THE PROPOSED UPGRADE AND RE-ALIGNMENT OF THE SIYATHUTHUKA ROAD, BELFAST, MPUMALANGA

FINAL BASIC ASSESSMENT REPORT

DEDET REFERENCE NUMBER:17/2/3N-187

JANUARY 2013

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EXECUTIVE SUMMARY

Project Description

The Mpumalanga Department of Culture, Sports and Recreation (DCSR) together with the Emakhazeni Local Municipality proposes to develop a world class High Altitude Training Centre to unearth talent, develop champions and to provide top level support for elite athletes and this will involve the upgrade of the existing road networks. The upgrade will involve the widening and re-alignment of a portion of the road and the upgrade of two existing culverts. The upgrade will start at the point of the road marked as main entrance and will end at the traffic circle before entering the township.

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The preferred alternative is to realign the portion for the road as indicated in figure 1, Appendix 1 and 3. The re-aligned portion of the road will consist of two lanes, one in each direction as well as a paved shoulder. Each lane will be 3.5m wide and a paved shoulder / pavement of 1.5m on either side of the road. The remaining portions of the road will be resurfaced with asphalt.

The existing culvert structure at culvert 1 will be removed and replaced with a bigger culvert. The upgraded culvert will consist of 7 barrels, each of which is 2.275m high and 3.135m wide (See Appendix 3 – Drawing 204 and 206). The overall size of the culvert will be 24.5m wide, the overall length of the inside of the culvert will be 90m and the overall length of the outside of the culvert will be 116m. The culvert will be made up of barrels, pre-cast concrete culvert portions, re-enforced concrete culvert portions, gabion walls and gabion mattresses.

Culvert 2 will be upgraded to a total width of 37.8m and length of 21.75m. The culvert structure will also consist of 7 barrels, each of which will be 3.5m high and 5m wide (See Appendix 3 – Drawing 201 and 202).

Legislation

The process for seeking authorisation is undertaken in accordance with the Environmental Impact Assessment (EIA) Regulations (GNR 543 and 544of 18 June 2010), promulgated in terms of Chapter 5 of NEMA. The EIA decision-making authority is the Mpumalanga Department of Economic Development, Environment and Tourism (DEDET). Other authorities such as Department of Water Affairs and Local Government will comment on this document in an advisory capacity. The environmental assessment for proposed upgrade and re-alignment of Siyathuthuka Road and associated structures will be conducted as a Basic Assessment (BA) process.

The key objectives of this BA process include the following:

- Carry out relevant specialist studies;
- Conduct public participation;
- Assess receiving environment;
- Undertake quantitative assessment of significant environmental impacts and identify concomitant mitigation measures;
- Evaluate alternatives through a comparative analysis; and
- Compile EIA Report in accordance with the requirements stipulated in GN No. R543 of 18 June 2010 regulation 32(2). Refer to **Chapter 1** for the document's composition, in terms of the regulatory requirements.

The main purpose of the report is the following:

- To describe the need for the project;
- To explain the environmental legal framework governing the project;
- To explain the Environmental Impact Assessment (EIA) – Basic Assessment Process;
- To present the assumptions and limitations associated with the EIA;
- To describe how the proposed project will be executed during the project life-cycle;
- To provide a description of the receiving environment that could be affected by the proposed project;
- To provide a summary of the specialist studies conducted as part of the EIA;
- To assess the significant impacts associated with the project;
- To conduct a comparative analysis of the proposed;
- To describe the public participation process that was undertaken to date, as part of the EIA phase; and
- To draw conclusions regarding the EIA – BA Process and to make recommendations for decision-making.

In addition, the draft Basic Assessment report provides an opportunity for I&APs to review and comment on the findings of the Specialist Studies undertaken. These comments will be taken into account in the final BAR which will be submitted to DEDET.

Alternatives

Two alternative re-alignment options are therefore considered as part of this application in addition to the no-go option:

Alternative 1: The preferred alternative is to realign the portion for the road as indicated in figure 1. The re-aligned portion of the road will consist of two lanes, one in each direction as well as a paved shoulder. Each lane will be 3.5m wide and a paved shoulder / pavement of 1.5m on either side of the road. The remaining portions of the road will be resurfaced with asphalt. The existing culvert structure at culvert 1 will be removed and replaced with a bigger culvert. The upgraded culvert will consist of 7 barrels, each of which is 2.275m high and 3.135m wide. The overall size of the culvert will be 24.5m wide, the overall length of the inside of the culvert will be 90m and the overall length of the outside of the culvert will be 116m. The culvert will be made up of barrels, pre-cast concrete culvert portions, re-enforced concrete culvert portions, gabion walls and gabion mattresses. Culvert 2 will be upgraded to a total width of 37.8m and length of 21.75m. The culvert structure will also consist of 7 barrels, each of which will be 3.5m high and 5m wide.

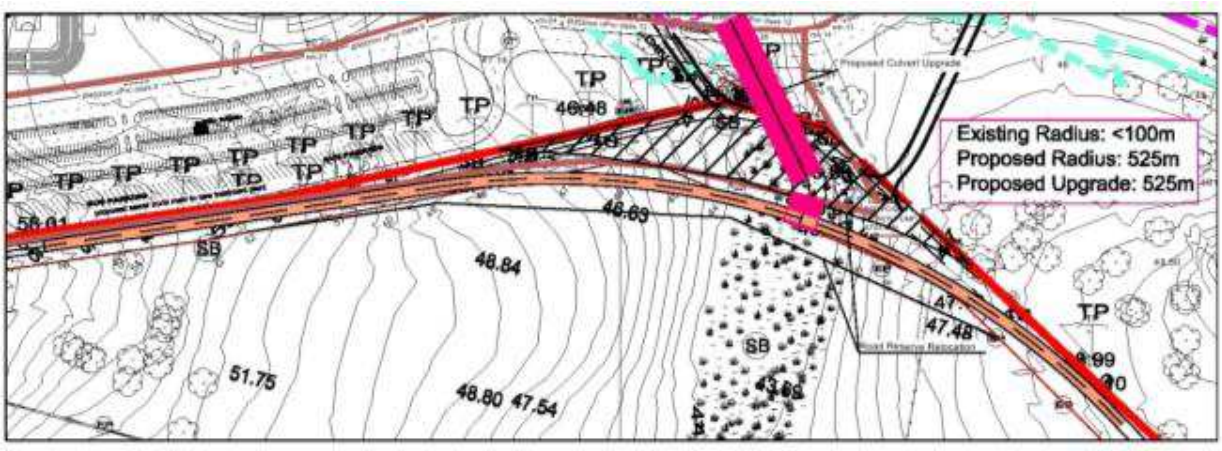

Figure 1: Map showing route alternative 1(in orange) and culvert structure 1(in pink) (MSW, 2012)

Alternative 2: The upgrade of the road will be the same as described for alternative 1, however this alternative differs from alternative 1 in that portion of the road to be re-aligned follows a different route as indicated in the figure below. The culverts that will be constructed will be the same size irrespective of the route.

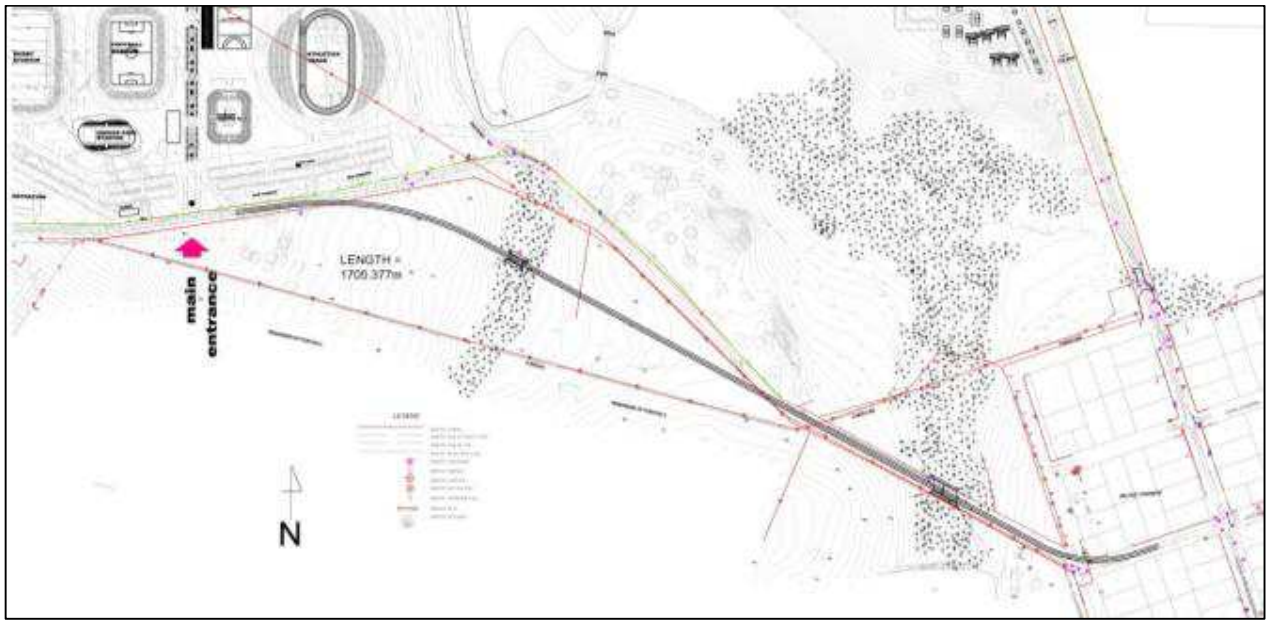

Figure 2: Map showing alternative 2 route alignments and location of culvert structures (in black) (MSW, 2012)

No-go Option:

This means that the existing Siyathuthuka Road will not be upgraded and resurfaced with asphalt. The two undersized culverts will remain in the existing positions and will continue to be inefficient. The portioned that was supposed to be realigned will not happen and as such the current safety risk associated with the sharp turn in the road will remain. There will be a potential for flooding as the culverts cannot accommodate the 1:50 floods. There will be no impact to the surrounding vegetation. The wetland functionality has been impaired by constricting the surface water flow through single culverts (Enviross, 2012).

Best Practicable Environmental Option

Based on the recommendations of the specialists and the comparison of the impacts associated with the various alternatives, Alternative 1 is considered to be the preferred alternative.

Environmental Impact Statement

Based on the recommendations of the specialists and the impact assessment associated with the various site alternatives, the following alternative is considered to be the Best Practicable Environmental Option (BPEO):

- **Alternative 1** – This option is considered to be the preferred alternative from a wetland perspective, the wetland already suffers from the impacts of the existing road crossing and by establishing new crossing points as close as possible to the existing crossings will reduce the

overall footprint area, which will ultimately reduce the cumulative impacts on the wetland habitat units.

With the selection of the BPEO for the proposed upgrade and re-alignment of the Siyathuthuka Road; the adoption of the mitigation measures included in the EIA Report and the dedicated implementation of the EMP, it is believed that the significant environmental aspects and impact associated with this project can be suitably mitigated. With the aforementioned in mind, it can be concluded that there are no fatal flaws associated with the project and that authorisation can be issued, based on the findings of the specialists and the impact assessment, through the compliance with the identified environmental management provisions.

Key Recommendations / Opinion of the EAP

Based on the findings of the impact assessment and the specialist studies, **alternative 1** is supported as the preferred option.

All recommendations made by the specialists must be adhered to.

Conditions for Authorisation

- Diligent compliance monitoring of the EMPr, environmental authorisation and other relevant environmental legislation by an Independent Environmental Control Officer (ECO) is crucial to ensure compliance with the stipulated management measures of the BAR.
- All relevant recommendations made by the specialists relating to the preferred site alternative must be adhered to in terms of fauna, flora, heritage, and wetland issues.
- Areas affected by construction activities need to be suitably stabilised due to the close proximity of the watercourses within the project area. A stormwater control plan must be implemented manage stormwater and prevent erosion.
- Protected flora species are to be relocated prior to vegetation clearance, should avoidance not be possible. Permits need to be obtained under National Forests Act (Act No. 84 of 1998) if protected trees are to be cut, disturbed, damaged, destroyed or removed.
- The construction camp area needs to be identified prior to commencement of construction activities. The camp must be adequately fenced and secure at all times.
- All relevant permits must be obtained prior to the commencement of construction activities or as deemed necessary.

TITLE AND APPROVAL PAGE

TITLE: The Proposed Upgrade and Re-alignment of the Siyathuthuka Road Located in Belfast, Mpumalanga

CLIENT : Mpumalanga Department of Culture Sports and Recreation

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APPROVAL

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Signature **Date**

AMENDMENTS PAGE

Date	Nature of Amendment	Amendment No.	Signature
05 November 2012	Draft Copy for Public Review	0	
08 January 2013	Final Copy for Public Review	1	

1. DOCUMENT ROADMAP

The Basic Assessment (BA) Report for the proposed Upgrade and re-alignment of the Siyathuthuka Road, In Belfast, Mpumalanga aims to satisfy all requirements stipulated in GN.R. 543. of 18 June 2010 (EIA Regulations, 2010). To this end, the following table provides the composition of the draft BA report together with the requirements from the aforementioned legislation.

Table 1: Document Roadmap

CORRELATION WITH GN No. R. 543 (EIA REGULATIONS)				
Chapter	title	Section	Description	Included
1	Document Roadmap			
2.1	Project Background and Motivation			
4	Basic Assessment Process			
3	Legislation and Guidelines considered	22(e)	An identification of all legislation and guidelines that have been considered in the preparation of the basic assessment report.	
5	Assumptions and Limitations	22(m)	A description of any assumptions, uncertainties and gaps in knowledge.	
2.2	Need & Desirability	22(g)	A description of the need and desirability of the proposed activity.	
6	Environmental Assessment Practitioner	22(a)	Details of the EAP who prepared the report; and the expertise of the EAP to carry out basic assessment procedures.	
12	Public Participation	22(f)	Details of the public participation process conducted in terms of regulation **21**(2)(a) in connection with the application, including— (i) the steps that were taken to notify potentially interested and affected parties of the proposed application; (ii) proof that notice boards, advertisements and notices notifying potentially interested and affected parties of the proposed application have been displayed, placed or given; (iii) a list of all persons, organisations and organs of state that were registered in terms of regulation **55** as interested and affected parties in relation to the application; and (iv) a summary of the issues raised by interested and affected parties, the date of receipt of and the response of the EAP to those issues;	
7	Project Location	22(c)	A description and a map of the property on which the activity is to be undertaken and the location of the activity on the property, or, if it is— (i) a linear activity, a description of the route of the activity; or	

			(ii) an ocean-based activity, the coordinates within which the activity is to be undertaken.	
8	Project Description	22(b)	A description of the proposed activity.	
10	Profile of the Receiving Environment	22(d)	A description of the environment that may be affected by the proposed activity and the manner in which the geographical, physical, biological, social, economic and cultural aspects of the environment may be affected by the proposed activity.	
9	Alternatives	22(h)	A description of any identified alternatives to the proposed activity that are feasible and reasonable, including the advantages and disadvantages that the proposed activity or alternatives will have on the environment and on the community that may be affected by the activity.	 
13	Methodology used to determine significance of Environmental Impacts			
11	Summary of Specialist Studies	22(k)	Any inputs and recommendations made by specialists to the extent that may be necessary.	
13	Environmental Issues			
13	Assessment of Environmental Issues	22(i)	A description and assessment of the significance of any environmental impacts, including— (i) cumulative impacts, that may occur as a result of the undertaking of the activity or identified alternatives or as a result of any construction, erection or decommissioning associated with the undertaking of the activity; (ii) the nature of the impact; (iii) the extent and duration of the impact; (iv) the probability of the impact occurring; (v) the degree to which the impact can be reversed; (vi) the degree to which the impact may cause irreplaceable loss of resources; and (vii) the degree to which the impact can be mitigated;	
		22(j)	Any environmental management and mitigation measures proposed by the EAP.	
114	Environmental Impact Statement		An environmental impact statement which contains— (i) a summary of the key findings of the environmental impact assessment; and (ii) a comparative assessment of the positive and negative implications of the proposed activity and identified alternatives.	
14	Opinion of the Environmental Assessment Practitioner	22(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 that authorisation.	

15	References			
-		22(r)	Any specific information required by the competent authority.	
-		22(s)	Any other matters required in terms of sections 24(4)(a) and (b) of the Act.	
Appendi 6	Draft Environmental Management Plan	22(l)	A draft environmental management programme containing the aspects contemplated in regulation **33.**	
N/A for Draft Report	Comments and Response Report	22(o)	Any representations and comments received in connection with the application or the basic assessment report.	
		22(q)	Any responses by the EAP to those representations, comments and views.	
N/A for Draft Report	Meeting Minutes	22(p)	The minutes of any meetings held by the EAP with interested and affected parties and other role players which record the views of the participants.	
		22(q)	Any responses by the EAP to those representations, comments and views.	
Appendi 5	Specialist Studies report		Copies of any specialist reports and reports on specialised processes complying with regulation 32.	

2. PROJECT BACKGROUND AND MOTIVATION

2.1. Background

The Mpumalanga Department of Culture, Sports and Recreation (DCSR) together with the Emakhazeni Local Municipality proposes to upgrade and re-align the existing Siyathuthuka Road. This road will be used as the main access point to the proposed Mpumalanga High Altitude Training Centre (HATC). Furthermore the two culverts located on this road do not function efficiently due to the size of the culvert structures.

Nemai Consulting has been appointed by Masetlaoka Scott Wilson Consulting Engineers on behalf of the Mpumalanga Department of Culture, Sports and Recreation to undertake the requisite Environmental Authorisation Process for the re-alignment and upgrade of the Siyathuthuka Road and associated infrastructure. The proposed development triggers activities listed in Government Notices No. R 544 and hence requires a basic assessment study as per the August 2010 Environmental Impact Assessment (EIA) Regulations promulgated in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998).

2.2. Need and Desirability

In terms of Regulation 22(2)g of GN No. R543 (18 June 2012), this section discusses the need and desirability of the project. In order to address the need and desirability of the project, the questions raised in the Guideline on Need and Desirability (DEA&DP, 2009) are answered in the table to follow.

Table 2: Need and Desirability of the Project

No.	Question	Response
NEED ('timing')		
1.	Is the land use (associated with the activity being applied for) considered within the timeframe intended by the existing approved Spatial Development Framework (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 IDP).	Yes, the realignment of Siyathuthuka Road is specifically mentioned in eMakhazeni IDP.
2.	Should development, or if applicable, expansion of the town/area concerned in terms of this land use (associated with the activity being applied for) occur here at this point in time?	Yes, a town planning application was made in 2011 and approval for the proposed Township establishment has been received on the condition of environmental authorization.

No.	Question	Response
3.	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)	An Environmental Impact Assessment is currently being undertaken for a proposed High Altitude Training centre, the road realignment is necessary for access to the proposed centre. The existing road also provides direct access to the Belfast and Siyathuthuka Townships and therefore needs to be upgraded.
4.	Are the necessary services with appropriate capacity currently available (at the time of application), or must additional capacity be created to cater for the development?	No additional capacity will be required for this development.
5.	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)?	Yes
6.	Is this project part of a national programme to address an issue of national concern or importance?	No
DESIRABILITY ('placing')		
7.	Is the development the best practicable environmental option (BPEO) for this land/site?	The Siyathuthuka road is and existing road and as such is the best option for this site.
8.	Would the approval of this application compromise the integrity of the existing approved municipal IDP and SDF as agreed to by the relevant authorities?	No, this is an existing road.
9.	Would the approval of this application compromise the integrity of the existing environmental management priorities for the area (e.g. as defined in Environmental Management Frameworks), and if so, can it be justified in terms of sustainability considerations?	No, this application is to upgrade an existing road.
10.	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).	The proposal is to upgrade and re-align and existing road.

No.	Question	Response
11.	How will the activity or the land use associated with the activity applied for, impact on sensitive natural and cultural areas (built and rural/natural environment)?	There will be an impact on the wetland areas, however the existing culverts need to be upgraded as they do not function efficiently. A Wetland Impact Assessment has been undertaken.
12.	How will the development impact on people's health and wellbeing (e.g. i.t.o. noise, odours, visual character and sense of place, etc)?	Potential impacts during construction phase to be managed through EMP.
13	Will the proposed activity or the land use associated with the activity applied for, result in unacceptable opportunity costs?	No
14	Will the proposed land use result in unacceptable cumulative impacts?	No.

The proposed project is therefore the re-alignment and upgrade of an existing asphalt road which currently provides access to the Belfast / Siyathuthuka Township. The road has two undersized culverts on it which need increasing to 1:50 year flood and two light corners which need smoothing. Furthermore, the upgrade is required to provide access to the proposed High Altitude Training centre (HATC) for potential spectators.

3. LEGISLATION AND GUIDELINES CONSIDERED

3.1. Legislation

The legislation that has possible bearing on the proposed Siyathuthuka Road re-alignment Mpumalanga is captured below.

Note: This list does not attempt to provide an exhaustive explanation, but rather an identification of the most appropriate sections from pertinent legislation.

Table 3: Legislation related to the re-alignment and upgrade of the Siyathuthuka Road, Belfast, Mpumalanga

Legislation	Relevance
Constitution of the Republic of South Africa, (no 108 of 1996)	• Chapter 2 – Bill of rights. • Section 24 – Environmental rights
National Environmental Management Act (no. 107 of 1998)	• Section 24 - Environmental Authorization (control of activities which may have detrimental effect on the environment). • Section 28 – Duty of care and remediation of environmental damage

		• Environmental management Principles
GN R. 544 of 18 June 2010	40	• Two existing culverts will be upgraded as part of the road alignment. A portion of the road to be upgraded is located within 32m of the watercourse.
Environmental Conservation Act (No 73 of 1989):		• Environmental Protection and conservation. • Section 25 – Noise regulation • Section 20 – Waste Management
National Environmental Management Air Quality Act (no 39 of 2004)		• Air quality Management. • Section 32 – Dust control. • Section 34 - Noise Control.
National Environmental Management : Biodiversity Act, 2004 (no. 10 of 2004)		• Management and conservation of the country's biodiversity. • Protection of species and ecosystems. •
National Environmental management : Protected Areas Act (No. 57 of 2003)		• Protection and conservation of ecological viable areas representative of South Africa's biological diversity and natural landscapes
Occupation Health and Safety Act (No.25 of 1999)		• Provisions for occupational health and Safety • Authority – Department of Labour.
National Heritage Resource Act (no 25 of 1999)		• Section 38 – Heritage Impact Assessment for construction of a road, wall, powerline, pipeline, canal, or other similar linear development exceeding 300meters.
Conservation of Agricultural resource Act (no. 43 of 1983)		• Control measures for erosion. • Control measures for alien and invasive plant species. • Authority – Department of Agriculture.
National Environmental Management : Waste Management Act (59 of 2008)		• Authority – Department of Environmental Affairs

3.2. Guidelines

The following guidelines were considered in the preparation of the Basic Assessment Report:

- MPTA Guidelines
- Guideline 3: General Guide to the Environmental Impact Assessment Regulations, 2005. Integrated Environmental Management Guideline Series (DEAT, 2005a);
- Guideline 4: Public Participation, in support of the EIA Regulations. Integrated Environmental Management Guideline Series (DEAT, 2005);

- Guideline on Need and Desirability, NEMA Environmental Impact Assessment Regulations Guideline and Information Document Series. Department of Environmental Affairs and Development Planning (DEADP, 2009); and
- Assessment of alternatives and impacts (Guideline 5) in support of the EIA Regulations, Department of Environmental Affairs and Tourism, Pretoria (DEAT, 2006).

3.3. Environmental Authorisation Required

From the relevant legislation the following authorization may be required for the proposed new Urea production facility.

1. Approval required from DEDET for listed activities associated with the project. Basic Assessment conducted under NEMA, in accordance with the EIA Regulations (Government Notice No. R544 and R545 of 18 June 2010).
2. Permit to be obtained from South African Heritage Resources Agency (SAHRA) under the National Heritage Resources Act (No. 25 of 1999) if heritage resources are to be impacted on.

3.4. Regional Plans

The following regional plans were considered during the Basic Assessment Process:

- Govan Mbeki local Municipality integrated development plan 2012.
- Relevant provincial, district and local policies and strategies

4. EIA – BASIC ASSESSMENT PROCESS

4.1. Environmental Assessment Triggers

As noted in **Section 3**, the project entails certain activities that require authorisation in terms of the National Environmental Management Act (Act No. 107 of 1998) (NEMA).

The EIA – Basic Assessment Process is being undertaken in accordance with the EIA Regulations of 2010 (GN No. R543 of 18 June 2010). **Table 3** lists (amongst others) the associated relevant activities that apply to the proposed project in terms of GN No. R544 of 18 June 2010.

