Appendix K: Soils and Agricultural Potential

environmental affairs

Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

DETAILS OF SPECIALIST AND DECLARATION OF INTEREST

	(For official use only)
File Reference Number:	12/12/20/
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Application for authorisation in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended and the Environmental Impact Assessment Regulations, 2010

PROJECT TITLE

ENVIRONMENTAL IMPACT ASSESSMENT FOR THE PROPOSED CONTINUOUS ASH DISPOSAL FACILITY FOR THE MATIMBAPOWER STATION IN LEPHALALE, LIMPOPO PROVINCE

Specialist:	Dr. Johan Hilgard van der Waals		
Contact person:	Johan van der Waals		
Postal address:	PO Box 40568, Garsfontein		
Postal code:	0060	Cell:	0825701297
Telephone:	0129930969	Fax:	0862746653
E-mail:	johan@terrasoil.co.za		
Professional affiliation(s) (if any)	SACNASP Reg. Nr. 400106/08		

Project Consultant:	Royal HaskoningDHV		
Contact person:	Prashika Reddy		
Postal address:	PO Box 25302, Monument Park, Gauteng, South Africa		
Postal code:	0105	Cell:	083 2848687
Telephone:	012 367 5973	Fax:	012 367 5878
E-mail:	prashika.reddy@rhdhv.com		

4.2 The specialist appointed in terms of the Regulations_

I, Johan Hilgard van der Waals, declare that --

General declaration:

I act as the independent specialist in this application

I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant

I declare that there are no circumstances that may compromise my objectivity in performing such work;

I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, regulations and any guidelines that have relevance to the proposed activity;

I will comply with the Act, regulations and all other applicable legislation;

I have no, and will not engage in, conflicting interests in the undertaking of the activity;

I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;

all the particulars furnished by me in this form are true and correct; and

I realise that a false declaration is an offence in terms of Regulation 71 and is punishable in terms of section 24F of the Act.

Signature of the specialist:

Terra Soil Science cc

Name of company (if applicable):

20/04/2015

Date:

EIA PHASE REPORT

SOIL, LAND USE, LAND CAPABILITY AND AGRICULTURAL POTENTIAL SURVEY:

THE PROPOSED CONTINUOUS ASH DISPOSAL FACILITY FOR THE MATIMBA POWER STATION, LIMPOPO PROVINCE

March 2014

Compiled by:
J.H. van der Waals
(PhD Soil Science, Pr.Sci.Nat)
Member of:
Soil Science Society of South Africa (SSSSA)

Accredited member of:
South African Soil Surveyors Organisation (SASSO)

Registered with:
The South African Council for Natural Scientific Professions
Registration number: 400106/08

DECLARATION

I, Johan Hilgard van der Waals, declare that I –

- I act as the independent specialist in this application
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- all the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of Regulation 71 and is punishable in terms of Section 24F of the Act.

J.H. VAN DER WAALS
TERRA SOIL SCIENCE

ACRONYMS

ARC – Agricultural Research Council
DEM – Digital Elevation Model
ISCW – Institute for Soil, Climate and Water
TWI – Topographic Wetness Index

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EIA PHASE SOIL, LAND USE, LAND CAPABILITY AND AGRICULTURAL POTENTIAL SURVEY – MATIMBA CONTINUOUS ASH DISPOSAL FACILITY IN THE LIMPOPO PROVINCE

1. TERMS OF REFERENCE

Terra Soil Science (TSS) was commissioned by Royal HaskoningDHV to undertake an EIA level soil, land use, land capability and agricultural potential survey for the proposed continuous ash disposal facility for Matimba power station in the Limpopo Province.

2. INTRODUCTION

2.1 Project Background

Matimba Power Station, located in the Limpopo Province close to Lephalale (Ellisras) town, is a 3990MW installed capacity base load coal fired power station, consisting of 6 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 the Exxaro 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 three kilometres south of the existing power station on the Eskom owned Farm Zwartwater 507 LQ.

Matimba Power Station envisages the continuation of ash disposal (dry ashing) and therefore, Eskom requires the licensing of its proposed continuous ash disposal facility in terms of the National Environmental Management Waste Act (NEMWA), Act 59 of 2008 and the EIA Regulations (2010) promulgated under the National Environmental Management Act (NEMA) Act 107 of 1998, "NEMA")(as amended).

The proposed development is an ash disposal facility site with the following specifications:

- Capacity of airspace of 297 million m^3 (remaining); and
- Ground footprint of 651 Ha (Remaining fenced Area including pollution control dams).

This ash disposal facility will be able to accommodate the ashing requirements of the power station for the next 44 years.

The EIA process requires the investigation of alternatives and as such two site alternatives are under consideration for the construction of the ash disposal facility. This includes the new proposed linear infrastructure route for Alternative 2.

a) Site 1

This site is located in the southern section of the 8 km radius study area, on the farm Zwartwater 507 LQ which is owned by Eskom. Part of this farm is currently utilized as an ash disposal facility.

Site 2

This site is located in the northern section of the 8 km radius study area and straddles four different farms namely: Vooruit 449 LQ, Droogeheuvel 447LQ, Ganzepan 446 LQ, and Appelvlakte 448LQ and have different owners.

2.1 Study Aim and Objectives

The site alternatives have been proposed to serve as a locality for the construction of an ash disposal facility and associated infrastructure (including conveyor belt and roads to Alternative 2). This study aims to determine the possible impact that this development could have on the soils, land use, land capability and agricultural potential, as well as to identify areas of high sensitivity regarding the establishment of an ash disposal facility.

The study has as objectives the identification and estimation of:

» Soil form (SA taxonomic system) and soil depth for the area;
» Soil potential linked to current land use and other possible uses and options;
» Discussion of the agricultural potential in terms of the soils, water availability, surrounding developments and current status of land; and
» Discussion of impacts (potential and actual) as a result of the proposed development.

2.2 Agricultural Potential Background

The assessment of agricultural potential rests primarily on the identification of soils that are suited to crop production. In order to qualify as high potential soils they must have the following properties:

- Deep profile (more than 600 mm) for adequate root development,
- Deep profile and adequate clay content for the storing of sufficient water so that plants can withstand short dry spells,
- Adequate structure (loose enough and not dense) that allows for good root development,
- Sufficient clay or organic matter to ensure retention and supply of plant nutrients,
- Limited quantities of rock in the matrix that would otherwise limit tilling options and water holding capacity,
- Adequate distribution of soils and size of high potential soil area to constitute a viable economic management unit, and
- Good enough internal and external (out of profile) drainage if irrigation practices are considered. Drainage is imperative for the removal (leaching) of salts that accumulate in profiles during irrigation and fertilization.

In addition to soil characteristics, climatic characteristics need to be assessed to determine the agricultural potential of a site. The rainfall characteristics are of primary importance and in order to provide an adequate baseline for the viable production of crops rainfall quantities and distribution need to be sufficient and optimal. The combination of the above mentioned factors will be used to assess the agricultural potential of the soils on the site.

2.3 Sites Boundary

The surveyed sites are situated as follows:

- Alternative 1 - between 23° 41’ 52’’ and 23° 43’ 40’’ south and 27° 34’ 33’’ and 27° 37’ 19’’ east approximately 14 km west-south-west of the town of Lephalale; and
- Alternative 2 - between 23° 35’ 47’’ and 23° 37’ 38’’ south and 27° 34’ 51’’ and 27° 37’ 33’’ east approximately 15 km north-west of the town of Lephalale in the Limpopo Province (Refer to **Figure 1**).
- The linear infrastructure route connects Alternative 2 to the power plant.

