I+P) | |
|---|---|---|---|---|---|---|---|---|
| | Decommissioning.<br><br>**Impact:**<br>Impacts on unique or protected habitat types (including loss and degradation). | **With** | -2 | -2 | -1 | -1 | -6 | **Low** |
| | | **Mitigation measures:**<br>• Refer to mitigation measures above. | | | | | | |
| | **Aspect:**<br>Decommissioning.<br><br>**Impact:**<br>Loss of sensitive/ natural habitat types (including plant diversity and abundance). | **Without** | -1 | -2 | -2 | -2 | -7 | **Medium** |
| | | **With** | -1 | -2 | -1 | -1 | -5 | **Low** |
| | | **Mitigation measures:**<br>• Refer to mitigation measures above. | | | | | | |
| | **Aspect:**<br>Decommissioning.<br><br>**Impact:**<br>Displacement of fauna species, human-animal conflicts and interactions (including diversity and abundance). | **Without** | -1 | -3 | -2 | -2 | -8 | **Medium** |
| | | **With** | -1 | -2 | -1 | -1 | -5 | **Low** |
| | | **Mitigation measures:**<br>• Refer to mitigation measures above. | | | | | | |
| | **Aspect:**<br>Decommissioning.<br><br>**Impact:**<br>Impacts on ecological connectivity and ecosystem functioning. | **Without** | -2 | -3 | -2 | -2 | -9 | **Medium** |
| | | **With** | -2 | -2 | -1 | -1 | -6 | **Low** |
| | | **Mitigation measures:**<br>• Refer to mitigation measures above. | | | | | | |

| Phase | Aspect and Impact | Mitigation | Extent | Duration | Intensity | Probability | Significance (E+D+I+P) | |
|---|---|---|---|---|---|---|---|---|
| | **Aspect:** Decommissioning.<br><br>**Impact:** Indirect impacts on surrounding habitat. | **Without** | -2 | -3 | -2 | -2 | -9 | **Medium** |
| | | **With** | -2 | -2 | -1 | -1 | -6 | **Low** |
| | | **Mitigation measures:**<br>• Refer to mitigation measures above. | | | | | | |
| **Cumulative** | • Cumulative impacts on conservation obligations and targets (including national and regional).<br>• Cumulative increase in local and regional fragmentation/ isolation of habitat.<br>• Cumulative increase in environmental degradation, pollution.<br><br>Mitigation measures are same as those in the construction, operation and decommissioning phases above. | | | | | | | |

**Table 65: Site Alternative 2 biodiversity impacts**

| Phase | Aspect and Impact | Mitigation | Extent | Duration | Intensity | Probability | Significance (E+D+I+P) | |
|---|---|---|---|---|---|---|---|---|
| **Construction** | **Aspect:** Construction activities.<br><br>**Impact:** Impacts on flora species of conservation importance (including habitat suitable for these species). | **Without** | -4 | -4 | -2 | -4 | -14 | **Very High** |
| | | **With** | -4 | 4 | -2 | -4 | -14 | **Very High** |
| | | **Mitigation measures:**<br>• Provide an adequate buffer between areas of development and surrounding natural habitat.<br>• Demarcate construction areas by semi-permanent means/ material, in order to control movement of personnel, vehicles, providing boundaries for construction and operational sites.<br>• No painting or marking of rocks or vegetation to identify locality or other information shall be allowed, as it will disfigure the natural setting. Marking shall be done by steel stakes with tags, if required.<br>• Provide demarcated fire-safe zones, facilities and suitable fire control measures. | | | | | | |

| Phase | Aspect and Impact | Mitigation | Extent | Duration | Intensity | Probability | Significance (E+D+I+P) | |
|---|---|---|---|---|---|---|---|---|
| | | • A road management plan should be compiled prior to the commencement of construction activities.<br>• Access is to be established by vehicles passing over the same track on natural ground. Multiple tracks are not permitted.<br>• Dust control on all roads should be prioritised.<br>• No roads should be allowed within ecologically sensitive areas.<br>• Conduct a protected species survey. Results of this survey will guide permitting requirements for the removal of protected trees from the selected property.<br>• The Applicant must immediately take steps to remove alien vegetation.<br>• The size of areas subjected to land clearance will be kept to a minimum.<br>• Only areas as instructed by the Site Manager must be cleared and grubbed.<br>• Cleared vegetation and debris that has not been utilised will be collected and disposed of to a suitable waste disposal site. It will not be burned on site.<br>• All vegetation not required to be removed will be protected against damage.<br>• Removal of vegetation/ plants shall be avoided until such time as soil stripping is required and similarly exposed surfaces must be re-vegetated or stabilised as soon as is practically possible.<br>• Remove and store topsoil separately in areas where excavation/ degradation takes place. Removal of topsoil should be done to a depth of at least 1 m.<br>• Stored topsoil will be free of deleterious matter such as large roots, stones, refuse, stiff or heavy clay and noxious weeds, which would adversely affect its suitability for planting.<br>• No spoil material will be dumped outside the defined site.<br>• Disturbance of vegetation must be limited to areas of construction.<br>• The removal or picking of any protected or unprotected plants shall not be permitted and no horticultural specimens (even within the demarcated working area) shall be removed, damaged or tampered with unless agreed to by the ECO. | | | | | | |
| | **Aspect:**<br>Construction activities.<br><br>**Impact:**<br>Impacts on fauna species of conservation importance (including | **Without** | -4 | -4 | -2 | -3 | -13 | **Very High** |
| | | **With** | -3 | -3 | -2 | -3 | -11 | **High** |
| | | **Mitigation measures:**<br>• Refer to mitigation measures above. | | | | | | |

| Phase | Aspect and Impact | Mitigation | Extent | Duration | Intensity | Probability | Significance (E+D+I+P) | |
|---|---|---|---|---|---|---|---|---|
| | habitat suitable for these species). | | | | | | | |
| | **Aspect:**<br>Construction activities.<br><br>**Impact:**<br>Impacts on unique or protected habitat types (including loss and degradation). | **Without** | -2 | -4 | -3 | -3 | -12 | **High** |
| | | **With** | -2 | -4 | -3 | -3 | -12 | **High** |
| | | **Mitigation measures:**<br>• Refer to mitigation measures above. | | | | | | |
| | **Aspect:**<br>Construction activities.<br><br>**Impact:**<br>Loss of sensitive/ natural habitat types (including plant diversity and abundance). | **Without** | -2 | -4 | -2 | -3 | -11 | **High** |
| | | **With** | -2 | -4 | -2 | -2 | -10 | **High** |
| | | **Mitigation measures:**<br>• Refer to mitigation measures above. | | | | | | |
| | **Aspect:**<br>Construction activities.<br><br>**Impact:**<br>Displacement of fauna species, human-animal conflicts and interactions (including diversity and abundance). | **Without** | -2 | -4 | -3 | -3 | -12 | **High** |
| | | **With** | -2 | -3 | -3 | -3 | -11 | **High** |
| | | **Mitigation measures:**<br>• Refer to mitigation measures above. | | | | | | |
| | **Aspect:**<br>Construction activities. | **Without** | -2 | -3 | -2 | -3 | -10 | **High** |
| | | **With** | -2 | -3 | -2 | -2 | -9 | **Medium** |

| Phase | Aspect and Impact | Mitigation | Extent | Duration | Intensity | Probability | Significance (E+D+I+P) | |
|---|---|---|---|---|---|---|---|---|
| | **Impact:**<br>Impacts on ecological connectivity and ecosystem functioning. | **Mitigation measures:**<br>• Refer to mitigation measures above. | | | | | | |
| | **Aspect:**<br>Construction activities.<br><br>**Impact:**<br>Indirect impacts on surrounding habitat. | **Without** | -2 | -3 | -2 | -4 | -11 | **High** |
| | | **With** | -2 | -3 | -2 | -2 | -9 | **Medium** |
| | | **Mitigation measures:**<br>• Refer to mitigation measures above. | | | | | | |
| **Operations** | **Aspect:**<br>Continuous ashing.<br><br>**Impact:**<br>Impacts on flora species of conservation importance (including habitat suitable for these species). | **Without** | -3 | -4 | -3 | -2 | -12 | **High** |
| | | **With** | -1 | -2 | -2 | -1 | -6 | **Low** |
| | | **Mitigation measures:**<br>• Compile and implement biodiversity monitoring programme, the aim of which should be ensuring long-term success of rehabilitation and prevention of environmental degradation. Biodiversity monitoring should be conducted at least once a year in order to assess the status of natural habitat and effects of the development on the natural environment,<br>• The Project team will compile a Fire Management Plan (FMP) and Contractors directed by the ECO will submit a FMP. The combined Project FMP shall be approved by local Fire Protection Association, and shall include inter alia aspects such as relevant training, equipment on site, prevention, response, rehabilitation and compliance to the National Veld and Forest Fire Act, Act No. 101 of 1998.<br>• No open fires allowed on site.<br>• Use of branches of trees, shrubs or any vegetation for fire making purposes is strictly prohibited.<br>• Monitoring the potential spread of declared weeds and invasive alien vegetation to neighbouring land and vice versa and protecting the agricultural resources and soil conservation works are regulated by NEM: Biodiversity Act (No. 10 of 2004) and Regulations and must be addressed on a continual basis, through an alien vegetation control and monitoring programme.<br>• The removal or picking of any protected or unprotected plants shall not be permitted and no horticultural specimens (even within the demarcated working area) shall be removed, damaged or tampered with unless | | | | | | |

| Phase | Aspect and Impact | Mitigation | Extent | Duration | Intensity | Probability | Significance (E+D+I+P) | |
|---|---|---|---|---|---|---|---|---|
| | | agreed to by the ECO. | | | | | | |
| | **Aspect:**<br>Continuous ashing.<br><br>**Impact:**<br>Impacts on fauna species of conservation importance (including habitat suitable for these species). | **Without** | -2 | -3 | -2 | -2 | -9 | **Medium** |
| | | **With** | -1 | -2 | -2 | -1 | -6 | **Low** |
| | | **Mitigation measures:**<br>• Refer to mitigation measures above. | | | | | | |
| | **Aspect:**<br>Continuous ashing.<br><br>**Impact:**<br>Impacts on unique or protected habitat types (including loss and degradation). | **Without** | -2 | -3 | -2 | -2 | -9 | **Medium** |
| | | **With** | -1 | -2 | -2 | -1 | -6 | **Low** |
| | | **Mitigation measures:**<br>• Refer to mitigation measures above. | | | | | | |
| | **Aspect:**<br>Continuous ashing.<br><br>**Impact:**<br>Loss of sensitive/ natural habitat types (including plant diversity and abundance). | **Without** | -1 | -2 | -2 | -1 | -6 | **Low** |
| | | **With** | -1 | -2 | -1 | -1 | -5 | **Low** |
| | | **Mitigation measures:**<br>• Refer to mitigation measures above. | | | | | | |
| | **Aspect:**<br>Continuous ashing. | **Without** | -2 | -3 | -2 | -3 | -10 | **High** |
| | | **With** | -2 | -2 | -1 | -2 | -7 | **Medium** |

| Phase | Aspect and Impact | Mitigation | Extent | Duration | Intensity | Probability | Significance (E+D+I+P) | |
|---|---|---|---|---|---|---|---|---|
| | **Impact:**<br>Displacement of fauna species, human-animal conflicts and interactions (including diversity and abundance). | **Mitigation measures:**<br>• Refer to mitigation measures above. | | | | | | |
| | **Aspect:**<br>Continuous ashing.<br><br>**Impact:**<br>Impacts on ecological connectivity and ecosystem functioning. | **Without** | -2 | -3 | -2 | -2 | -9 | **Medium** |
| | | **With** | -2 | -2 | -2 | -2 | -8 | **Medium** |
| | | **Mitigation measures:**<br>• Refer to mitigation measures above. | | | | | | |
| | **Aspect:**<br>Continuous ashing.<br><br>**Impact:**<br>Indirect impacts on surrounding habitat. | **Without** | -2 | -2 | -2 | -2 | -8 | **Medium** |
| | | **With** | -2 | -2 | -2 | -2 | -8 | **Medium** |
| | | **Mitigation measures:**<br>• Refer to mitigation measures above. | | | | | | |
| **Decommissioning** | **Aspect:**<br>Decommissioning.<br><br>**Impact:**<br>Impacts on flora species of conservation importance (including habitat suitable for these species). | **Without** | -2 | -2 | -2 | -2 | -8 | **Medium** |
| | | **With** | -2 | -2 | -2 | -1 | -7 | **Medium** |
| | | **Mitigation measures:**<br>• Implement a biodiversity monitoring programme that should be conducted at least twice per year.<br>• Ensure proper surface restoration and re-sloping in order to prevent erosion, taking cognisance of local contours and landscaping.<br>• Exposed areas with slopes less than 1:3 should be rehabilitated with a grass mix that blends in with the surrounding vegetation. | | | | | | |