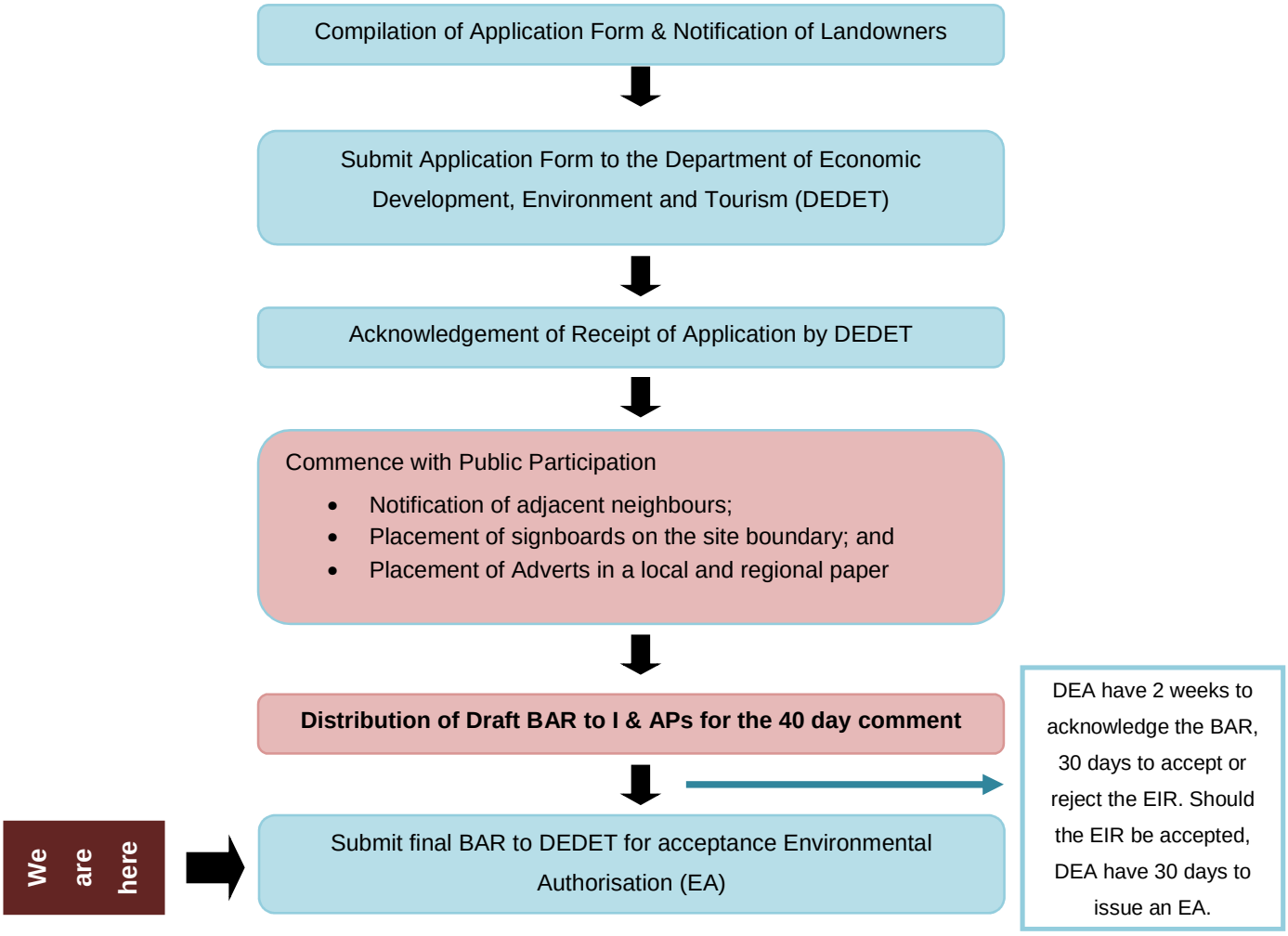
4.2. Environmental Assessment Authorities

The EIA decision-making authority is the Mpumalanga Department Economic Development, Environmental and Tourism (DEDET).

4.3. Basic Assessment Process

The Basic Assessment process as set out in EIA Regulations of 2010 (GN No. R543 of 18 June 2010) has commenced. The application form was submitted to DEDET on the 14th August 2012. Acknowledgement of receipt of the application form was provided on the 29th October 2012. The following reference number was then allocated to the project: 17/2/3N-187.

The public participation process then commenced an outline of Basic Assessment Process for the proposed Siyathuthuka Road upgrade and re-alignment is provided below:



Once the Environmental Authorisation (EA) has been issued, the applicant / EAP must notify all registered I & APs of the decision and this must be done within 12 days of receipt of the EA and provide them with the details should they wish to appeal the decision as per the EA.

5. ASSUMPTIONS AND LIMITATIONS

The following assumptions and limitations accompany the BAR for the proposed upgrade and realignment of the Siyathuthuka Road:

- The EIA process does not make provision for borrow pits. The necessary approval of borrow pits will be required from the Department of Mineral Resources (DMR) in terms of the Minerals and Petroleum Resources Development Act (Act No. 28 of 2002).
- It is assumed that the baseline information scrutinised and used to explain the environmental profile is accurate.

- The locations of camp sites are not known at this stage, and the associated impacts will need to be addressed through suitable mitigation measures in the Environmental Management Plan (EMP).
- The following are assumptions of the wetland specialist:
    - The findings of the survey provided within this report, together with the results and general observations and the conclusions and recommendations provided upon completion of the survey are based on the best scientific and professional knowledge of the field specialists. This is also dependent on the data and resources available at the time. The report is based on survey and assessment techniques that are limited by time and budgetary constraints relevant to the type and level of investigation undertaken.
- The following are assumption and limitations of the flora and fauna specialist:
    - The assessment was carried out during dry season. Although conditions for plant identification were generally favourable, some dormant species might be difficult to observe and therefore were not recorded. The majority of threatened plant species are extremely seasonal and only flower during specific periods of the year,
    - The majority of threatened faunal species are extremely secretive and difficult to survey even during thorough field surveys conducted over several seasons;
    - Even though every care is taken to ensure the accuracy of this report, environmental assessment studies are limited in time.
    - Since environmental impact studies deal with dynamic natural systems additional information may come to light at a later stage and Nemai Consulting can thus not accept responsibility for conclusions and mitigation measures made in good faith based information gathered or databases consulted at the time of the investigation.

6. DETAILS AND EXPERTISE OF THE ENVIRONMENTAL ASSESSMENT PRACTITIONER

Nemai Consulting was appointed by Mpumalanga Department of Culture Sports and Recreation as the independent Environmental Assessment Practitioner (EAP) to undertake the environmental assessment for the proposed realignment of the Siyathuthuka Road.

In accordance with Regulation22 (2) a of GN No. R. 543 of 18 June 2012, this section provides an overview of Nemai Consulting and the company's experience with EIAs, as well as the details and experience of the EAPs that form part of the Scoping and EIA team.

Nemai Consulting is an independent, specialist environmental, social development and Occupational Health and Safety (OHS) consultancy, which was founded in December 1999. The company is directed by a team of experienced and capable environmental engineers, scientists, ecologists, sociologists, economists and analysts. The company has offices in Randburg (Gauteng), Rustenburg (North West Province), and Durban (KwaZulu Natal).

Team members of Nemai Consulting that are involved with the Basic Assessment Process for the proposed upgrade and re-alignment of Siyathuthuka Road facility are captured in **Table 4** below, and their respective Curricula Vitae are contained in to ***Appendix 4***.

Table 4: Basic Assessment Team Members

Name	Qualifications	Experience	Duties
Ms D. Naidoo	• B.Sc Eng (Chem)	17 years	Project Director
Mr C. Chidley	• B.Sc Eng (Civil); • BA (Economics, Philosophy) • MBA	20 years	Quality Reviewer
Ms M. Chetty	• B.Sc Honours Biological Science	4 years	EAP

7. PROJECT LOCATION

Siyathuthuka road is located in the Mpumalanga province and falls within the Nkangala District Municipality and the Emakhazeni Local Municipality (See Appendix 1 for Topographical Map). Appendix 2 includes photographs of the site. The site for the proposed development is situated on Farm Tweefontein 357 JT (TOJT00000000035700000).

Figure 3: Aerial Map showing the location of the existing Siyathuthuka Road in red

8. PROJECT DESCRIPTION

The Mpumalanga Department of Culture, Sports and Recreation (DCSR) proposes to develop a world class High Altitude Training Centre to unearth talent, develop champions and to provide top level support for elite athletes and this will involve the upgrade of the existing road networks. The upgrade will involve the widening and re-alignment of a portion of the road and the upgrade of two existing culverts. The upgrade will start at the point marked as the main entrance and end at the junction off R33 to Lydenbergand. The upgrade will involve the widening and re-alignment of a portion of the road and the upgrade of two existing culverts.

The preferred alternative is to realign the portion for the road as indicated in figure 4, Appendix 1 and 3. The re-aligned portion of the road will consist of two lanes, one in each direction as well as a paved shoulder. Each lane will be 3.5m wide and a paved shoulder / pavement of 1.5m on either side of the road. The remaining portions of the road will be resurfaced with asphalt.

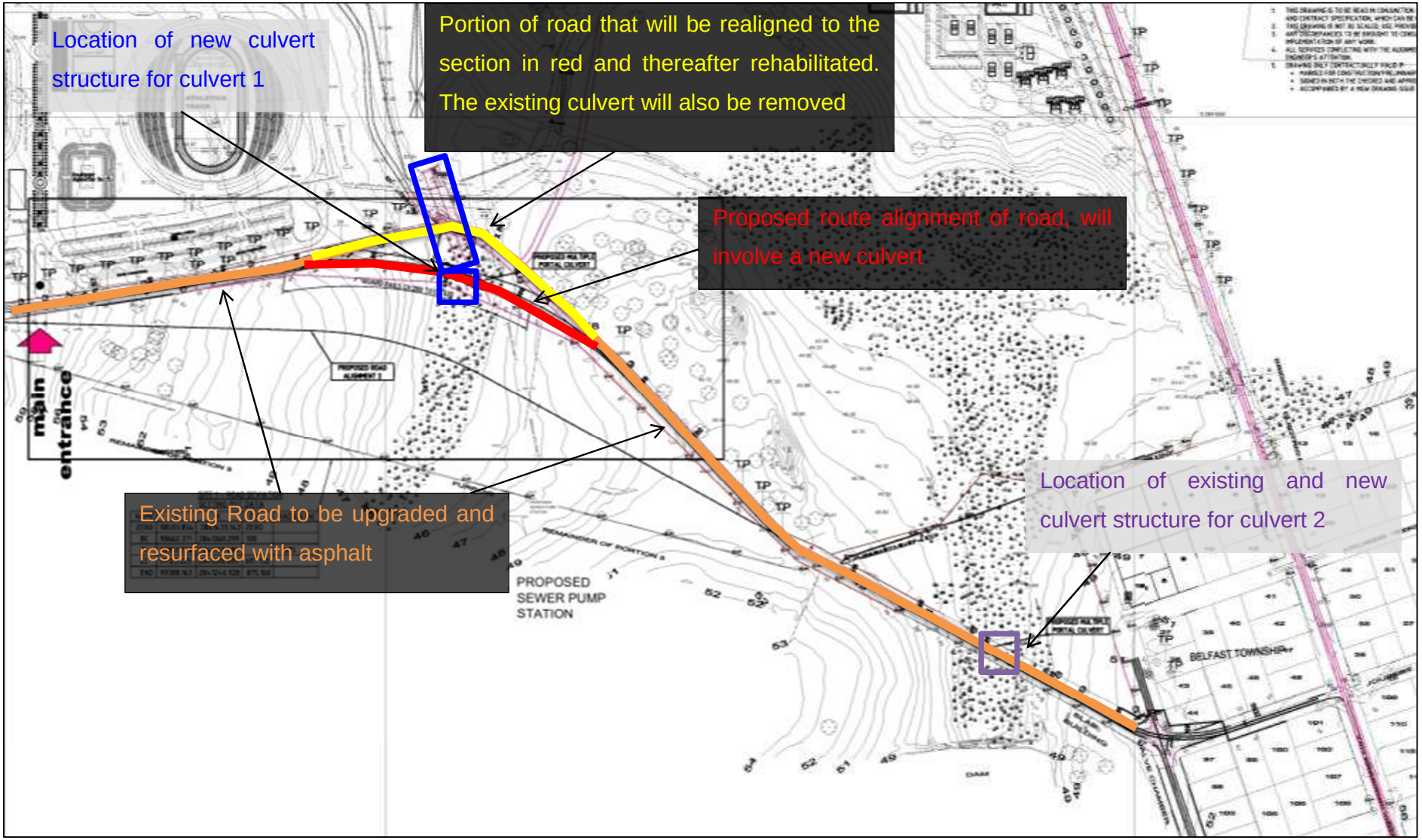


Figure 4: Map showing the proposed upgrade and realignment (MSW, 2012)

The existing culvert structure at culvert 1 will be removed and replaced with a bigger culvert. The upgraded culvert will consist of 7 barrels, each of which is 2.275m high and 3.135m wide (See Appendix 3 – Drawing 204 and 206). The overall size of the culvert will be 24.5m wide, the overall length of the inside of the culvert will be 90m and the overall length of the outside of the culvert will be 116m. The culvert will be made up of barrels, pre-cast concrete culvert portions, re-enforced concrete culvert portions, gabion walls and gabion mattresses.

Culvert 2 will be upgraded to a total width of 37.8m and length of 21.75m. The culvert structure will also consist of 7 barrels, each of which will be 3.5m high and 5m wide (See Appendix 3 – Drawing 201 and 202).

9. ANALYSIS OF ALTERNATIVES

In terms of the NEMA EIA Regulations one of the criteria to be taken into account by the competent authority when considering an application is "*any feasible and reasonable alternatives to the activity which is the subject of the application and any feasible and reasonable modifications or changes to the activity that may minimise harm to the environment*". Alternatives are defined in the Regulations as "*different means of meeting the general purpose and requirements of the activity*". It is therefore necessary to provide a description of the need and desirability of the proposed activity and any identified alternatives to the proposed activity that are feasible and reasonable, including the advantages and disadvantages that the proposed activity or alternatives will have on the environment and on the community that may be affected by the activity.

Two alternative re-alignment options are therefore considered as part of this application:

Alternative 1 (preferred alternative):

The preferred alternative is to realign the portion for the road as indicated in figure 5. The re-aligned portion of the road will consist of two lanes, one in each direction as well as a paved shoulder. Each lane will be 3.5m wide and a paved shoulder / pavement of 1.5m on either side of the road. The remaining portions of the road will be resurfaced with asphalt. The existing culvert structure at culvert 1 will be removed and replaced with a bigger culvert. The upgraded culvert will consist of 7 barrels, each of which is 2.275m high and 3.135m wide. The overall size of the culvert will be 24.5m wide, the overall length of the inside of the culvert will be 90m and the overall length of the outside of the culvert will be 116m. The culvert will be made up of barrels, pre-cast concrete culvert portions, re-enforced concrete culvert portions, gabion walls and gabion mattresses. Culvert 2 will be upgraded to a total width of 37.8m and length of 21.75m. The culvert structure will also consist of 7 barrels, each of which will be 3.5m high and 5m wide.

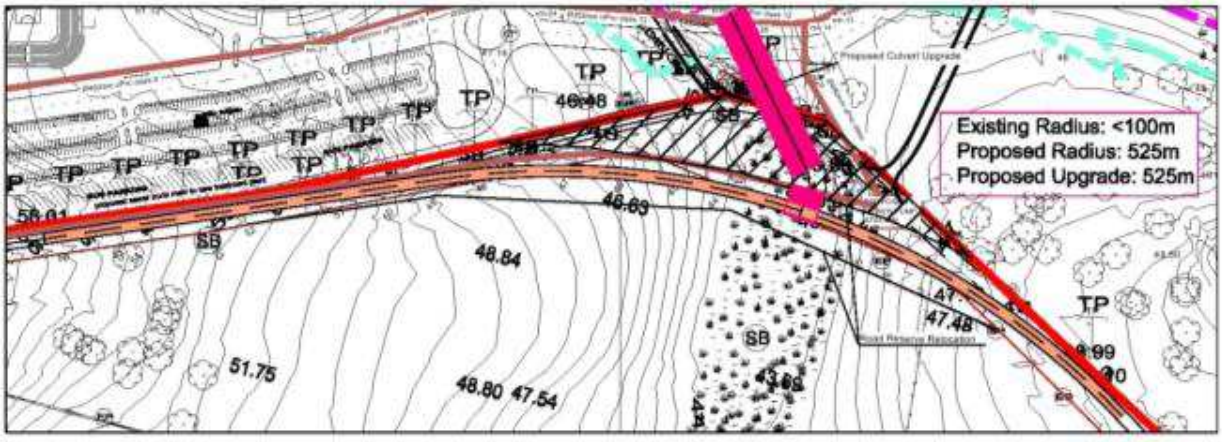


Figure 5: Map showing route alternative 1(in orange) and culvert structure 1(in pink) (MSW, 2012)

Alternative 2:

The upgrade of the road will be the same as described for alternative 1, however this alternative differs from alternative 1 in that portion of the road to be re-aligned follows a different route as indicated in the figure below. The culverts that will be constructed will be the same size irrespective of the route.

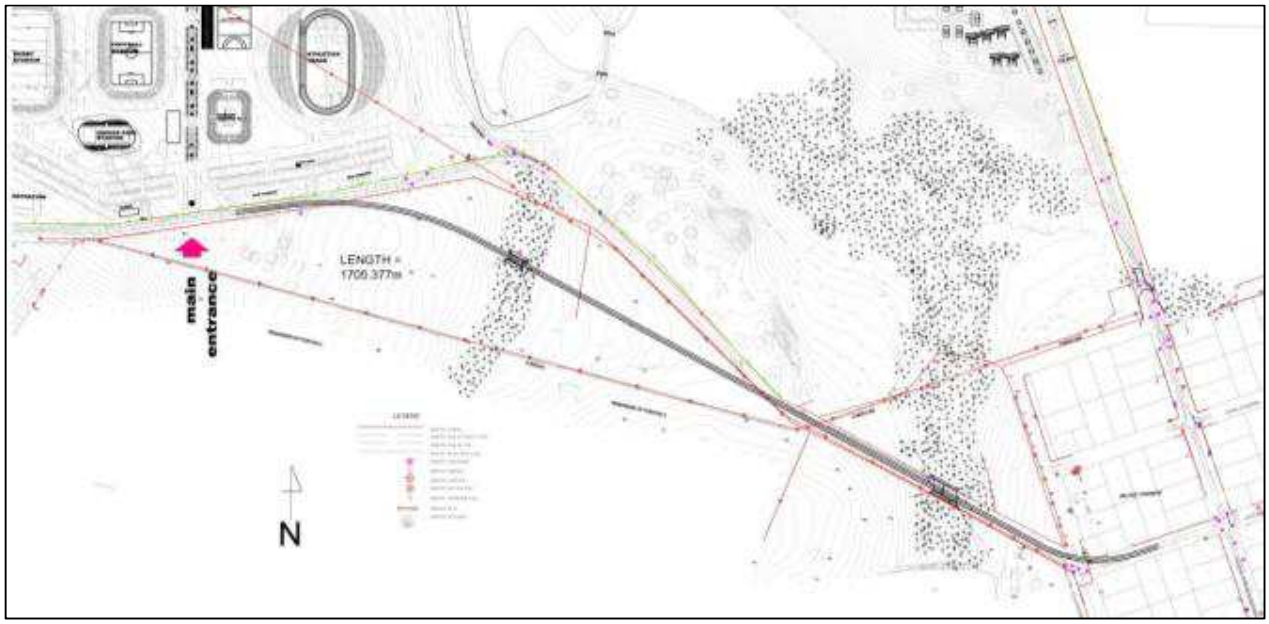


Figure 6: Map showing alternative 2 route alignments and location of culvert structures (in black) (MSW, 2012)

No-go Option:

This means that the existing Siyathtuthuka Road will not be upgraded and resurfaced with asphalt. The two undersized culverts will remain in the existing positions and will continue to be inefficient. The portioned that was supposed to be realigned will not happen and as such the current safety risk

associated with the sharp turn in the road will remain. There will be a potential for flooding as the culverts cannot accommodate the 1:50 floods. There will be no impact to the surrounding vegetation. The wetland functionality has been impaired by constricting the surface water flow through single culverts (Enviross, 2012).

The following table discusses the advantages of each alternative:

Table 5: Table showing alternative route options and advantages and disadvantages

	Alternative 1	Alternative 2	No-go Option
Advantage	**Environment:** The potential impact on the environment posed by this alternative is less significant in comparison to alternative 2. It is anticipated that provided that all mitigation measures are adhered to, the potential impacts can posed can be mitigated and prevented in some cases. **Social:** A more efficient access road will be provided to the members of the Belfast Township as well as other users of this road. **Economic:** There may be potential employment for local member during the construction phase. This option is the preferred from an economic perspective to the municipality / applicant as it less expensive than alternative 2.	**Environment:** This alternative will pose a greater impact to the environment than alternative 1 due to the size of the re-alignment. **Social:** A more efficient access road will be provided to the members of the Belfast Township as well as other users of this road. **Economic:** There may be potential employment for local member during the construction phase.	**Environment:** There will be no construction related impacts posed by the no-go alternative. **Social:** There will be no social impacts due to construction related activities. **Economic:** There is no advantage from an economic perspective as there will be construction or upgrade of the road.

Disadvantage	**Environment:** This option is located within the Dullstroom Plateau Grasslands which is a threatened ecosystem; however the potential impact posed is less significant as it is closer to the existing road than alternative 2. **Social:** Disruption of traffic will occur during the construction phase, however these impacts can be mitigated against. **Economic:** There are costs associated with the upgrade and re-alignment of the Siyathuthuka Road, however the costs are less when compared to alternative 2.	**Environment:** This option will result in a greater impact on the Dullstroom Plateau Grasslands which is a threatened ecosystem in comparison to alternative 1 due to increased size of the realignment. **Social**: Disruption of traffic will occur during the construction phase, however these impacts can be mitigated against. **Economic:** This option is the more costly option to the applicant (i.e. Emakhazeni Municipality), who is also responsible for maintenance of this road.	**Environment:** The surface water flow will continue to be impaired due to the size of the existing culverts. This has an effect on wetland functionality. There is a potential for flooding posing an environmental risk as well as a health and safety risk. **Social:** The existing road does not accommodate pedestrians as there is no pavement; this means that pedestrians will continue to walk along the road, which poses a safety risk. Due to the size of the existing culverts, there is a risk of flooding as the existing structures cannot accommodate the 1:50 year flood events. **Economic:** There will be no job creation with the no-go option. However there will be direct costs associated with the existing road in the short term.

10. DESRCIPTION OF THE RECEIVING ENVIRONMENT

10.1. Climate

Temperature

The maximum temperatures range up to 24°C while minimum temperatures can reach -1°C. The area is characterized by moderate fluctuations in temperature between seasons.

Precipitation

The area has relatively low precipitation - between 0mm to 200mm per month in summer and 0mm to 36mm per month in winter. Precipitation mainly occurs during summer (Table 6).

Table 6: Average Monthly Rainfall (mm) for station [0517041 2] – Emakhazeni (25.6910; 30.0340; 1879 m) for the period 2005 to 2011. *Unreliable average due to missing data

YR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2005	48.2*	48.6	50	32.6	0.2	0	0	0	0.0*	42.8	92.8	46.4
2006	200.4	136.6	63.6*	35.8	1.2*	0.2	0	36.0*	4.0*	58	116.8	157.4
2007	79	52	30.4	33.6	0	21.8	1.2	0.6	9	71.4	134	36
2008	137.6	80.4	39.6	1.4	2.8	2	0	0.6	1	51.8	43.2	96
2009	103.2	26.8*	-	-	-	0.0*	0	0	0	0.0*	-	-
2010	-	-	0.0*	2.8*	2.4*	0.0*	0.0*	0.0*	0.0*	84.2*	182.2*	51.6*
2011	26.2*	43.6*	147.8*	126.2	19.6	9.4	1.2	26.4	15.6	21.0*	-	-

Wind

Figure 7 provides monthly wind roses for the period 2005 to 2011 for Emakhazeni. Wind direction is usually from the North East to East in the summer months and West – North West in the winter months

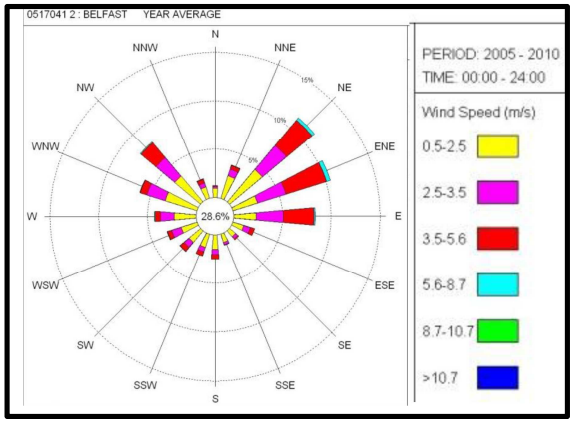


Figure 7: Wind Roses for station [0517041 2] – Emakhazeni (25.6910; 30.0340; 1879 m) for the period 2005 to 2010.

10.2. Topography

Emakhazeni has an undulating environment with rolling hills. The town is located 1800m to 2100m above sea level and slopes gently from south to north. The overall topography falls away from Emakhazeni eastwards to the Elands River, rises into a ridge and then drops into the Lowveld. The proposed site adjacent to the existing road is approximately 1850m above sea level and is slight undulating (Figure 8). There is a distinct slope towards the tributary of rivers that converge toward the dam that's in the centre of the site.