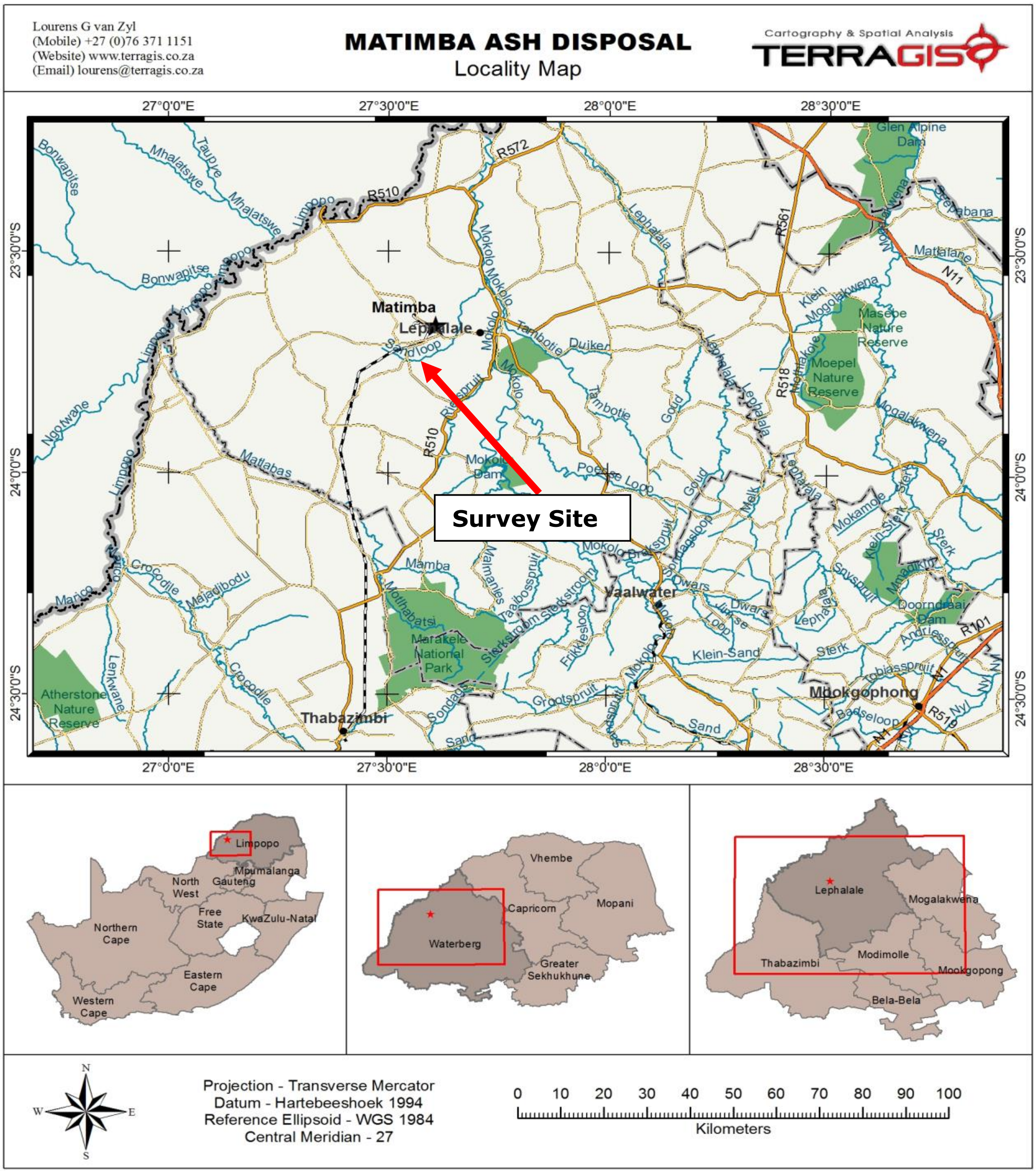

Figure 1: Locality of the surveyed sites

2.4 Site Alternatives Physical Features

The Site **Alternative 1** lies on relatively level terrain (**Figure 2**) with an altitude that varies from 870 m in the east to 890 m above mean sea level in the west. The geology is dominated by sandstone and conglomerate. The Site **Alternative 2** also lies on relatively level (**Figure 2**) terrain with an altitude that varies from 855 m in the south-east to 880 m above mean sea level in the south-west. The geology is dominated by sandstone.

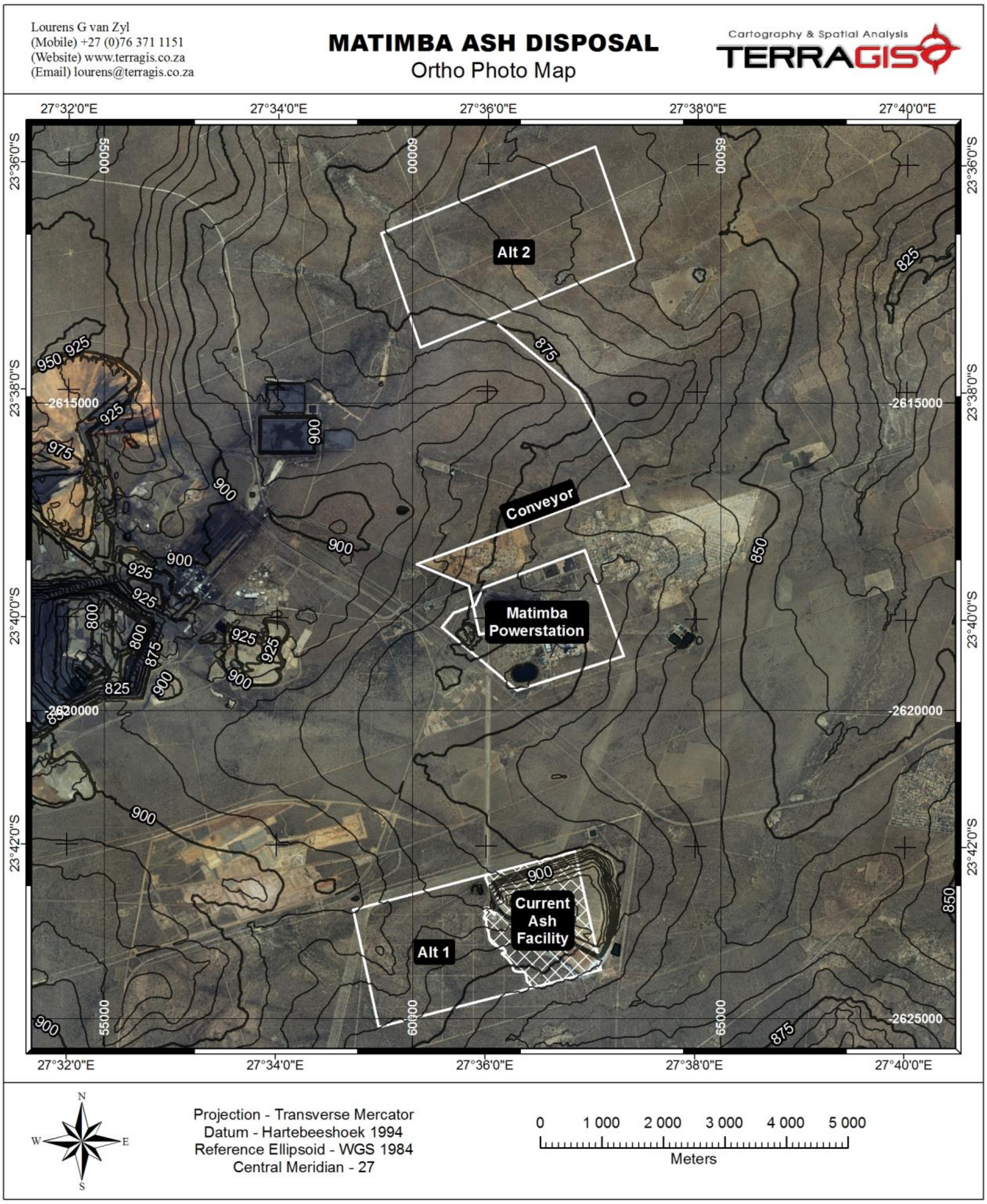

Figure 2: Ortho photo map of the two alternative sites and linear infrastructure route as well as Matimba Power Station