| Phase | Aspect and Impact | Mitigation | Extent | Duration | Intensity | Probability | Significance (E+D+I+P) | |
|---|---|---|---|---|---|---|---|---|
| | | • The grass mix should consist of indigenous grasses adapted to the local environmental conditions.<br>• Re-vegetated areas should be fenced to prevent damage by grazing animals.<br>• Re-vegetated areas showing inadequate surface coverage (less than 30 % within eight months after re-vegetation) should be prepared and re-vegetated from scratch.<br>• Damage to re-vegetated areas should be repaired promptly.<br>• Exotic weeds and invaders that might establish on the re-vegetated areas should be controlled to allow the grasses to properly establish. | | | | | | |
| | **Aspect:**<br>Decommissioning.<br><br>**Impact:**<br>Impacts on fauna species of conservation importance (including habitat suitable for these species). | **Without** | -2 | -2 | -2 | -2 | -8 | **Medium** |
| | | **With** | -2 | -2 | -1 | -1 | -6 | **Low** |
| | | **Mitigation measures:**<br>• Refer to mitigation measures above. | | | | | | |
| | **Aspect:**<br>Decommissioning.<br><br>**Impact:**<br>Impacts on unique or protected habitat types (including loss and degradation). | **Without** | -1 | -2 | -2 | -2 | -7 | **Medium** |
| | | **With** | -1 | -2 | -1 | -1 | -5 | **Low** |
| | | **Mitigation measures:**<br>• Refer to mitigation measures above. | | | | | | |
| | **Aspect:** | **Without** | -1 | -2 | -2 | -2 | -7 | **Medium** |

| Phase | Aspect and Impact | Mitigation | Extent | Duration | Intensity | Probability | Significance (E+D+I+P) | |
|---|---|---|---|---|---|---|---|---|
| | Decommissioning.<br><br>**Impact:**<br>Loss of sensitive/ natural habitat types (including plant diversity and abundance). | **With** | -1 | -2 | -1 | -1 | -5 | **Low** |
| | | **Mitigation measures:**<br>• Refer to mitigation measures above. | | | | | | |
| | **Aspect:**<br>Decommissioning.<br><br>**Impact:**<br>Displacement of fauna species, human-animal conflicts and interactions (including diversity and abundance). | **Without** | -2 | -3 | -2 | -2 | -9 | **Medium** |
| | | **With** | -2 | -1 | -2 | -1 | -6 | **Low** |
| | | **Mitigation measures:**<br>• Refer to mitigation measures above. | | | | | | |
| | **Aspect:**<br>Decommissioning.<br><br>**Impact:**<br>Impacts on ecological connectivity and ecosystem functioning | **Without** | -2 | -3 | -2 | -2 | -9 | **Medium** |
| | | **With** | -2 | -2 | -1 | -1 | -6 | **Low** |
| | | **Mitigation measures:**<br>• Refer to mitigation measures above. | | | | | | |
| | **Aspect:**<br>Decommissioning.<br><br>**Impact:**<br>Indirect impacts on surrounding habitat. | **Without** | -2 | -3 | -2 | -2 | -9 | **Medium** |
| | | **With** | -2 | 2 | -1 | -1 | -6 | **Low** |
| | | **Mitigation measures:**<br>• Refer to mitigation measures above. | | | | | | |

| Phase | Aspect and Impact | Mitigation | Extent | Duration | Intensity | Probability | Significance (E+D+I+P) | |
|---|---|---|---|---|---|---|---|---|
| **Cumulative** | • Cumulative impacts on conservation obligations and targets (including national and regional).<br>• Cumulative increase in local and regional fragmentation/ isolation of habitat.<br>• Cumulative increase in environmental degradation, pollution.<br><br>Mitigation measures are same as those in the construction, operation and decommissioning phases above. | | | | | | | |

**Table 66: Linear infrastructure route biodiversity impacts**

| Phase | Aspect and Impact | Mitigation | Extent | Duration | Intensity | Probability | Significance (E+D+I+P) | |
|---|---|---|---|---|---|---|---|---|
| **Construction** | **Aspect:**<br>Construction activities.<br><br>**Impact:**<br>Impacts on flora species of conservation importance (including habitat suitable for these species). | **Without** | -2 | -3 | -2 | -3 | -10 | **High** |
| | | **With** | -2 | -3 | -2 | -2 | -9 | **Medium** |
| | | **Mitigation measures:**<br>• Provide an adequate buffer between areas of development and surrounding natural habitat.<br>• Demarcate construction areas by semi-permanent means/ material, in order to control movement of personnel, vehicles, providing boundaries for construction and operational sites.<br>• No painting or marking of rocks or vegetation to identify locality or other information shall be allowed, as it will disfigure the natural setting. Marking shall be done by steel stakes with tags, if required.<br>• Provide demarcated fire-safe zones, facilities and suitable fire control measures.<br>• A road management plan should be compiled prior to the commencement of construction activities.<br>• Access is to be established by vehicles passing over the same track on natural ground. Multiple tracks are not permitted.<br>• Dust control on all roads should be prioritised.<br>• No roads should be allowed within ecologically sensitive areas.<br>• Conduct a protected species survey. Results of this survey will guide permitting requirements for the removal of protected trees from the selected property. | | | | | | |

| Phase | Aspect and Impact | Mitigation | Extent | Duration | Intensity | Probability | Significance (E+D+I+P) | |
|---|---|---|---|---|---|---|---|---|
| | | • The Applicant must immediately take steps to remove alien vegetation.<br>• The size of areas subjected to land clearance will be kept to a minimum.<br>• Only areas as instructed by the Site Manager must be cleared and grubbed.<br>• Cleared vegetation and debris that has not been utilised will be collected and disposed of to a suitable waste disposal site. It must not be burned on site.<br>• All vegetation not required to be removed will be protected against damage.<br>• Removal of vegetation/ plants shall be avoided until such time as soil stripping is required and similarly exposed surfaces must be re-vegetated or stabilised as soon as is practically possible.<br>• Remove and store topsoil separately in areas where excavation/ degradation takes place. Removal of topsoil should be done to a depth of at least 1m.<br>• Stored topsoil will be free of deleterious matter such as large roots, stones, refuse, stiff or heavy clay and noxious weeds, which would adversely affect its suitability for planting.<br>• No spoil material will be dumped outside the defined site.<br>• Disturbance of vegetation must be limited to areas of construction.<br>• The removal or picking of any protected or unprotected plants shall not be permitted and no horticultural specimens (even within the demarcated working area) shall be removed, damaged or tampered with unless agreed to by the ECO. | | | | | | |
| | **Aspect:**<br>Construction activities.<br><br>**Impact:**<br>Impacts on fauna species of conservation importance (including habitat suitable for these species). | **Without** | -3 | -3 | -3 | -4 | -13 | **Very High** |
| | | **With** | -2 | -3 | -2 | -3 | -10 | **High** |
| | | **Mitigation measures:**<br>• Refer to mitigation measures above. | | | | | | |
| | **Aspect:**<br>Construction activities.<br><br>**Impact:**<br>Impacts on unique or protected habitat types (including loss and | **Without** | -2 | -3 | -3 | -4 | -12 | **High** |
| | | **With** | -2 | -3 | -2 | -2 | -9 | **Medium** |
| | | **Mitigation measures:**<br>• Refer to mitigation measures above. | | | | | | |

| Phase | Aspect and Impact | Mitigation | Extent | Duration | Intensity | Probability | Significance (E+D+I+P) | |
|---|---|---|---|---|---|---|---|---|
| | degradation). | | | | | | | |
| | **Aspect:**<br>Construction activities.<br><br>**Impact:**<br>Loss of sensitive/ natural habitat types (including plant diversity and abundance). | **Without** | -2 | -3 | -2 | -4 | -11 | High |
| | | **With** | -1 | -3 | -2 | -3 | -9 | **Medium** |
| | | **Mitigation measures:**<br>• Refer to mitigation measures above. | | | | | | |
| | **Aspect:**<br>Construction activities.<br><br>**Impact:**<br>Displacement of fauna species, human-animal conflicts and interactions (including diversity and abundance). | **Without** | -2 | -3 | -3 | -3 | -11 | High |
| | | **With** | -2 | -3 | -2 | -2 | -9 | **Medium** |
| | | **Mitigation measures:**<br>• Refer to mitigation measures above. | | | | | | |
| | **Aspect:**<br>Construction activities.<br><br>**Impact:**<br>Impacts on ecological connectivity and ecosystem functioning. | **Without** | -2 | -3 | -3 | -3 | -11 | High |
| | | **With** | -2 | -3 | -2 | -2 | -9 | **Medium** |
| | | **Mitigation measures:**<br>• Refer to mitigation measures above. | | | | | | |
| | **Aspect:**<br>Construction activities.<br><br>**Impact:**<br>Indirect impacts on surrounding | **Without** | -2 | -3 | -2 | -2 | -9 | **Medium** |
| | | **With** | -2 | -2 | -2 | -1 | -7 | **Medium** |
| | | **Mitigation measures:**<br>• Refer to mitigation measures above. | | | | | | |

| Phase | Aspect and Impact | Mitigation | Extent | Duration | Intensity | Probability | Significance (E+D+I+P) | |
|---|---|---|---|---|---|---|---|---|
| | habitat. | | | | | | | |
| **Operations** | **Aspect:**<br>Continuous ashing.<br><br>**Impact:**<br>Impacts on flora species of conservation importance (including habitat suitable for these species). | **Without** | -2 | -3 | -2 | -3 | -10 | **High** |
| | | **With** | -2 | -3 | -2 | -2 | -9 | **Medium** |
| | | **Mitigation measures:**<br>• Compile and implement a biodiversity monitoring programme, the aim of which should be ensuring long-term success of rehabilitation and prevention of environmental degradation. Biodiversity monitoring should be conducted at least once a year in order to assess the status of natural habitat and effects of the development on the natural environment.<br>• The Project team will compile a Fire Management Plan (FMP) and Contractors directed by the ECO will submit a FMP. The combined Project FMP shall be approved by local Fire Protection Association, and shall include inter alia aspects such as relevant training, equipment on site, prevention, response, rehabilitation and compliance to the National Veld and Forest Fire Act, Act No. 101 of 1998.<br>• No open fires allowed on site.<br>• Use of branches of trees, shrubs or any vegetation for fire making purposes is strictly prohibited.<br>• Monitoring the potential spread of declared weeds and invasive alien vegetation to neighbouring land and vice versa and protecting the agricultural resources and soil conservation works are regulated by the NEM: Biodiversity Act (No. 10 of 2004) and Regulations and must be addressed on a continual basis, through an alien vegetation control and monitoring programme.<br>• The removal or picking of any protected or unprotected plants shall not be permitted and no horticultural specimens (even within the demarcated working area) shall be removed, damaged or tampered with unless agreed to by the ECO. | | | | | | |
| | **Aspect:**<br>Continuous ashing.<br><br>**Impact:**<br>Impacts on fauna species of conservation importance (including habitat suitable for these species). | **Without** | -2 | -3 | -3 | -3 | -11 | **High** |
| | | **With** | -2 | -3 | -2 | -2 | -9 | **Medium** |
| | | **Mitigation measures:**<br>• Refer to mitigation measures above. | | | | | | |
| | **Aspect:** | **Without** | -2 | -3 | -2 | -2 | -9 | **Medium** |

| Phase | Aspect and Impact | Mitigation | Extent | Duration | Intensity | Probability | Significance (E+D+I+P) | |
|---|---|---|---|---|---|---|---|---|
| | Continuous ashing.<br><br>**Impact:**<br>Impacts on unique or protected habitat types (including loss and degradation). | **With** | -2 | -2 | -2 | -1 | -7 | **Medium** |
| | | **Mitigation measures:**<br>• Refer to mitigation measures above. | | | | | | |
| | **Aspect:**<br>Continuous ashing.<br><br>**Impact:**<br>Loss of sensitive/ natural habitat types (including plant diversity and abundance). | **Without** | -1 | -3 | -2 | -2 | -8 | **Medium** |
| | | **With** | -1 | -2 | -2 | -1 | -6 | **Low** |
| | | **Mitigation measures:**<br>• Refer to mitigation measures above. | | | | | | |
| | **Aspect:**<br>Continuous ashing.<br><br>**Impact:**<br>Displacement of fauna species, human-animal conflicts and interactions (including diversity and abundance). | **Without** | -2 | -3 | -3 | -3 | -11 | **High** |
| | | **With** | -2 | -3 | -2 | -2 | -9 | **Medium** |
| | | **Mitigation measures:**<br>• Refer to mitigation measures above. | | | | | | |
| | **Aspect:**<br>Continuous ashing. | **Without** | -2 | -3 | -2 | -2 | -9 | **Medium** |
| | | **With** | -2 | -2 | -2 | -1 | -7 | **Medium** |

| Phase | Aspect and Impact | Mitigation | Extent | Duration | Intensity | Probability | Significance (E+D+I+P) | |
|---|---|---|---|---|---|---|---|---|
| | **Impact:**<br>Impacts on ecological connectivity and ecosystem functioning. | **Mitigation measures:**<br>• Refer to mitigation measures above. | | | | | | |
| | **Aspect:**<br>Continuous ashing.<br><br>**Impact:**<br>Indirect impacts on surrounding habitat. | **Without** | -2 | -3 | -2 | -2 | -9 | **Medium** |
| | | **With** | -2 | -2 | -2 | -1 | -7 | **Medium** |
| | | **Mitigation measures:**<br>• Refer to mitigation measures above. | | | | | | |
| | **Aspect:**<br>Decommissioning.<br><br>**Impact:**<br>Impacts on flora species of conservation importance (including habitat suitable for these species). | **Without** | -1 | -3 | -2 | -2 | -8 | **Medium** |
| | | **With** | -1 | -2 | -2 | -1 | -6 | **Low** |
| | | **Mitigation measures:**<br>• Implement a biodiversity monitoring programme that should be conducted at least twice per year.<br>• Ensure proper surface restoration and re-sloping in order to prevent erosion, taking cognisance of local contours and landscaping.<br>• Exposed areas with slopes less than 1:3 should be rehabilitated with a grass mix that blends in with the surrounding vegetation.<br>• The grass mix should consist of indigenous grasses adapted to the local environmental conditions.<br>• Re-vegetated areas should be fenced to prevent damage by grazing animals.<br>• Re-vegetated areas showing inadequate surface coverage (less than 30% within eight months after re-vegetation) should be prepared and re-vegetated from scratch.<br>• Damage to re-vegetated areas should be repaired promptly.<br>• Exotic weeds and invaders that might establish on the re-vegetated areas should be controlled to allow the grasses to properly establish. | | | | | | |
| | **Aspect:**<br>Decommissioning. | **Without** | -2 | -3 | -2 | -2 | -9 | **Medium** |
| | | **With** | -1 | -2 | -1 | -2 | -6 | **Low** |