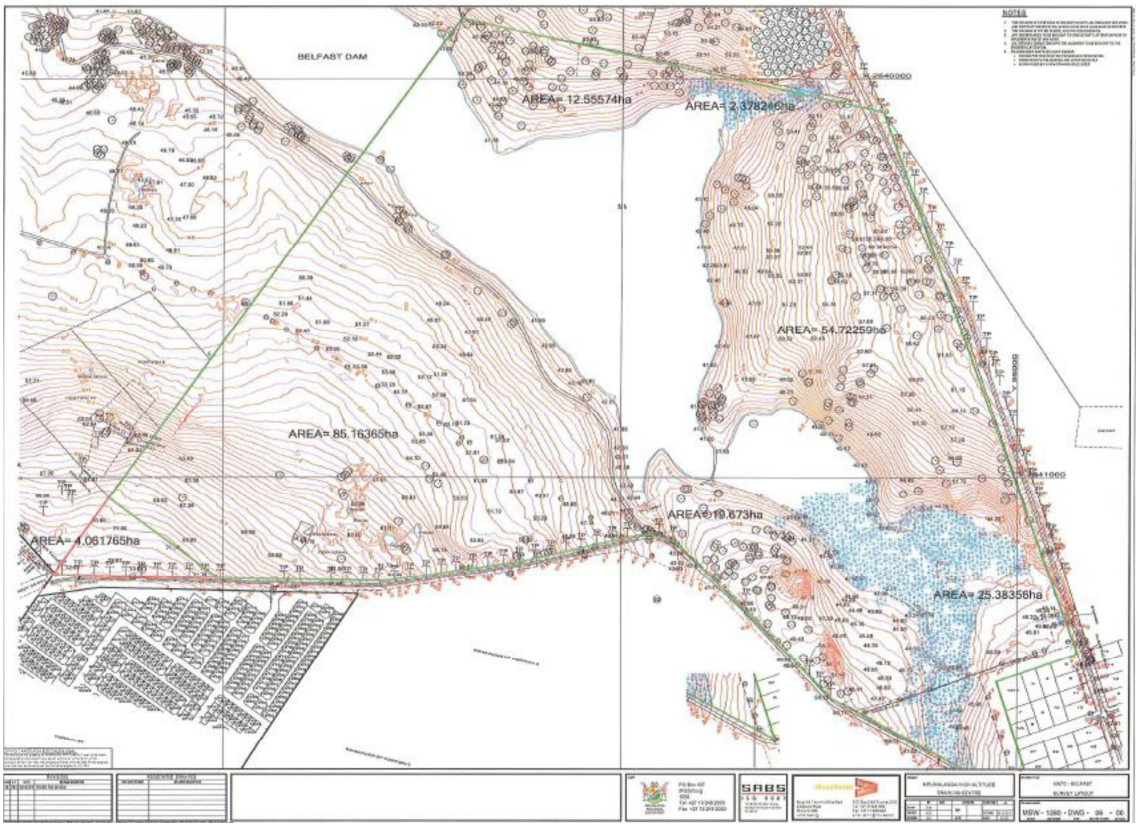


Figure 8: Site Layout showing contours (From MSW Site Survey).

10.3. Watercourses

The site falls within the Olifants Water Management Area (WMA). Emakhazeni itself forms part of the Steelpoort sub drainage system. The Steelpoort River has its source near Emakhazeni and then flows northwards through the Highveld. The Olifants and Inkomati WMAs face a water deficit (ELM, 2008). Irrigation is the chief water use in the area.

Dams

Belfast dam is largest dam in the immediate vicinity of the site although larger dams do occur in the Olifants WMA (for example, Loskop Dam and Nooitgedacht Dam). The dam has a 6,000,000.00 m3 capacity (Figure 9). Belfast Dam together with Kraaispruit weir provides approximately 3.5ML/day of water. In addition, Belfast dam is used for recreation (canoeing and fishing). The dam's water

resource includes run off and waste water as well as the Steelpoort River. The dam is owned and managed by the Local Municipality.

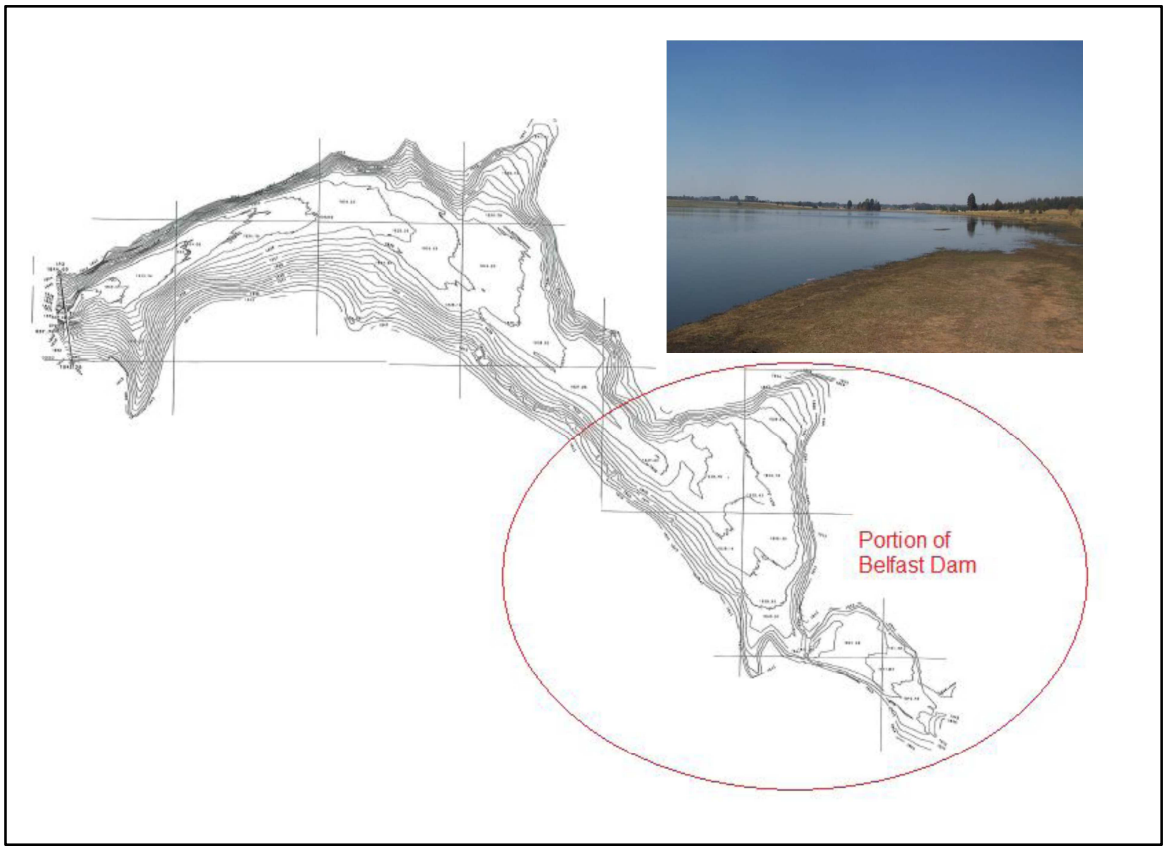


Figure 9: Belfast Dam

The Belfast Dam has gradually sloping banks, with shallow edges. There is a high presence of aquatic submerged vegetation, including species of Lagarasiphon, Isolepis and two Potamogeton species. The high density and biomass of these species are indicative of a eutrophic system (a system within a high, unbalanced nutrient load due to various catchment management impacts and contamination by effluents). Some rocky habitat exists, but is limited to isolated occurrences. The dam is ideally suited to supporting Cyprinus carpio (Common carp), Clarias gariepinus (Sharptooth catfish/Barbel) and Micropterus salmoides (Largemouth bass). Confirmation with local anglers at the sites indicated that these species are the regular target species. The presence of dominant populations of these species, however, would largely preclude the presence of smaller indigenous species.

Pans and Wetlands

Wetlands are areas that are wet, temporarily, seasonally or permanently (including pans of open water). Most wetlands support a vigorous and diverse cover of hydrophilic plants due to the high water table (Ferrar and Lȍtter, 2007). One of the distinguishing characteristics of wetlands is

hydromorphic soils which are often site specific and vulnerable to damage. In addition, once damaged or eroded, wetland soils are very difficult and expensive to restore or replace (Ferrar and Lôtter, 2007). The importance of palustrine wetlands (wetlands associated with rivers and channelled drainage lines) is great as it maintains connectivity between patches of untransformed grassland) (ELM, 2008).

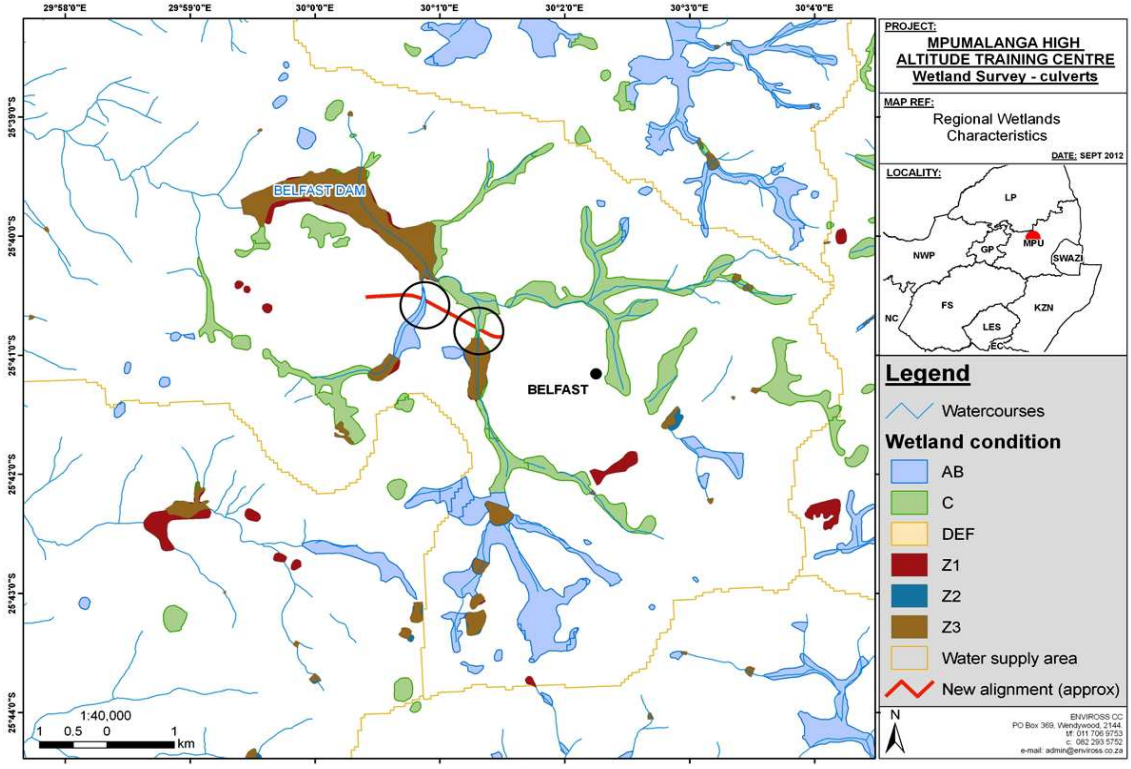


Figure 10: Characteristics of the regional wetlands associated with the survey area (*adapted from NFEPA Wetland Shapefile & metadata, 2011 cited in Enviross, 2012*).

The following is an extract from the wetland assessment report undertaken by Enviross, 2012:

The survey area is also located along the eastern periphery of the catchment area. The region is rich in wetland habitat, with the hydrogeomorphic wetland forms being dominated mostly by hillslope seepages feeding into unchannelled valley-bottom wetlands that become channelled valley-bottom wetlands as the watercourse gains momentum and is subject to various impacting features. The South African Biodiversity Institute (SANBI) has undertaken a national wetland inventory and, through the National Freshwater Ecosystem Priority Areas (NFEPA), has designated wetland types and broad ecological integrity classes for all the majority of wetland areas throughout the country. The details of the regional wetlands associated with the proposed development area are presented in Figure 10. The descriptions and explanations of the wetland condition categories are presented in Table 7.

Table 7: Descriptions of NFEPA wetland conditions categories.

PES Equivalent	NFEPA condition	Description
Natural or Good	AB	Percentage natural land cover ≥ 75%.
Moderately Modified	C	Percentage of natural land cover 25-75%.
Heavily to critically modified	DEF	Riverine wetland associated with a D, E, F or Z ecological category river.
	Z1	Wetland overlaps with a 1:50 000 "artificial" inland water body from the Department of Land Affairs: Chief Directorate of Surveys and Mapping (2005-2007).
	Z2	Majority of wetland unit is classified as "artificial" in the wetland delineation GIS layer.
	Z3	Percentage natural land cover <25%.

From Figure 10, it can be seen that the wetlands locally associated with the survey sites are dominated by wetlands in an "AB" or "C" condition, translating to natural or good to moderately modified. The wetland units, as a whole are both categorised as a "C" condition class. Surrounding land use adjacent to and upstream of the survey sites is dominated by mixed residential/commercial, informal/semi-formal residential and mining/quarrying activities. This is the justification for the area being placed in a "Z3" condition category as these land use practices typically have a profound impact on the vegetation community structures and percentage overall cover.

The wetland habitat throughout the survey region is dominated by *Eastern Temperate Freshwater Wetlands,* which is an *Inland Inter-zonal* vegetation type of the *Freshwater Vegetation* biome. It is embedded within the Grassland biome. This is a habitat unit that is regarded as *Least threatened* (SANBI, 2006), but is threatened through transformation from mining, dam construction (inundation) and agriculture.

The study area included two wetland crossing points that form part of the feeder streams at the south-eastern side of Belfast Dam. The survey area is located on the north-western outskirts of Belfast town, with the informal to semiformal area of Siyathuthuka being located to the adjacent south. Belfast Dam forms the main surface water feature of the site, having been constructed on the confluence of various streams. The main watercourse is the Dorpspruit, which enters the dam from the east.

The two wetland units had largely retained overall ecological integrity and functionality and are regarded as ecologically sensitive habitat units. Wetland functionality has been impaired by constricting the surface water flow through single culverts. This has enhanced unnatural channel formation downstream of the culvert outfall points. It is recommended that the flow of surface waters be spread through more culverts that span along the width of the wetland areas to included potential flood zones so as to reduce the scouring effects of fast-flowing water. This can be implemented if new crossing points are to be established. The wetland already suffers from the impacts of the existing road crossing and by establishing new crossing points as close as possible to the existing

crossings will reduce the overall footprint area, which will ultimately reduce the cumulative impacts on the wetland habitat units and as such alternative 1 is preferred in terms of wetlands.

10.4. Geology and Soil

In terms of Geology, the site occurs in medium-grained sandstone with thin grit beds and subordinate grey shale. The site has soils mostly derived from shale and quartzite as well as lavas and dolomites of the Pretoria group of the Transvaal Supergroup (Mucina and Rutherford, 2006). Several minerals are found in the Emakhazeni region including gold, copper and bismuth. In addition 'black granite' of Emakhazeni lies in a 44km strip although extraction is focused on specific farms to the east of Emakhazeni. In addition, investigations into the viability of diamond prospecting is currently occurring (ELM, 2008). There are also two coal mines in the vicinity of Emakhazeni. Other minerals in the area include copper, nickel, cobalt, arsenic, platinum, sink and silver (north of Emakhazeni) and flint clay (Emakhazeni).

10.5. Flora and Fauna

The following description of the fauna and flora within the proposed site is an extract from the specialist report undertaken by Phampe, 2012.

10.5.1. Flora

10.5.1.1. Biomes and Vegetation Types

The study area falls within the grassland biome and within the following vegetation type units Lydenburg Montane Grassland and Eastern Highland Grassland as indicated in **Figure 11.**

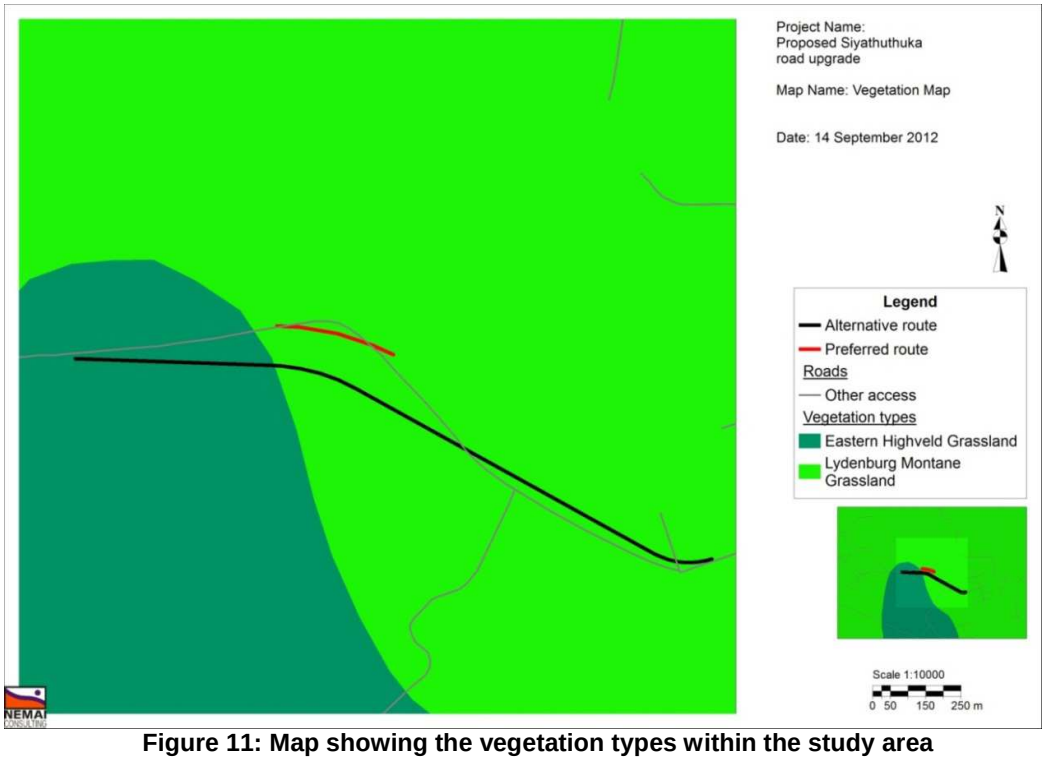


Figure 11: Map showing the vegetation types within the study area

Lydenburg Montane Grassland

This vegetation unit occurs in Mpumalanga Province from just above Pilgrim's Rest in the north, southwards and westwards skirting Lydenburg and extending to Dullstroom, Belfast and Waterval Boen in the south. It occurs in high altitude plateus, undulating plains, mountain peaks and slopes, hills and deep valleys if the northern Escarpment region which supports predominately very low grasslands on high-lying areas. Grassland contains small trees such as *Protea roupelliae* subsp*. roupelliae,* and *Faurea galpinii,* low shrubs such as *Phymaspermum acerosum* (Mucina and Rutherford, 2006). Biogeographically important species include Northern Sourveld endemics such as *Graderia linearifolia, Helichrysum truncatum,* and *Hemizygia foliosa.* This vegetation type includes endemic taxa such as *Erica atherstonei, E. Holtii, Helichrysum lesliei, Crotalaria monophylla, Disa alticola, Watsonia occulta* and *Crassula setulosa* var*. deminuta* (to name a few) (Mucina and Rutherford, 2006 cited in Phampe, 2012).

Conservation status

Currently this vegetation type is considered Vulnerable. Only 2.4% is formally protected within reserves (Gustav Klinmgbiel, Makobulaan, Mt Anderson, Ohrigstad Dam, Sterkspruit and Verlorenvlei) and as well as in a number of private conservation areas (Buffelskloof, Crane Creek, ETTC, In-de-Diepte, Kaalboom, Kalmoesfontein, Mbesan, Mondi Indigenous Forest, Mt Sheba, and Waterval etc). More than 23% has been transformed by cultivated lands and mostly alien plantations. Erosion potential is very low (74%) and low (12%) across the entire unit (Mucina & Rutherford, 2006 cited in Phampe, 2012).

Eastern Highland Grassland

This vegetation unit occurs in the Mpumalanga and Gauteng Provinces. It occurs in plains between Belfast in the east and the eastern side of Johannesburg in the west and also extending southwards to Bethal, Ermelo and west of Piet Retief. The altitude of its distribution area ranges from 1 520–1 780 m. It occurs on slightly to moderately undulating plains, which includes some low hills and pan depressions (Mucina & Rutherford, 2006 cited in Phampe, 2012).

The vegetation comprises of short dense grassland dominated by usual Highveld grasses including *Aristida* spp. *Digitaria* spp., *Eragrastis* spp., *Themeda* spp. etc. with small scattered rocky outcrops with wiry sour grasses and some woody species. Important taxa include a number of graminoid species as well as herbs such as *Berkheya setifera* and *Pelargonium luridum;* geophytic herbs such as *Gladiolus crassifolius, Haemanthus humilis* subsp*. hirsutus*, *Ledebouria ovatifolia* and succulent herbs such as *Aloe ecklonis*. Approximately 44% is transformed due to cultivation, plantations, mining, urbanisation and by building of dams (Mucina and Rutherford, 200 cited in Phampe, 2012 6).

Conservation status

Currently this vegetation type is considered Endangered. A very small fraction is statutorily conserved in the Nooitgedacht Dam and Jericho Dam Nature Reserves. Some 44% has been transformed by

cultivation, plantations, mining, urbanisation and by building of dams (Mucina & Rutherford, 2006 cited in Phampe, 2012).

Dullstroom Plateau Grasslands (Endangered) and Eastern Highland Grassland (Vulnerable) are listed as the two threatened terrestrial ecosystems occurring on site (**Figure 12**).

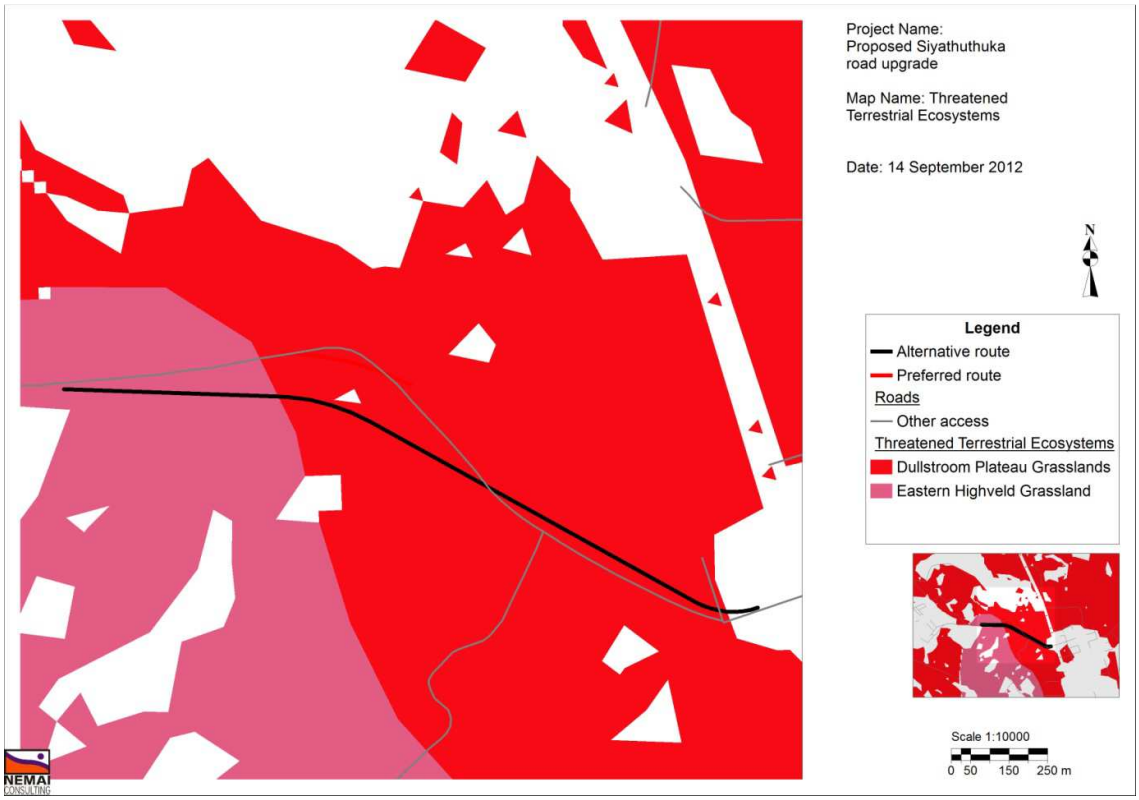


Figure 12: Threatened Terrestrial Ecosystems in the proposed Siyathuthuka road upgrade

The description of the two Threatened Terrestrial Ecosystems follows below:

Dullstroom Plateau Grasslands (MP4)

Grassland plateau occurs between Die Berg in the north and Belfast in the south (2530AA, 2530AC, 2530AD, and 2530CA). This ecosystem is delineated by breeding and feeding habitat for Cranes and Rudd's Lark. The Key biodiversity features include five mammal species such as Robust Golden Mole, Rough-haired Golden Mole, Cape Molerat, Oribi and Welwitch'siry Bat. Eight bird species including Blue Crane, Wattle Crane, Grey Crowned Crane, Blue Korhaan, Southern Bald Ibis, White-winged Flufftail, Yellowbreasted Pipit and Rudd's Lark occur on this ecosystem. Only one amphibian, *Bufo gariepensis nubicolus* was recorded in Dullstroom plateau grasslands. Twenty plant species including *Eucomis vandermerwei, Gladiolus cataractarum, Gladiolus malvinus, Nerine gracilis, Streptocarpus denticulatus and Watsonia occulta* were recorded on this ecosystem (Mpumalanga Tourism and Parks Agency & Department of Agriculture and Land Administration, 2007 cited in Phampe, 2012).