3. SOIL, LAND CAPABILITY, LAND USE SURVEY AND AGRICULTURAL POTENTIAL SURVEY

3.1 Method of Survey

The soil, land capability, land use and agricultural potential surveys were conducted in four phases.

3.1.1 Phase 1: Land Type Data

Land type data for the site was obtained from the Institute for Soil Climate and Water (ISCW) of the Agricultural Research Council (ARC) (Land Type Survey Staff, 1972 – 2006). The land type data is presented at a scale of 1:250 000 and entails the division of land into land types, typical terrain cross sections for the land type and the presentation of dominant soil types for each of the identified terrain units (in the cross section). The soil data is classified according to the Binomial System (MacVicar et al., 1977). The soil data was interpreted and re-classified according to the Taxonomic System (The Soil Classification Working Group, 1991).

3.1.2 Phase 2: Aerial Photograph Interpretation and Land Use Mapping

Google Earth imagery was interpreted to identify and delineate different land uses on the two alternative sites.

3.1.3 Phase 3: Digital Elevation Model and Topographic Wetness Index

Topographic data in the form of 5 m contours was used to construct a digital elevation model (DEM) of the two alternative sites. From this data, a topographic wetness index (TWI) was produced. The TWI indicates the surface water flow and accumulation zones on the site.

3.1.4 Phase 4: Site Visit and Soil Survey

The sites were surveyed at in terms of soil distribution and land characteristics. In both cases the sites were traversed on foot and in a vehicle with the aim of ascertaining as much of the soil variability as possible. Soils were described and photographs were taken of pertinent soil, landscape and land use characteristics.

3.2 Survey Results

3.2.1 Phase 1: Land Type Data

The Alternative 1 site falls into the **Bd46** land type and the Alternative 2 site falls into the **Ah85** land type (Land Type Survey Staff, 1972 - 2006). The new proposed linear infrastructure route to Alternative 2 runs through land types Ae252 and Ah85 (Refer to **Figure 3** for the land type map of the area). Below follows a brief description of the land types in terms of soils, land capability, land use and agricultural potential.

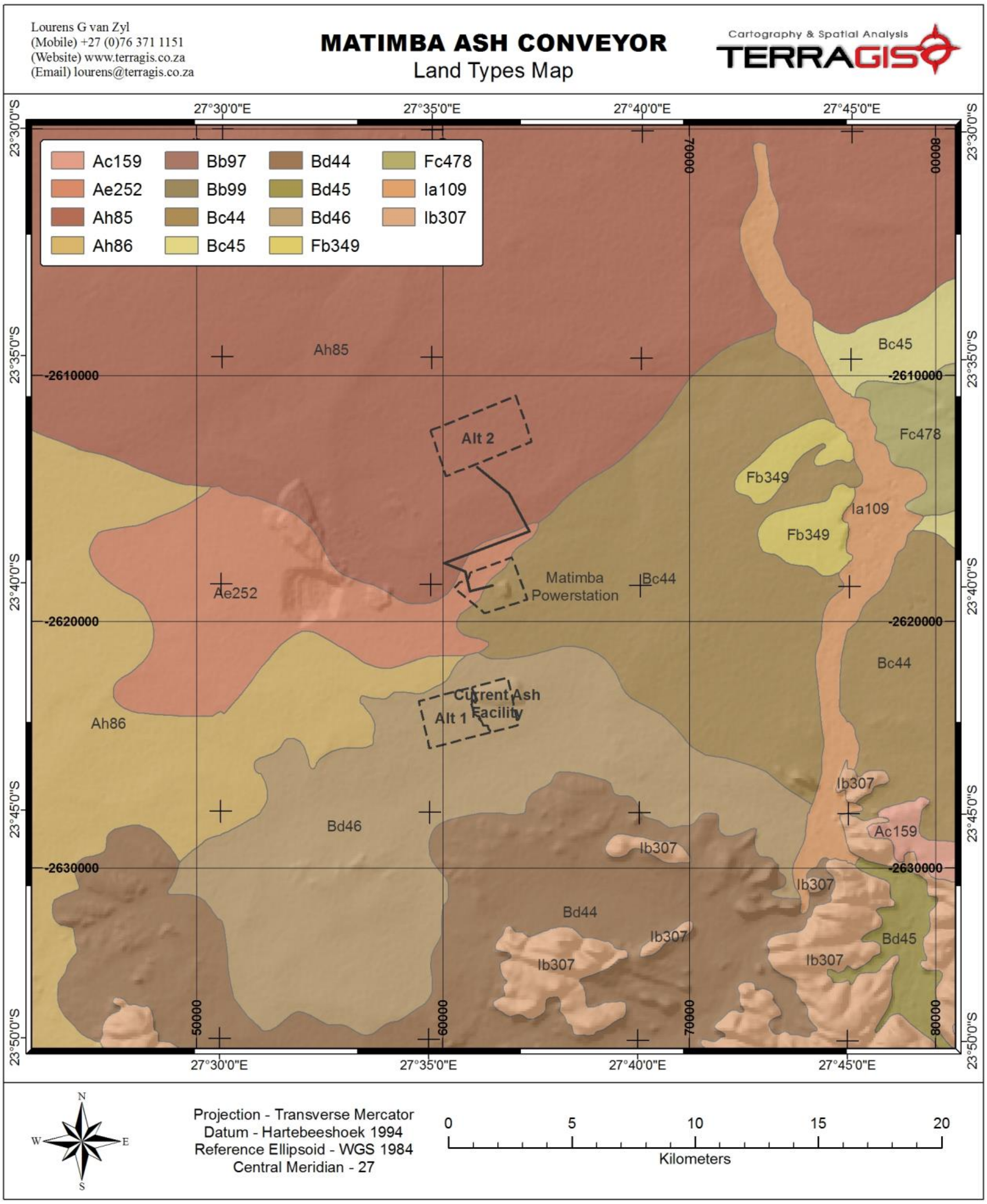

Figure 3: Land type map of the survey site with location of two alternatives

Land Type Ae252

Soils: 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.

Land capability and land use: 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.

Agricultural potential: Low potential due to relatively low and often erratic rainfall (in the region of 400 – 500 mm per year – **Figure 4**) 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).