| Phase | Aspect and Impact | Mitigation | Extent | Duration | Intensity | Probability | Significance (E+D+I+P) | |
|---|---|---|---|---|---|---|---|---|
| | **Impact:**<br>Impacts on fauna species of conservation importance (including habitat suitable for these species). | **Mitigation measures:**<br>• Refer to mitigation measures above. | | | | | | |
| | **Aspect:**<br>Decommissioning.<br><br>**Impact:**<br>Impacts on unique or protected habitat types (including loss and degradation). | **Without** | -1 | -2 | -2 | -2 | -7 | **Medium** |
| | | **With** | -1 | -1 | -1 | -2 | -5 | **Low** |
| | | **Mitigation measures:**<br>• Refer to mitigation measures above. | | | | | | |
| | **Aspect:**<br>Decommissioning.<br><br>**Impact:**<br>Loss of sensitive/ natural habitat types (including plant diversity and abundance). | **Without** | -1 | -2 | -2 | -2 | -7 | **Medium** |
| | | **With** | -1 | -1 | -1 | -2 | -5 | **Low** |
| | | **Mitigation measures:**<br>• Refer to mitigation measures above. | | | | | | |
| | **Aspect:**<br>Decommissioning.<br><br>**Impact:**<br>Displacement of fauna species, human-animal conflicts and interactions (including diversity and abundance). | **Without** | -2 | -3 | -2 | -2 | -9 | **Medium** |
| | | **With** | -1 | -1 | -2 | -1 | -5 | **Low** |
| | | **Mitigation measures:**<br>• Refer to mitigation measures above. | | | | | | |

| Phase | Aspect and Impact | Mitigation | Extent | Duration | Intensity | Probability | Significance (E+D+I+P) | |
|---|---|---|---|---|---|---|---|---|
| | **Aspect:** Decommissioning.<br><br>**Impact:** Impacts on ecological connectivity and ecosystem functioning. | **Without** | -1 | -2 | -2 | -2 | -7 | **Medium** |
| | | **With** | -1 | -1 | -2 | -1 | -5 | **Low** |
| | | **Mitigation measures:**<br>• Refer to mitigation measures above. | | | | | | |
| **Decommissioning** | **Aspect:** Decommissioning.<br><br>**Impact:** Indirect impacts on surrounding habitat. | **Without** | -1 | -2 | -2 | -2 | -7 | **Medium** |
| | | **With** | -1 | -1 | -1 | -1 | -4 | **Low** |
| | | **Mitigation measures:**<br>• Refer to mitigation measures above. | | | | | | |
| **Cumulative** | • Cumulative impacts on conservation obligations and targets (including national and regional).<br>• Cumulative increase in local and regional fragmentation/ isolation of habitat.<br>• Cumulative increase in environmental degradation, pollution.<br><br>Mitigation measures are same as those in the construction, operation and decommissioning phases above. | | | | | | | |

## 9.8 Social

**Table 67: Site Alternative 1 social impacts**

| | Aspect and Impact | Mitigation | Extent | Duration | Intensity | Probability | Significance (E+D+I+P) | |
|---|---|---|---|---|---|---|---|---|
| **Pre-construction** | **Aspect**: Construction of the ADF and associated infrastructure. | **Without** | -3 | -2 | -2 | -4 | -11 | **High** |
| | | **With** | -2 | -1 | -2 | -3 | -8 | **Medium** |

| | Aspect and Impact | Mitigation | Extent | Duration | Intensity | Probability | Significance (E+D+I+P) | |
|---|---|---|---|---|---|---|---|---|
| | **Impact**:<br>Negative feelings in relation to the project. | **Mitigation measures:**<br>• Stakeholders and affected parties should be kept informed of any developments during the project lifecycle.<br>• The Applicant should be accessible to the public when concerns, complaints or questions arise. | | | | | | |
| **Construction** | **Aspect**:<br>Construction of the ADF and associated infrastructure.<br><br>**Impact:**<br>Impact on health due to impacts on air quality. | **Without** | -2 | -2 | -2 | -2 | -8 | **Medium** |
| | | **With** | -2 | -2 | -1 | -1 | -6 | **Low** |
| | | **Mitigation measures:**<br>• The authorities should be informed if the incidence of respiratory disease in the area increases. It is advised that clinics and hospitals in the area adopt a formal monitoring programme to enable the identification of increases in respiratory diseases.<br>• Through the legislated annual occupational health examinations, any increase in respiratory diseases should be investigated to determine the source and immediate measures should be put in place to correct it.<br>• Should any out-of-the-ordinary risks to health and safety arise it should be widely communicated to the surrounding community, including employees, business owners, and all other stakeholders.<br>• Measures to prevent air, surface water and groundwater pollution should be implemented, adhered to and monitored (refer to Sections 9.3, 9.4, 9.5 and 9.9).<br>• All employees who are exposed to ash at the power station and the ADF should be supplied with protective gear and the use of such protective gear should be compulsory. | | | | | | |
| | **Aspect**:<br>Construction of the ADF and associated infrastructure.<br><br>**Impact:**<br>Land-use change. | **Without** | -3 | -2 | -3 | -1 | -9 | **Medium** |
| | | **With** | -2 | -2 | -2 | -1 | -7 | **Medium** |
| | | **Mitigation measures:**<br>• Measures to prevent air, surface water and ground water pollution should be implemented, adhered to and monitored (refer to Sections 9.3, 9.4, 9.5 and 9.9). | | | | | | |
| | **Aspect**: | **Without** | -2 | -2 | -3 | -3 | -10 | **High** |

| | Aspect and Impact | Mitigation | Extent | Duration | Intensity | Probability | Significance (E+D+I+P) | |
|---|---|---|---|---|---|---|---|---|
| | Construction of the ADF and associated infrastructure.<br><br>**Impact:**<br>Reduced visibility due to dust. | **With** | -1 | -2 | -1 | -2 | -6 | **Low** |
| | | **Mitigation measures:**<br>• Road users must be warned of dust storms through appropriate signage. | | | | | | |
| | **Aspect**:<br>Construction of ADF and associated infrastructure.<br><br>**Impact:**<br>Financial impacts. | **Without** | -3 | -2 | -2 | -2 | -9 | **Medium** |
| | | **With** | -2 | -2 | -1 | -1 | -6 | **Low** |
| | | **Mitigation measures:**<br>• All mitigation measures contained in the specialist studies should be included in the EMPr, in order to minimise social impacts that could result from any other impacts as a result of the proposed continuous ashing. | | | | | | |
| | **Aspect**:<br>Construction of the ADF and associated infrastructure.<br><br>**Impact:**<br>Potential employment opportunities. | **Without** | +3 | +2 | +3 | +1 | +9 | **Medium (+)** |
| | | **With** | | | | | | |
| | | **Mitigation measures:**<br>• Should any employment opportunities be created, it is recommended that local labour be used. | | | | | | |
| | **Aspect**:<br>Construction of the ADF and associated infrastructure.<br><br>**Impact:**<br>Migration. | **Without** | -3 | -2 | -2 | -1 | -8 | **Medium** |
| | | **With** | | | | | | |
| | | **Mitigation measures:**<br>• No mitigation suggested. | | | | | | |
| | **Aspect**:<br>Construction of the ADF and associated infrastructure. | **Without** | -2 | -2 | -2 | -2 | -8 | **Medium** |
| | | **With** | -2 | -2 | -1 | -1 | -6 | **Low** |

| | Aspect and Impact | Mitigation | Extent | Duration | Intensity | Probability | Significance (E+D+I+P) | |
|---|---|---|---|---|---|---|---|---|
| | **Impact:**<br>Impact on business in the area. | **Mitigation measures:**<br>• The Applicant should be accessible to the public when concerns, complaints or questions arise.<br>• Road users must be warned of dust storms through appropriate signage. | | | | | | |
| **Operations** | **Aspect**:<br>Continuous ashing.<br><br>**Impact:**<br>Impact on health due to impacts on air quality. | **Without** | -3 | -4 | -4 | -3 | -14 | **Very High** |
| | | **With** | -3 | -1 | -1 | -1 | -6 | **Low** |
| | | **Mitigation measures:**<br>• The authorities should be informed if the incidence of respiratory disease in the area increases. It is advised that clinics and hospitals in the area adopt a formal monitoring programme to enable the identification of increases in respiratory diseases.<br>• Through the legislated annual occupational health examinations, any increase in respiratory diseases should be investigated to determine the source and immediate measures should be put in place to correct it.<br>• Should any out-of-the-ordinary risks to health and safety arise it should be widely communicated to the surrounding community, including employees, business owners, and all other stakeholders.<br>• Measures to prevent air, surface water and groundwater pollution should be implemented, adhered to and monitored.<br>• All employees who are exposed to ash at the power station and the ADF should be supplied with protective gear and the use of such protective gear should be compulsory.<br>• Road users must be warned of dust storms through appropriate signage. | | | | | | |
| | **Aspect**:<br>Continuous ashing.<br><br>**Impact:**<br>Impact on health due to water contamination. | **Without** | -3 | -4 | -4 | -3 | -14 | **Very High** |
| | | **With** | -3 | -1 | -1 | -1 | -6 | **Low** |
| | | **Mitigation measures:**<br>• Should any out-of-the-ordinary risks to health and safety arise it should be widely communicated to the surrounding community, including employees, business owners, and all other stakeholders.<br>• Measures to prevent air, surface water and ground water pollution should be implemented, adhered to and monitored.<br>• Air, surface water and groundwater monitoring should take place on a regular basis, as agreed to by the various specialists, so that any potential threat to health can be detected and rectified immediately.<br>• All employees who are exposed to ash at the power station and the ADF should be supplied with protective | | | | | | |

| | Aspect and Impact | Mitigation | Extent | Duration | Intensity | Probability | Significance (E+D+I+P) | |
|---|---|---|---|---|---|---|---|---|
| | | gear and the use of such protective gear should be compulsory. | | | | | | |
| | **Aspect**:<br>Continuous ashing.<br><br>**Impact:**<br>Impact on health due to consumption of contaminated food. | **Without** | -3 | -4 | -4 | -3 | -14 | **Very High** |
| | | **With** | -3 | -1 | -1 | -1 | -6 | **Low** |
| | | **Mitigation measures:**<br>• Should any out-of-the-ordinary risks to health and safety arise it should be widely communicated to the surrounding community, including employees, business owners, and all other stakeholders.<br>• Measures to prevent air, surface water and groundwater pollution should be implemented, adhered to and monitored.<br>• Air, surface water and groundwater monitoring should take place on a regular basis, as stipulated by the various specialists, so that any potential threat to health can be detected and rectified immediately. | | | | | | |
| | **Aspect**:<br>Continuous ashing.<br><br>**Impact:**<br>Reduced visibility due to dust generation. | **Without** | -2 | -2 | -2 | -2 | -8 | **Medium** |
| | | **With** | -1 | -2 | -1 | -1 | -5 | **Low** |
| | | **Mitigation measures:**<br>• Measures to prevent air, surface water and groundwater pollution should be implemented, adhered to and monitored (refer to Sections 9.3, 9.4, 9.5 and 9.9).<br>• Road users must be warned of dust storms through appropriate signage. | | | | | | |
| | **Aspect**:<br>Continuous ashing.<br><br>**Impact:**<br>Financial impacts. | **Without** | -3 | -2 | -2 | -2 | -9 | **Medium** |
| | | **With** | -2 | -2 | -1 | -1 | -6 | **Low** |
| | | **Mitigation measures:**<br>• All mitigation measures contained in the specialist studies should be included in the EMPr, in order to minimise social impacts that could result from any other impacts as a result of the proposed continuous ashing. | | | | | | |
| | **Aspect**:<br>Continuous ashing.<br><br>**Impact:** | **Without** | +3 | +2 | +1 | +1 | +7 | **Medium (+)** |
| | | **With** | | | | | | |
| | | **Mitigation measures:** | | | | | | |