Conservation status

Dullstroom Plateau Grasslands has an ecosystem threat status of Endangered (EN) and approximately 5% of the ecosystem is protected in the Verloren Vlei Nature Reserve (Mpumalanga Tourism and Parks Agency & Department of Agriculture and Land Administration, 2007 cited in Phampe, 2012).

Eastern Highveld Grassland (Gm12)

Eastern Highland Grassland occurs in plains between Belfast in the east and the eastern side of Johannesburg in the west and extending southwards to Bethal, Ermelo and west of Piet Retief. It is recorded in slightly to moderately undulating plains, including some low hills and pan depressions. The vegetation is short dense grassland dominated by the usual highveld grass composition such as *Aristida, Digitaria, Eragrostis, Themeda* and *Tristachya*, with small, scattered rocky outcrops of wiry, sour grasses and some woody species, for example *Acacia caffra, Celtis africana, Diospyros lycioides* subsp *lycioides, Parinari capensis, Protea caffra, P. welwitschii* and *Rhus magalismontanum* (Mucina & Rutherford, 2006 (cited in Phampe, 2012)).

Conservation status

Eastern Highland Grassland has an ecosystem threat status of Vulnerable (Vu). Only a very small fraction of the ecosystem is protected in Nooitgedacht Dam Nature Reserve and Jericho Dam Nature Reserves. The ecosystem is also found in private reserves such as Holkranse, Kransbank and Morgenstond (Mucina & Rutherford, 2006 (cited in Phampe, 2012)).

10.5.1.2. Flora within the study site

The proposed road upgrade is located within the following quarter degree square in terms of the 1:50 000 grids of South Africa, namely 2530CA and the SANBI used this grid system as a point of reference to determine sensitive, Vulnerable, Orange and Red Data plant species which occurs in South Africa, or which could potentially occur within an area. **Table 8 and 9.** It is, therefore, imperative, during the construction phase, that detailed searches for these rare/threatened and protected species are made during the appropriate time of year when plants are likely to be visible.

Table 8: Red Data Plant species recorded in grid 2530CA which could potentially occur in the study area (SANBI data).

Family	Species	Threat status	SA Endemic	Growth forms
Amaryllidaceae	*Crinum bulbispermum*	Declining	No	Geophyte
Apocynaceae	*Riocreuxia aberrans*	NT	Yes	Herb
Aquifoliaceae	*Ilex mitis var. mitis*	Declining	No	Shrub
Araceae	*Zantedeschia pentlandii*	VU	Yes	Geophyte
Asphodelaceae	*Aloe reitzii var. reitzii*	NT	Yes	Dwarf shrub
Asteraceae	*Callilepis leptophylla.*	Declining	No	Herb

Family	Species	Threat status	SA Endemic	Growth forms
Asteraceae	*Cymbopappus piliferus*	Threatened	Yes	Herb
Asteraceae	*Helichrysum homilochrysum*	Rare	Yes	Dwarf shrub
Fabaceae	*Pearsonia hirsuta.*	VU	Yes	Herb
Gesneriaceae	*Streptocarpus latens*	Rare	Yes	Herb
Gunneraceae	*Gunnera perpensa*	Declining	No	Herb
Hyacinthaceae	*Eucomis montana*	Declining	No	Geophyte
Iridaceae	*Gladiolus malvinus*	VU	Yes	Geophyte
Mesembryanthemaceae	*Khadia alticola*	Rare	Yes	Succulent
Mesembryanthemaceae	*Khadia carolinensis*	VU	Yes	Succulent
Proteaceae	*Protea parvula*	NT	No	Dwarf shrub
Rosaceae	*Prunus africana*	VU	No	Tree

Table 9: Red Data Plant species recorded in grid 2530CA which could potentially occur in the study area (MTPA data).

Farm Name	Scientific Name	Conservation RSA	Conservation MTPA	Endemic
Avontuur 319 JT	*Khadia carolinensis*	VU	VU	SA
	Kniphofia rigidifolia	LC	Rare	SA
Belfast	*Callilepis leptophylla*	Declining	Declining	FSA
	Eulophia parvilabris	LC	Rare	NOT
	Gunnera perpense	Declining	Declining	NOT
	Khadia carolinensis	VU	VU	SA
	Kniphofia rigidifolia	LC	Rare	SA
	Prunus africana	VU	VU	NOT
	Riocreuxia aberrans	NT	NT	SA
Belfast Dist.; N. Slopes of MT. At Saaihoek	*Zantedeschia pentlandii*	VU	VU	SA
Belfast Dist.; Near belfast, between rocks.	*Gladiolus malvinus*	VU	VU	SA
Belfast District: Mareskop	*Kniphofia triangularis subsp. obtusiloba*	Rare	Rare	SA
Belfast; near Belfast	*Centrostigma occultans*	LC	Rare	NOT
Bergendal 378 JT	*Kniphofia rigidifolia*	LC	Rare	SA
Blaauwboschkraal 346 JT	*Kniphofia triangularis subsp. obtusiloba*	Rare	Rare	SA
Doornhoek 324 JT	*Kniphofia rigidifolia*	LC	Rare	SA
Driefontein 377 JT	*Kniphofia rigidifolia*	LC	Rare	SA
Elandsfontein 322 JT	*Gladiolus malvinus*	VU	VU	SA
Geluk 348 JT	*Moraea robusta*	LC	Rare	SA
Lakenvalei 355 JT	*Boophane disticha*	Declining	Declining	NOT
	Eucomis autumnalis	Declining	Declining	FSA
	Eucomis montana	Declining	Declining	FSA
	Eucomis montana	Declining	Declining	FSA
	Eucomis montana	Declining	Declining	FSA
	Gladiolus malvinus	VU	VU	SA
	Khadia carolinensis	VU	VU	SA

Farm Name	Scientific Name	Conservation RSA	Conservation MTPA	Endemic
	Riocreuxia aberrans	NT	NT	SA
Paardeplaats 380 JT	*Streptocarpus latens*	Rare	Rare	SA
Tweefontein 357 JT	*Kniphofia rigidifolia*	LC	Rare	SA
	Aloe reitzii var. reitzii	NT	NT	SA
Vlakfontein 323 JT	*Kniphofia triangularis subsp. obtusiloba*	Rare	Rare	SA
	Helictotrichon natalense	VU	SA	SA
Vlakplaats 317 JT	*Streptocarpus latens*	Rare	Rare	SA
Wachteenbeetjeshoek 327 JT	*Gnidia variabilis*	VU	VU	SA
	Gladiolus malvinus	VU	VU	SA
Waterloo 367 JT	*Kniphofia rigidifolia*	LC	Rare	SA
Winnaarspoort 350 JT	*Gladiolus malvinus*	VU	VU	SA
	Gunnera perpense	Declining	Declining	NOT
Zwartkoppies 316 JT	*Kniphofia rigidifolia*	LC	Rare	SA

NOTE: VU=Vulnerable, NT=Near Threatened, LC=Least Concern

Natural grassland community

Open grasslands are generally transformed through overgrazing or are planted with pasture grasses for cattle fodder and grazing. Cows were observed grazing on this study area (**Figure 13**). Grasslands are rated as the second most important biome for conservation and are characterized by high species richness and high forb diversity (Emery *et al*. 2002 (cited in Phampe 2012)). Grasslands are found within the Eastern Highveld Grasslands and the Lydenburg Montane Grasslands of the study area. The grasslands were found to be heavily fragmented and overgrazed. Initiatives like the Ekangala Grassland Biosphere programme seeks to establish and maintain a biosphere reserve geared at preserving the high altitude moist grasslands of Mpumalanga, KwaZulu-Natal and Free State Provinces (Emery *et al*. 2002 cited in Phampe, 2012).

Figure 13: Natural grassland in the study area

The natural vegetation is dominated by grass species reaching a height of ~2.1 m tall (*Cymbopogon excavatus* and *Hyparrhenia hirta*) while the herbaceous component (averaging 50 cm tall) comprises a cover of about 5%, with very few shrubs and trees. Dominant grass species are *Themeda triandra, Sporobolus africanus* and *Setaria sphacelata var. Sphacelata.* The herbaceous and shrub layers are dominated by *Berkheya setifera, Asparagus aethiopicus, Helichrysum aureonitens, Oxalis obliquifolia* and *Gnidia kraussiana.* The *Eucalyptus cinerea and Pinus patula* are invading the natural grasslands as indicated in **Figure 14**.

Figure 14: Invasion by *Eucalyptus cinerea* and *Pinus patula* on natural grasslands on the study area

Wetland vegetation community

This community consists of wetland species and is dominated by species such *Phragmites australis,* and *Typha capensis as* indicated in **Figure 15**. Wetlands are sensitive ecological systems which are important for biodiversity maintenance and for the ecosystem service that provide to society and they are known to reduce the severity of droughts and floods by regulating the flow of the streams as they purify water by trapping pollutants and control soil erosion (Pfab, 2009 cited in Phampe 2012).

Figure 15: *Typha capensis* dominates the wetland vegetation

Medicinal plants and Red Data Listed plant species

According to National Environmental Management Biodiversity Act 2004 (Act No 10 of 2004), there is a dire need to conserve biodiversity in each province and as such, natural or indigenous resources must be utilised sustainably. Along the proposed road upgrade there are a number of plants that are used to provide medicinal products and for which, in some cases, there is merit in protecting or translocating them before the proposed road upgrade commences. Recovery plans are designed to reverse the decline of a threatened or endangered species and eventually bring the population to a self-sustaining level.

No Red Data plant species were recorded in this study. This could be attributed to the fragmentation of natural habitats and overgrazing and illegal harvesting of medicinal species. The species that is being illegal harvested by sangomas or traditional healers in the study area was *Gnidia kraussiana* (Lesser Yellow Head) (**Figure 16**). According to Pooley (1998) (cited in Phampe 2012), this species is used in traditional medicine to treat stomach and chest pains, lumbago, toothache, snakebite and also to heal fractured limbs in stock. The other use of this species is to ensure easy childbirth during pregnancy.

Figure 16: Lesser Yellow Head recorded in the study area

Habitat available for sensitive or endangered species

Some of the sensitive or endangered species listed by MTPA and SANBI that likely to occur in the study area were *Prunus africana, Gunnera perpensa, Riocreuxia aberrans,* and *Aloe reitzii* var*. reitzii*.

Gunnera perpensa (River pumpkin) is an obligate wetland plant that grows in shallow water around the edge of pools in marshy areas or along streams. It cannot tolerate frost and even when growing in warm protective areas it will die back for the coldest months of the year. In South Africa, a decoction of the roots of *Gunnera perpensa* is used to expel the placenta after birth or to relieve menstrual pains

(Ngwenya *et al*. 2003; Van Wyk & Gericke 2000; and Von Ahlenfeldt *et al*. 2003). This species is very likely to occur site.

Prunus africana (Red stinkwood) is confined to evergreen forests from near the coast to the mist belt and montane forests in KwaZulu-Natal, Eastern Cape, Swaziland, Mpumalanga, Zimbabwe and tropical Africa. It is a moderately fast-growing tree which is sensitive to heavy frost, preferring areas where there is regular rain; it will tolerate moderate frosts. According to Pooley (1998), the bark is used to treat chest pains. This species is unlikely to occur on site.

Riocreuxia aberrans is restricted to quartzite ridges in the Ermelo and Belfast districts of Mpumalanga and has large attractive flowers and is the only species that tends to rather form a bush than being a climber. It flowers mainly in November to January at altitude 1900–2100 m (Pooley, 2005). This species is unlikely to occur on site.

Aloe reitzii var*. reitzii* is a robust and spectacular aloe species which comes from the grassland areas of Mpumalanga but is restricted to a very small area in the vicinity of Belfast. This aloe is endemic to this area and occurs nowhere else in the world (http://www.plantzafrica.com/plantab/aloereitzii.htm). This species is unlikely to occur on site.

While a search of likely habitat yielded no confirmed individuals of these species, the field survey was conducted slightly earlier than the known flowering period of these species and it is possible that individuals may have been present, but not detectable.

In terms of flora, the potential impact on the flora is anticipated to be minimal provided that all mitigation measures are adhered to.

10.5.2. Fauna

10.5.2.1. Mammals

The potential Red Data mammal species list was compiled from a desktop survey from MTPA database (**Table 10**) for the grid 2530CA. This list is therefore based on all historical recordings of mammalian species relevant to the area. At present and considering the habitat degradation and generally poor state of ecological integrity, this is not thought to be a realistic list of potential species and therefore should be viewed with circumspect.

Table 10: Mammal species recorded in grid 2530CA (MTPA databse)

Farm name	Scientific Name	Common name	Conservation RSA	Conservation MTPA
Waterloo 367 JT	*Ourebia ourebi*	Oribi	EN	EN
Zwartkoppies 316 JT	*Leptailurus serval*	Serval	NT	NT
Avontuur 319 JT	*Chrysospalax*	Rough-haired	VU	VU

Farm name	Scientific Name	Common name	Conservation RSA	Conservation MTPA
	villosus	golden mole		
Groenvlei 353 JT	*Amblysomus robustus*	Robust Golden Mole	VU	VU
	Amblysomus robustus	Robust Golden Mole	VU	VU
Paardeplaats 380 JT	*Amblysomus robustus*	Robust Golden Mole	VU	VU
	Amblysomus robustus	Robust Golden Mole	VU	VU
Wemmershuis 379 JT	*Amblysomus robustus*	Robust Golden Mole	VU	VU
	Amblysomus robustus	Robust Golden Mole	VU	VU
Zwartkoppies 316 JT	*Amblysomus robustus*	Robust Golden Mole	VU	VU
	Amblysomus robustus	Robust Golden Mole	VU	VU

NOTE: VU=Vulnerable, NT=Near Threatened, EN=Endangered

Some small rodent species were observed on the study area but these species could not be verified due to the lack of close-up observation.

Two mammal species were recorded in the study area, as shown in **Table 11**. No sensitive or endangered mammals were recorded during the site visits. Evidence such as holes or diggings (**Figure 17**) and bones (skull) (**Figure 18**) were also observed during the survey.

Figure 17: Holes observed during the field survey

Figure 18: Head skull observed during the field survey

Table 11: Composition of the mammals that were recorded at the proposed road upgrade.

Common name	Species
Scrub Hare	*Lepus saxatilis*
Bushveld Gerbil	*Tatera leucogaster*

The wetlands provide a good habitat for many mammals' species such as *Aonyx capensis* (Cape Clawless Otter) and *Atilax paludinosus* (Water mongoose). Good habitat cover is present at the site within all the wetlands and riparian zones and therefore a wide diversity of small mammalian species are expected to flourish. Even though good habitat cover exists, mammals are sensitive to disturbances and habitat destruction and degradation. The likelyhood of finding those species on the proposed road upgrade are low. The dam, river and wetlands do form an ecological corridor that highly-mobile species would utilize for migratory purposes, and therefore these wetlands promote ecological functionality. Care should therefore be exercised in order to negate the negative ecological impacts through habitat fragmentation.

10.5.2.2. Avifauna

Grassland biome is considered as a home to 52 of the 122 Important Bird Areas (IBA) in South Africa, including the Endemic Bird Area with the highest global priority, which contains 10 of the 14 globally, threatened bird species found in South Africa (O' Connor & Bredenkamp, 1997 cited in Phampe, 2012). No IBA occurs in the study area and the nearest IBA (Steenkampsberg) is 1Km away from the proposed site (**Figure 19**). Numbers of bird species in Mpumalanga have declined mainly due to massive habitat transformation and degradation as well as increased levels of human disturbances,

extensive habitat transformation due to mining, industrial, commercial and agricultural activities (Low & Rebelo, 1996 cited in Phampe, 2012). Human activity has transformed grasslands in South Africa to a point where few pristine examples exist. Factors such as agricultural intensification, intensive open cast mining, increased pasture management (overgrazing), decrease in grassland management due to frequent fires and land-use alteration (urbanisation) (Low & Rebelo, 1996 cited in Phampe, 2012). Continuing pressure on sensitive wetland and surrounding open grassland habitat are largely responsible for the decline of the avifaunal species (Low & Rebelo, 1996 cited in Phampe 2012). More intensive surveys conducted over longer periods over several seasons are required in order to ascertain the current status of the threatened bird species on and surrounding the site.

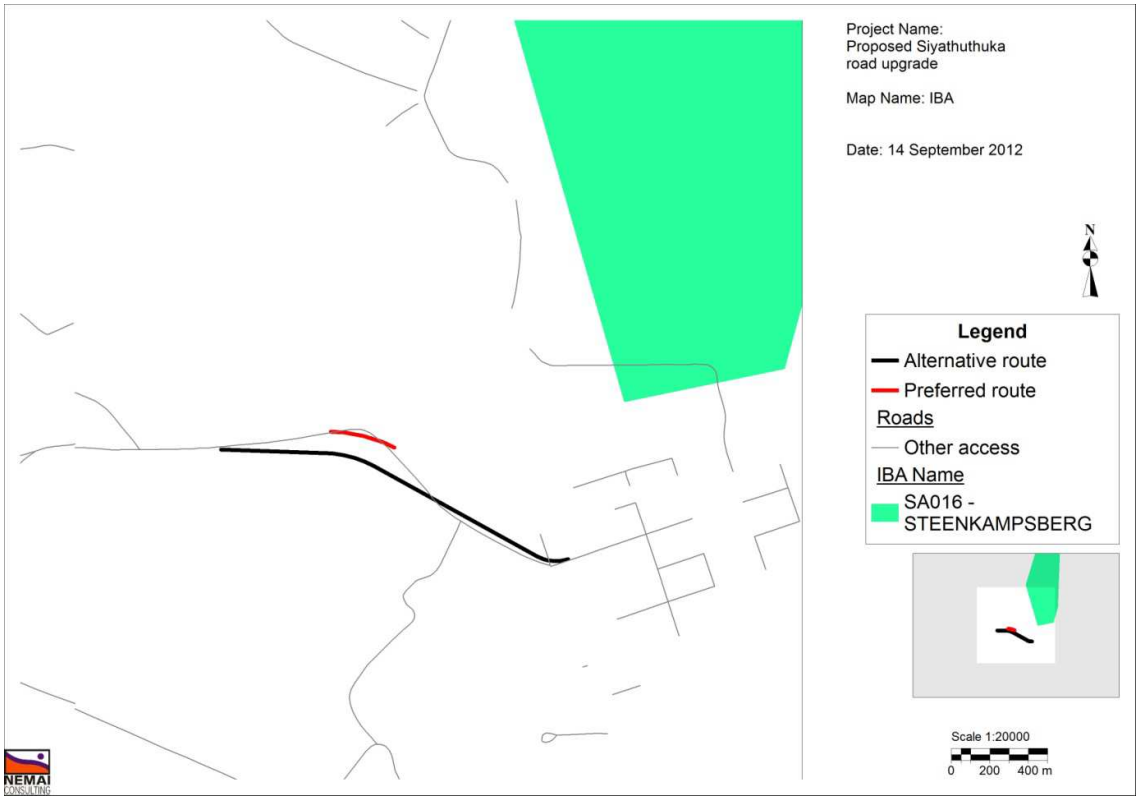


Figure 19: IBA near the proposed Siyathuthuka road upgrade

Table 12 indicates the Red Data bird species that were previously recorded in 2530CA by MTPA.

Table 12: Red Data bird species recorded in grid 2530CA (MTPA database)

Farm Name	Common Name	Scientific Name	Conservation MTPA	Endemic
Avontuur 319 JT	Southern Bald Ibis	*Geronticus calvus*	VU	RSA
	Wattled Crane	*Bugeranus carunculatus*	CR	
Belfast; Belfast	Eurasian Bittern	*Botaurus stellaris*	CR	
Bergendal 378 JT	Lanner Falcon	*Falco biarmicus*	NT	
De Goede Hoop 362 JT	Lanner Falcon	*Falco biarmicus*	NT	
Doornhoek 324 JT	Blue Crane	*Anthropoides paradiseus*	VU	
Elandsfontein 322 JT	Blue Crane	*Anthropoides paradiseus*	VU	
	Grey Crowned Crane	*Balearica regulorum*	VU	
	Southern Bald Ibis	*Geronticus calvus*	VU	RSA
	Southern Bald Ibis	*Geronticus calvus*	VU	RSA
	Wattled Crane	*Bugeranus carunculatus*	CR	
Elandskloof 321 JT	Denham's Bustard	*Neotis denhami*	VU	
Farrefontein 349 JT	Blue Crane	*Anthropoides paradiseus*	VU	
Groenvlei 353 JT	Blue Crane	*Anthropoides paradiseus*	VU	
	Grey Crowned Crane	*Balearica regulorum*	VU	
Lakenvalei 355 JT	African Marsh-Harrier	*Circus ranivorus*	VU	
	Barrow's (White-bellied) Korhaan	*Eupodotis senegalensis*	VU	RSA
	Blue Crane	*Anthropoides paradiseus*	VU	
	Blue Crane	*Anthropoides paradiseus*	VU	
	Denham's Bustard	*Neotis denhami*	VU	
	Grey Crowned Crane	*Balearica regulorum*	VU	
	Pallid Harrier	*Circus macrourus*	NT	
	Wattled Crane	*Bugeranus carunculatus*	CR	
	Wattled Crane	*Bugeranus carunculatus*	CR	
Langkloof 356 JT	Grey Crowned Crane	*Balearica regulorum*	VU	
Middelpunt 320 JT	African Marsh-Harrier	*Circus ranivorus*	VU	

Farm Name	Common Name	Scientific Name	Conservation MTPA	Endemic
	Blue Crane	*Anthropoides paradiseus*	VU	
	Blue Crane	*Anthropoides paradiseus*	VU	
	Chestnut-banded Plover	*Charadrius pallidus*	NT	
	Denham's Bustard	*Neotis denhami*	VU	
	Grey Crowned Crane	*Balearica regulorum*	VU	
	Rudd's Lark	*Heteromirafra ruddi*	CR	RSA
	Secretarybird	*Sagittarius serpentarius*	NT	
	Wattled Crane	*Bugeranus carunculatus*	CR	
	Wattled Crane	*Bugeranus carunculatus*	CR	
	White-winged Flufftail	*Sarothrura ayresi*	CR	
Moeilykheid 129 JT	Blue Crane	*Anthropoides paradiseus*	VU	
Ontevreden 358 JS	Wattled Crane	*Bugeranus carunculatus*	CR	
Tweefontein 357 JT	Denham's Bustard	*Neotis denhami*	VU	
Valkfontein 325 JT	Blue Crane	*Anthropoides paradiseus*	VU	
	Grey Crowned Crane	*Balearica regulorum*	VU	
Vlakplaats 317 JT	Wattled Crane	*Bugeranus carunculatus*	CR	
Waterval 351 JT	Blue Crane	*Anthropoides paradiseus*	VU	
	Blue Crane	*Anthropoides paradiseus*	VU	
Winnaarspoort 350 JT	Grey Crowned Crane	*Balearica regulorum*	VU	
	Blue Crane	*Anthropoides paradiseus*	VU	
	Blue Crane	*Anthropoides paradiseus*	VU	
Zwartkoppies 316 JT	Grey Crowned Crane	*Balearica regulorum*	VU	
	Wattled Crane	*Bugeranus carunculatus*	CR	
	Wattled Crane	*Bugeranus carunculatus*	CR	

NOTE: VU=Vulnerable, NT=Near Threatened, EN=Endangered, CR=Critically ENdangered

Many avifaunal species are adaptable as they are habitat generalists and can therefore accommodate a certain degree of habitat degradation and transformation. Other species are extremely habitat specific and have to rely on certain habitat units for breeding, hunting or foraging and roosting. It is the survival of these species that become threatened as they cannot adapt to changes to the habitat. Habitat destruction is accredited as being the leading cause of species decline worldwide (Barnes, 2000). It is widely accepted that vegetation structure, rather than the actual plant species, influences bird species' distribution and abundance (Harrison *et al.,* 1997 cited in Phampe, 2012). Due to high levels of human disturbances; the site offers limited suitable habitat for any larger terrestrial birds such as Secretarybird as well as certain smaller raptor species. Within the vegetation types found in the study area and immediate surrounding areas, four major bird habitat systems were identified. A short description of each habitat type follows below:

Grassland: These open areas represent a significant feeding area for many bird species in the area (**Figure 20**). Areas of untransformed natural grassland have remained in the study area. The (Co-ordinated Road Count project) CAR data indicate that natural grassland remains the preferred habitat of large terrestrial birds in the Highveld (Young *et al.,* 2003 cited in Phampe, 2012). Several typical Red Data grassland species were recorded in the square grid by SABAP1 however it is highly unlikely that these species could occur in the grassland remaining on the site due to human disturbance. The Blue Crane (*Anthropoides paradisea*), Grey Crowned Crane (*Balearica regulorum*) and Wattled Crane (*Bugeranus carunculatus*) are amongst the RDL species recorded from the area that readily utilize this habitat unit. Non-threatened species that may from time to time frequent the grassland habitat in the study area are Swainson's Spurfowl (*Pternistis swainsonii)*, African Pipit (*Anthus cinnamomeus)*, Cape Longclaw (*Macronyx capensis)*, several cisticola species, Long-tailed Widowbird (*Euplectes progne)*, Rufous-naped Lark (*Mirafra Africana)*, and Black-shouldered Kite (*Elanus caeruleus)* (Harrison *et al*., 1997 cited in Phampe, 2012). Open grasslands not associated to wetland habitat also form an important habitat unit support a diversity of species that also include various RDL species.