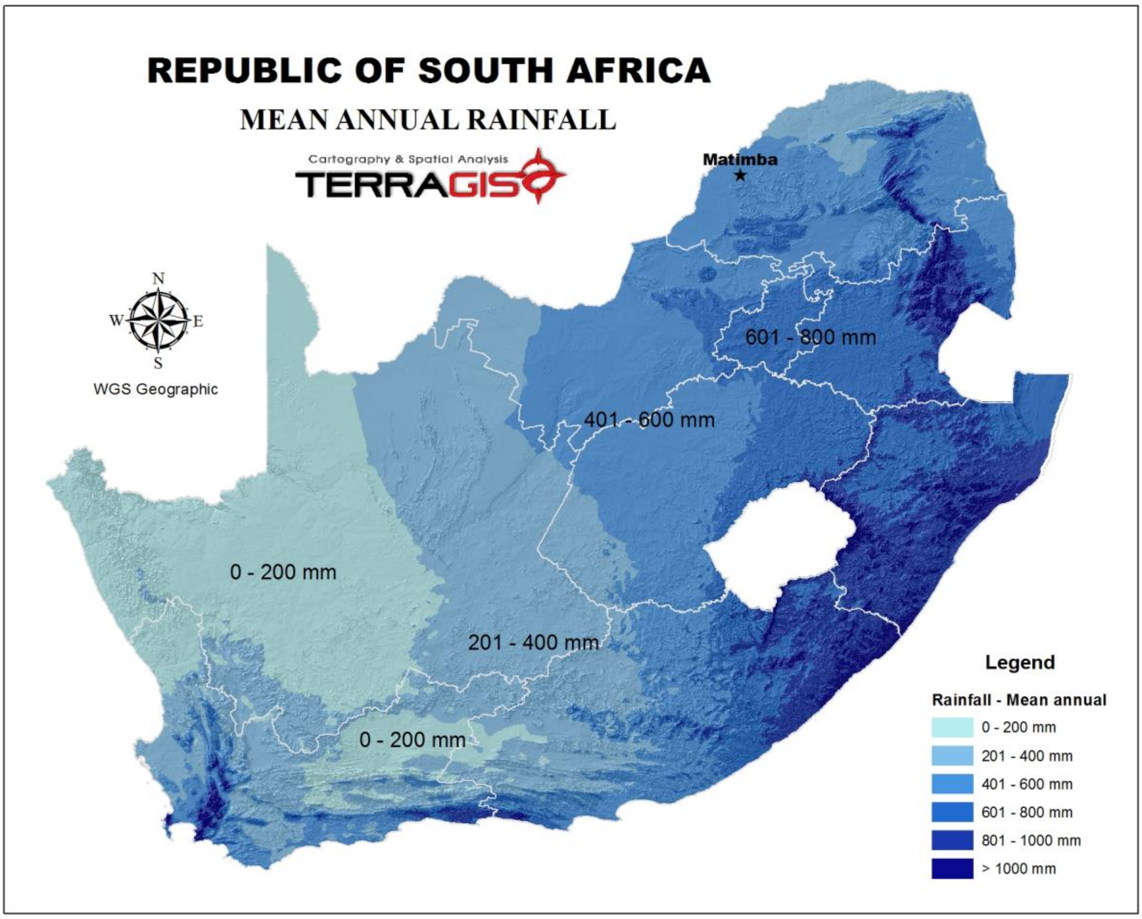

Figure 4: Rainfall map for South Africa indicating the position of the survey site

Land Type Ah85

Soils: 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 areas occur (not widespread) and are associated with incised drainage channels or stream beds.

Land capability and land use: 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.

Agricultural potential: Low potential due to relatively low and often erratic rainfall (in the region of 400 – 500 mm per year – **Figure 4**) 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).

Land Type Bd46

Soils: 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.

Land capability and land use: Predominantly extensive grazing due to climatic constraints in terms of dryland crop production. Due to the level terrain water related soil erosion is not a major factor.

Agricultural potential: Low potential due to the relatively low and erratic rainfall (around 400 - 500 mm per year – **Figure 4**) as well as high evaporative demand. Certain areas can be used for irrigated crop production but then only if adequate water (quantity and quality) is available.

3.2.2 Phase 2: Aerial Photograph Interpretation and Land Use/Capability Mapping

The interpretation of the Google Earth image (**Figure 2**) yielded that Alternative 1 has two land uses namely extensive grazing (dominant) and an anthropogenic land use (ash disposal) adjacent to the proposed site. Alternative 2 is exclusively extensive grazing (**Figure 2**). The linear infrastructure route traverses areas with similar land use as alternative 2. 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 site Alternative 1. 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.

3.2.3 Phase 3: Digital Elevation Model and Topographic Wetness Index

The Digital Elevation Model (DEM) for the site is provided in **Figure 5**. From this map it is evident that the sites are situated on relatively level terrain.