| | Aspect and Impact | Mitigation | Extent | Duration | Intensity | Probability | Significance (E+D+I+P) | |
|---|---|---|---|---|---|---|---|---|
| | Potential employment opportunities. | • Should any employment opportunities be created, it is recommended that local labour be used. | | | | | | |
| | **Aspect**: Continuous ashing.<br><br>**Impact:** Impact on tourism. | **Without** | -3 | -1 | -1 | -1 | -6 | **Low** |
| | | **With** | -3 | -1 | -1 | -1 | -6 | **Low** |
| | | **Mitigation measures:**<br>• Measures to prevent air, surface water and groundwater pollution should be implemented, adhered to and monitored (refer to Sections 9.3, 9.4, 9.5 and 9.9).<br>• Road users must be warned of dust storms through appropriate signage. | | | | | | |
| | **Aspect**: Continuous ashing.<br><br>**Impact:** Continuous supply of electricity. | **Without** | +4 | +3 | +4 | +4 | +15 | **Very High (+)** |
| | | **With** | | | | | | |
| | | **Mitigation measures:**<br>• No mitigation suggested. | | | | | | |
| | **Aspect**: Continuous ashing.<br><br>**Impact:** Migration. | **Without** | -3 | -2 | -1 | -1 | -7 | **Medium** |
| | | **With** | | | | | | |
| | | **Mitigation measures:**<br>• No mitigation suggested. | | | | | | |
| | **Aspect**: Continuous ashing.<br><br>**Impact:** Impact on business in the area. | **Without** | -3 | -2 | -2 | -2 | -9 | **Medium** |
| | | **With** | -2 | -1 | -1 | -1 | -5 | **Low** |
| | | **Mitigation measures:**<br>• The Applicant should be accessible to the public when concerns, complaints or questions arise.<br>• All mitigation measures contained in the specialist studies should be included in the EMPr, in order to minimise social impacts that could result from any other impacts as a result of the proposed continuous ashing. | | | | | | |

| | Aspect and Impact | Mitigation | Extent | Duration | Intensity | Probability | Significance (E+D+I+P) | |
|---|---|---|---|---|---|---|---|---|
| **Decommissioning** | **Aspect:** Decommissioning activities.<br><br>**Impact:** Impact on health due to impacts air quality | **Without** | -2 | -2 | -2 | -2 | -8 | **Medium** |
| | | **With** | -1 | -2 | -1 | -1 | -5 | **Low** |
| | | **Mitigation measures:**<br>• Refer to construction phase mitigation measures. | | | | | | |
| | **Aspect:** Decommissioning activities.<br><br>**Impact:** Reduced visibility due to dust. | **Without** | -2 | -2 | -2 | -2 | -8 | **Medium** |
| | | **With** | -2 | -2 | -1 | -1 | -6 | **Low** |
| | | **Mitigation measures:**<br>• Measures to prevent air, surface water and groundwater pollution should be implemented, adhered to and monitored.<br>• Road users must be warned of dust storms through appropriate signage. | | | | | | |
| | **Aspect:** Decommissioning activities.<br><br>**Impact:** Employment opportunities created. | **Without** | +3 | +2 | +1 | +1 | +7 | **Medium (+)** |
| | | **With** | | | | | | |
| | | **Mitigation measures:**<br>• No mitigation suggested. | | | | | | |

**Table 68: Site Alternative 2 and linear infrastructure route social impacts**

| Phase | Aspect and Impact | Mitigation | Extent | Duration | Intensity | Probability | Significance (E+D+I+P) | |
|---|---|---|---|---|---|---|---|---|
| **Pre-construction** | **Aspect**: Construction of the ADF and associated infrastructure. | **Without** | -3 | -2 | -3 | -4 | -12 | **High** |
| | | **With** | -3 | -1 | -3 | -4 | -11 | **High** |

| Phase | Aspect and Impact | Mitigation | Extent | Duration | Intensity | Probability | Significance (E+D+I+P) | |
|---|---|---|---|---|---|---|---|---|
| | **Impact**:<br>Negative feelings in relation to the project. | **Mitigation measures:**<br>• Stakeholders and affected parties should be kept informed of any developments during the project lifecycle.<br>• The Applicant should be accessible to the public when concerns, complaints or questions arise. | | | | | | |
| **Construction** | **Aspect**:<br>Construction of the ADF and associated infrastructure.<br><br>**Impact:**<br>Impact on health due to impacts on air quality. | **Without** | -2 | -2 | -2 | -2 | -8 | **Medium** |
| | | **With** | -2 | -2 | -2 | -2 | -8 | **Medium** |
| | | **Mitigation measures:**<br>• The authorities should be informed if the incidence of respiratory disease in the area increases. It is advised that clinics and hospitals in the area adopt a formal monitoring programme to enable the identification of increases in respiratory diseases.<br>• Through the legislated annual occupational health examinations, any increase in respiratory diseases should be investigated to determine the source and immediate measures should be put in place to correct it.<br>• Should any out-of-the-ordinary risks to health and safety arise it should be widely communicated to the surrounding community, including employees, business owners, and all other stakeholders.<br>• Measures to prevent air, surface water and groundwater pollution should be implemented, adhered to and monitored (refer to Sections 9.3, 9.4, 9.5 and 9.9).<br>• All employees who are exposed to ash at the power station and the ADF should be supplied with protective gear and the use of such protective gear should be compulsory. | | | | | | |
| | **Aspect**:<br>Construction of the ADF and associated infrastructure.<br><br>**Impact:**<br>Land-use change. | **Without** | -3 | -2 | -4 | -4 | -13 | **Very High** |
| | | **With** | -3 | -2 | -4 | -4 | -13 | **Very High** |
| | | **Mitigation measures:**<br>• Measures to prevent air, surface water and groundwater pollution should be implemented, adhered to and monitored (refer to Sections 9.3, 9.4, 9.5 and 9.9). | | | | | | |
| | **Aspect**:<br>Construction of the ADF and associated infrastructure. | **Without** | -2 | -2 | -3 | -3 | -10 | **High** |
| | | **With** | -1 | -2 | -1 | -2 | -6 | **Low** |

| Phase | Aspect and Impact | Mitigation | Extent | Duration | Intensity | Probability | Significance (E+D+I+P) | |
|---|---|---|---|---|---|---|---|---|
| | **Impact:**<br>Reduced visibility due to dust. | **Mitigation measures:**<br>• Road users must be warned of dust storms through appropriate signage. | | | | | | |
| | **Aspect**:<br>Construction of the ADF and associated infrastructure.<br><br>**Impact:**<br>Financial impacts. | **Without** | -3 | -2 | -2 | -2 | -9 | **Medium** |
| | | **With** | -2 | -2 | -1 | -1 | -6 | **Low** |
| | | **Mitigation measures:**<br>• All mitigation measures contained in the specialist studies should be included in the EMPr, in order to minimise social impacts that could result from any other impacts as a result of the proposed continuous ashing. | | | | | | |
| | **Aspect**:<br>Construction of the ADF and associated infrastructure.<br><br>**Impact:**<br>Potential employment opportunities. | **Without** | +3 | +2 | +3 | +1 | +9 | **Medium (+)** |
| | | **With** | | | | | | |
| | | **Mitigation measures:**<br>• Should any employment opportunities be created, it is recommended that local labour be used. | | | | | | |
| | **Aspect**:<br>Construction of the ADF and associated infrastructure.<br><br>**Impact:**<br>Migration. | **Without** | -3 | -2 | -2 | -1 | -8 | **Medium** |
| | | **With** | | | | | | |
| | | **Mitigation measures:**<br>• No mitigation suggested. | | | | | | |
| | **Aspect**:<br>Construction of the ADF and associated infrastructure.<br><br>**Impact:** | **Without** | -2 | -3 | -2 | -2 | -9 | **Medium** |
| | | **With** | -2 | -3 | -1 | -1 | -7 | **Medium** |
| | | **Mitigation measures:**<br>• The Applicant should be accessible to the public when concerns, complaints or questions arise. | | | | | | |

| Phase | Aspect and Impact | Mitigation | Extent | Duration | Intensity | Probability | Significance (E+D+I+P) | |
|---|---|---|---|---|---|---|---|---|
| | Impact on business in the area. | • Road users must be warned of dust storms through appropriate signage. | | | | | | |
| **Operations** | **Aspect**: Continuous ashing.<br><br>**Impact:** Impact on health due to impacts on air quality. | **Without** | -3 | -4 | -4 | -3 | -14 | **Very High** |
| | | **With** | -1 | -4 | -3 | -1 | -9 | **Medium** |
| | | **Mitigation measures:**<br>• The authorities should be informed if the incidence of respiratory disease in the area increases. It is advised that clinics and hospitals in the area adopt a formal monitoring programme to enable the identification of increases in respiratory diseases.<br>• Through the legislated annual occupational health examinations, any increase in respiratory diseases should be investigated to determine the source and immediate measures should be put in place to correct it.<br>• Should any out-of-the-ordinary risks to health and safety arise it should be widely communicated to the surrounding community, including employees, business owners, and all other stakeholders.<br>• Measures to prevent air, surface water and groundwater pollution should be implemented, adhered to and monitored.<br>• All employees who are exposed to ash at the power station and the ADF should be supplied with protective gear and the use of such protective gear should be compulsory.<br>• Road users must be warned if dust storms could develop. | | | | | | |
| | **Aspect**: Continuous ashing.<br><br>**Impact:** Impact on health due to water contamination. | **Without** | -3 | -4 | -4 | -3 | -14 | **Very High** |
| | | **With** | -3 | -1 | -1 | -1 | -6 | **Low** |
| | | **Mitigation measures:**<br>• Should any out-of-the-ordinary risks to health and safety arise it should be widely communicated to the surrounding community, including employees, business owners, and all other stakeholders.<br>• Measures to prevent air, surface water and groundwater pollution should be implemented, adhered to and monitored.<br>• Air, surface water and groundwater monitoring should take place on a regular basis, as agreed to by the various specialists, so that any potential threat to health can be detected and rectified immediately.<br>• All employees who are exposed to ash at the power station and the ADF should be supplied with protective gear and the use of such protective gear should be compulsory. | | | | | | |

| Phase | Aspect and Impact | Mitigation | Extent | Duration | Intensity | Probability | Significance (E+D+I+P) | |
|---|---|---|---|---|---|---|---|---|
| | **Aspect**: Continuous ashing.<br><br>**Impact:** Impact on health due to consumption of contaminated food. | **Without** | -3 | -4 | -4 | -3 | -14 | **Very High** |
| | | **With** | -3 | -1 | -1 | -1 | -6 | **Low** |
| | | **Mitigation measures:**<br>• Should any out-of-the-ordinary risks to health and safety arise it should be widely communicated to the surrounding community, including employees, business owners, and all other stakeholders.<br>• Measures to prevent air, surface water and groundwater pollution should be implemented, adhered to and monitored.<br>• Air, surface water and ground water monitoring should take place on a regular basis, as agreed to by the various specialists, so that any potential threat to health can be detected and rectified immediately. | | | | | | |
| | **Aspect**: Continuous ashing.<br><br>**Impact:** Reduced visibility due to dust generation. | **Without** | -2 | -2 | -2 | -2 | -8 | **Medium** |
| | | **With** | -1 | -2 | -1 | -1 | -5 | **Low** |
| | | **Mitigation measures:**<br>• Measures to prevent air, surface water and groundwater pollution should be implemented, adhered to and monitored.<br>• Road users must be warned of dust storms through appropriate signage. | | | | | | |
| | **Aspect**: Continuous ashing.<br><br>**Impact:** Financial impacts. | **Without** | -3 | -2 | -2 | -2 | -9 | **Medium** |
| | | **With** | -2 | -1 | -1 | -1 | -5 | **Low** |
| | | **Mitigation measures:**<br>• All mitigation measures contained in the specialist studies should be included in the EMPr, in order to minimise social impacts that could result from any other impacts as a result of the proposed continuous ashing. | | | | | | |
| | **Aspect**: Continuous ashing.<br><br>**Impact:** Potential employment opportunities. | **Without** | +3 | +2 | +1 | +1 | +7 | **Medium (+)** |
| | | **With** | | | | | | |
| | | **Mitigation measures:**<br>• Should any employment opportunities be created, it is recommended that local labour be used. | | | | | | |

| Phase | Aspect and Impact | Mitigation | Extent | Duration | Intensity | Probability | Significance (E+D+I+P) | |
|---|---|---|---|---|---|---|---|---|
| | **Aspect**: Continuous ashing.<br><br>**Impact:** Impact on tourism. | **Without** | -3 | -3 | -3 | -4 | -13 | **Very High** |
| | | **With** | -3 | -3 | -3 | -4 | -13 | **Very High** |
| | | **Mitigation measures:**<br>• Measures to prevent air, surface water and groundwater pollution should be implemented, adhered to and monitored.<br>• Road users must be warned of dust storms through appropriate signage. | | | | | | |
| | **Aspect**: Continuous ashing.<br><br>**Impact:** Continuous supply of electricity. | **Without** | +4 | +3 | +4 | +4 | +15 | **Very High (+)** |
| | | **With** | | | | | | |
| | | **Mitigation measures:**<br>• No mitigation suggested. | | | | | | |
| | **Aspect**: Continuous ashing.<br><br>**Impact:** Migration. | **Without** | -3 | -2 | -1 | -1 | -7 | **Medium** |
| | | **With** | | | | | | |
| | | **Mitigation measures:**<br>• No mitigation suggested. | | | | | | |
| | **Aspect**: Continuous ashing.<br><br>**Impact:** Impact on business in the area. | **Without** | -3 | -2 | -2 | -2 | -9 | **Medium** |
| | | **With** | -2 | -1 | -1 | -1 | -5 | **Low** |
| | | **Mitigation measures:**<br>• The Applicant should be accessible to the public when concerns, complaints or questions arise.<br>• All mitigation measures contained in the specialist studies should be included in the EMPr, in order to minimise social impacts that could result from any other impacts as a result of the proposed continuous ashing. | | | | | | |
| **Decommissioning** | **Aspect:** | **Without** | -2 | -2 | -2 | -2 | -8 | **Medium** |

| Phase | Aspect and Impact | Mitigation | Extent | Duration | Intensity | Probability | Significance (E+D+I+P) | |
|---|---|---|---|---|---|---|---|---|
| | Decommissioning activities.<br><br>**Impact:**<br>Impact on health due to impacts on air quality. | **With** | -1 | -1 | -1 | -1 | -4 | **Low** |
| | | **Mitigation measures:**<br>• Refer to construction phase mitigation measures. | | | | | | |
| | **Aspect:**<br>Decommissioning activities.<br><br>**Impact:**<br>Reduced visibility due to dust. | **Without** | -2 | -2 | -2 | -2 | -8 | **Medium** |
| | | **With** | -1 | -2 | -1 | -1 | -5 | **Low** |
| | | **Mitigation measures:**<br>• Measures to prevent air, surface water and groundwater pollution should be implemented, adhered to and monitored.<br>• Road users must be warned of dust storms through appropriate signage. | | | | | | |
| | **Aspect:**<br>Decommissioning activities.<br><br>**Impact:**<br>Employment opportunities created. | **Without** | -3 | -2 | -1 | -1 | -7 | **Medium** |
| | | **With** | | | | | | |
| | | **Mitigation measures:**<br>• Should any employment opportunities be created, it is recommended that local labour be used. | | | | | | |