Figure 20: Natural grassland areas on site

Dams: The dam near the proposed alternative route represents a part of the study area, as shown in **Figure 21** as a variety of non Red Data species such as ducks, coots and geese are utilising this dam. Dams are extremely important sources of water for most bird species and will be regularly utilised not only as a source of drinking water and foraging areas, but also for bathing. Greater and Lesser Flamingos are extremely unlikely to use this dam due to high disturbance levels.

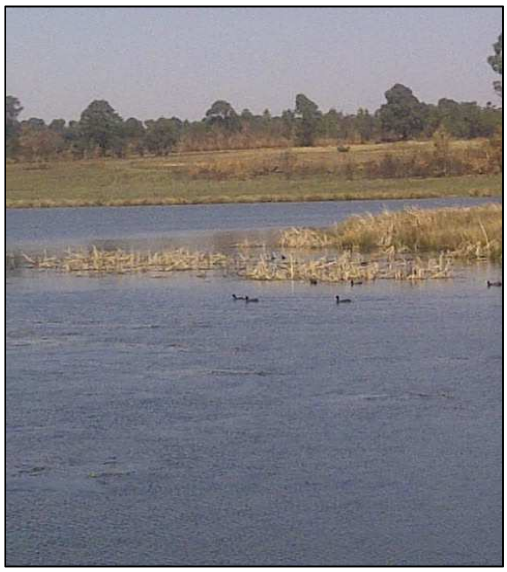


Figure 21: The dam near the proposed alternative route presents a feeding area for species such as Red Knobbed coots

This dam has undoubtedly benefited the colonisation and range expansion of many waterbird species that favour open water habitat and provides a refuge for waterbird species during prolonged periods of drought.

Wetlands and rivers: The study area includes one of the significant sensitive faunal habitats such as wetland, which believed could be suitable habitats for birds. Wetlands (**Figure 22**) are of particular importance for birds in the study area and also essential breeding grounds for many threatened cranes and other waterbirds. The marshland vegetation of the pans and surrounding dense *Themeda triandra* grasslands offers favourable roosting and possible nesting habitat for African Grass Owls but the human presence could be a deterrent. Areas with reeds, sedges or grassy tangles are suitable for Common Waxbills (*Estrilda astrilda)* and various warblers (Marais & Peacock, 2008). Plant species such as Common reed provides nesting and roosting sites for bird species.

Figure 22: Wetlands and rivers in the study area

A comprehensive bird species list requires intensive surveys compiled over several years. Twenty four (24) bird species (**Table 13**) were recorded during the field survey. Species recorded were common and widespread and typical of grassland environment.

Table 13: Bird species recorded during the survey

Species number	Common name	Scientific name
8	Dabchick	*Tachybaptus ruficollis*
62	Grey Heron	*Ardea cinerea*
71	Cattle Egret	*bubulus ibis*
94	Hadeda ibis	*Bostrychia hagedash*
104	Yellowbilled Duck	*Anas undulata*
116	Spurwinged Goose	*Plectropterus gambensis*
227	Common Moorhen	*Gallinule chloropus*
228	Redknobbed Coot	*Fulica cristata*
240	African jacana	*Actophilornis africanus*
249	Three-banded plover	*Charadrius pallidus*
258	Blacksmith Lapwing (Plover)	*Vanellus armatus*
349	Rock pigeon	*Columba guinea*
352	Red-eyed Dove	*Streptopelia semitorquata*
355	Laughing Dove	*Streptopelia senegalensis*
476	Lesser Honeyguide	*Indicator minor*
520	White-throated Swallow	*Hirundo albigularis*
526	Greater Striped Swallow	*Hirundo cucullata*
	Eastern long-billed lark	*Certhilauda semitorquata*
548	Pied crow	*Corvus albus*
568	Red-eyed Bulbul	*Pycnonotus nigricans*
732	Common fiscal (Fiscal Shrike)	*Lanius collaris*
758	Commom (Indian) Myna	*Acridotheres zeylonus*
814	Southern Masked-Weaver	*Ploceus velatus*
832	Long-tailed Widowbird	*Euplectes progne*

No Red Data Listed species were observed during the brief field survey. High levels of human activities occur on site and limit the presence of any RDL species that could be found on site. Construction workers must be made aware of the avifauna on site and toolbox talks should be carried out to ensure that they know how to relocate these birds if required.

10.5.2.3. Reptiles

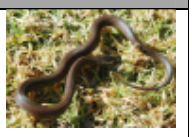
Table 14 and **Table 15** listed reptile species for the grid 2530CA based on South African Reptile Conservation Assessment (SARCA) and MTPA

Table 14: Reptiles species recorded in 2530CA (MTPA database)

Farm name	Common Name	Scientific name	Conservation RSA	Conservation MTPA
Avontuur 319 JT	Many-spotted Snake	*Amplorhinus multimaculatus*	LC	NT
	Highveld grass lizard	*Chamaesaura aenea*	NT	VU
Belfast	Short-headed legless sjink	*Acontias breviceps*	LC	VU
	Giant legless skink	*Acontias plumbeus*	LC	NT
	Many-spotted Snake	*Amplorhinus multimaculatus*	LC	NT
	Highveld grass lizard	*Chamaesaura aenea*	NT	VU
Lakenvalei 355 JT	Highveld grass lizard	*Chamaesaura aenea*	NT	VU
Schoongezicht 364 JT	Many-spotted Snake	*Amplorhinus multimaculatus*	LC	NT

NOTE: VU=Vulnerable, NT=Near Threatened, LC=Least Concern

Table 15: Reptile species recorded in grid 2530CA (SARCA, ADU)

Family	Common Name	Scientific name	Picture
Colubridae	Brown House Snake	*Boaedon capensis*	
Atractaspididae	Black-headed Centipede-eater	*Aparallactus capensis*	
Viperidae	Rhombic Night Adder	*Causus rhombeatus*	
Agamidae	Southern Rock Agama	*Agama atra*	

Searching for reptiles took place through turning over rocks and logs along the proposed road upgrade, although this did not yield much data. Sites were walked, covering as many habitats as possible. Habitat characteristics were surveyed to note potential occurrences of reptiles.
Wetland habitat is traditionally rich in reptile (snake) diversity and densities due to the habitat unit supporting a high abundance of prey species such as frogs, birds and small mammals. Habitat cover is also greater within wetland habitat. Species are also very often "forced" into wetland and riparian zones due to the lack of suitable habitat elsewhere within catchment areas that have been transformed such as in large agricultural regions (Ross & Ross, 2009 cited in Phampe, 2012).

Reptile lists require intensive surveys conducted for several years. Reptiles are extremely secretive and difficult to observe during field surveys. The majority of reptile species are sensitive to severe habitat alteration and fragmentation. **No reptile species were observed during the field survey**. The indiscriminate killing of snake species as well as the illegal collecting of certain species for private and the commercial pet industry reduces reptile populations especially snake populations drastically (Jacobsen, 2005 cited in Phampe, 2012). The frequent burning of the site has also a high impact on reptiles. Fires during the winter months will severely impact on the hibernating species, which are extremely sluggish. Fires during the early summer months destroy the emerging reptiles as well as refuge areas increasing predation risks (Jacobsen, 2005 cited in Phampe, 2012).

According to Branch (2001) (cited in Phampe, 2012), many-spotted Snake is an unusual, secretive snake that is found in isolated populations in the cool, moist eastern regions while the Highveld grass lizard is restricted to the eastern escarpment grasslands with an isolated population in the Winterberg.

Natural grassland systems are therefore the identified unit most important to the conservation of these species. The presence of feral cats on and surrounding the site and high levels of human presence and disturbances has a detrimental impact on remaining reptile species especially snake species in the area.

10.5.2.4. Amphibians

There are 15 species known to occur in grassland areas, with one species of conservational concern, namely Giant bullfrog (*Pyxicephalus adspersus).* According to the South African Frog Atlas Project, which falls within the Avian Demography Unit, University Of Cape Town, no data was recorded for the grid 2530CA but Minter *et. al.,* (2004) has recorded amphibian species which occur in grassland areas, as indicated in **Table 16.**

Table 16: Potential amphibian species biodiversity list based on the historical recording of species from the region.

English name	Scientific name	Red Data Listed status
Common platanna	*Xenopus laevis*	
Bubbling kassina	*Kassina senegalensis*	
Bushveld rain frog	*Breviceps adspersus*	

English name	Scientific name	Red Data Listed status
Giant bullfrog	*Pyxicephalus adspersus*	Vulnerable
Tremolo sand frog	*Tomopterna cryptotus*	
Knocking sand frog	*Tomopterna krugerensis*	
Natal sand frog	*Tomopterna natalensis*	
Raucous toad	*Amietophrynus rangeri*	
Guttural toad	*Amietophrynus gutturalis*	
Red toad	*Schismaderma carens*	
Common river frog	*Amietia angolensis*	
Striped stream frog	*Strongylopus fasciatus*	
Striped grass frog	*Ptychadena porosissima*	
Boettger's caco	*Cacosternum boettgeri*	
Snoring puddle frog	*Phrynobatrachus natalensis*	

Wetlands and associated moist grasslands form a significant proportion of habitat types within the survey area. The incorporation of this habitat unit and the associated good habitat cover due to the increase vegetation cover means that amphibian species should be present in high abundance. Maybe due to timing of survey, **no amphibian species were recorded or observed during the field assessment.**

The Giant Bullfrog has a potential to occur in the study area and is currently assigned a Near-Threatened status, according to IUCN Red List category (Minter *et al*., 2004 cited in Phampe, 2012). There are wetlands in the area that could serve as potential breeding sites of this species. There is a moderate likelihood that this species occurs in the vicinity of the study area, although there were no records in the grid 2530CA during the South African Frog Atlas Project (Minter *et al.,* 2004 cited in Phampe, 2012). Bullfrogs are explosive breeders that emerge from their underground burrows in years of sufficient rainfall and return to their burrows soon after breeding (Cook, 2007 cited in Phampe, 2012). It is possible that they may already have been hibernating at the time of the survey. Explosive breeding frogs utilise ephemeral pans or inundated grasslands for their short duration reproductive cycles. Giant Bullfrog usually breeds within the grassland biome, but also has been shown to breed within savanna wetlands. In order to conserve this species, appropriate conservation buffer zones should be implemented surrounding all suitable wetland habitat units. The presence of amphibians is also generally regarded as an indication of intact ecological functionality and therefore construction activities within these habitat units should be undertaken in an ecologically-sensitive manner.

10.6. Socio-Economic

The population of eMakhazeni Local Municipality is really small in comparison to the District. It makes. eMkakhazani makes up 4 percent of the district in 2001 and in 2007 only accounts for 4 percent of the district population. The impacted area, eMakhazeni and Siyathuthuka, has a population of 9 910 persons which account for 23 percent of the eMakhazeni population. The population of Siyathuthuka is 7 482 which more than double that of eMakhazeni which has 2 482 persons.

The proposed upgrade and re-alignment is anticipated to have a positive impact during the construction as there is a potential for job creation for local community members where unskilled labour is required. Furthermore, the upgrade will provide a better access road to the Belfast Township.

10.7. Air Quality

The air quality of the area is not well documented however; the Environmental Management Framework of the Emakhazeni Local Municipality has recognised the need for air quality monitoring due to the presence of mines in the area. The mining areas are most likely to have the greatest impact on air quality.

10.8. Noise

Noise in the region emanates primarily from the following sources:

- Mining operations at GLISA;
- Noise from Emakhazeni Town and Siyathuthuka;
- Farming operations (e.g. use of farming equipment);
- Vehicles on the road network; and
- Trains on the Railway system.

10.9. Visual Quality

The road is existing and there is therefore no anticipated impact during the operational phase, only a potential impact during the construction phase of the project as a result of the construction vehicles.

11. SPECIALIST STUDIES

11.1. Fauna and Flora Assessment

A fauna and flora study was undertaken by Mr R Phampe from Nemai Consulting in 2012 and has been included in Appendix 5 for review.

Flora and Fauna surveys were carried out in September 2012 to determine the impacts of the proposed upgrade of the existing Siyathuthuka Road on the receiving environment. The Mpumalanga Department of Culture, Sports and Recreation (DCSR) proposes to develop a world class High Altitude Training Centre to unearth talent, develop champions and to provide top level support for elite athletes and this development will require the upgrade of the existing road networks.

The study area falls within the grassland biome and has been categorised as Lydenburg Montane Grassland and Eastern Highland Grassland vegetation units. Dullstroom Plateau Grasslands (Endangered) and Eastern Highland Grassland (Vulnerable) are listed as the two threatened terrestrial ecosystems occurring on site. During the field assessment, no red data plant species were observed on sites. Exotic plant species such as Eucalyptus cinerea and Pinus patula were common at the site. Invader and weed species must be controlled to prevent further infestation and it is recommended that all individuals of the invader species be eradicated. The Mpumalanga Biodiversity Conservation Plan (MBCP) Terrestrial Biodiversity Assessment described the sites as classified “least concern” and “no natural habitat remaining”.

Mammals are sensitive to disturbances and habitat destruction and degradation and are reliant on pristine and stable habitats, few, if any, threatened small mammals are expected to occur in the study area. Two mammals were visually observed on site even though signs such as holes and a skull, which indicated more animals found on site, were also observed. The field assessment showed that the proposed road upgrade will traverse the wetlands and this will have an impact on the loss of ecological sensitive and important habitat units, ecosystem function, and loss of faunal habitat. Considering that the disturbance of the project is temporary in nature, the proposed development will have no lasting effect on mammals typical of the site.

The avifauna study indicated that the wetlands, a nearby dam and grasslands will provide natural habitats for bird species that are known to occur on site. However, this section is heavily grazed and infested by alien vegetation. The globally threatened Whitewinged Flufftail is restricted in the region to a few high-altitude sponges in South Africa in the QDS of 2530CA where the proposed road upgrade is located. In addition, the region is known to support the Endangered Wattled Crane and the African Grass-owl population. Various other RDL avifaunal species have also been recorded from the region. Throughout the study area, suitable habitat for various Red Data Listed avifaunal species was observed, so mitigation measures to reduce the impact on the associated habitat units pertaining to these species have been proposed. The project will only have a negative impact during the construction phase whereafter the birds will return to the area if rehabilitation is carried out properly.

According to South African Reptile Conservation Assessment, four species, namely Brown House Snake, Black-headed Centipede-eater, Rhombic Night Adder and Southern Rock Agama are known to occur in the region. No reptile species were observed during the survey. The high levels of human presence and disturbances have a detrimental impact on the remaining reptile species in the area.

The dam near the study site provided excellent breeding habitat for Giant Bullfrogs. It is quite likely that giant bullfrogs will migrate to the study site for feeding and aestivation. No frogs were recorded in the study area.

Of the two options investigated, the alternative route will traverse two wetlands whilst the preferred option which realigns the road to a lesser extent will only cross one wetland and for this reason, **the preferred option is chosen as it will have less impact on the wetland**. The Dullstroom Plateau Grasslands will be highly impacted should the alternative option be considered.

11.2. Wetland and Aquatic Assessment

A wetland assessment was undertaken by Mathew Ross from Enviross in 2012 and has been included in Appendix 5 for review.

The re-alignment of the road between Belfast and Siyathuthuka necessitates that two existing wetland crossing point either require upgrading, or shifting. EnviRoss CC was appointed to assess the overall ecological integrity of the two wetland areas and to evaluate the potential impacts on those wetland habitat units emanating from a development of this nature. A field survey was undertaken during September 2012, where after the following salient conclusions were drawn:

- The two wetland units had largely retained overall ecological integrity and functionality and are regarded as ecologically sensitive habitat units;
- The delineation procedures were undertaken and the outer limits of the wetland boundaries, together with the 32 m and 100 m conservation buffer zones, are indicated. Adherence to the 100 m buffer zones is recommended to protect the ecologically sensitive habitat units;
- An aquatic survey of the watercourses yielded results that are not a true reflection of the overall functionality of the systems as characteristics that are natural features of the wetland habitats actually inhibit inhabitation by aquatic macro-invertebrates. The effects of this feature dissipates as the system gains momentum;
- Wetland functionality has been impaired by constricting the surface water flow through single culverts. This has enhanced unnatural channel formation downstream of the culvert outfall points. It is recommended that the flow of surface waters be spread through more culverts that span along the width of the wetland areas to included potential flood zones so as to reduce the scouring effects of fast-flowing water.
- Two alternative alignments were offered, **with the preferred alternative being Option 1**. The wetland already suffers from the impacts of the existing road crossing and by establishing new

crossing points as close as possible to the existing crossings will reduce the overall footprint area, which will ultimately reduce the cumulative impacts on the wetland habitat units.

11.3. Heritage Impact Assessment

A heritage impact assessment was undertaken by Ms Khosi Mngomezulu from Nemai Consulting in 2012 and has been included in Appendix 5 for review.

Emakhazeni Local Municipality proposes to upgrade the existing Siyathuthuka Road. The upgrade will involve the widening and re-alignment of a portion of the road and the upgrade of two existing culverts. The upgrade will start at the point of the road marked as main entrance and will end at the traffic circle before entering the township.

The preferred alternative is to realign the portion for the road as indicated on the drawing. The re-aligned portion of the road will consist of two lanes, one in each direction as well as a paved shoulder. Each lane will be 3.5m wide and a paved shoulder / pavement of 1.5m on either side of the road. The remaining portions of the road will be resurfaced with asphalt.

The existing culvert structure at culvert 1 will be removed and replaced with a bigger culvert. The upgraded culvert will consist of 7 barrels, each of which is 2.275m high and 3.135m wide. The overall size of the culvert will be 24.5m wide, the overall length of the inside of the culvert will be 90m and the overall length of the outside of the culvert will be 116m. The culvert will be made up of barrels, pre-cast concrete culvert portions, re-enforced concrete culvert portions, gabion walls and gabion mattresses.

Culvert 2 will be upgraded to a total width of 37.8m and length of 21.75m. The culvert structure will consist of 7 barrels, each of which will be 3.5m high and 5m wide.

Nemai Consulting was appointed by Emakhazeni Local Municipality to undertake an environmental assessment on the proposed Siyathuthuka road upgrade in Belfast, Mpumalanga. Part of the environmental assessment is a Heritage Impact Assessment (HIA) study which serves to identify cultural heritage resources which may be impacted by the proposed development. The surface survey was conducted and completed on 12 September 2012. This report was undertaken according to the National Heritage Resources Act 1999 (Act no 25 of 1999). **No heritage resources were found within the proximity of the proposed road construction.** It is therefore recommended that based on the findings of the survey the construction may proceed.

12. PUBLIC PARTICIPATION

The public participation process that was followed for proposed Siyathuthuka Road Upgrade and Re-Alignment in Belfast is governed by GN. R. 543 of 18 June 2010.

The purpose of public participation includes:

1. Providing I&APs with an opportunity to obtain information about the project;
2. Allowing I&APs to present their views, issues and concerns with regard to the project;
3. Granting I&APs an opportunity to recommend measures to avoid or reduce adverse impacts and enhance positive impacts associated with the project; and
4. Enabling the project team to incorporate the needs, concerns and recommendations of I&APs into the project.

12.1. Notification of I & APs

Notification of I&APs was undertaken in the following ways:

- A database of I&APs, which contained authorities, stakeholders, landowners and members of the general public, was prepared for the project (Appendix 7).
- Notification of the BA Process/Invitations to a Public Open Session was delivered to all members of the I&AP database via fax, email or by hand on the 08 and 09 November 2012 (see attached notice – Appendix 7).
- Newspaper advertisements will be placed in the following newspapers:
    - The Middleburg Observer Newspaper – 08 November 2012
    - The New Age Newspaper – 08 November 2012.

  The newspaper advertisement had details of the proposed project, contact details of the Environmental Assessment practitioner and an invitation for any interested or affected party to comment or register as an I&AP for the proposed project. The advertisement invited I&APs to the Public Open session on the 23 November 2012.
- A Background Information Document with a response form was provided to I&APs (see Appendix 7).
- Onsite notices of regulated size, regarding the commencement of the EIA process were placed at strategic points on 9 November 2012.
- Copies of the draft BA Report were placed at the following locations to provide I&APs with the opportunity to review and comment on the draft BA report. A forty day review period (from 09 November 2012 to 14 December 2012 and 02 January 2013 – 04 January 2013) was granted.
- I & APs will be notified of the release of the Final BAR for review. A 14 day review period has been granted.

Copy No.	Location	Address	Telephone Number
2	eMakhazeni Library	Scheepers Street, eMakhazeni (Belfast)	013 253 1121 (ext 121)

12.2. Distribution of BAR

Copies of the Draft BAR were distributed to the following authorities:

- Department of Economic Development, Environment and Tourism (DEDET);
- Department of Water Affairs (DWA);
- Mpumalanga Department of Water Affairs;
- Mpumalanga Parks and Tourism Agency (MTPA);
- Mpumalanga Department of Agriculture Forestry and Fisheries (DAFF);
- Mpumalanga Department of Mineral Resources (DMR);
- Department of Agriculture, Rural Development and Land Administration (DARDLA);
- South African Heritage Resource Agency (SAHRA);
- Mpumalanga Provincial Heritage Resource Agency;
- South African National Biodiversity Institute.
- eMakhazeni Local Municipality; and
- Nkangala District Municipality.

12.3. Summary of Comments and Responses

Comment	Received By	Response
The MTPA has no objection to the proposal, and thank you very much for a comprehensive and credible BAR. Based on the report, it is acknowledged that alternative 1 with the associated impacts such as depicted in figure 1, on page 3 is the best option. MTPA recommends that alternative 1 be implemented; this alternative is the best practical environmental option and is therefore regarded as the preferred option. The head skull as depicted in figure 18, has it been identified. It could be a bulldog skull.	MTPA – 23 November 2012	Noted. It is noted that the MTPA recommends alternative 1. The skull has not been identified any further.
The Sub Directorate E & R acknowledges receipt of the	DWA - 22 November 2012	

documents on 13 November 2012. Should the activity be identified as a section 21 (c) water use or section (i) water use, the applicant must apply for the relevant water use license.		Just to clarify the proposed activity is not for the proposed solar park and solar power plant as indicated in the comments but for the re-alignment and upgrade of the Siyathuthuka Road.
The review and comments / recommendations off environmental reports is a regional office competency. In line with DWA water use authorisation business processes, and in order to avoid unnecessary setbacks in the environmental authorisation processes, please ensure that all environmental reports for review are submitted to the regional office (Mpumalanga Regional Office – Mr F Guma), the regional office will consult E & R should specialist information / input be required. Please note that a comprehensive, hard copy set of documents must be sent to the Regional office.		Noted. A hard copy of the Draft BAR was submitted to the Mpumalanga Regional office to Mr F Guma. To date we have not received any comments from the regional department. Should a water use license be required, the application will be submitted to the regional department.

13. IMPACT ASSESSMENT AND MITIGATION

13.1. Overview

This section focuses on the pertinent environmental impacts that could potentially be caused by the proposed re-alignment and upgrade of the Siyathuthuka Road during the pre-construction, construction and operation phases of the project.

The impacts to the environmental features are linked to the project activities, which in broad terms relate to the physical infrastructure (emphasis on construction and operation stages). Impacts were identified as follows:

- An appraisal of the project description and the receiving environment;
- Impacts associated with listed activities contained in GN No. R544;
- Issues highlighted by environmental authorities;
- Findings from specialist studies; and
- Comments received during public participation.

13.2. Impacts associated with Listed Activities

As mentioned, the project requires authorisation for certain activities listed in the EIA Regulations (2006), which serves as triggers for the environmental assessment process. The impacts associated with the key listed activities follows (note that list is not exhaustive – refer to complete list under **Table 3**).

The potential impacts linked to the listed activities are then addressed in the subsequent sections.

Table 17: Impacts associated with the key listed activities

GN No.	Activity	Description	Potential Impact Overview
544	**40**	The expansion of infrastructure by more than 50 square metres within a watercourse or within 32 metres of a watercourse, measured from the edge of a watercourse, but excluding where such expansion will occur behind the development setback line.	Environmental (i.e. potential impact on wetlands and associated vegetation and fauna) and socio-economic impacts (i.e. potential increase in traffic, potential job creation) associated with the upgrade and re-alignment of the Siyathuthuka Road and culvert structures.

13.3. Issues raised by Environmental Authorities and I & APs

Any issues raised by authorities and I & Aps will be included in the final BAR for review.

13.4. Project Activities and Environmental Aspects

The main project components include the following:

- The upgrade and re-alignment of the existing Siyathuthuka Road and culvert structures.