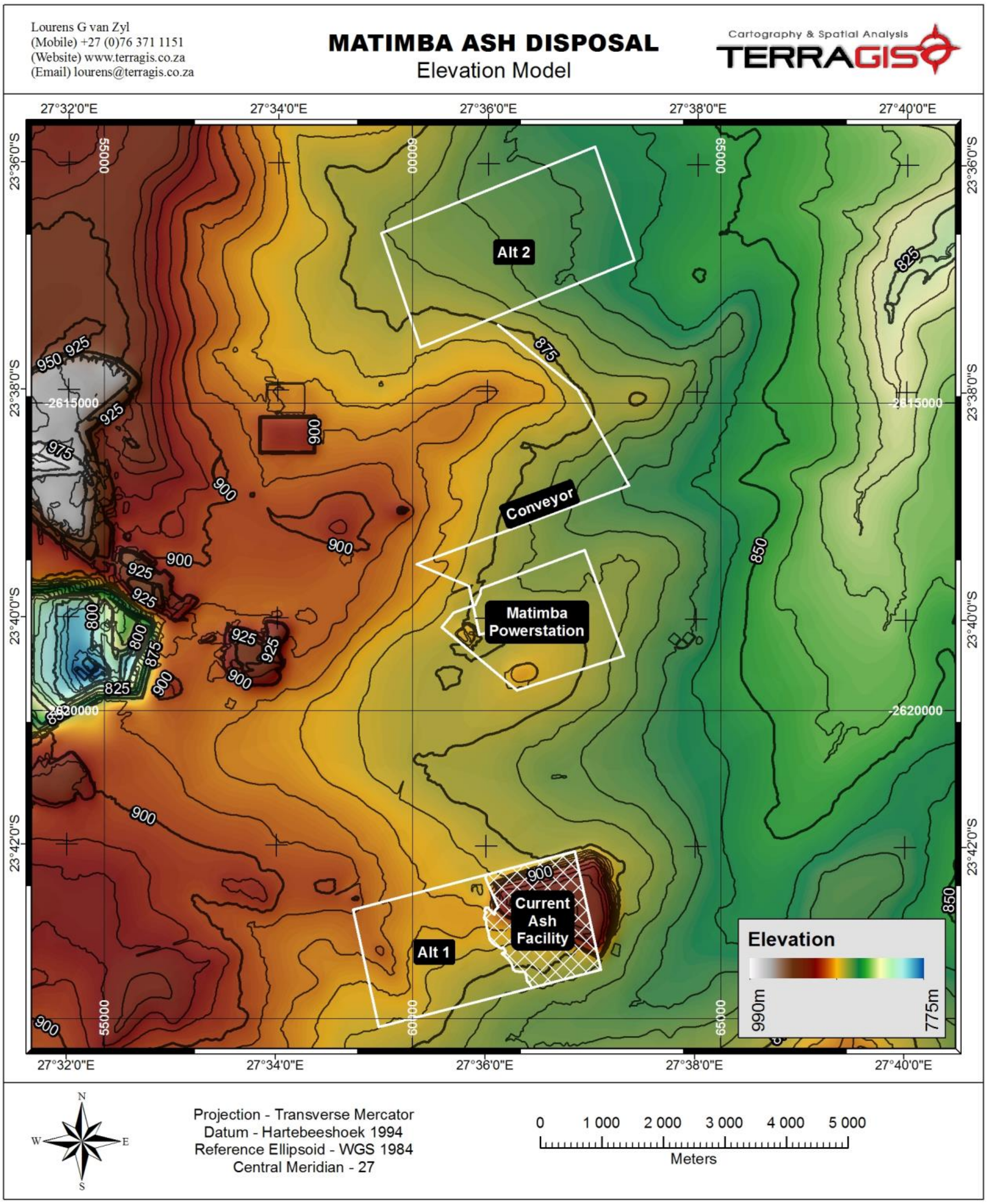

Figure 5: Digital elevation model (DEM) of the two alternative sites

The Topographic Wetness Index (TWI) map (**Figure 6**) indicates that there are significant areas of surface water flow on Alternative 2 site. This aspect is confirmed by the soil survey as will be discussed in the next section.

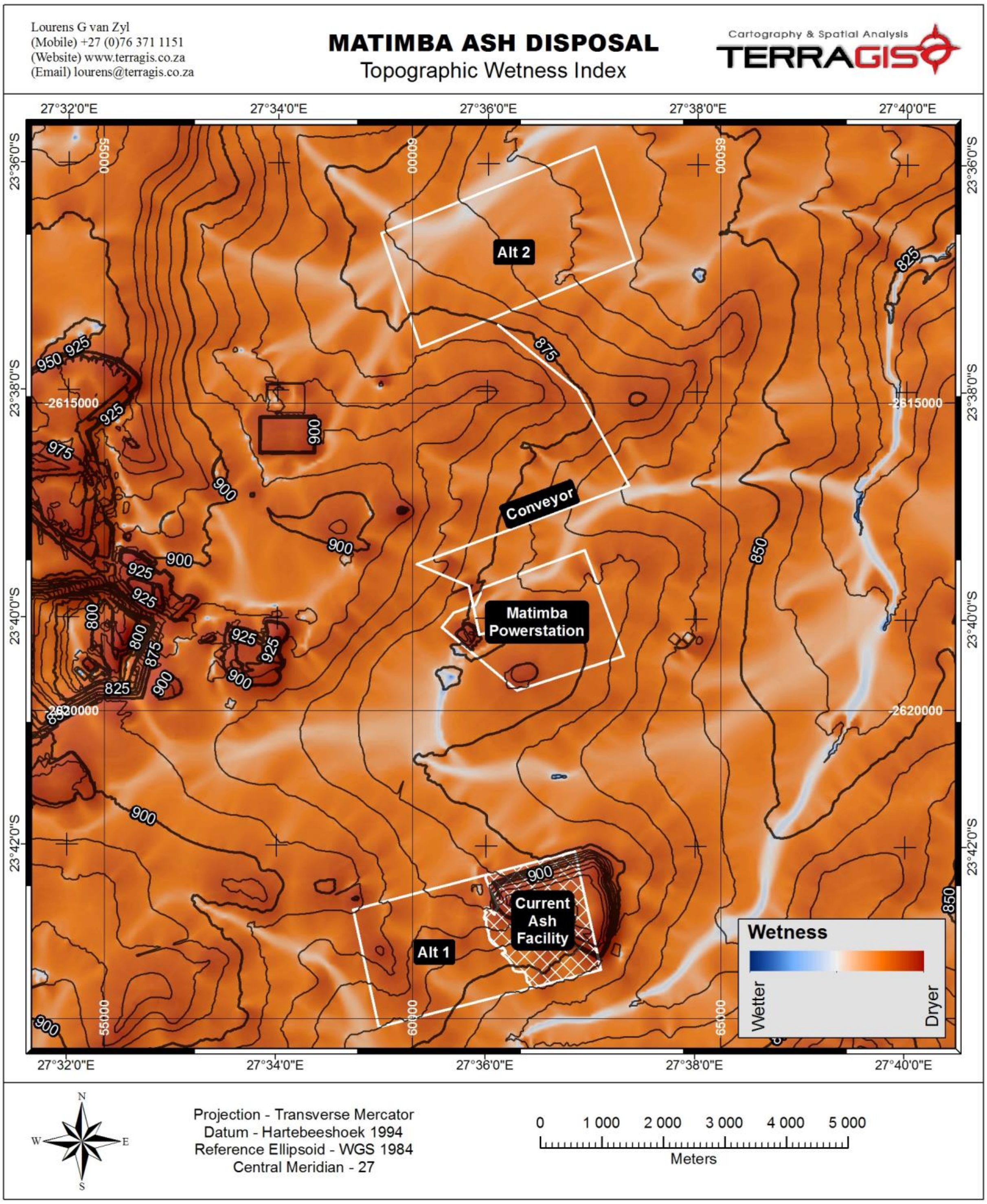

Figure 6: Topographic wetness index (TWI) of the two alternative sites

3.2.4 Phase 4: Site Visit and Soil Survey

The soil maps for site **Alternative 1**, **Alternative 2** and **linear infrastructure Route** are provided in **Figures 7** and **13** respectively. There is a distinct difference between the soils found on the sites north of the power station and the soils found to the south.

3.2.4.1 Site Alternative 1

The soils encountered on Alternative 1 site (**Figure 7**) can be grouped into three groups namely 1) dominantly Clovelly, 2) stony Clovelly and 3) Valsrivier and Oakleaf soils.

Figure 7: Soil map of the Alternative 1 site

(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 – **Figure 8**) 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).

(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 (**Figures 9** and **10**) and are often intercepted at the surface by conglomerate rock outcrops (**Figure 10** and **11**).

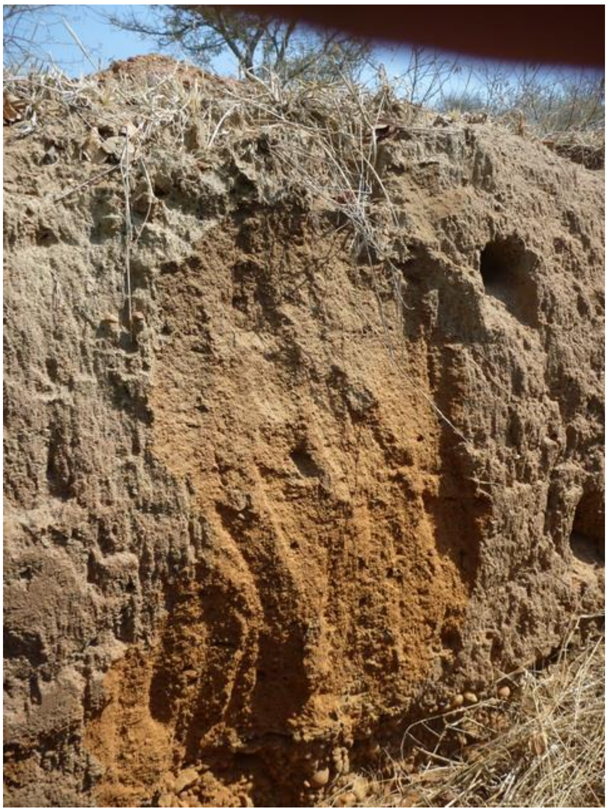

Figure 8: Exposed profile of the Clovelly soil form in site Alternative 1

(iii) Valsrivier / Oakleaf

These areas are characterised by slight depressions in the landscape (**Figure 12**) 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. 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 (DWAF, 2005) for classifying these areas as wetlands.