## 9.9 Air Quality

**Table 69: Site Alternative 1 air quality impacts**

| Phase | Aspect and Impact | Mitigation | Extent | Duration | Intensity | Probability | Significance (E+D+I+P) | |
|---|---|---|---|---|---|---|---|---|
| **Construction** | **Aspect:** | **Without** | -1 | -2 | -2 | -3 | -8 | **Medium** |

| Phase | Aspect and Impact | Mitigation | Extent | Duration | Intensity | Probability | Significance (E+D+I+P) | |
|---|---|---|---|---|---|---|---|---|
| | Construction of the ADF.<br><br>**Impact:**<br>• Dust generation from bare areas including existing conveyor corridor.<br>• Fugitive emissions from material handling.<br>• Emissions from construction machinery and equipment.<br>• Trucks transporting material. | **With** | -1 | -2 | -1 | -2 | -6 | **Low** |
| | | **Mitigation measures:**<br>• There should be strict speed limits on site roads to prevent the liberation of dust into the atmosphere.<br>• Dust must be suppressed at the construction site, conveyor areas, and temporary dirt roads and during the transportation of material during dry periods by the regular application of water or binding chemicals. Water used for this purpose must be used in quantities that will not result in the generation of run-off.<br>• All site workers during construction will need to wear the appropriate PPE to avoid excessive exposure to dust particles. | | | | | | |
| **Operations** | **Aspect:**<br>Continuous ashing.<br><br>**Impact:**<br>Dust generation from:<br>• the working face;<br>• recently worked areas;<br>• material handling;<br>• emissions from machinery and equipment; and<br>• conveyor transfer points. | **Without** | -3 | -3 | -3 | -4 | -13 | **Very High** |
| | | **With** | -2 | -2 | -2 | -2 | -8 | **Medium** |
| | | **Mitigation measures:**<br>• There should be strict speed limits on site roads to prevent the liberation of dust into the atmosphere.<br>• Dust must be suppressed on the site during the transportation and handling of material during dry periods by the regular application of water, as per Ash Dump Operating Manual. Water used for this purpose must be used in quantities that will not result in the generation of run-off.<br>• All site workers will need to wear the appropriate PPE to avoid excessive exposure to dust particles.<br>• Dust is expected to be generated from each of the conveyor transfer points (and change in direction or drop from one conveyor to another). Dust sprays can be fitted to the transfer points to ensure minimum dust liberation. | | | | | | |
| **Decommissioning** | **Aspect:**<br>Decommissioning activities.<br><br>**Impact:**<br>Dust generation (i.e. dust from bare areas, material handling for rehabilitation and emissions from | **Without** | -1 | -2 | -2 | -3 | -8 | **Medium** |
| | | **With** | -1 | -2 | -1 | -2 | -6 | **Low** |
| | | **Mitigation measures:**<br>• There should be strict speed limits on site roads to prevent the liberation of dust into the atmosphere.<br>• Dust must be suppressed on the site, temporary dirt roads and during the transportation of material during dry periods by the regular application of water. Water used for this purpose must be used in quantities that | | | | | | |

| Phase | Aspect and Impact | Mitigation | Extent | Duration | Intensity | Probability | Significance (E+D+I+P) |
|---|---|---|---|---|---|---|---|
| | construction machinery and equipment). | will not result in the generation of run-off.<br>• All site workers during construction will need to wear the appropriate PPE to avoid excessive exposure to dust particles. | | | | | |

**Table 70: Site Alternative 2 and linear infrastructure route air quality impacts**

| Phase | Aspect and Impact | Mitigation | Extent | Duration | Intensity | Probability | Significance (E+D+I+P) | |
|---|---|---|---|---|---|---|---|---|
| **Construction** | **Aspect:**<br>Construction of the ADF.<br><br>**Impact:**<br>• Dust generation from bare areas including existing conveyor corridor.<br>• Fugitive emissions from material handling.<br>• Emissions from construction machinery and equipment.<br>• Trucks transporting material. | **Without** | -1 | -2 | -2 | -3 | -8 | **Medium** |
| | | **With** | -1 | -2 | -1 | -2 | -6 | **Low** |
| | | **Mitigation measures:**<br>• There should be strict speed limits on site roads to prevent the liberation of dust into the atmosphere.<br>• Dust must be suppressed at the construction site, conveyor areas, and temporary dirt roads and during the transportation of material during dry periods by the regular application of water or binding chemicals. Water used for this purpose must be used in quantities that will not result in the generation of run-off.<br>• All site workers during construction will need to wear the appropriate PPE to avoid excessive exposure to dust particles. | | | | | | |
| **Operations** | **Aspect:**<br>Continuous ashing.<br><br>**Impact:**<br>Dust generation from:<br>• the working face;<br>• recently worked areas;<br>• material handling;<br>• emissions from machinery and | **Without** | -3 | -3 | -3 | -4 | -13 | **Very High** |
| | | **With** | -2 | -3 | -2 | -2 | -9 | **Medium** |
| | | **Mitigation measures:**<br>• There should be strict speed limits on site roads to prevent the liberation of dust into the atmosphere.<br>• Dust must be suppressed on the site during the transportation and handling of material during dry periods by the regular application of water, as per Ash Disposal Operating Manual. Water used for this purpose must be used in quantities that will not result in the generation of run-off.<br>• All site workers will need to wear the appropriate PPE to avoid excessive exposure to dust particles. | | | | | | |

| Phase | Aspect and Impact | Mitigation | Extent | Duration | Intensity | Probability | Significance (E+D+I+P) | |
|---|---|---|---|---|---|---|---|---|
| | equipment; and<br>• conveyor transfer points. | • Dust is expected to be generated from each of the conveyor transfer points (and change in direction or drop from one conveyor to another). Dust sprays can be fitted to the transfer points to ensure minimum dust liberation. | | | | | | |
| **Decommissioning** | **Aspect:**<br>Decommissioning activities.<br><br>**Impact:**<br>Dust generation (i.e. dust from bare areas, material handling for rehabilitation and emissions from construction machinery and equipment). | **Without** | -1 | -2 | -2 | -3 | -8 | **Medium** |
| | | **With** | -1 | -2 | -1 | -2 | -6 | **Low** |
| | | **Mitigation measures:**<br>• There should be strict speed limits on site roads to prevent the liberation of dust into the atmosphere.<br>• Dust must be suppressed on the site, temporary dirt roads and during the transportation of material during dry periods by the regular application of water. Water used for this purpose must be used in quantities that will not result in the generation of run-off.<br>• All site workers during construction will need to wear the appropriate PPE to avoid excessive exposure to dust particles. | | | | | | |

## 9.10 Visual

**Table 71: Site Alternative 1 visual impacts**

| Phase | Aspect and Impact | Mitigation | Extent | Duration | Intensity | Probability | Significance (E+D+I+P) | |
|---|---|---|---|---|---|---|---|---|
| **Construction** | No construction activities will occur as operation at the dump will continue – i.e. further vegetation clearing in the footprint of the extension and continued ash disposal is discussed under the operational phase. | | | | | | | |
| **Operations** | **Aspect:**<br>Continuous ashing.<br><br>**Impact:**<br>Operational activities will continue at | **Without** | -2 | -4 | -2 | -3 | -11 | **High** |
| | | **With** | -2 | -4 | -2 | -2 | -10 | **High** |
| | | **Mitigation measures:**<br>• Rehabilitation of parts of the ADF that on which ash disposal is completed, especially relating to planting of vegetation to provide the ADF with a more natural appearance. | | | | | | |

| Phase | Aspect and Impact | Mitigation | Extent | Duration | Intensity | Probability | Significance (E+D+I+P) | |
|---|---|---|---|---|---|---|---|---|
| | the existing ADF as the facility increases its footprint – i.e. clearing of natural vegetation as the active face is extended westwards.<br><br>However in addition to the westward expansion of the ash dump, piggy backing would entail the development of new ashing cells on top of the existing ash dump and the heightening of the structure, making it more visible.<br><br>This would represent a continuation (consolidation) of the existing visual baseline associated with the ashing facility. | • The retention of a strip (buffer) of natural woodland vegetation on the western edge of any new expansion to the Onverwacht housing area in order to assist in the screening of the active eastern face of the ashing facility from view. | | | | | | |
| **Decommissioning** | **Aspect:**<br>Decommissioning activities.<br><br>**Impact:**<br>If the ADF is not fully rehabilitated, the decommissioned facility will retain the appearance of an active dump / disposal facility, as opposed to a rehabilitated facility that is more easily perceived as a natural part of the landscape. | **Without** | -2 | -4 | -2 | -2 | -10 | **High** |
| | | **With** | -2 | -4 | -1 | -1 | -8 | **Medium** |
| | | **Mitigation measures:**<br>• Once all ashing has been completed, the facility needs to be fully re-vegetated so that no bare 'face' exists.<br>• Rehabilitation follow ups need to be conducted, with re-planting if necessary in order to ensure the success of rehabilitation.<br>• All operational equipment such as conveyor system etc. must be fully removed from the ADF. | | | | | | |
| **Cumulative** | The continued ash disposal at the current facility represents a continuation of the existing visual baseline, especially when viewed from certain areas | | | | | | | |

| Phase | Aspect and Impact | Mitigation | Extent | Duration | Intensity | Probability | Significance (E+D+I+P) | |
|---|---|---|---|---|---|---|---|---|
| | around the site. The development of SA1 would thus be unlikely to be associated with a cumulative impact.<br><br>Refer to activity / phase specific mitigation measures above. | | | | | | | |

**Table 72: Site Alternative 2 and linear infrastructure route visual impacts**

| Phase | Aspect and Impact | Mitigation | Extent | Duration | Intensity | Probability | Significance (E+D+I+P) | |
|---|---|---|---|---|---|---|---|---|
| **Construction** | **Aspect:**<br>Construction of the ADF and linear infrastructure route.<br><br>**Impact:**<br>The construction of the conveyor belt could be associated with a visual impact if cranes are utilised for construction. | **Without** | -1 | -2 | -2 | -2 | -7 | **Medium** |
| | | **With** | -1 | -2 | -1 | -1 | -5 | **Low** |
| | | **Mitigation measures:**<br>• Limited clearing of vegetation on the development site unless required for construction facilities. This will retain the screening function of natural vegetation. | | | | | | |
| **Operations** | **Aspect:**<br>Continuous ashing.<br><br>**Impact:**<br>The establishment of the ADF over time (as the facility grows vertically) will make the facility increasingly visible from a wider area. The bare face of the ashing facility could be perceived to be an unwelcome / | **Without** | -2 | -4 | -3 | -4 | -13 | **Very High** |
| | | **With** | -2 | -4 | -2 | -3 | -11 | **High** |
| | | **Mitigation measures:**<br>• Rehabilitation of parts of the ADF on which ash disposal is completed must be initiated as soon as practically possible to limit the visual exposure factor of the facility's active face. Planting and establishment of vegetation is very important in this context. | | | | | | |

| Phase | Aspect and Impact | Mitigation | Extent | Duration | Intensity | Probability | Significance (E+D+I+P) | |
|---|---|---|---|---|---|---|---|---|
| | incongruous feature associated with industrial expansion into areas of currently natural visual character. | | | | | | | |
| **Decommissioning** | **Aspect:**<br>Decommissioning activities.<br><br>**Impact:**<br>If the ADF is not fully rehabilitated, the decommissioned facility will retain the appearance of an active dump / disposal facility, as opposed to a rehabilitated facility that is more easily perceived as a natural part of the landscape. | **Without** | -2 | -4 | -2 | -2 | -10 | **High** |
| | | **With** | -2 | -4 | -1 | -1 | -8 | **Medium** |
| | | **Mitigation measures:**<br>• Once all ashing has been completed, the facility needs to be fully re-vegetated so that no bare 'face' exists.<br>• Rehabilitation follow ups need to be conducted, with re-planting if necessary in order to ensure the success of rehabilitation.<br>• All operational equipment such as cranes, etc. must be fully removed from the ADF. | | | | | | |
| **Cumulative** | The creation of a new ADF at SA2 would represent an extension of the industrialised part of the Lephalale area into an area of currently natural visual character. This would represent a cumulative impact in terms of the alteration of the visual character and extension of the industrialised part of the area, potentially detracting from the 'sense of place' in surrounding areas.<br><br>Refer to activity / phase specific mitigation measures above. | | | | | | | |