In order to understand the impacts related to the project it is necessary to unpack the activities associated with the project life-cycle, as shown below:

Table 18: Activities associated with the Siyathuthuka Project Life-Cycle

Pre-construction
Project Activities
• Detailed engineering design
• Detailed geotechnical investigation
• Geophysical investigations
• Survey of the site
• Arrangements with individual landowners and/or land users
• Procurement process for Contractors
Construction
Project Activities
• *On-going consultation with affected parties*
• Vegetation clearance
• Pegging of overall construction footprint
• Site establishment
• Establish construction camp (including material lay-down areas)
• *Construction employment*
• Delivery of construction material
• Storage and handling of material
• Transportation of equipment, materials and personnel
• Topsoil clearance
• Fencing of site camp
• Upgrade and re-alignment of existing road
• Grading of site (where necessary)
• Excavations and Foundation related activities
• Stormwater Drain network for aligned portion of road
• Traffic Control
• Waste Management
• Wetland rehabilitation
• *Refuelling*
• *Crossing* inaccessible sites
• *Crossing* sensitive areas
• *Managing construction sites*
• *Reinstatement and rehabilitation*
• Final road surface finishes and walkways
• Handing and taking over of the servitude
Operation
Project Activities
• Access arrangements and requirements
• Routine maintenance inspections
• Management of vegetation clearance
• Repair and maintenance works

Environmental aspects are regarded as those components of an organisation's activities, products and services that are likely to interact with the environment. The following environmental aspects have been identified for the proposed upgrade and re-alignment of the Siyathuthuka Road (note that only high-level aspects are provided):

Table 19: Environmental Aspects associated with the upgrade and re-alignment of the Siyathuthuka Road and associated structures

Pre-construction
Environmental Aspects
• Poor construction site planning and layout
• Inaccurate site survey
Construction
Environmental Aspects
• *Lack of environmental awareness creation*
• *Poor consultation with affected parties*
• Indiscriminate site clearing
• Poor site establishment
• Poor management of access and use of access roads
• Poor transportation practices
• Poor fencing arrangements
• Erosion
• Disruptions to existing services
• *Disturbance of topsoil*
• Poor management of excavations
• Inadequate *storage and handling of material*
• Inadequate *storage and handling of hazardous material*
• Lack of **equipment maintenance**
• Poor management of labour force
• Pollution from **ablution facilities**
• Inadequate management of **construction camp**
• Poor waste management practices
• *Wastage of water*
• *Disturbance to landowners*
• Poor management of pollution generation potential
• *Damage to significant flora*
• *Damage to significant fauna*
• *Environmental damage at crossings of* inaccessible sites
• *Environmental damage at crossings of* sensitive areas
• *Disruption of* archaeological and cultural features
• Poor reinstatement and rehabilitation
Operation
Environmental Aspects
• Inadequate management of access, routine maintenance and maintenance works
• Inadequate management of wetlands and associated vegetation

13.5. Significant Environmental Impacts

Environmental impacts are the change to the environment resulting from an environmental aspect, whether desirable or undesirable. Note that it is not the intention of the impact assessment to evaluate all potential environmental impacts associated by the project's environmental aspects, but rather to focus on the potentially **significant** direct and indirect impacts identified. The significant environmental impacts are listed in **Table 20**.

The EMPr strives to provide a comprehensive list of mitigation measures associated with the overall project-related aspects and impacts for the entire project life-cycle (i.e. pre-construction, construction, operation and decommissioning).

The cumulative impacts are discussed in **Sections 13.9**.

Table 20: Significant environmental impacts associated with the project

Construction Phase	
Feature	**Impact**
Topography	• Erosion associated with the realignment and upgrade of the culverts
Surface Water	• Potential contamination of the surface water • Soil erosion resulting in increased sedimentation of the watercourse
Pans and Wetlands	• Damage to wetland habitat
Geology and Soil	• Erosion of stockpiled soil
Flora	• Excess removal of indigenous vegetation • Damage to sensitive / protected plants • Encroachment of alien vegetation
Fauna	• Disturbance of fauna
Socio-Economic	• Potential job creation for skilled and unskilled labourers from the local community
Archaeological and Cultural Features	• Damage to heritage resources
Infrastructure and Services	• Poor stormwater attenuation resulting damage to surround habitats
Transportation	• Disruption to traffic as a result of construction activities
Visual	• Construction – related activities resulting in negative visual impact
Operational Phase	
Feature	**Feature**
Surface Water	• Inadequate stormwater management resulting in contamination of the watercourse
Wetlands	• Loss of wetland habitat
Soil	• Erosion on site

Flora	• Encroachment by alien vegetation
Fauna	• Impact on faunal biodiversity
Socio-economic	• Better access road for residents of the nearby township and other community members
Infrastructure and Services	• Inadequate stormwater management resulting in contamination of the watercourse
Transportation	• Better access road with a walkway for pedestrians
Visual	• Inadequate rehabilitation of the construction footprint
Tourism	• More efficient access road to new sports facility

The findings of the specialists are of particular importance in terms of understanding the impacts of the project and managing the adverse implications of the project life-cycle, as these studies focused on the significant environmental issues identified during the execution of the EIA. As can be seen from the various impact assessments performed by the specialists, there are a host of cross-cutting impacts that are addressed in a number of these studies, with particular reference to the visual, social and economic effects of the proposed upgrade and re-alignment. The mitigation measures proposed by the specialists for these similar types of impacts are not regarded as contradictory, as they are aligned with best practices and principles.

13.6. Impact Assessment Methodology

The impacts and the proposed management thereof are assessed by using the methodology provided below. Where applicable, the impact assessments and significance ratings provided by the respective specialists are included.

In the case of the specialist studies, most of the impact assessment methodologies deviated from the approach to follow. However, the quantitative basis for these specialist evaluations of the impacts to specific environmental features still satisfied the intention of EIA.

For the methodology of the impact assessment, the analysis is conducted on a quantitative basis with regard to the nature, extent, magnitude, duration, probability and significance of the impacts. The following definitions and scoring system apply:

Nature (/Status)
The project could have a positive, negative or neutral impact on the environment.

Extent
- Local - extend to the site and its immediate surroundings.
- Regional - impact on the region but within the province.
- National - impact on an interprovincial scale.
- International - impact outside of South Africa.

Magnitude
Degree to which impact may cause irreplaceable loss of resources.

- Low - natural and social functions and processes are not affected or minimally affected.
- Medium - affected environment is notably altered; natural and social functions and processes continue albeit in a modified way.
- High - natural or social functions or processes could be substantially affected or altered to the extent that they could temporarily or permanently cease.

Duration

- Short term - 0-5 years.
- Medium term - 5-11 years.
- Long term - impact ceases after the operational life cycle of the activity either because of natural processes or by human intervention.
- Permanent - mitigation either by natural process or by human intervention will not occur in such a way or in such a time span that the impact can be considered transient.

Probability

1. Almost certain - the event is expected to occur in most circumstances.
2. Likely - the event will probably occur in most circumstances.
3. Moderate - the event should occur at some time.
4. Unlikely - the event could occur at some time.
5. Rare/Remote - the event may occur only in exceptional circumstances.

Significance

Provides an overall impression of an impact's importance, and the degree to which it can be mitigated. The range for significance ratings is as follows-

0 - Impact will not affect the environment. No mitigation necessary.
1- No impact before / after mitigation.
2- Residual impact before / after mitigation.
3- Impact cannot be mitigated.

13.7. Impact Mitigation

Impacts are to be managed by assigning suitable mitigation measures. According to DEAT (2006), the objectives of mitigation are to:

- Find more environmentally sound ways of doing things;
- Enhance the environmental benefits of a proposed activity;
- Avoid, minimise or remedy negative impacts; and
- Ensure that residual negative impacts are within acceptable levels.

Mitigation should strive to abide by the following hierarchy – (1) prevent; (2) reduce; (3) rehabilitate; and/or (4) compensate for the environmental impacts.

Figure 23: Mitigation Hierarchy

The proposed mitigation of the impacts includes specific measures identified by the technical team (including engineering solutions) and environmental specialists, stipulations of environmental authorities and environmental best practices. The mitigation measures that follow in the subsequent sections are not intended to be exhaustive, but rather focus on the significant impacts identified.

The EMPr (refer to ***Appendix 6***) provides a comprehensive list of mitigation measures for the entire project, which extends beyond the impacts evaluated in the body of the BA Report.

	Overview of the EMPr
	The scope of the Siyathuthuka Road EMPr is as follows: • Establish management objectives during the project life-cycle in order to enhance benefits and minimise adverse environmental impacts; • Provide targets for management objectives, in terms of desired performance; • Describe actions required to achieve management objectives; • Outline institutional structures and roles required to implement the EMPr; • Provide legislative framework; and • Description of requirements for record keeping, reporting, review, auditing and updating of the EMPr. All liability for the implementation of the EMPr (as well as the BA findings and environmental authorisation) lies with the project proponent.

13.8. Impact Assessment

13.8.1. Fauna

Mammals are sensitive to disturbances and habitat destruction and degradation and are reliant on pristine and stable habitats, few, if any, threatened small mammals are expected to occur in the study area. Two mammals were visually observed on site even though signs such as holes and a skull, which indicated more animals found on site, were also observed. The field assessment showed that the proposed road upgrade will traverse the wetlands and this will have an impact on the loss of ecological sensitive and important habitat units, ecosystem function, and loss of faunal habitat. Considering that the disturbance of the project is temporary in nature, **the proposed development will have no lasting effect on mammals typical of the site.**

The avifauna study indicated that the wetlands, a nearby dam and grasslands will provide natural habitats for bird species that are known to occur on site. However, this section is heavily grazed and infested by alien vegetation. The globally threatened Whitewinged Flufftail is restricted in the region to a few high-altitude sponges in South Africa in the QDS of 2530CA where the proposed road upgrade is located. In addition, the region is known to support the Endangered Wattled Crane and the African Grass-owl population. Various other RDL avifaunal species have also been recorded from the region. Throughout the study area, suitable habitat for various Red Data Listed avifaunal species was observed, so mitigation measures to reduce the impact on the associated habitat units pertaining to these species have been proposed. **The project will only have a negative impact during the construction phase whereafter the birds will return to the area if rehabilitation is carried out properly.**

According to South African Reptile Conservation Assessment, four species, namely Brown House Snake, Black-headed Centipede-eater, Rhombic Night Adder and Southern Rock Agama are known to occur in the region. **No reptile species were observed during the survey. The high levels of**

human presence and disturbances have a detrimental impact on the remaining reptile species in the area.

The dam near the study site provided excellent breeding habitat for Giant Bullfrogs. **It is quite likely that giant bullfrogs will migrate to the study site for feeding and aestivation.** No frogs were recorded in the study area.

Therefore, in terms of fauna, the construction phase of the project is anticipated to have a greater impact than the operational phase, however the potential impacts can be mitigated by ensuring that all mitigation measures are adhered to and that the site is effectively rehabilitated.

The impact assessment for the faunal section is supplemented by the following evaluation conducted as part of the Flora and Fauna study (Phampe, 2012). These impacts are applicable to all alternative options.

FAUNA - PRE – CONSTRUCTION PHASE					
Impact	Nature	Description		Mitigation	
Direct	Positive	Search and Rescue		A qualified and / or appropriately experienced Zoologist or an experienced person who knows the animals in the region well will identify any possible Red Data fauna on site and the necessary permits to relocate fauna will be obtained if avoidance is not possible. Training of construction workers to recognise threatened animal species will reduce the probability of fauna being harmed unnecessarily.	
Without Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Medium	Medium-term	Likely	2
With Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Low	Medium-term	Likely	1

FAUNA - PRE – CONSTRUCTION PHASE					
Impact	Nature	Description		Mitigation	
Direct	Negative	Site preparation		During site preparation special care must be taken during the clearing of the works area to minimise damage or disturbance of roosting and nesting sites. Before construction commences, all sensitive habitats, such as rivers and wetlands must be clearly demarcated with fencing or orange mesh netting. Barricading measures to be utilised should not restrict the movement of the fauna in the area.	
Without Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	High	Medium-term	Likely	2
With Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Medium	Medium-term	Likely	1

FAUNA - PRE – CONSTRUCTION PHASE					
Impact	Nature	Description		Mitigation	
Direct	Negative	Disturbance to animals on site		Stringent and dedicated control not to disturb animals on site.	
Without Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	High	Medium-term	Likely	2
With Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Medium	Medium-term	Likely	1

FAUNA - CONSTRUCTION PHASE			
Impact	Nature	Description	Mitigation
Direct	Negative	Disturbance to animals	Animals residing within the designated area shall not be unnecessarily disturbed.

FAUNA - CONSTRUCTION PHASE					
Impact	Nature	Description		Mitigation	
				Before construction starts, construction workers must be educated with regards to littering and poaching. The Contractor and his/her employees shall not bring any domestic animals onto site. Photographs of sensitive animals must be displayed in the construction camp to heighten awareness of the creatures. Toolbox talks should be provided to contractors regarding disturbance to animals. Particular emphasis should be placed on talks regarding snakes.	
Without Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Medium	Medium-term	Likely	2
With Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Medium	Medium-term	Likely	1

FAUNA - CONSTRUCTION PHASE			
Impact	Nature	Description	Mitigation
Direct	Negative	Removal of vegetation	Leave as much of the natural vegetation intact as possible in order to maintain ecological corridors for the movement of species. Make an effort to increase the natural areas around sensitive features such as rivers and wetlands. In areas where there are nesting sites for birds, vegetation should not be disturbed, particularly near rivers and dam. All soils should be stored and

FAUNA - CONSTRUCTION PHASE					
Impact	Nature	Description		Mitigation	
				managed correctly for rehabilitation to maintain natural habitats for animals. Construction activities should be limited to daylight hours, in order to minimise impacts on nocturnal fauna	
Without Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	High	Medium-term	Likely	2
With Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Medium	Medium-term	Likely	2

FAUNA - CONSTRUCTION PHASE					
Impact	Nature	Description		Mitigation	
Direct	Negative	Transportation of materials		Construction trucks should travel at a maximum speed of 10Km/h on site in order to avoid unnecessary killings of animals found on site. Loose material such as sand and gravel must be covered with tarpaulins during transport.	
Without Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Medium	Medium-term	Likely	2
With Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Medium	Medium-term	Likely	1

FAUNA - CONSTRUCTION PHASE			
Impact	Nature	Description	Mitigation
Direct	Negative	Allow for safe animal passage through and specifically out of the construction site.	Construction areas must be fenced using palisades for the migration of small faunal species out of the construction zone. This

FAUNA - CONSTRUCTION PHASE					
Impact	Nature	Description		Mitigation	
				excludes areas where animal activity could be hazardous where such areas should be appropriately blocked off. Site camps should be placed in areas that do not impact on animal movement corridors.	
Without Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Medium	Medium-term	Likely	2
With Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Medium	Medium-term	Likely	1

FAUNA - CONSTRUCTION PHASE					
Impact	Nature	Description		Mitigation	
Direct	Negative	To protect and maintain habitats of sensitive species.		Important sensitive habitats such as rivers and wetlands need to be preserved in order to protect species that utilise these areas as their preferred habitats. A buffer-zone around sensitive areas (wetlands) must be demarcated with hazard tape or orange mesh netting to prevent accidental disturbance.	
Without Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Medium	Medium-term	Likely	2
With Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Medium	Medium-term	Likely	2

FAUNA OPERATIONAL PHASE			
Impact	Nature	Description	Mitigation
Direct	Negative	Ongoing impacts that will affect faunal biodiversity	Ecologically sensitive areas (such as rivers and wetlands)

FAUNA OPERATIONAL PHASE					
Impact	Nature	Description		Mitigation	
				should be retained as prohibited areas to workers. Workers and machinery to remain inside construction footprint. All labourers to be informed of disciplinary actions for the wilful damage to plants and animals. Cut material emanating from bush clearing should be removed from the site. If it is to remain within the site, it should not be stacked, but spread out so that it remains close to the ground. This will enhance grass growth and microbial interaction that will enhance decomposition. By spreading the cut material, the risk of damage caused from fires that burn with too much heat, which will damage natural plant life and sterilize seedbeds can be avoided (Vosloo, 2004).	
Without Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Medium	Medium-term	Likely	2
With Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Medium	Medium-term	Likely	1

13.8.2. Flora

The study area falls within the grassland biome and has been categorised as Lydenburg Montane Grassland and Eastern Highland Grassland vegetation units. Dullstroom Plateau Grasslands (Endangered) and Eastern Highland Grassland (Vulnerable) are listed as the two threatened terrestrial ecosystems occurring on site. During the field assessment, no red data plant species were observed on sites. Exotic plant species such as *Eucalyptus cinerea* and *Pinus patula* were common at the site. Invader and weed species must be controlled to prevent further infestation and it is

recommended that all individuals of the invader species be eradicated. The Mpumalanga Biodiversity Conservation Plan (MBCP) Terrestrial Biodiversity Assessment described the sites as classified "**least concern**" and "**no natural habitat remaining**".

Of the two options investigated, the alternative route will traverse two wetlands whilst the preferred option which realigns the road to a lesser extent will only cross one wetland and for this reason, the preferred option is chosen as it will have less impact on the wetland. **The Dullstroom Plateau Grasslands will be highly impacted should the alternative option (alternative 2) be considered.**

The impact assessment for the floral section is supplemented by the following evaluation conducted as part of the Flora and Fauna study (Phampe, 2012). The impacts discussed below are applicable to all alternative options.

FLORA - PRE – CONSTRUCTION PHASE					
Impact	Nature	Description		Mitigation	
Direct	Negative	Search and Rescue		A qualified and / or appropriately experienced Botanist or an experienced person who knows specific vegetation types well should mark any species of conservation importance and other medicinal plants when the route is pegged.	
Without Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Medium	Medium-term	Almost certain	2
With Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Low	Short-term	Likely	1

FLORA - PRE – CONSTRUCTION PHASE			
Impact	Nature	Description	Mitigation
Direct	Negative	Site preparation	During site preparation topsoil must be removed and stored separately from organic material and spoil material for use in the rehabilitation phase. It should be protected from wind and rain, as well as contamination from diesel, concrete or wastewater.

FLORA - PRE – CONSTRUCTION PHASE					
Impact	Nature	Description		Mitigation	
				Records of all environmental incidents must be maintained and a copy of these records must be made available to authorities on request throughout the project execution.	
Without Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	High	Medium-term	Likely	2
With Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Medium	Short-term	Likely	2

FLORA - PRE – CONSTRUCTION PHASE					
Impact	Nature	Description		Mitigation	
Direct	Negative	Establishment of Site Camps		A suitable position for the construction camp to be selected, in consultation with the Environmental Control Officer (ECO). The positioning of the site camp must not be near any sensitive areas such as wetlands, but rather be positioned in areas that are already disturbed.	
Without Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	High	Medium-term	Likely	2
With Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Medium	Medium-term	Likely	1

FLORA - CONSTRUCTION PHASE			
Impact	Nature	Description	Mitigation
Direct	Negative	Destruction of species of conservation importance and their natural habitats	The removal of any plant material from site, including flowers or bulbs is strictly prohibited unless

FLORA - CONSTRUCTION PHASE					
Impact	Nature	Description		Mitigation	
				unavoidable and essential for the purposes of construction. The contractor for vegetation clearing must have the knowledge to be able to identify different species, declared weeds and alien species.	
Without Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	High	Medium	Likely	2
With Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Medium	Medium	Likely	2

FLORA - CONSTRUCTION PHASE					
Impact	Nature	Description		Mitigation	
Direct	Negative	Vegetation and soil disturbance around construction sites due to general construction activities		Minimise topsoil disturbance as far as possible. Level and landscape disturbed topsoil areas to facilitate plant succession. Erosion control measures, such as stone packing, brush packing and reseeding, should be included on disturbed areas.	
Without Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	High	Medium-term	Likely	2
With Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Medium	Medium-term	Likely	1

FLORA - CONSTRUCTION PHASE			
Impact	Nature	Description	Mitigation
Direct	Negative	Soil contamination, vegetation loss and vegetation disturbance due to fuel and chemical spills.	Employ on site personnel responsible for preventing and controlling potential soil pollution

FLORA - CONSTRUCTION PHASE					
Impact	Nature	Description		Mitigation	
				through fuel and oil leaks and spills. Make sure construction vehicles are maintained and serviced to prevent oil and fuel leaks. Emergency on-site maintenance should be done over appropriate drip trays and all oil or fuel must be disposed of according to waste regulations. Drip-trays must be placed under vehicles and equipment when not in use. Containers containing potential contaminating substances must be kept on drip-trays or tarpaulins in case of spills.	
Without Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	High	Medium-term	Likely	2
With Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Medium	Medium-term	Likely	1

FLORA - CONSTRUCTION PHASE					
Impact	Nature	Description		Mitigation	
Direct	Negative	Loss of aesthetic value and sense of place.		Ensure that development designs compliment the natural surroundings in order to preserve a sense of place.	
Without Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Medium	Medium-term	Likely	2
With Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Medium	Medium-term	Likely	1

FLORA - CONSTRUCTION PHASE					
Impact	Nature	Description		Mitigation	
Direct	Negative	Vegetation disturbance in and around construction camps.		Fencing of construction camps. No equipment or personnel will be allowed outside of the fenced construction servitude. Level and landscape disturbed topsoil areas to facilitate plant succession and to match surrounding topography. Erect construction camps on previously disturbed areas and on level surfaces only.	
Without Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Medium	Medium-term	Likely	2
With Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Medium	Medium-term	Likely	1

FLORA - CONSTRUCTION PHASE					
Impact	Nature	Description		Mitigation	
Direct	Negative	Vegetation and habitat disturbance due to the accidental introduction of alien species.		Promote awareness of all personnel. After construction programme monitoring and control of alien weeds and invaders through hand removal; slashing (annuals) or chemical control (perennials).	
Without Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	High	Medium-term	Likely	2
With Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Medium	Medium-term	Likely	1

FLORA - CONSTRUCTION PHASE			
Impact	Nature	Description	Mitigation
Direct	Negative	Vegetation and habitat disturbance due	Employ personnel on site

FLORA - CONSTRUCTION PHASE					
Impact	Nature	Description		Mitigation	
		to pollution and littering during construction phase.		responsible for preventing and controlling of litter. Promote housekeeping with daily clean-ups on site. Before construction commences, construction workers should be educated with regards to littering, *ad hoc* veld fires, and dumping. Fires must be limited to designated areas and monitored closely.	
Without Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Medium	Medium-term	Likely	2
With Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Medium	Medium-term	Likely	1

FLORA - CONSTRUCTION PHASE					
Impact	Nature	Description		Mitigation	
Direct	Negative	Damage to plant life outside of the proposed road upgrade area		Measures must be taken to penalise construction workers who damage plants intentionally or remove plants accidentally without reporting the incident.	
Without Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Medium	Medium-term	Likely	2
With Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Medium	Medium-term	Likely	2

FLORA - CONSTRUCTION PHASE			
Impact	Nature	Description	Mitigation
Direct	Negative	Vegetation disturbance due to increased dust during construction phase.	Wetting down of work areas can be used to reduce dust levels but not to a degree that causes

FLORA - CONSTRUCTION PHASE					
Impact	Nature	Description		Mitigation	
				runoff and contamination. Cultivate awareness among personnel to limit excessive and unnecessary dust.	
Without Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Medium	Medium-term	Likely	2
With Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Medium	Medium-term	Likely	1

FLORA - OPERATIONAL PHASE					
Impact	Nature	Description		Mitigation	
Direct	Negative	The construction of the proposed Siyathuthuka road upgrade may affect biodiversity through the encroachment of exotic vegetation following soil disturbance, in addition the maintenance of the area would disturb naturalised species within the area.		Encroachment of alien vegetation should be monitored regularly and controlled; the area must be kept clear of all invader plants as per the Conservation of Agricultural Resources Act, 1983 (Act No 43 of 1983). Rehabilitation measures must be employed until such a time as indigenous species are established.	
Without Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Medium	Medium-term	Likely	2
With Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Medium	Medium-term	Likely	1

FLORA - OPERATIONAL PHASE			
Impact	Nature	Description	Mitigation
Direct	Negative	Ongoing impacts that will affect faunal biodiversity	Ecologically sensitive areas (such as rivers and wetlands) should be retained as prohibited areas to workers.

FLORA - OPERATIONAL PHASE					
Impact	Nature	Description		Mitigation	
				Workers and machinery to remain inside construction footprint. All labourers to be informed of disciplinary actions for the wilful damage to plants and animals. Cut material emanating from bush clearing should be removed from the site. If it is to remain within the site, it should not be stacked, but spread out so that it remains close to the ground. This will enhance grass growth and microbial interaction that will enhance decomposition. By spreading the cut material, the risk of damage caused from fires that burn with too much heat, which will damage natural plant life and sterilize seedbeds can be avoided (Vosloo, 2004).	
Without Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Medium	Medium-term	Likely	2
With Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Medium	Medium-term	Likely	1

13.8.3. Watercourses

For the discussion to follow watercourses are considered as rivers, streams, natural channels (perennial and seasonal), wetlands and dams. The two culvert structures will be located with the wetlands. Construction activities could cause impacts to the "resource quality" of the affected watercourses, which is defined by the National Water Act (Act No. 36 of 1998) as the following:

- Quantity, pattern, timing, water level and assurance of instream **flow**;
- **Water quality**, including physical, chemical and biological characteristics of the water;
- Character and condition of the instream and riparian **habitat**; and
- Characteristics, condition and distribution of the **aquatic biota**.