Figure 9: Copious amounts of pebbles on the surface

Figure 10: Copious amounts of pebbles on the surface with the occasional rock outcrop

Figure 11: Distinct rock outcrops

Figure 12: Depression in the landscape with structured and high clay content soils

3.2.4.2 Site Alternative 2

The soils encountered on the Alternative 2 site (**Figure 13**) can be grouped into three groups namely 1) Clovelly, 2) Fernwood and 3) Valsrivier.

Figure 13: Soil map of the Alternative 2 site

(i) Clovelly

The dominant soil form in this area is of the Clovelly (*orthic A horizon / yellow-brown apedal B horizon / unspecified material – usually weathering rock* – **Figure 14**) form that is deep and of sandy texture. There is a degree of variation in this area as redder hues are also encountered but these are subdominant.

(ii) Fernwood

Distinct areas occur where the soils are bleached sandy soils of the Fernwood (*orthic A horizon / E horizon*) form (**Figure 15**). These areas are not indicative of wetland conditions as often associated with E horizons in the wetland delineation guidelines (DWAF, 2005).

(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 (**Figure 16**). The presence of lime was confirmed through a field test with a 10% HCl solution. 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 14: Auger profile of a deep sandy Covelly soil form

Figure 15: Auger profile of a deep sandy Fernwood with a degree of yellowing in the subsoil

Figure 16: Addition of HCl (10 % solution) to subsoil lime (left) and effervescence confirming the presence of carbonates (right)

3.2.4.3 Linear Infrastructure Route

The soils encountered along the linear infrastructure route (**Figure 17**) can be grouped into two groups namely 1) Clovelly and 2) Fernwood. These soils have been discussed in preceding sections and the same applies for the linear infrastructure route.

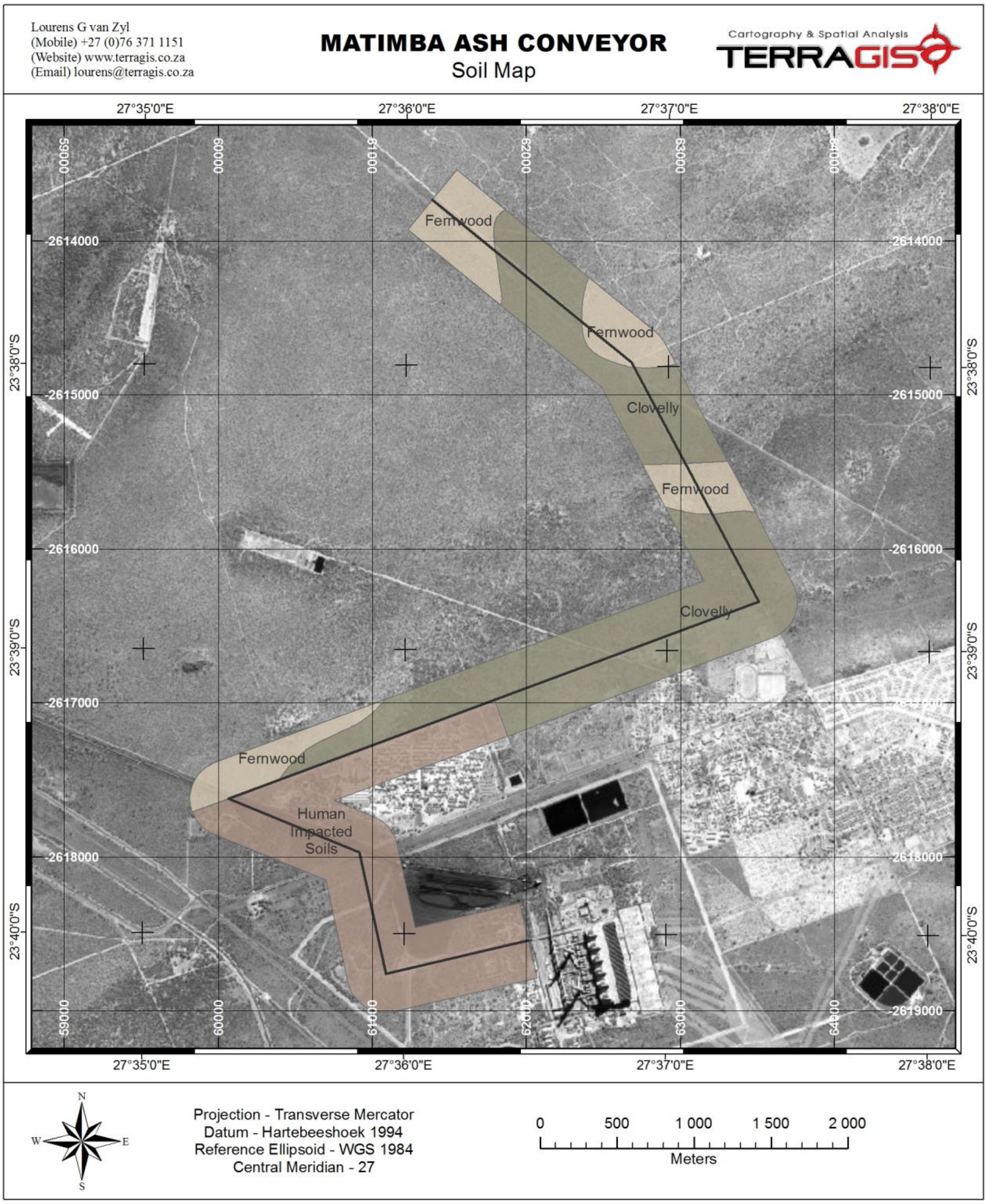

Figure 17: Soil map of the Linear Infrastructure Route site

4. INTERPRETATION OF SOIL, LAND CAPABILITY AND LAND USE SURVEY RESULTS

The interpretation of the land use and land capability results yielded a number of aspects that are of importance to the project.

4.1 Agricultural Potential

The agricultural potential of the two alternative sites as well as the linear infrastructure route are determined by two factors namely 1) the deep sandy soils (adequate for deep rooting and water storage) and 2) the erratic rainfall and high evapotranspiration potential. The deep soils (refer to section 2.2) 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.

4.2 Wetland Distribution

During the investigation distinct depressions were identified on the sites and the TWI confirms 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 water courses due to the flat topography.

4.3 Overall Soil and Land Impacts

Due to the low agricultural potential of the two alternative sites and the linear infrastructure route as well as the variable rainfall the impacts on soils and agriculture is expected to be low. Storm water management is not considered critical on the sites as the soils are very deep with subsequent quick infiltration to lower layers. The implementation of storm water mitigation measures is however still recommended. This applies to both alternative sites and the linear infrastructure route.

5. ASSESMENT OF IMPACT

5.1 Assessment Criteria

The following assessment criteria (**Table 1**) were used for the impact assessment.