## 9.11 Heritage

**Table 73: Site Alternative 1 heritage impacts**

| Phase | Aspect and Impact | Mitigation | Extent | Duration | Intensity | Probability | Significance (E+D+I+P) | |
|---|---|---|---|---|---|---|---|---|
| **Construction** | **Aspect:**<br>Construction activities.<br><br>**Impact:**<br>Impact on identified site (i.e. small roomed-structure in a bad state of repair). | **Without** | -1 | -1 | -1 | -2 | -5 | **Low** |
| | | **With** | -1 | -1 | -1 | -2 | -5 | **Low** |
| | | **Mitigation measures:**<br>• As this feature is accorded a low significance (Grade III site), it is viewed as recorded in full after inclusion in this report and no further mitigation action is required.<br>• Generic mitigation for findings exposed during construction:<br>– Should any heritage artefacts be exposed during excavation, work on the area where the artefacts were discovered, shall cease immediately and all discoveries shall be reported immediately to a heritage practitioner so that an investigation and evaluation of the finds can be made.<br>– Under no circumstances shall any artefacts be removed, destroyed or interfered with by anyone on the site.<br>• Contractors and workers shall be advised of the penalties associated with the unlawful removal of cultural, historical, archaeological or palaeontological artefacts, as set out in the National Heritage Resources Act (No. 25 of 1999), Section 51. These penalties will be determined prior to the commencement of construction. | | | | | | |

**Table 74: Site Alternative 2 and linear infrastructure route heritage impacts**

| Phase | Aspect and Impact | Mitigation | Extent | Duration | Intensity | Probability | Significance (E+D+I+P) | |
|---|---|---|---|---|---|---|---|---|
| **Construction** | **Aspect:**<br>Construction activities.<br><br>**Impact:** | **Without** | 0 | -1 | -1 | -1 | -3 | **Low** |
| | | **With** | | | | | | **No impact** |
| | | **Mitigation measures:** | | | | | | |

| Phase | Aspect and Impact | Mitigation | Extent | Duration | Intensity | Probability | Significance (E+D+I+P) |
|---|---|---|---|---|---|---|---|
| | Impact on identified site (remains of a small house structure and potential grave(s) in the vicinity of the house). | • It is recommended that before development takes place on SA2, Exxaro should get their workers, to locate and identify the graves, after which they should be properly plotted and isolated in order to prevent accidental damage.<br>• Generic mitigation for findings exposed during construction:<br>– Should any heritage artefacts be exposed during excavation, work on the area where the artefacts were discovered, shall cease immediately and all discoveries shall be reported immediately to a heritage practitioner so that an investigation and evaluation of the finds can be made.<br>– Under no circumstances shall any artefacts be removed, destroyed or interfered with by anyone on the site.<br>• Contractors and workers shall be advised of the penalties associated with the unlawful removal of cultural, historical, archaeological or palaeontological artefacts, as set out in the National Heritage Resources Act (No. 25 of 1999), Section 51. These penalties will be determined prior to the commencement of construction. | | | | | |

## 9.12 Noise

**Table 75: Site Alternative 1, 2 and linear infrastructure route impacts**

| Phase | Aspect and Impact | Mitigation | Extent | Duration | Intensity | Probability | Significance (E+D+I+P) | |
|---|---|---|---|---|---|---|---|---|
| **Construction** | **Aspect:**<br>Construction activities.<br><br>**Impact:**<br>Noise generation associated with construction activities. | **Without** | -2 | -2 | -1 | -2 | -7 | **Medium** |
| | | **With** | -2 | -2 | -1 | -2 | -7 | **Medium** |
| | | **Mitigation measures:**<br>• Construction site yards and other noisy fixed facilities should be located well away from noise sensitive areas adjacent to the development sites.<br>• All construction vehicles and equipment are to be kept in good repair.<br>• Where possible, stationary noisy equipment (for example compressors, pumps, pneumatic breakers,) should be encapsulated in acoustic covers, screens or sheds. Proper sound insulation can reduce noise by | | | | | | |

| Phase | Aspect and Impact | Mitigation | Extent | Duration | Intensity | Probability | Significance (E+D+I+P) | |
|---|---|---|---|---|---|---|---|---|
| | | up to 20 dBA. Portable acoustic shields should be used in the case where noisy equipment is not stationary (for example drills, angle grinders, chipping hammers, poker vibrators).<br>• Construction activities, and particularly the noisy ones, are to be contained to reasonable hours during the day and early evening.<br>• With regard to unavoidable very noisy construction activities in the vicinity of noise sensitive areas, the power station should liaise with local residents on how best to minimise the impact.<br>• Machines in intermittent use should be shut down in the intervening periods between work or throttled down to a minimum.<br>• In general, operations should meet the noise standard requirements of the Occupational Health and Safety Act (No 85 of 1993).<br>• Construction staff working in areas where the 8-hour ambient noise levels exceed 75 dBA should wear ear protection equipment. | | | | | | |
| **Operations** | **Aspect:**<br>Continuous ashing.<br><br>**Impact:**<br>Noise impacts associated with operational activities. | **Without** | -2 | -3 | -2 | -3 | -10 | **High** |
| | | **With** | -2 | -3 | -2 | -3 | -10 | **High** |
| | | **Mitigation measures:**<br>• The design of all major infrastructure for the project should incorporate all the necessary acoustic design aspects required in order that the overall generated noise level from the new installation does not exceed a maximum equivalent continuous day/night rating level (LRdn), namely a noise level of 70 dBA (just inside the property projection plane, namely the property boundary of the power station and the boundary of the pipeline/conveyor servitude) as specified for industrial districts in SANS 10103. Notwithstanding this provision; the design is also to take into account the maximum allowable equivalent continuous day and night rating levels of the potentially impacted sites outside the power station property and the boundary of the pipeline/conveyor servitude. Where the noise level at such an external site is presently lower than the maximum allowed, the maximum shall not be exceeded. Where the noise level at the external site is presently at or exceeds the maximum, the existing level shall not be increased by more than indicated as acceptable in SANS 10103.<br>• The latest technology incorporating maximum noise mitigation measures for components of the project should be designed into the system. When ordering plant and machinery, manufacturers should be requested to provide details of the sound power level (SPL). Where possible, those with the lowest SPL (most quiet) should be selected. | | | | | | |

| Phase | Aspect and Impact | Mitigation | Extent | Duration | Intensity | Probability | Significance (E+D+I+P) | |
|---|---|---|---|---|---|---|---|---|
| | | • The design process is to consider the insulation of particularly noisy plant and equipment.<br>• All plant, equipment and vehicles are to be kept in good repair.<br>• Where possible, very noisy activities should not take place at night (between the hours of 20h00 to 06h00). | | | | | | |
| **Decommissioning** | **Aspect:**<br>Decommissioning.<br><br>**Impact:**<br>Noise impacts associated with decommissioning activities. | **Without** | -2 | -2 | -1 | -2 | -7 | **Medium** |
| | | **With** | -2 | -2 | -1 | -2 | -7 | **Medium** |
| | | **Mitigation measures:**<br>• All decommissioning vehicles and equipment are to be kept in good repair.<br>• Where possible, stationary noisy equipment should be encapsulated in acoustic covers, screens or sheds. Proper sound insulation can reduce noise by up to 20 dBA.<br>• Portable acoustic shields should be used in the case where noisy equipment is not stationary (for example drills, angle grinders, chipping hammers, poker vibrators). | | | | | | |

## 9.13 Traffic

**Table 76: Site Alternative 1 traffic impacts**

| Phase | Aspect and Impact | Mitigation | Extent | Duration | Intensity | Probability | Significance (E+D+I+P) | |
|---|---|---|---|---|---|---|---|---|
| **Construction** | **Aspect:**<br>Construction.<br><br>**Impact:**<br>Increase in traffic from construction vehicles. | **Without** | -1 | -1 | -2 | -2 | -6 | **Low** |
| | | **With** | -1 | -1 | -1 | -2 | -5 | **Low** |
| | | **Mitigation measures:**<br>• As per Eskom Policy, no person is allowed to drive more than 40 km/h on a gravel road. This is applicable only to the access roads on site. All areas within the site itself, has a reduced speed limit of 30 km/h. This is communicated to all persons by means of National Speed Signs.<br>• Seatbelts are to be worn at all times.<br>• When using heavy or large vehicles / equipment, “spotters” are to be present to assist the driver with his | | | | | | |

| Phase | Aspect and Impact | Mitigation | Extent | Duration | Intensity | Probability | Significance (E+D+I+P) | |
|---|---|---|---|---|---|---|---|---|
| | | blind spots.<br>• Any incident or damage to a vehicle must be reported immediately as per Eskom Policies and Procedures. | | | | | | |
| **Operations** | **Aspect:**<br>Continuous ashing.<br><br>**Impact:**<br>Operational phase traffic. | **Without** | -1 | -3 | -1 | -3 | -8 | **Medium** |
| | | **With** | -1 | -3 | -1 | -2 | -7 | **Medium** |
| | | **Mitigation measures:**<br>• Refer to mitigation above. | | | | | | |
| **Decommissioning** | **Aspect:**<br>Decommissioning.<br><br>**Impact:**<br>Increase in traffic from construction vehicles. | **Without** | -1 | -2 | -2 | -3 | -8 | **Medium** |
| | | **With** | -1 | -2 | -2 | -2 | -7 | **Medium** |
| | | **Mitigation measures:**<br>• Refer to mitigation above. | | | | | | |

**Table 77: Site Alternative 2 and linear infrastructure route traffic impacts**

| Phase | Aspect and Impact | Mitigation | Extent | Duration | Intensity | Probability | Significance (E+D+I+P) | |
|---|---|---|---|---|---|---|---|---|
| **Construction** | **Aspect:**<br>Construction.<br><br>**Impact:**<br>Increase in traffic from construction vehicles. | **Without** | -1 | -2 | -4 | -4 | -11 | **High** |
| | | **With** | -1 | -2 | -4 | -3 | -10 | **High** |
| | | **Mitigation measures:**<br>• As per Eskom Policy, no person is allowed to drive more than 40 km/h on a gravel road. This is applicable only to the access roads on site. All areas within the site itself, has a reduced speed limit of 30 km/h. This is communicated to all persons by means of National Speed Signs.<br>• Seatbelts are to be worn at all times.<br>• When using heavy or large vehicles / equipment, “spotters” are to be present to assist the driver with his | | | | | | |

| Phase | Aspect and Impact | Mitigation | Extent | Duration | Intensity | Probability | Significance (E+D+I+P) | |
|---|---|---|---|---|---|---|---|---|
| | | blind spots.<br>• Any incident or damage to a vehicle must be reported immediately as per Eskom Policies and Procedures. | | | | | | |
| **Operations** | **Aspect:**<br>Continuous ashing.<br><br>**Impact:**<br>Operational phase traffic. | **Without** | -1 | -3 | -4 | -3 | -11 | **High** |
| | | **With** | -1 | -3 | -2 | -3 | -9 | **Medium** |
| | | **Mitigation measures:**<br>• Refer to mitigation above. | | | | | | |
| **Decommissioning** | **Aspect:**<br>Decommissioning.<br><br>**Impact:**<br>Increase in traffic from construction vehicles. | **Without** | -1 | -2 | -2 | -3 | -8 | **Medium** |
| | | **With** | -1 | -2 | -2 | -2 | -7 | **Medium** |
| | | **Mitigation measures:**<br>• Refer to mitigation above. | | | | | | |

## 9.14 Comparative Analysis of the Site Alternatives

Table 78 provides an average of the impacts of the two site alternatives as well as the linear infrastructure route (LIR), for the construction, operation and decommissioning phases of the project.

**Table 78: Comparative analysis of site alternatives**

| Phase | SA1 (Wo) Unmitigated | SA1 (W) Mitigated | SA2 (Wo) Unmitigated | SA2 (W) Mitigated | LIR (Wo) Unmitigated | LIR (W) Mitigated |
|---|---|---|---|---|---|---|
| **Construction** | **8.81** | **7.09** | **8.83** | **7.61** | **9.01** | **7.34** |
| **Operations** | **10.96** | **7.86** | **11.27** | **8.26** | **11.05** | **8.37** |
| **Decommissioning** | **9.08** | **6.87** | **9.05** | **6.76** | **9.01** | **6.68** |

From the above analysis, the following should be noted:

- During the construction phase, the significance of impacts after mitigation for SA1 (7.09) is lower than SA2 (7.61). The expectation was that the construction impacts for SA1 before and after mitigation would be significantly lower than that for SA2 due to SA1 already having existing infrastructure available. However, the Biodiversity impacts after mitigation for SA1 (11.86) was much higher than SA2 (10.86) after mitigation. This is as a result of the impact to the gravels plain habitat.
- During the operation phase, the significance of impacts for SA2 before (11.27) and after mitigation (8.26) is higher than SA1 (10.96 *vs* 7.86).
- The linear infrastructure route during construction and operations has medium rated impacts after mitigation i.e. 7.34 and 8.37 respectively.
- During decommissioning, the significance of impacts for both sites as well as the linear infrastructure route are similar and the differences in ratings is small.