Impacts to the resource quality of the affected watercourses could include:

- Damage to / loss or habitat (both instream and riparian zone) within the works area;
- Destabilisation of morphology (i.e. river structure);
- Reduction of water quality through sedimentation and poor construction practices;
- Alteration of the flow regime caused by temporary diversions; and
- Reduction in biodiversity of aquatic biota.

Should construction activities encroach upon the regulated area of a watercourse (i.e. 1:100 year floodline / delineated riparian or wetland habitats) water use authorisation will be required in terms of Section 21 of the National Water Act (Act No. 36 of 1998). In accordance with Section 27 of this Act, the following factors need to be taken into consideration by DWA before an authorisation may be issued:

- Existing lawful water uses;
- The need to redress the results of past racial and gender discrimination;
- Efficient and beneficial use of water in the public interest;
- The socio-economic impact of the water use or uses if authorised; or of the failure to authorise the water use or uses;
- Any catchment management strategy applicable to the relevant water resource;
- The likely effect of the water use to be authorised on the water resource and on other water users;
- The class and the resource quality objectives of the water resource;
- Investments already made and to be made by the water user in respect of the water use in question;
- The strategic importance of the water use to be authorised;
- The quality of water in the water resource which may be required for the Reserve and for meeting international obligations; and
- The probable duration of any undertaking for which a water use is to be authorised.

Abstraction of water for construction purposes will not be permitted without the requisite authorisations.

The impact assessment for the wetlands is supplemented by the following evaluation conducted as part of the Wetland Impact Assessment (Enviross, 2012).

Potential environmental impact	Project activity or issue	Environmental significance *before* mitigation**								Environmental significance *after* mitigation**							
		S	D	I	E	R	P	Conf*	SP	S	D	I	E	R	P	Conf	SP
PRECONSTRUCTION & CONSTRUCTION PHASES																	
Wetland habitat features	Loss of wetland habitat through indiscriminate destruction and development within wetland zones.	1	2	3	3	2	3	High	21	1	1	1	2	3	2	High	4
	Destruction of wetland habitat leading to displacement and destruction of wetland biodiversity.	2	4	3	4	1	5	High	60	1	1	1	2	3	2	High	4
	Restricting water flow through culverts will induce erosion of the channel.	2	4	3	3	2	5	High	50	1	1	1	2	3	2	High	4
Soils	Soil stripping, soil compaction and vegetation removal will increase rates of erosion and entry of sediment into the general aquatic ecosystem.	2	4	3	4	1	4	High	48	1	1	1	2	2	2	High	6
	Erosion of stockpiled topsoil & disturbance of soils due to vegetation stripping leading to erosion and habitat inundation.	2	4	3	4	1	4	High	48	1	1	1	2	2	2	High	6
Water quality	Contamination of surface waters through fluid leaks from poorly serviced construction vehicles.	2	1	3	3	1	2	High	16	1	1	1	2	3	1	High	2
	Soil erosion leading to impacts on water quality.	2	1	3	3	1	2	High	16	1	1	1	2	3	1	High	2
MANAGEMENT PHASE																	
Biodiversity impacts	Exotic vegetation encroachment following soil disturbances	2	4	1	2	2	4	High	28	1	1	1	1	4	2	High	0
Soil erosion	Resulting from roadway runoff through poor stormwater attenuation and drainage design leading to habitat transformations.	2	4	3	4	1	4	High	48	1	1	1	2	2	2	High	6

Conf – Confidence limits
*****See Appendix A of the wetland impact assessment report for calculations & methodologies.***
SP ratings: 0-33 (Low), 34-74 (Medium), 75-100 (High)

The impacts of both alternatives are generalised as the ratings calculations are not of a fine enough scale to differentiate any significant differences. It can be seen that most impacts can be significantly reduced with implementation of appropriate mitigation measures.

Wetland functionality has been impaired by constricting the surface water flow through single culverts. This has enhanced unnatural channel formation downstream of the culvert outfall points. It is recommended that the flow of surface waters be spread through more culverts that span along the width of the wetland areas to included potential flood zones so as to reduce the scouring effects of

fast-flowing water. This can be implemented if new crossing points are to be established. Two alternative alignments were offered, **with the preferred alternative being Option 1.** The wetland already suffers from the impacts of the existing road crossing and by establishing new crossing points as close as possible to the existing crossings will reduce the overall footprint area, which **will ultimately reduce the cumulative impacts on the wetland habitat units**.

13.8.4. Soil

Soil erosion could occur following the clearing of vegetation or grading of the site. Construction equipment could potentially lead to soil compaction.

Soil	
Nature of Impact (potential)	**Erosion of exposed soil**
Relevant Alternatives and Activities	All alternatives
Direct, Indirect or cumulative	Direct
Extent	Local
Can impact be prevented/ reversed or managed?	Yes
Possibility of impact before Mitigation	Likely
Possibility of impact after mitigation	Unlikely
Possible Mitigation measure	• No cutting and filling in areas of 4% sideslope and less. • Stabilisation of cleared areas to prevent and control erosion. The method chosen (e.g. watering, planting, retaining structures, commercial anti-erosion compounds) will be selected according to the site specific conditions. • Drainage management should also be implemented to ensure the minimisation of potential erosion on access roads. • Acceptable reinstatement and rehabilitation to prevent erosion during the operation phase.
Significance before mitigation	2
Significance after mitigation	1

13.8.5. Socio-Economic

The Siyathuthuka Road is an existing road and as such the most significant impacts will arise during the construction phase where skilled and unskilled labour will be required. Furthermore the proposed upgrade will result in access to a more efficient road and will create walkways for pedestrians thus providing a safer road. The walkways will also be beneficial to cyclists who wish to use those walkways.

Socio-Economic	
Nature of Impact (potential)	Potential job creation as a result of the construction related activities
Relevant Alternatives and Activities	All alternatives
Direct, Indirect or cumulative	Direct
Level & duration of impact	Local. Short term – during construction phase
Can impact be prevented/ reversed or managed?	N/A
Possibility of impact before Mitigation	N/A
Possibility of impact after mitigation	N/A
Possible Mitigation measure	No mitigation required as it is a positive impact
Significance before mitigation	3
Significance after mitigation	3

Socio-Economic	
Nature of Impact (potential)	Provision of a safer access road
Relevant Alternatives and Activities	All alternatives
Direct, Indirect or cumulative	Direct
Level & duration of impact	Local. Short term – during construction phase
Can impact be prevented/ reversed or managed?	N/A
Possibility of impact before Mitigation	N/A
Possibility of impact after mitigation	N/A
Possible Mitigation measure	No mitigation required as it is a positive impact.
Significance before mitigation	3
Significance after mitigation	3

13.8.6. Archaeological and Cultural

The proposed project will have no impact on any items of cultural or heritage significance as the HIA conducted found that there were no items of significance on or near the site.

Archaeological and Cultural	
Nature of Impact (potential)	**Potential damage to graves or any items of cultural or heritage significance**
Relevant Alternatives and Activities	All alternatives
Direct, Indirect or cumulative	Direct
Extent	Local
Can impact be prevented/ reversed or managed?	Yes
Possibility of impact before Mitigation	Likely
Possibility of impact after mitigation	Unlikely
Possible Mitigation measure	Should any graves or artefacts be identified, then all activities must stop and SAHRA must be immediately contacted.
Significance before mitigation	2
Significance after mitigation	1

13.8.7. Transportation

The proposed project is anticipated to have an impact on traffic during the construction phase; however this can be mitigated against by ensuring that mitigation measures are adhered to.

Transportation	
Nature of Impact (potential)	Potential disruption of traffic
Relevant Alternatives and Activities	All alternatives
Direct, Indirect or cumulative	Direct
Level & duration of impact	Local. Short term – during construction phase
Can impact be prevented/ reversed or managed?	Yes the impact can be prevented
Possibility of impact before Mitigation	Likely
Possibility of impact after mitigation	Unlikely
Possible Mitigation measure	• Adequate signage must be implemented along the construction route; • Flagmen must be used to control the traffic flow;

	• All conditions of the EMPr must be adhered to.
Significance before mitigation	2
Significance after mitigation	1

13.8.8. Visual

The proposed project is anticipated to have minimal visual impact. The road is and existing structure and as such the only potential impact is anticipated to occur during the construction phase as a result of construction equipment.

Visual	
Nature of Impact (potential)	Potential visual impact associated with construction activities and equipment
Relevant Alternatives and Activities	All alternatives
Direct, Indirect or cumulative	Direct
Level & duration of impact	Local. Short term – during construction phase
Can impact be prevented/ reversed or managed?	Yes the impact can be mitigated
Possibility of impact before Mitigation	Likely
Possibility of impact after mitigation	Unlikely
Possible Mitigation measure	• The construction camp must be fenced to minimise the visual impact; • Disturbance to the site must be kept to a minimum; • Rehabilitation measures must be implemented as soon as construction activities have been completed; • The conditions of the EMPr must be strictly adhered to.
Significance before mitigation	2
Significance after mitigation	1

13.8.9. Infrastructure and Services

All existing services must be identified and clearly demarcated prior to the commencement of any construction activities on site. Should any infrastructure / service be damaged or disrupted, the contractor must ensure that it is immediately repaired. The potential impact on existing services is anticipated to be minimal.

Infrastructure and Services	
Nature of Impact (potential)	Inadequate stormwater management resulting in soil erosion
Relevant Alternatives and Activities	All alternatives
Direct, Indirect or cumulative	Direct

Level & duration of impact	Local. Short term – during construction phase
Can impact be prevented/ reversed or managed?	Yes the impact can be prevented
Possibility of impact before Mitigation	Likely
Possibility of impact after mitigation	Unlikely
Possible Mitigation measure	A stormwater control plan must be prepared and implemented for the construction and operational phases of the development to ensure that no erosion occurs as a result of the proposed upgrade.
Significance before mitigation	2
Significance after mitigation	1

13.9. Cumulative Impacts

What is a "Cumulative Impact"?
According to GN No. R. 385 (2006), ***"cumulative impact"***, 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.

Cumulative impacts can be identified by combining the potential environmental implications of the project with the impacts of projects that have occurred in the past, are currently occurring, or are proposed in the future within the site and surrounding area.

The following cumulative impacts can be anticipated:

- Increase in the amount of waste sent to the landfill;
- Damage to wetland habitats and water resources;
- Loss of open space;
- Encroachment of alien vegetation;

Cumulative Impacts	
Nature of Impact (potential)	Increase in waste sent to landfill site
Direct, Indirect or cumulative	Cumulative
Level & duration of impact	Long term
Can impact be prevented/ reversed or managed?	Yes the impact can be prevented / mitigated
Possibility of impact before Mitigation	Likely
Possibility of impact after	Unlikely

mitigation	
Possible Mitigation measure	• Recycling must be undertaken where possible to reduce the amount of waste sent to the landfill site. • Waste must be sent to registered landfills and safe disposal certificates must be retained on site. • All conditions of the EMPr must be adhered to.
Significance before mitigation	2
Significance after mitigation	1
Nature of Impact (potential)	Improvement to wetland functionality
Direct, Indirect or cumulative	Cumulative
Level & duration of impact	Long term
Can impact be prevented/ reversed or managed?	Yes the impact can be prevented / mitigated
Possibility of impact before Mitigation	N/A
Possibility of impact after mitigation	N/A
Possible Mitigation measure	Wetland functionality has been impaired by constricting the surface water flow through single culverts. This has enhanced unnatural channel formation downstream of the culvert outfall points. It is recommended that the flow of surface waters be spread through more culverts that span along the width of the wetland areas to included potential flood zones so as to reduce the scouring effects of fast-flowing water. This can be implemented if new crossing points are to be established. The proposed development will therefore have a positive impact on the wetland and functionality
Significance before mitigation	3
Significance after mitigation	3
Nature of Impact (potential)	Loss of open space resulting in further degradation of vegetation in the area
Direct, Indirect or cumulative	Cumulative
Level & duration of impact	Long term
Can impact be prevented/ reversed or managed?	Yes the impact can be prevented / mitigated
Possibility of impact before Mitigation	Likely
Possibility of impact after mitigation	Unlikely
Possible Mitigation measure	This is anticipated to be minimal as the road is an existing road and as such the potential areas affected during the construction phase must be rehabilitated to prevent any degradation of surrounding open spaces. All conditions of the EMPr must be adhered to.
Significance before mitigation	2

Significance after mitigation	1
Nature of Impact (potential)	Encroachment of alien vegetation
Direct, Indirect or cumulative	Cumulative
Level & duration of impact	Long term
Can impact be prevented/ reversed or managed?	Yes the impact can be prevented / mitigated
Possibility of impact before Mitigation	Likely
Possibility of impact after mitigation	Unlikely
Possible Mitigation measure	Rehabilitation measures must be implemented once construction activities are complete to ensure that. Alien vegetation must be controlled during the construction and operational phases. All conditions of the EMPr must be adhered to.
Significance before mitigation	2
Significance after mitigation	1

14. CONCLUSION AND RECOMMENDATIONS

14.1. Environmental Impact Statement

Based on the recommendations of the specialists and the impact assessment associated with the various site alternatives, the following alternative is considered to be the Best Practicable Environmental Option (BPEO):

- **Alternative 1** – This option is considered to be the preferred alternative from a wetland perspective, the wetland already suffers from the impacts of the existing road crossing and by establishing new crossing points as close as possible to the existing crossings will reduce the overall footprint area, which will ultimately reduce the cumulative impacts on the wetland habitat units.

With the selection of the BPEO for the proposed upgrade and re-alignment of the Siyathuthuka Road; the adoption of the mitigation measures included in the EIA Report and the dedicated implementation of the EMP, it is believed that the significant environmental aspects and impact associated with this project can be suitably mitigated. With the aforementioned in mind, it can be concluded that there are no fatal flaws associated with the project and that authorisation can be issued, based on the findings of the specialists and the impact assessment, through the compliance with the identified environmental management provisions.

14.2. Key Recommendations / Opinion of the EAP

Based on the findings of the impact assessment and the specialist studies, **alternative 1** is supported as the preferred option.

All recommendations made by the specialists must be adhered to.

14.3. Conditions for Authorisation

- Diligent compliance monitoring of the EMPr, environmental authorisation and other relevant environmental legislation by an Independent Environmental Control Officer (ECO) is crucial to ensure compliance with the stipulated management measures of the BAR.
- All relevant recommendations made by the specialists relating to the preferred site alternative must be adhered to in terms of fauna, flora, heritage, and wetland issues.
- Areas affected by construction activities need to be suitably stabilised due to the close proximity of the watercourses within the project area. A stormwater control plan must be implemented manage stormwater and prevent erosion.
- Protected flora species are to be relocated prior to vegetation clearance, should avoidance not be possible. Permits need to be obtained under National Forests Act (Act No. 84 of 1998) if protected trees are to be cut, disturbed, damaged, destroyed or removed.
- The construction camp area needs to be identified prior to commencement of construction activities. The camp must be adequately fenced and secure at all times.

- All relevant permits must be obtained prior to the commencement of construction activities or as deemed necessary.

15. REFERENCES

- Phampe R, 2012. **Flora and Fauna Assessment**. Nemai Consulting cc
- Ross M, 2012. **Wetland Delineation, Ecological and Aquatic Impact Survey.** Enviross cc
- Mngomezulu K, 2012. **Heritage Impact Assessment**. Nemai Consulting cc

Appendix 1: Maps

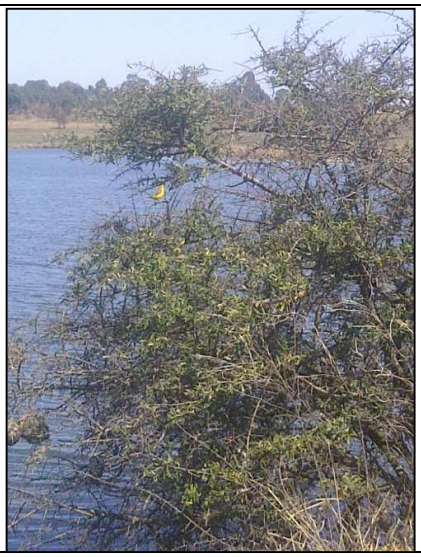
Topographical and Google Earth Maps

Site Layout – Alternative 1

Site Layout – Alternative 2

Appendix 2: Site Photographs

Please note that all images were taken from the western side of the Siyathuthuka Road

	
Photographer facing West of the Siyathuthuka Road	Photographer facing North of the Siyathuthuka Road
	
Photographer facing South, at the beginning of the proposed upgrade	Photographer facing East of the Siyathuthuka Road

	
Photographer facing North West	Photographer facing North East
	
Photographer facing South West	Photographer facing South East

Pictures of Culvert 1

Pictures of Culvert 2

Appendix 3: Facility Illustration

Culvert 1

Culvert 2

Appendix 4: CVs of EAPs

Appendix 5: Specialist Reports

Wetland Impact Assessment Report

Fauna and Flora Report

Heritage Impact Assessment Report

Appendix 6: Environmental Management Programme

Appendix 7: Public Participation

Background Information Document (BID)

List of Registered I & APs

Notification of I & APs

Site Notice and Placement of Site Notices

Advert Placement

Public Meeting Presentation and Register

Meeting Minutes

Comments and Response Table

Comment	Received By	Response
The MTPA has no objection to the proposal, and thank you very much for a comprehensive and credible BAR. Based on the report, it is acknowledged that alternative 1 with the associated impacts such as depicted in figure 1, on page 3 is the best option. MTPA recommends that alternative 1 be implemented; this alternative is the best practical environmental option and is therefore regarded as the preferred option. The head skull as depicted in figure 18, has it been identified. It could be a bulldog skull.	MTPA – 23 November 2012	Noted. It is noted that the MTPA recommends alternative 1. The skull has not been identified any further.
The Sub Directorate E & R acknowledges receipt of the documents on 13 November 2012. Should the activity be identified as a section 21 (c) water use or section (i) water use, the applicant must apply for the relevant water use license. The review and comments / recommendations off environmental reports is a regional office competency. In line with DWA water use authorisation business processes, and in order to avoid	DWA - 22 November 2012	Just to clarify the proposed activity is not for the proposed solar park and solar power plant as indicated in the comments but for the re-alignment and upgrade of the Siyathuthuka Road. Noted. A hard copy of the Draft BAR was submitted to the Mpumalanga Regional office to Mr F Guma. To date we have not received any comments from the regional department.

unnecessary setbacks in the environmental authorisation processes, please ensure that all environmental reports for review are submitted to the regional office (Mpumalanga Regional Office – Mr F Guma), the regional office will consult E & R should specialist information / input be required. Please note that a comprehensive, hard copy set of documents must be sent to the Regional office.		Should a water use license be required, the application will be submitted to the regional department.

Proposed upgrade of the existing Siyathuthuka Road

FLORA AND FAUNA ASSESSMENT

September 2012

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EXECUTIVE SUMMARY

Flora and Fauna surveys were carried out in September 2012 to determine the impacts of the proposed upgrade of the existing Siyathuthuka Road on the receiving environment. The Mpumalanga Department of Culture, Sports and Recreation (DCSR) proposes to develop a world class High Altitude Training Centre to unearth talent, develop champions and to provide top level support for elite athletes and this development will require the upgrade of the existing road networks.

The study area falls within the grassland biome and has been categorised as Lydenburg Montane Grassland and Eastern Highland Grassland vegetation units. Dullstroom Plateau Grasslands (Endangered) and Eastern Highland Grassland (Vulnerable) are listed as the two threatened terrestrial ecosystems occurring on site. During the field assessment, no red data plant species were observed on sites. Exotic plant species such as *Eucalyptus cinerea* and *Pinus patula* were common at the site. Invader and weed species must be controlled to prevent further infestation and it is recommended that all individuals of the invader species be eradicated. The Mpumalanga Biodiversity Conservation Plan (MBCP) Terrestrial Biodiversity Assessment described the sites as classified "**least concern**" and "**no natural habitat remaining**".

Mammals are sensitive to disturbances and habitat destruction and degradation and are reliant on pristine and stable habitats, few, if any, threatened small mammals are expected to occur in the study area. Two mammals were visually observed on site even though signs such as holes and a skull, which indicated more animals found on site, were also observed. The field assessment showed that the proposed road upgrade will traverse the wetlands and this will have an impact on the loss of ecological sensitive and important habitat units, ecosystem function, and loss of faunal habitat. Considering that the disturbance of the project is temporary in nature, the proposed development will have no lasting effect on mammals typical of the site.

The avifauna study indicated that the wetlands, a nearby dam and grasslands will provide natural habitats for bird species that are known to occur on site. However, this section is heavily grazed and infested by alien vegetation. The globally threatened Whitewinged Flufftail is restricted in the region to a few high-altitude sponges in South Africa in the QDS of 2530CA where the proposed road upgrade is located. In addition, the region is known to

support the Endangered Wattled Crane and the African Grass-owl population. Various other RDL avifaunal species have also been recorded from the region. Throughout the study area, suitable habitat for various Red Data Listed avifaunal species was observed, so mitigation measures to reduce the impact on the associated habitat units pertaining to these species have been proposed. The project will only have a negative impact during the construction phase whereafter the birds will return to the area if rehabilitation is carried out properly.

According to South African Reptile Conservation Assessment, four species, namely Brown House Snake, Black-headed Centipede-eater, Rhombic Night Adder and Southern Rock Agama are known to occur in the region. No reptile species were observed during the survey. The high levels of human presence and disturbances have a detrimental impact on the remaining reptile species in the area.

The dam near the study site provided excellent breeding habitat for Giant Bullfrogs. It is quite likely that giant bullfrogs will migrate to the study site for feeding and aestivation. No frogs were recorded in the study area.

Of the two options investigated, the alternative route will traverse two wetlands whilst the preferred option which realigns the road to a lesser extent will only cross one wetland and for this reason, the preferred option is chosen as it will have less impact on the wetland. The Dullstroom Plateau Grasslands will be highly impacted should the alternative option be considered.

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QUALITY VERIFICATION

Verification	Name	Qualification	Professional registration
Author	Mr. Ronald Phamphe	M.Sc. (Botany)	**Professional Member** of South African Institute of Ecologists and Environmental Scientists **Candidate Natural Scientist**: South African Council for Natural Scientific Professions **Professional Member**: South African Association of Botanists.

1. INTRODUCTION

The Mpumalanga Department of Culture, Sports and Recreation (DCSR) proposes to develop a world class High Altitude Training Centre to unearth talent, develop champions and to provide top level support for elite athletes and this will involve the upgrade of the existing road networks. The upgrade will involve the widening and re-alignment of a portion of the road and the upgrade of two existing culverts. The upgrade will start at the point of the road marked as main entrance and will end at the traffic circle before entering the township.

The preferred alternative is to realign the portion for the road as indicated on the drawing. The re-aligned portion of the road will consist of two lanes, one in each direction as well as a paved shoulder. Each lane will be 3.5m wide and a paved shoulder / pavement of 1.5m on either side of the road. The remaining portions of the road will be resurfaced with asphalt.

The existing culvert structure at culvert 1 will be removed and replaced with a bigger culvert. The upgraded culvert will consist of 7 barrels, each of which is 2.275m high and 3.135m wide. The overall size of the culvert will be 24.5m wide, the overall length of the inside of the culvert will be 90m and the overall length of the outside of the culvert will be 116m. The culvert will be made up of barrels, pre-cast concrete culvert portions, re-enforced concrete culvert portions, gabion walls and gabion mattresses.

Culvert 2 will be upgraded to a total width of 37.8m and length of 21.75m. The culvert structure will consist of 7 barrels, each of which will be 3.5m high and 5m wide.

Nemai Consulting has been appointed by Masetlaoka Scott Wilson (MSW) Consulting Engineers on behalf of the Mpumalanga Department of Culture, Sports and Recreation to undertake the requisite Environmental Authorisation Process for the proposed upgrade of the existing Siyathuthuka road in Belfast, Mpumalanga. Flora and Fauna surveys were carried out to determine the impacts of the proposed transmission line on the receiving environment. The objective of the Flora and Fauna assessment was to identify sensitive species and their habitats in three proposed alternative routes. The current ecological status and conservation priority of vegetation on the sites were assessed. Potential faunal habitats were assessed in the study area and all mammals, birds, reptiles and amphibians found occurring on sites were recorded. Red Data species that are known to occur on sites were also investigated.

According to Mpumalanga Biodiversity Conservation Plan (MBCP) Terrestrial Biodiversity Assessment, the site is classified as “least concern” and “no natural habitat remaining” (Lötter, 2007).

Objectives of the survey

- To apply relevant literature to determine the diversity and eco-status of the plants, mammals, birds, reptiles and amphibians at the two proposed sites;
- To carry out field surveys to gain an indication of the diversity and eco-status of the above-mentioned taxa which inhabit the proposed study area, as well as the presence of unique habitats that might need further investigation or protection;
- To assess the current habitat and conservation status of plant and animal species in the study sites;
- To comment on ecological sensitive species/areas;
- To assess the possible impacts of the proposed project on these taxa and/or habitats;
- To list the species on site and to recommend necessary mitigation measures in case of occurrence of endangered, vulnerable or rare species or any species of conservation importance; and
- To provide management recommendations to mitigate negative and enhance positive impacts of the proposed sites.

2. RELEVANT LEGISLATION AND GUIDELINES

The following pieces of legislation are relevant to this project.