Table 1: Impact Assessment Criteria

CATEGORY	DESCRIPTION OF DEFINITION
Cumulative impacts	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.
Nature	A description of the cause of the effect, what will be affected and how it will be affected.
Extent (Scale) • 1 • 2 • 3 • 4 • 5	The area over which the impact will be expressed – ranging from site (1) to regional (5).
Duration • 1 • 2 • 3 • 4 • 5	Indicates what the lifetime of the impact will be. • Very short term: 0 – 1 years • Short-term: 2 – 5 years • Medium-term: 5 – 15 years • Long-term: > 15 years • Permanent
Magnitude • 2 • 4 • 6 • 8 • 10	This is quantified on a scale from 0-10, where 0 is small and will have no effect on the environment, 2 is minor and will not result in an impact on processes, 4 is low and will cause a slight impact on processes, 6 is moderate and will result in processes continuing but in a modified way, 8 is high (processes are altered to the extent that they temporarily cease), and 10 is very high and results in complete destruction of patterns and permanent cessation of processes.
Probability • 1 • 2 • 3 • 4 • 5	Describes the likelihood of an impact actually occurring. • Very Improbable • Improbable • Probable • Highly probable • Definite

CATEGORY	DESCRIPTION OF DEFINITION
Significance	The significance of an impact is determined through a synthesis of <u>all</u> of the above aspects. S = (E + D + M)*P S = Significance weighting E = Extent D = Duration M = Magnitude P=Probability?
Status • Positive • Negative • Neutral	Described as either positive, negative or neutral
Other	• Degree to which the impact can be reversed • Degree to which the impact may cause irreplaceable loss of resources • Degree to which the impact can be mitigated

5.2 List of Activities for the Site

Table 2 lists the anticipated activities for the sites. The last two columns in the table list the anticipated forms of soil degradation and geographical distribution of the impacts.

Table 2: List of activities and their associated forms of soil degradation

Activity	Form of Degradation / Impact		Comment (Section described)
Construction Phase			
Construction of ash disposal facility	Physical degradation (surface)		(Section 5.3.1)
Construction of buildings and other infrastructure	Physical degradation (compound)		(Section 5.3.2)
Construction of roads	Physical degradation (compound)		(Section 5.3.3)
Construction of conveyor	Physical degradation (compound)		(Section 5.3.4)
Construction and Operational Phase			
Vehicle operation on site	Physical and chemical degradation (hydrocarbon spills)		(Section 5.3.5)
Dust generation	Physical degradation		(Section 5.3.6)
Continuous disposal of ash	Physical degradation (surface)		(Section 5.3.7)

5.3 Assessment of the Impacts of Activities

Many of the aspects are generic and their impacts will remain similar for most areas on both sites as well as the linear infrastructure route. The generic activity will therefore be assessed. The impacts associated with the different activities have been assessed below for each activity. These impacts have been summarized in **Table 10**.

Note: *The impacts listed below indicate that no mitigation is possible. It is important to note that any soil impact in the form of drastic physical disturbance (as with construction activities) is a permanent one and no mitigation is possible. The mitigation that can be applied is the restriction of off-site effects due to developments through adequate implementation of environmental management measures (discussed later in the report).*

The impact on the specific sites will be similar for both the sites (Alternative 1 and Alternative 2) as well as the linear infrastructure route. This aspect will be discussed in further detail in the conclusions and recommendations section.

5.3.1 Construction of Ash Disposal Facility

Table 3 presents the impact criteria and a description with respect to soils, land capability and land use for the construction of the proposed ash disposal facility.

Table 3: Construction of ash disposal facility

Criteria	Description
Cumulative Direct Impact	The cumulative impact of this activity will be small as it is constructed on land with low agricultural potential.
Nature	This activity entails the construction of an ash disposal facility with the associated disturbance of soils and existing land use.
Extent	1 - Site: The impact is two dimensional but then limited to the immediate area that is being developed
Duration	5 – Permanent (unless removed)
Magnitude	2 - minor
Probability	4 (highly probable due to inevitable changes in land use)
Significance of impact	S = (1 + 5 + 2)*4 = 32
Status	Negative
Mitigation	None possible. Limit footprint to the immediate development area

5.3.2 Construction of Buildings and Other Infrastructure

Table 4 presents the impact criteria and a description with respect to soils, land capability and land use for the construction of buildings and other infrastructure.

Table 4: Construction of buildings and other infrastructure

Criteria	Description
Cumulative Direct Impact	The cumulative impact of this activity will be small as it is constructed on land with low agricultural potential.
Nature	This activity entails the construction of buildings and other infrastructure with the associated disturbance of soils and existing land use.
Extent	1 - Site: The impact is two dimensional but then limited to the immediate area that is being developed
Duration	5 – Permanent (unless removed)
Magnitude	2 - minor
Probability	4 (highly probable due to inevitable changes in land use)
Significance of impact	S = (1 + 5 + 2)*4 = 32
Status	Negative
Mitigation	None possible. Limit footprint to the immediate development area

5.3.3 Construction of Roads

Table 5 presents the impact criteria and a description with respect to soils, land capability and land use for the construction of roads.

Table 5: Construction of roads

Criteria	Description
Cumulative Direct Impact	The cumulative impact of this activity will be small as it is linear and limited in geographical extent.
Nature	This activity entails the construction of roads with the associated disturbance of soils and existing land use.
Extent	1 - Site: The impact is two dimensional but then limited to the immediate area that is being developed along the road
Duration	5 – Permanent (unless removed)
Magnitude	2
Probability	4 (highly probable due to inevitable changes in land use)
Significance of impact	S = (1 + 5 + 2)*4 = 32
Status	Negative
Mitigation	None possible. Limit footprint to the immediate development area and keep to existing roads as far as possible

5.3.4 Construction of Conveyor

Table 6 presents the impact criteria and a description with respect to soils, land capability and land use for the construction of the proposed ash disposal facility.

Table 6: Construction of conveyor

Criteria	Description
Cumulative Direct Impact	The cumulative impact of this activity will be small as it is constructed on land with low agricultural potential.
Nature	This activity entails the construction of a conveyor system with the associated disturbance of soils and existing land use.
Extent	1 - Site: The impact is two dimensional but then limited to the immediate area that is being developed
Duration	5 – Permanent (unless removed)
Magnitude	2 - minor
Probability	4 (highly probable due to inevitable changes in land use)
Significance of impact	S = (1 + 5 + 2)*4 = 32
Status	Negative
Mitigation	None possible. Limit footprint to the immediate development area

5.3.5 Vehicle Operation on Site

It is assumed that vehicle movement will be restricted to the construction site and established roads. Vehicle operation impacts in this sense are restricted to spillages of lubricants and petroleum products. **Table 7** presents the impact criteria and a description with respect to soils, land capability and land use for the operation of vehicles on the sites.

Table 7: Assessment of impact of vehicle operation on site

Criteria	Description
Cumulative Direct Impact	The cumulative impact of this activity will be small if managed.
Nature	This activity entails the operation of vehicles on site and their associated impacts in terms of spillages of lubricants and petroleum products
Extent	1 - Site: The impact is two dimensional but then limited to the immediate area that is being developed
Duration	4 – Long term
Magnitude	2 - minor
Probability	4 highly probable (2 - improbable with prevention and mitigation)
Significance of impact	S = (1 + 4 + 2)*4 = 28 (14 with prevention and mitigation)
Status	Negative
Mitigation	Maintain vehicles, prevent and address spillages

5.3.6 Dust Generation

Generated dust can impact large areas depending on environmental and climatic conditions. **Table 8** presents the impact criteria and a description with respect to soils, land capability and land use for dust generation on the sites.