## 9.15 Site Alternative Preference

The preference of a site alternative was made based on the impact assessment included above as well as the findings of the specialist assessments (Chapter 8):

### 9.15.1 Geology

SA1 is best suited for the proposed ADF due to the following reasons:

- Location of the existing ADF, which would make economic sense to extend further i.e. facilities are already set up and in place to extend operations for the next 40 years;
- Proven reliability of existing ADF from a foundation stability perspective during the past years of operation;
- The landform across SA1 is generally flat to very gently sloping i.e. disposal facilities placed on flat ground of competent soil/bedrock are least likely to fail. In contrast, SA2 slopes gently, with occasional small hills;
- Shallow depth to bedrock (i.e. 1.0 to 2.0 m below existing ground level) which would prove suitable for the ADF foundations as well as foundations for large building structures if required;
- Presence of sandy Aeolian sands which are generally non-corrosive; and
- In contrast to SA2, SA1 is not characterised by any drainage courses where intermittent development of strong groundwater seepage is anticipated during the rainy season. The sudden occurrence of groundwater will likely cause embankment/foundation failures and affect the long term stability of the ADF.

### 9.15.2 Geohydrology

SA1 is located further away from geological structures in comparison to SA2. Furthermore there are less production boreholes and groundwater users within a 2 km radius of SA2. A comparison in the groundwater chemistry made between the boreholes surrounding SA1 and SA2 shows a clear distinction between the results. Although several boreholes associated with SA2 indicated elevated concentrations of parameters (conductivity, TDS; chloride; sulphate; calcium; sodium; manganese and magnesium) which appear to be problematic, it is clear that the concentrations in general are much lower than those associated with boreholes surrounding SA1.

The proposed linear infrastructure route will traverse two faults (one the Daarby fault and another just north of the Daarby fault). However, the only adverse environmental impacts of conveyor belts for coal transport are coal dust losses during loading, unloading, or transport.

### 9.15.3 Hydrology

For both site alternatives the proposed development will not have a significant impact on the run-off in the immediate or greater areas. Development on either site is not anticipated to have a large potential stream flow reduction impact on the run-off of the immediate and general area.

A conceptual stormwater management plan (SWMP) for each proposed alternative site has been developed that indicates proposed stormwater management measures. SA1 requires a PCD storage capacity for a dam that spills on average only once in 50 years of 203 600 $m^3$. Matimba Power Station has already commissioned an independent PCD for this site and a dam of this capacity is available. For SA2 the entire ADF should be regarded as a dirty water area. A single, large PCD is recommended to the north of the ADF and below all likely spoil heaps. A reduced ADF area would lead to a reduced PCD of approximately 180 000 $m^3$ capacity.

For the conveyor belt SWMP, sumps are recommended at the lowest point to collect the dirty water and for it to be pumped into the nearest PCD. In accordance with GN 704 regulations, these sumps must be able to accommodate a 1 in 50-year flood event. It is recommended that a detailed topography survey be done to determine the elevation profile of the belt and hence determine a more accurate SWMP.

It was found that downstream water uses are predominantly mining, irrigated agriculture and urban industrial water users. Potential risks and mitigation measures were largely centred on pollution of surface water resources. The proposed development is unlikely to pose significant risks to local surface water resources if appropriate measures are in place, as outlined in this document. Emphasis is placed on the monitoring programme and risk mitigation measures being implemented correctly.

The most important recommendation is to ensure that the proposed SWMP is implemented and that the associated infrastructure is properly designed by a registered Engineer and maintained.

Based on the available contour data and ash and water samples taken, neither site alternative is more favourable from a flood line, water quality or water balance perspective.

Based on the abovementioned conclusions it is recommended that SA1 is preferred over SA2.

### 9.15.4 Surface Water (Wetlands)

Both site alternatives contain surface water features however, the drainage line SA1 traverses a much smaller part of the site than the two drainage lines that converge within the north-western corner of the SA2. The drainage line on the SA1 is also much narrower and contains less pronounced riparian vegetation.

Looking slightly further than the drainage lines traversing the sites, the upper catchment of the drainage line that traverses the SA1 is located close to the western boundary of the site, and the Sandloop River is located

to the south of the site, about 650 – 850 m to the south. In the context of SA2, the drainage line downstream of the confluence of the northern and western drainage lines in the north-western part of the site runs parallel to the northern part of the site, being located between 100 – 500 m away from the northern boundary.

The distance of the Sandloop River away from SA1 is believed to be sufficient to ensure that the Sandloop would not be directly affected by surface water inflows from the site. In contrast, the closer location of SA2 to the downstream reach of the drainage line after it leaves the site indicates that this downstream reach could be adversely affected through stormwater discharge or polluted groundwater inputs in spite of not being located on the actual development site.

The riparian corridors on SA2 have been assessed to be in a very natural state and close to reference state, being surrounded by a catchment in natural condition (falling within a nature reserve and game farm to the east). While the drainage line that bisects a small area of SA1 was assessed to be in a natural condition, with its immediate catchment comprising of natural woodland vegetation, the wider setting is important. The upper-most part of the catchment of this drainage line is currently undergoing development and thus transformation as part of the development of the Medupi Power Station. Accordingly it is possible that stormwater discharges of the Medupi construction site may be channelled into this drainage line, potentially affecting its hydrology.

Immediately upstream of the area assessed, a number of power line servitudes traverse the riparian corridor and accordingly the riparian habitat has been transformed as part of the clearing of the servitudes. Perhaps most importantly, SA1 is located immediately adjacent to the existing Matimba ADF, and in the context of consolidating impacts the expansion of the ADF onto the remainder of the Zwartwater property (SA1) would be preferable to the creation of impacts in area that is currently relatively un-impacted by industrial development (i.e. SA2). The development of the SA1 would thus constitute the consolidation of impacts on the affected drainage line in the context of it being impacted by the Medupi Power Station and the existing power line servitudes.

For the reasons presented above, SA1 is strongly preferred over the SA2.

### 9.15.5 Soils and Agricultural Potential

SA1 is the preferred site as the impacts related to ash transport and disposal have already been largely incurred (save for new connections). From a soil classification and mapping perspective SA2 poses larger risks as it has a much more pronounced drainage feature (north-western edge) that is linked to areas outside of the survey site. From this perspective again the site of the existing ADF (SA1) is preferred for the proposed development.

### 9.15.6 Biodiversity

SA1 located next to the existing ADF. The eastern third of the site is characterised by artificial faunal woodland habitat (low faunal sensitivity). The remaining (approximately) two thirds of SA1 include *Kyphocarpa angustifolia – Eragrostis rigidior* Woodland (medium-high faunal sensitivity), *Nymphaea – Schoenoplectus* impoundments (medium-high faunal sensitivity) and *Portulaca – Oldenlandia* sheetrock faunal habitat (high faunal sensitivity). A higher habitat diversity is associated with this site alternative; while the status of the habitat is also in a better condition. Sixty-four animal species were recorded in SA1, including the Red Data species *Aquila rapax* (Temminck, 1828) and *Parahyaena brunnea* (Thunberg, 1820).

SA2 is situated north-east of the Grootegeluk opencast coalmine. Most of this site is characterised by *Vernonia – Panicum maximum* degraded woodland faunal habitat (medium faunal sensitivity). Some areas of artificial woodland habitat (low faunal sensitivity) is evident, also two small *Nymphaea – Schoenoplectus* impoundments (medium-high faunal sensitivity). SA2 does not include any faunal habitat fragments of high faunal sensitivity. Low habitat diversity and variability is associated with SA2, hence a moderate faunal

sensitivity is ascribed to this option. Sixty-five animal species were confirmed to be present in SA2, including the Red Data species *Panthera pardus* (Linnaeus, 1758) and *Parahyaena brunnea* (Thunberg, 1820).

Based on these considered factors, SA2 is considered the most preferred alternative as it is less sensitive than SA1. However, technical constraints of SA2 do not render this option optimal. The loss of sensitive habitat within SA1 is therefore unavoidable and impossible to mitigate against. Spatial and temporal impacts will therefore be unavoidable, permanent and irreversible. The recommendation is therefore to implement an added value biodiversity enhancement strategy, of which the major objective would be to improve biodiversity conservation and management on a local and regional scale.

Eskom will access the Limpopo Conservation Plan to align current land management practices of the Eskom-owned Grootvallei Game Reserve Figure 95 with 'conservation added value projects', for the purposes of enhancing and securing biodiversity of the region through stewardship.

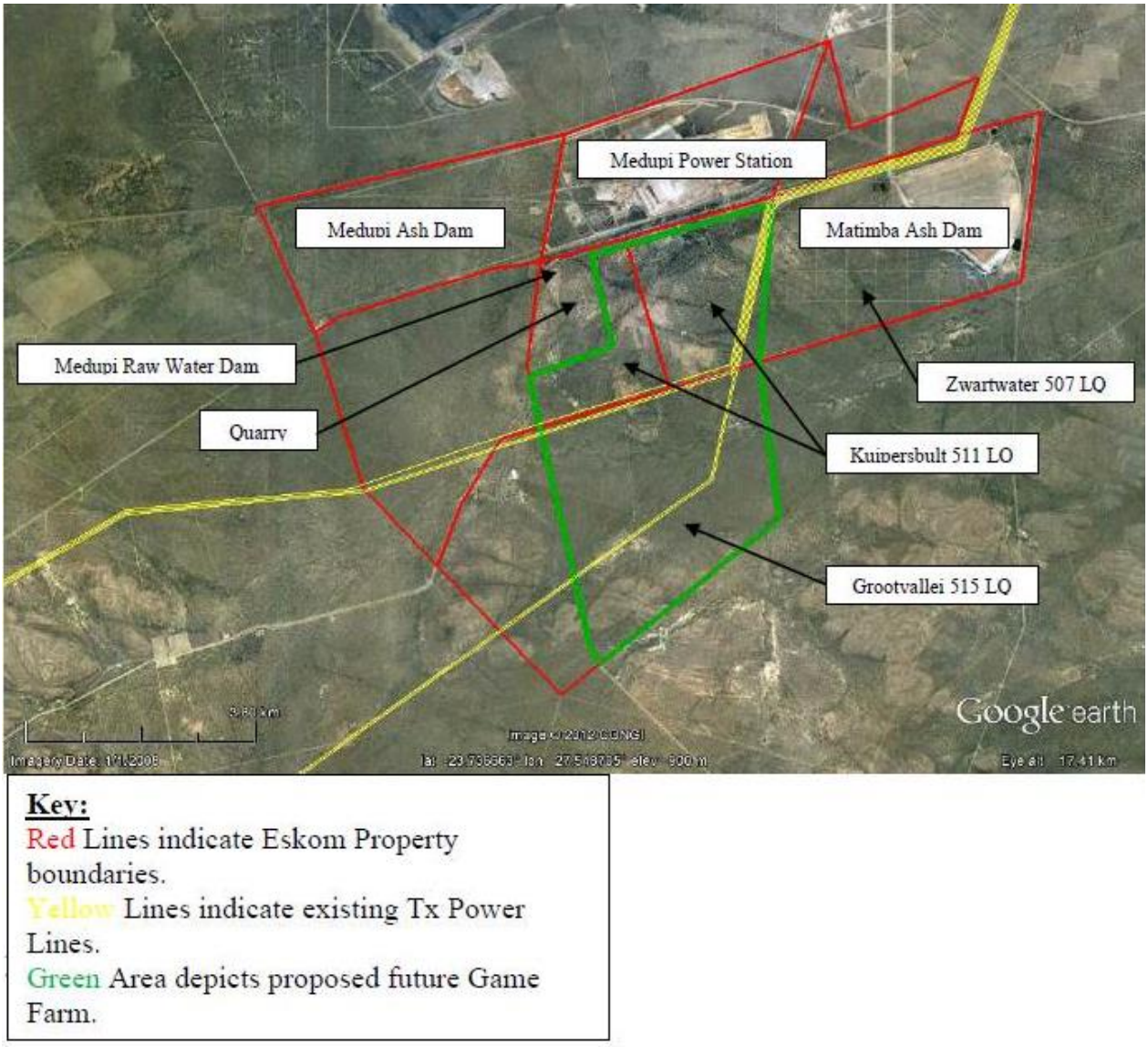


**Figure 95: Location of the Grootvallei game farm**

The details of such a strategy should form part of a subsequent phase, subjected to the approval by authorities, i.e. a post authorisation requirement.

Based on the faunal habitat status, diversity, ecological connectivity, Red Data hosting ability and inherent sensitivity, different faunal sensitivities are assigned to the three macro-habitat types of the proposed linear infrastructure route. Degraded and Natural Woodland habitats are not deemed particularly sensitive and it is regarded unlikely that any animal species, assemblage or community of conservation importance will be adversely affected by the construction and operation of the proposed linear infrastructure route. However, the *Spirostachys africana* Woodland faunal habitat type exhibit unique and sensitive faunal habitat within the general arid landscape of the region. This faunal habitat is therefore deemed sensitive and not suitable for the construction and operation of a linear infrastructure route. It is strongly recommended that it is excluded by means of a realignment of the proposed line towards the north.

### 9.15.7 Social

SA1 is the preferred site alternative from a social point of view, as it will be an extension of the existing ADF. It will therefore not have any or significant impacts on the aesthetics of the area and there will be no changes in land-use, which could otherwise result in several negative social impacts. The existing linear infrastructure route would also be used and there will be no need to consider a new or additional linear infrastructure route to transport ash to the disposal site.