Table 8: Assessment of impact of dust generation on site (all phases)

Criteria	Description
Cumulative Direct Impact	The cumulative impact of this activity will be small if managed and is expected to be low due to the sandy nature of the soils.
Nature	This activity entails the operation of vehicles on site and their associated dust generation and other activities such as clearing of areas, handling of rubble, transport of material etc.
Extent	2 - Local: The impact is diffuse (depending on environmental and climatic conditions) and will probably be limited to within 3 – 5 km of the site
Duration	4 - Long term
Magnitude	4 – Low
Probability	4 – highly probable (2 with mitigation and adequate management)
Significance of impact	S = (2 + 4 + 4)*4 = 40 (20 with mitigation and adequate management)
Status	Negative
Mitigation	Limit vehicle movement to absolute minimum or construct proper roads for access. In the absence of adequate roads dust suppression should be practiced.

5.3.7 Continuous Ash Disposal

Table 9 presents the impact criteria and a description with respect to soils, land capability and land use for the continuous disposal of ash.

Table 9: Continuous disposal of ash

Criteria	Description
Cumulative Direct Impact	The cumulative impact of this activity will add nothing to the other impacts as the footprint of roads and disposal facility have already been established.
Nature	This activity entails the continuous disposal of ash on a facility that has already been constructed with associated infrastructure..
Extent	1 - Site: The impact is two dimensional but then limited to the immediate area that is being developed
Duration	5 – Permanent (unless removed)
Magnitude	0 - minor
Probability	4 (highly probable due to inevitable changes in land use)
Significance of impact	S = (1 + 5 + 0)*4 = 24
Status	Neutral – impacts already discounted
Mitigation	None possible. Limit footprint to the immediate development area

Table 10: Summary of the impact of the development on agricultural potential and land capability

Nature of Impact	*Loss of agricultural potential and land capability owing to the development*	
	Without mitigation	With mitigation
Extent	Low (1) – Site	Low (1) – Site
Duration	Permanent (5)	Permanent (5)
Magnitude	Low (2)	Low (2)
Probability	Highly probable (4)	Highly probable (4)
Significance*	32 (Low)	32 (Low)
Status (positive or negative)	Negative	Negative
Reversibility	Medium	Medium
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	No	No
Mitigation: The loss of agricultural land (crop production and grazing) is a long term loss and there are no mitigation measures that can be put in place to combat this loss.		
Cumulative impacts: Soil erosion may arise owing to increased surface water runoff. Adequate management and erosion control measures should be implemented.		
Residual Impacts: The loss of agricultural land is a long term loss. This loss extends to the post-construction phase. The agricultural potential is low though.		

5.4 Environmental Management Plan

Tables 11 to **13** provide the critical aspects for inclusion in the EMP.

Table 11: Measures for erosion mitigation and control

Objective: Erosion control and mitigation		
Project components	Soil stabilisation, construction of impoundments/swales and erosion mitigation structures	
Potential Impact	Large scale erosion and sediment generation	
Activity / risk source	Poor planning of rainfall surface runoff and storm water management	
Mitigation: Target / Objective	Prevention of eroded materials and silt rich water running off the site	
Mitigation: Action/control	**Responsibility**	**Timeframe**
Plan and implement adequate erosion control measures	Construction team and engineer	Throughout project life time
Performance indicator	Assessment of storm water structures and erosion mitigation measures. Measurement of actual erosion and sediment generation.	
Monitoring	Monitor and measure sediment generation and erosion damage	

Table 12: Measures for limiting vehicle operation impacts on site (spillages)

Objective: Erosion control and mitigation		
Project components	Maintenance of vehicles and planning of vehicle service areas	
Potential Impact	Oil, fuel and other hydrocarbon pollution	
Activity / risk source	Poor maintenance of vehicles and poor control over service areas	
Mitigation: Target / Objective	Adequate maintenance and control over service areas	
Mitigation: Action/control	**Responsibility**	**Timeframe**
Service vehicles adequately	Construction team and engineer	Throughout project life time
Maintenance of service areas, regular clean-up	Construction team and engineer	Throughout project life time
Performance indicator	Assess number and extent of spillages on a regular basis.	
Monitoring	Monitor construction and service sites	

Table 13: Measures for limiting dust generation on site

Objective: Dust generation suppression		
Project components	Limit and address dust generation on site linked to construction and operation activities	
Potential Impact	Large scale dust generation on site	
Activity / risk source	Inadequate dust control measures, excessive vehicle movement or high speed movement on unpaved roads	
Mitigation: Target / Objective	Minimise generation of dust	
Mitigation: Action/control	**Responsibility**	**Timeframe**
Implement dust control strategy including dust suppressants and tarring of roads	Construction team and engineer	Throughout project life time
Limit vehicle movement on unpaved areas to and vehicle speeds should be restricted on site.	Construction team and engineer	Throughout project life time
Performance indicator	Assessment of dust generated on site	
Monitoring	Monitor construction site and surrounds	

6. CONCLUSIONS AND RECOMMENDATIONS

Two sites were identified for the possible location of the proposed ash disposal facility: Alternative 1 (situated adjacent to the existing ash disposal facility) and Alternative 2 to the north of the Matimba Power Station.

Alternative 1 site already has linear infrastructure that services the adjacent ash disposal facility. The Alternative 2 site has none of this infrastructure and such an alignment was provided to the specialists. This route was assessed on the same criteria as the two alternative sites.

From the outset therefore Alternative 1 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 Alternative 2 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 ash disposal facility (Alternative 1) is preferred for the proposed development.

The linear infrastructure route suffers from very similar restrictions to the Alternative 2 site and as such it is not the preferred option. Additionally, the route has very distinct sharp corners that are considered unrealistic. It is assumed that if a proper design was done the route would alter or the areas where sharp corners are situated would take up more land for infrastructure to accommodate the change in direction.

It is concluded that the proposed continuous ash disposal facility 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 site. The main aspect that will have to be managed on the site is dust generation during the construction and operation process. Soil erosion poses a limited risk due to the level nature of the terrain.

The main impacts that have to be managed on the site are:

1. Storm water must be controlled through adequate mitigation and control structures.
2. Impacts from vehicles, such as spillages of oil and hydrocarbons, should be prevented and mitigated.
3. Dust generation on site should be mitigated and minimised as the dust can negatively affect the quality of pastures as well as livestock production. Due to the nature of the soils on the site this is considered an aspect of high priority.

REFERENCES

Department of Water Affairs and Forestry (DWAF). 2005. A practical field procedure for identification and delineation of wetland and riparian areas. DWAF, Pretoria.

Land Type Survey Staff. 1972 – 2006. Land Types of South Africa: Digital map (1:250 000 scale) and soil inventory databases. ARC-Institute for Soil, Climate and Water, Pretoria.

MacVicar CN, De Villiers JM, Loxton RF, Verster E, Lambrechts JJN, Merryweather FR, Le Roux J, Van Rooyen TH, Harmse HJ von M. 1977. Soil Classification. A binomial system for South Africa. *Sci. Bull. 390. Dep. Agric. Tech. Serv., Repub. S. Afr*., Pretoria.

Soil Classification Working Group. 1991. Soil Classification. A taxonomic system for South Africa. *Mem. Agric. Nat. Resour. S.Afr.* No.15. Pretoria.