If the ADF is to be constructed on SA2, Marapong, which is located close to part of the linear infrastructure route would be directly affected. It would also result in a change in land-use, as the site itself currently consists of game farms. There could be an impact on tourism to the area and a loss of livelihood and income.

### 9.15.8 Air Quality

Based on the predicted model results, it is recommended that SA1 (expansion of the existing ADF) be the preferred site alternative for this project. This recommendation also ensures that the existing linear infrastructure route is used, and reduces the potential emissions that would be generated from the construction and operation of a second linear infrastructure route. Whilst this site has higher predicted daily particulate matter concentrations, for off-site (environmental) impacts, annually and cumulatively, this site produces lower concentrations than SA2.

Long-term exposure is the main concern for dust and particulate matter exposure, and therefore a lower annual concentration is preferred to a lower daily concentration.

### 9.15.9 Visual

Two alternative sites have been presented for assessment, each of which is associated with a differing degree of visual impact and exposure. SA1 is the existing ADF, and its continued use would include the western expansion of the ADF as well as the raising of the structure as part of piggy-backing. The raising of the structure would increase its visibility, but this must be considered in the context of it being an existing large structure that is already associated with a degree of visual change from a natural context, in the visual setting of a cluster of heavy industrial infrastructure. SA2 is located further away from the industrial hub in an area of mostly natural woodland vegetation, and thus the development of an ADF in this context would represent a new high intensity visual impact in a context of no or little visual landscape change.

However it should be noted that a proposal to expand the Onverwacht housing area into the current vacant property to the west of the current edge of the housing would result in the creation of human settlement (static receptor locations) very close to the eastern side of the ADF. For these new receptor locations the raised ash dump (and active ashing face) would present a highly prominent large structure that would dominate the

immediate visual environs, although the ADF would form part of the existing visual baseline in which the housing would be developed.

Due to the existing visual impacts associated with SA1 and its location within an industrial hub, the development of the continued ashing facility at SA1 is preferred to the new development of an ADF at SA2 which is located in a much more natural setting.

### 9.15.10 Heritage and Palaeontology

Both site alternatives as well as the proposed linear infrastructure route to SA2 can be utilised for the proposed project. For SA1, a ruined house structure has been identified to exist in the study area. As this feature is accorded a low significance, it is viewed as recorded in full after inclusion in this report and no further mitigation action is required.

As no heritage sites occur in SA2, there would be no impact resulting from the proposed development.

No heritage sites occur on the linear infrastructure route for SA2, therefore there would be no impact resulting from the proposed development.

No rocks and no fossils were found at SA1, SA2 or the linear infrastructure route.

### 9.15.11 Noise

Other than the road traffic noise, the main noise sources in the area are the Grootegeluk colliery, the Matimba Power Station and the Medupi Power Station (when commissioned). The noise from the dry ash stacking will be virtually continuous. The construction of the sections of the project (both site alternatives) will introduce a new loud noise source into the respective area of development. SA1 lies on Eskom property and will have minor cumulative noise effects. SA2 lies outside the Matimba Power Station property and is located primarily in a rural agricultural area surrounded by more intensive residential, mining and industrial activities.

Furthermore, SA1 will make use of an existing conveyor system and will thus have no additional impact whilst a new conveyor system is proposed for SA2. The noise impact of the new conveyor system will have marginal impact along this route. There are numerous noise sensitive receptors in the study area that potentially might be impacted by the various ashing operations of the project. From a noise impact perspective SA1 is preferable to SA2.

### 9.15.12 Traffic

The continuous ADF on the two site alternatives will have a very-small, if any, impact on the existing road network. However, during the construction phase, SA2 will have a greater impact on the road network than that of SA1 which is only an expansion of the existing site. If an access to SA2 is constructed, it is recommended that a short right-turn lane be provided. If the linear infrastructure route is constructed to SA2, it is recommended that, where the conveyor system crosses a road or path, a 5.2 m clearance is provided from the road surface and bottom of the conveyor system.

Based on the provisions stipulated above for the construction of SA2, SA1 is the preferred site.

# 10 ENVIRONMENTAL IMPACT STATEMENT

## 10.1 Key Findings of the EIA

The results of the impact assessment indicate that the most significant impacts as a result of the proposed project would include impacts on biodiversity, geohydrology, hydrology, wetlands, air quality and visual. These impacts can be successfully mitigated through the measures and recommendations proposed by the various specialist disciplines that have been included in Sections 9.2 - 9.13 and the Environmental Management Programme – EMPr (**Appendix S**).

Based on the comparative assessment of the two site alternatives, SA1 is preferred over SA2 as the development of the ADF on SA1 entails the continuation of ashing at the existing facility whilst SA2 is a greenfields site that would require new infrastructure e.g. linear infrastructure route, haul road, stormwater channels and leachate collection system, pollution control dam, access control; guardhouse; weighbridge system; office and ablutions; plant yard; parking; and vehicle washing area.

The EAP therefore, based on the findings of this EIA study, recommends that SA1 be authorised. The conceptual design for SA1 proposes that approximately one third of the new ADF (190 ha) is constructed over the existing ADF, using the piggy-backing concept as an optimisation strategy. The remaining 510 ha will be constructed over a greenfields portion of the farm Zwartwater 507 LQ. Therefore, the total footprint area required for the ADF development for SA1 is 700 ha (510 ha greenfields and 190 ha existing ADF) creating an airspace of approximately 325 000 000 $m^3$.

## 10.2 Environmental Sensitivity

Results of the respective floristic, faunal, surface water (wetlands), hydrology, geohydrology, soils, heritage, noise, air and social sensitivity analysis were combined to present an overview of the environmental sensitivity of the two site alternatives as well as the larger study area within the 8 km radius from the Matimba Power Station (Figure 96). SA1 is less sensitive than SA2 as part of SA1 has the existing ADF and the development of the ADF on this site would result in the continuation of ashing at the existing ADF.

SA2 would be constructed in a greenfields site and would require new infrastructure as mentioned above.

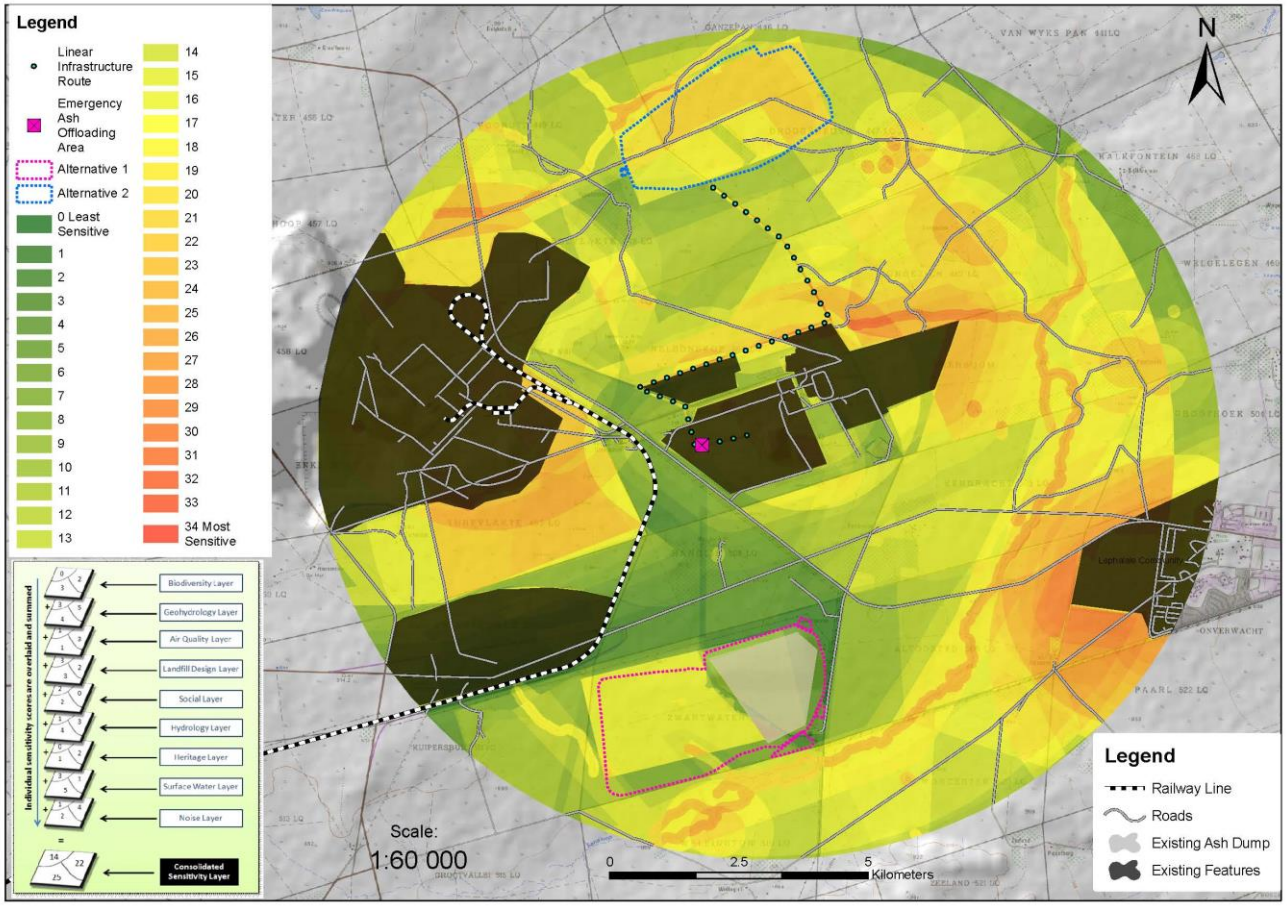


**Figure 96: Sensitivity map**

## 10.3 Conditions

In order to achieve appropriate environmental management standards and ensure that the findings of the environmental studies are implemented through practical measures, the recommendations from this EIA study are included within an EMPr. The EMPr would be used to ensure compliance with environmental specifications and management measures.

The implementation of this EMPr for the entire life-cycle (i.e. construction, operation and decommissioning) of the project is considered to be vital in achieving the appropriate environmental management standards as detailed for this project.

In addition, it is recommended that the following key conditions should be included as part of the authorisation:

a) The Applicant is not negated from complying with any other statutory requirements that is applicable to the undertaking of the activity. Relevant key legislation that must be complied with by the Applicant includes inter alia:
   - Provisions of the National Water Act, 1998 (No. 36 of 1998)
   - Provisions of the Minerals and Petroleum Resources Development Act, 2002 (No. 28 of 2002)
   - Provision of the National Heritage Resources Act, 1999 (No. 25 of 1999)
   - Provisions of the NEM: Biodiversity Act and Provincial Nature Conservation Ordinance

b) The Applicant must appoint a suitably experienced (independent) Environmental Control Officer (ECO) for the construction phase of the development that will have the responsibility to ensure that the mitigation /

rehabilitation measures and recommendations are implemented and to ensure compliance with the provisions of the EMPr.

c) The loss of sensitive habitat within SA1 is therefore unavoidable and impossible to mitigate against. Spatial and temporal impacts will therefore be unavoidable, permanent and irreversible. The recommendation is therefore to implement an added value biodiversity enhancement strategy, of which the major objective would be to improve biodiversity conservation and management on a local and regional scale. Eskom will access the Limpopo Conservation Plan to align current land management practices of the of the Eskom-owned Grootvallei Game Reserve with 'conservation added value projects', for the purposes of enhancing and securing biodiversity of the region through stewardship.

d) The details of such a plan should form part of a subsequent phase, subjected to the approval by authorities, i.e. a post authorisation requirement.

e) Only the greenfields portion of the ADF will be lined.

f) Due to the processes that need to be followed and the timeframes required for preparation of the footprint and construction of the lining system, there will be a period from current operations to disposal on the lining system. The area that will not be lined during the 4.69 year period is estimated to be 105.9 ha. The location of this area assumes that the lining provisions start from the time the project gets environmental approval, wherever the ash operations are at that point.

   The Applicant, will lodge an Application for Exemption (with the DEA) as stipulated under Section 44(1)(a) read with the Section 24M(3) of NEMA (No 107 of 1998) and the National Exemption Regulations (No R.994). In proposing and motivating for the exemption from lining, it must be noted that this situation is practically unavoidable as the basal lining system must first be approved before work can commence on the ground preparation and construction. During this time, it is in the Nation's best interest that the Matimba Power Station continue to operate according to its current ashing model, requiring ash disposal continue as at present. This will mean continued ashing on an unlined surface during this period.

   Mitigation measures which must be enforced during the 4.69 year ash disposal includes the following:

   - Any boreholes located on the site footprint where ash disposal will occur must be backfilled so as to prevent direct migration of potentially poor quality water into the aquifers and further groundwater pollution. The sealing procedure will be finalised with an appointed Contractor.
   - Prevent excess water on the ADF, dust suppression must be controlled.
   - The groundwater monitoring programme must be continued as detailed in Section 9.3 of this report as well as the EMPr (**Appendix S**).

g) A protected species survey must be conducted prior to construction. Results of this survey will guide permitting requirements for the removal of protected trees from the selected property.

## 10.4 Assumptions, Uncertainties or Gaps in Knowledge

- All information provided by Eskom Holdings SOC Ltd to the EAP was correct and valid at the time it was provided.
- All data from unpublished research is valid and accurate.

Royal HaskoningDHV

*Enhancing Society Together*