- The Constitution, 1996 (Act No 108 of 1996) – Section 24;
- Nature Conservation Ordinance, Ordinance 19 of 1974;
- Conservation of Agricultural Resources Act 1983 (Act No 43 of 1983);
- National Water Act (Act 36 of 1998);
- National Environmental Management Act 1998 (Act No 107 of 1998);
- Environment and Conservation Act 1989 (Act No 73 of 1989);
- Gauteng Conservation Plan version 2;
- GDARD Minimum Requirements for Biodiversity Assessments (2009);
- Mpumalanga Biodiversity Conservation Plan (MBCP) Terrestrial Biodiversity Assessment (2007);
- The white paper on the Conservation and Sustainable Use of South Africa’s Biological Diversity (1997); and
- National Environmental Management Biodiversity Act 2004 (Act No 10 of 2004).

3. STUDY AREA

The two proposed road upgrades are situated within the 2530CA quarter degree grid cell (q.d.g.c) within the Mpumalanga Province. The location of the proposed road upgrades falls within the Nkangala District Municipality and the Emakhazeni Local Municipality. The geographical area of Nkangala District is 16,760 km2 while the geographical area of the Emakhazeni Local Municipality is 4,737 km2. The site is on south western region of the Emakhazeni Local Municipality and lies approximately 5km from the N4 Highway between Johannesburg/Pretoria and Nelspruit (**Figure 1** and **Figure 2**).

Figure 1. Locality Map

Figure 2. Aerial view of the study area

The 2010 Environmental Impact Assessment (EIA) regulations require that feasible project specific alternatives are identified (including the "do nothing" option). The two site alternatives are described below:

The upgrade will involve the widening and re-alignment of a portion of the road and the upgrade of two existing culverts. The upgrade will start at the point of the road marked as main entrance and will end at the traffic circle before entering the township.

The preferred alternative is to realign the portion for the road as indicated on the drawing. The re-aligned portion of the road will consist of two lanes, one in each direction as well as a paved shoulder. Each lane will be 3.5m wide and a paved shoulder / pavement of 1.5m on either side of the road. The remaining portions of the road will be resurfaced with asphalt.

The existing culvert structure at culvert 1 will be removed and replaced with a bigger culvert. The upgraded culvert will consist of 7 barrels, each of which is 2.275m high and 3.135m wide. The overall size of the culvert will be 24.5m wide, the overall length of the inside of the culvert will be 90m and the overall length of the outside of the culvert will be 116m. The culvert will be made up of barrels, pre-cast concrete culvert portions, re-enforced concrete culvert portions, gabion walls and gabion mattresses.

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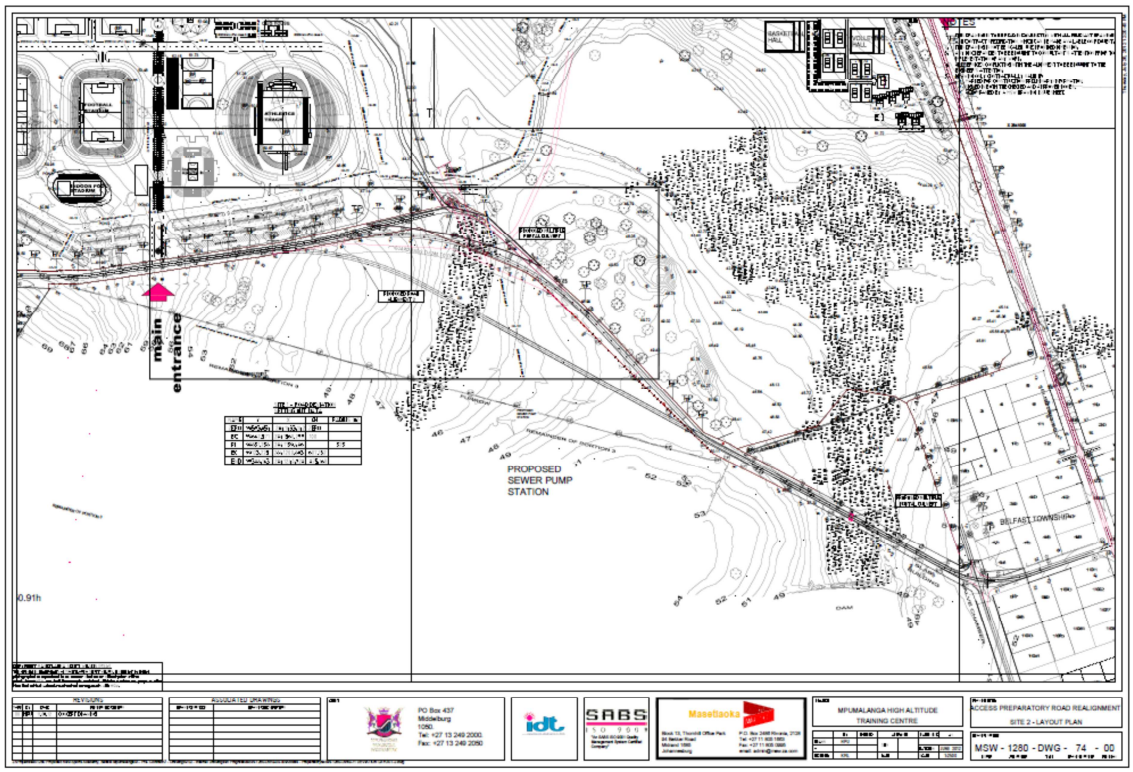


Figure 3: Alternative Layout 1: Preferred Option and Alternative Layout 2

The area pertaining to the survey area is rich in wetland and riverine habitats (**Figure 4**). Wetlands (**Figure 5**) are sensitive ecological systems which are important for the maintenance of biodiversity and for the ecosystem services they provide to society. Besides a source of water, wetlands reduce the severity of droughts and floods by regulation stream flow as they purify water by trapping pollutants and control soil erosion. Wetlands also provide essential habitats for a wide range of biodiversity, which are threatened with extinction. According to the National Water Act (Act 36 of 1998) a wetland is defined by the following criteria: 1) it has mostly hydric soils; 2) it must generally be inundated or saturated above or below the surface; and 3) support vegetation adapted to wet soil conditions. Wetlands serve as breeding grounds for migrating birds and resident amphibians, permanent homes for fish species, social interaction amongst mammals who congregate there for water, and an escape from the heat of the sun for countless reptiles, amphibians and mammals (Pfab, 2009).

Figure 4. Wetlands in the study area

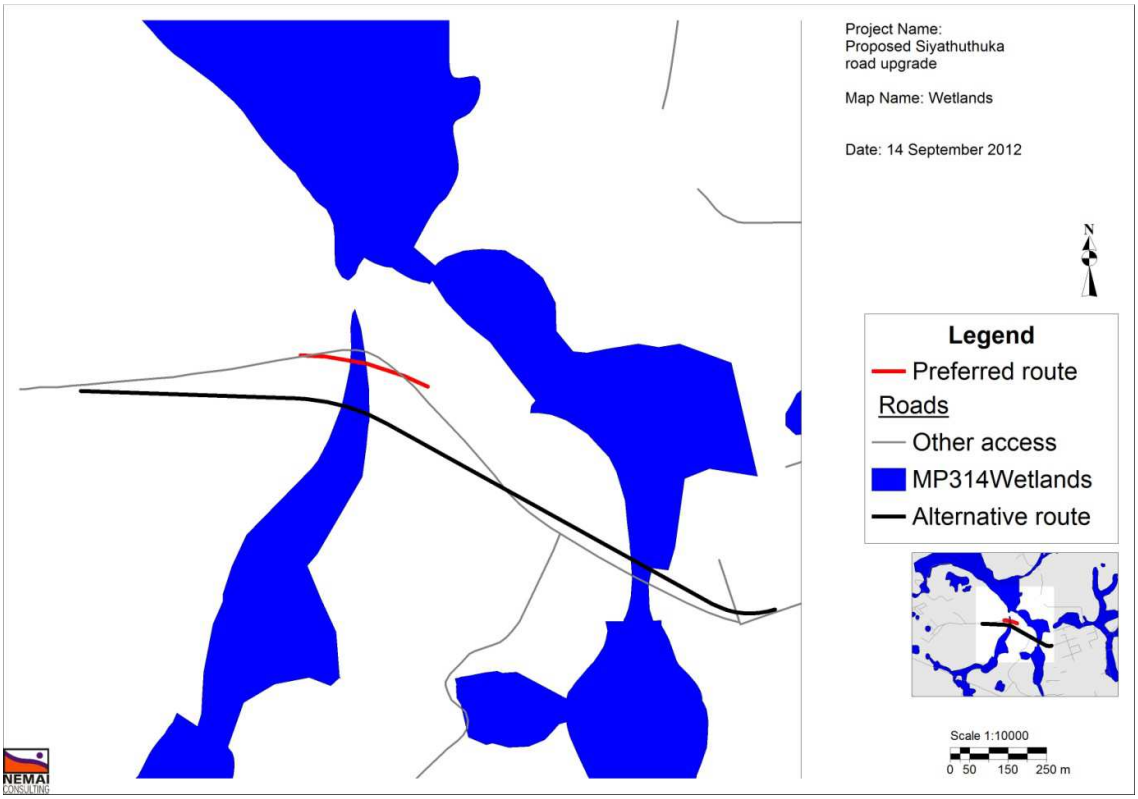


Figure 5. A map of SANBI Wetlands in relation to the study area

Mpumalanga Province has developed a Biodiversity Conservation Plan, which was jointly created by Mpumalanga Tourism and Parks Agency (MTPA) and the Mpumalanga Department of Agriculture and Land Administration (MDALA). This plan identifies all remaining natural areas in Mpumalanga that have not been transformed by development. It also prioritises these areas, based on their biodiversity importance and sensitivity to degradation (Lötter, 2007). Mpumalanga province is classified into six main areas according to their sensitivity, namely

- Highly Significant;
- Important & Necessary;
- Irreplaceable;
- Least Concern;
- No Natural habitat Remaining; and
- Protected areas (Lötter, 2007).

As previously mentioned, the study area is classified as "**least concern**" and "**no natural habitat remaining**" (**Figure 6**). Environmental aspects that will potentially be affected include perennial and non-perennial rivers. While the majority of the study areas are highly degraded, the only sensitive areas for this development are the southern end and parts of the northern areas.

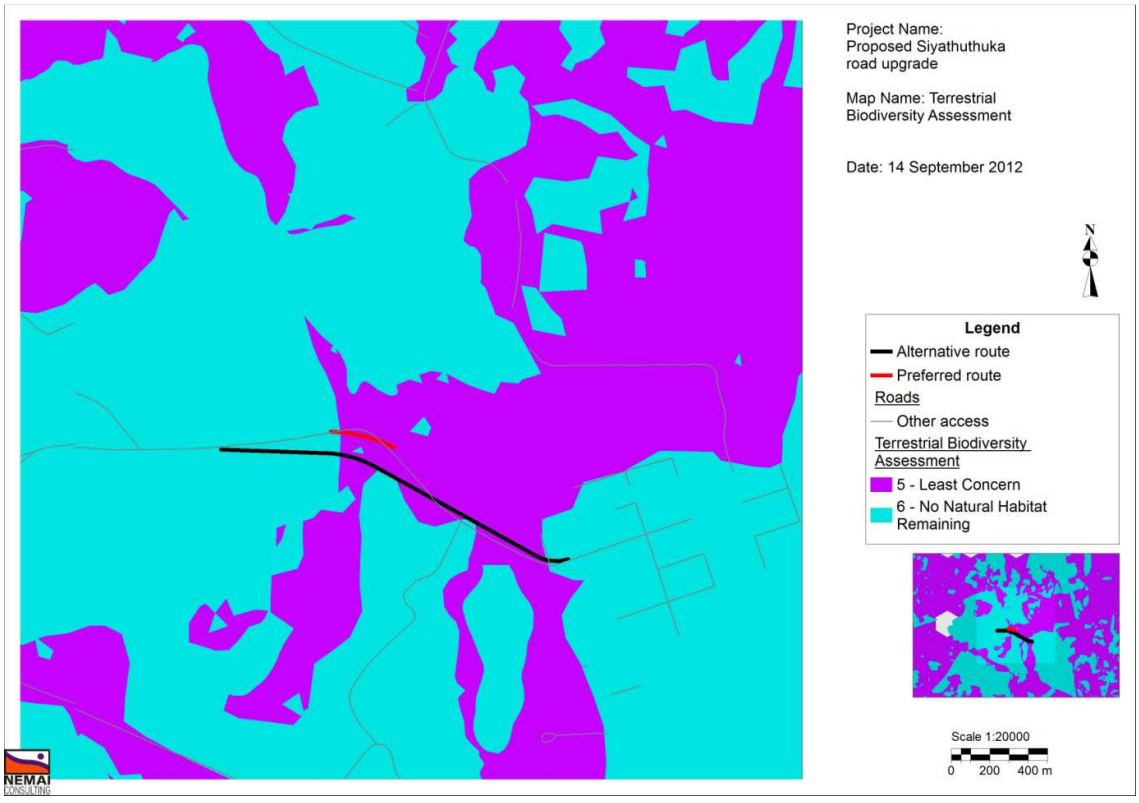


Figure 6. MBCP Terrestrial Biodiversity Assessment

4. LIMITATIONS AND GAPS

The constraints or limitations to the survey included:

- The assessment was carried out during dry season. Although conditions for plant identification were generally favourable, some dormant species might be difficult to observe and therefore were not recorded. The majority of threatened plant species are extremely seasonal and only flower during specific periods of the year,
- The majority of threatened faunal species are extremely secretive and difficult to survey even during thorough field surveys conducted over several seasons;
- Even though every care is taken to ensure the accuracy of this report, environmental assessment studies are limited in time.
- Since environmental impact studies deal with dynamic natural systems additional information may come to light at a later stage and Nemai Consulting can thus not accept responsibility for conclusions and mitigation measures made in good faith based information gathered or databases consulted at the time of the investigation.

5. VELD TYPE DESCRIPTION

The study area falls within the grassland biome (Rutherford & Westfall, 1994) and indicated in **Figure 7** below. Mucina & Rutherford (2006) classified the study area as comprised of the following vegetation type units Lydenburg Montane Grassland and Eastern Highland Grassland as indicated in **Figure 8.**

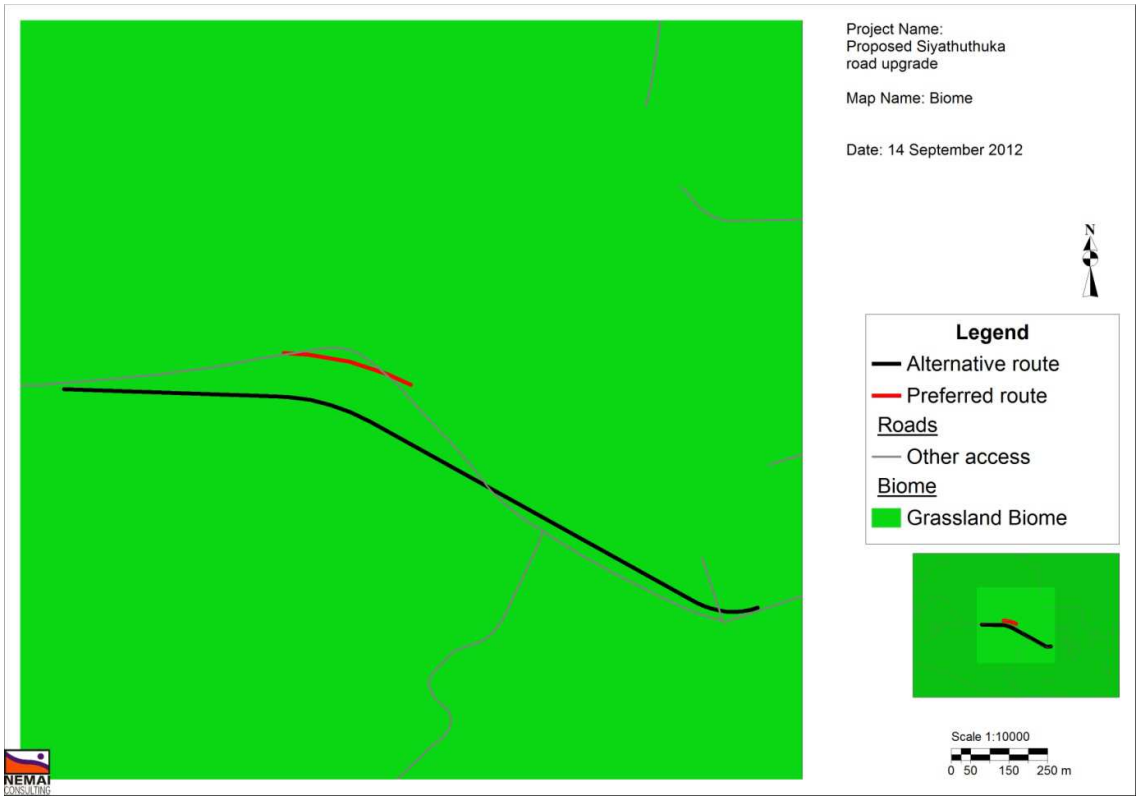


Figure 7. Biome in the study area

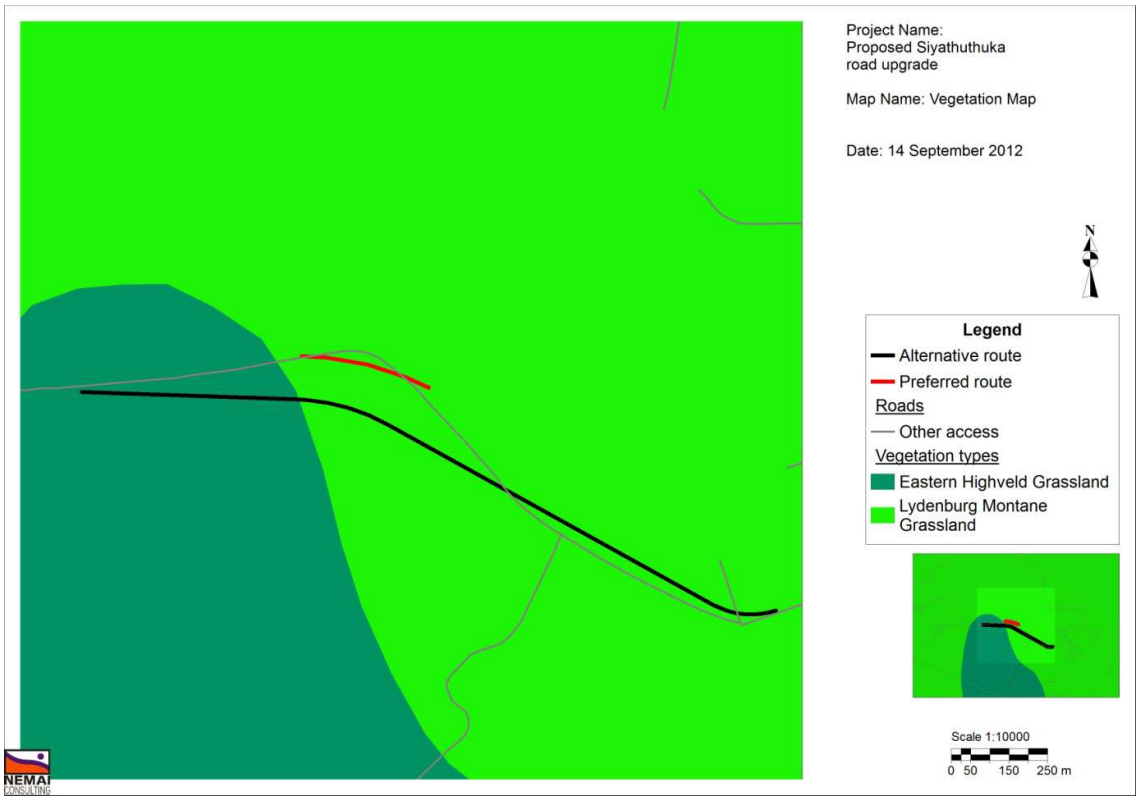


Figure 8. Vegetation units found in the study area

Landscape character and conservation status associated with each of the vegetation types are tabled below (**Table 1**):

Table 1. Conservation status of the vegetation units recorded in the study area

Vegetation unit	Ecosystem Status	Transformed	Protected	Target
Eastern Highland Grassland	Endangered	44%	Very small fraction	24%
Lydenburg Montane Grassland	Vulnerable	23%	2.4%	27%

The description of each vegetation type follows below:

5.1 Lydenburg Montane Grassland

This vegetation unit occurs in Mpumalanga Province from just above Pilgrim's Rest in the north, southwards and westwards skirting Lydenburg and extending to Dullstroom, Belfast and Waterval Boen in the south. It occurs in high altitude plateus, undulating plains, mountain peaks and slopes, hills and deep valleys if the northern Escarpment region which supports predominately very low grasslands on high-lying areas. It is situated on an altitude ranging from 1 260–2 160 m (Mucina & Rutherford, 2006).

Grassland contains small trees such as *Protea roupelliae* subsp*. roupelliae,* and *Faurea galpinii,* low shrubs such as *Phymaspermum acerosum* (Mucina and Rutherford, 2006). Biogeographically important species include Northern Sourveld endemics such as *Graderia linearifolia, Helichrysum truncatum,* and *Hemizygia foliosa.* This vegetation type includes endemic taxa such as *Erica atherstonei, E. Holtii, Helichrysum lesliei, Crotalaria monophylla, Disa alticola, Watsonia occulta* and *Crassula setulosa* var*. deminuta* (to name a few) (Mucina and Rutherford, 2006).

Conservation status

Currently this vegetation type is considered Vulnerable. Only 2.4% is formally protected within reserves (Gustav Klinmgbiel, Makobulaan, Mt Anderson, Ohrigstad Dam, Sterkspruit and Verlorenvlei) and as well as in a number of private conservation areas (Buffelskloof, Crane Creek, ETTC, In-de-Diepte, Kaalboom, Kalmoesfontein, Mbesan, Mondi Indigenous Forest, Mt Sheba, and Waterval etc). More than 23% has been transformed by cultivated lands and mostly alien plantations. Erosion potential is very low (74%) and low (12%) across the entire unit (Mucina & Rutherford, 2006).

5.2 Eastern Highland Grassland

This vegetation unit occurs in the Mpumalanga and Gauteng Provinces. It occurs in plains between Belfast in the east and the eastern side of Johannesburg in the west and also extending southwards to Bethal, Ermelo and west of Piet Retief. The altitude of its distribution area ranges from 1 520–1 780 m. It occurs on slightly to moderately undulating plains, which includes some low hills and pan depressions (Mucina & Rutherford, 2006).

The vegetation comprises of short dense grassland dominated by usual Highveld grasses including *Aristida* spp. *Digitaria* spp., *Eragrastis* spp., *Themeda* spp. etc. with small scattered rocky outcrops with wiry sour grasses and some woody species. Important taxa include a number of graminoid species as well as herbs such as *Berkheya setifera* and *Pelargonium luridum;* geophytic herbs such as *Gladiolus crassifolius, Haemanthus humilis* subsp*. hirsutus*, *Ledebouria ovatifolia* and succulent herbs such as *Aloe ecklonis*. Approximately 44% is transformed due to cultivation, plantations, mining, urbanisation and by building of dams (Mucina and Rutherford, 2006).

Conservation status

Currently this vegetation type is considered Endangered. A very small fraction is statutorily conserved in the Nooitgedacht Dam and Jericho Dam Nature Reserves. Some 44% has been transformed by cultivation, plantations, mining, urbanisation and by building of dams (Mucina & Rutherford, 2006).

6. THREATENED TERRESTRIAL ECOSYSTEMS

The first national list of threatened terrestrial ecosystems for South Africa was gazetted on 9 December 2011 (National Environmental Management: Biodiversity Act: National list of ecosystems that are threatened and in need of protection, (G 34809, GN 1002), 9 December 2011). It listed all the threatened or protected ecosystems in South Africa in terms of four categories; critically endangered (CR), endangered (EN), vulnerable (VU), or protected. The purpose of listing these ecosystems is primarily to reduce the rate of ecosystem and species extinction, as well as preventing further degradation and loss of structure, function, and composition of these ecosystems. It is estimated that threatened ecosystems make up 9.5% of the ecosystems in the country, with critically endangered and endangered ecosystems accounting for 2.7%, and vulnerable ecosystems 6.8% (SANBI, 2011).

The South African National Biodiversity Institute (SANBI) in conjunction with the Department of Environmental Affairs and Tourism (DEAT) released a draft report in 2009 entitled

"Threatened Ecosystems in South Africa: Descriptions and Maps", to provide background information on the above List of Threatened Ecosystems. The purpose of this report was to present a detailed description of each of South Africa's ecosystems and to determine their status using a credible and practical set of criteria. The following criteria were used in determining the status of threatened ecosystems:

- Irreversible loss of natural habitat.
- Ecosystem degradation and loss of integrity.
- Limited extent and imminent threat.
- Threatened plant species associations.
- Threatened animal species associations.
- Priority areas for meeting explicit biodiversity targets as defined in a systematic biodiversity plan.

Dullstroom Plateau Grasslands (Endangered) and Eastern Highland Grassland (Vulnerable) are listed as the two threatened terrestrial ecosystems occurring on site (**Figure 9**).

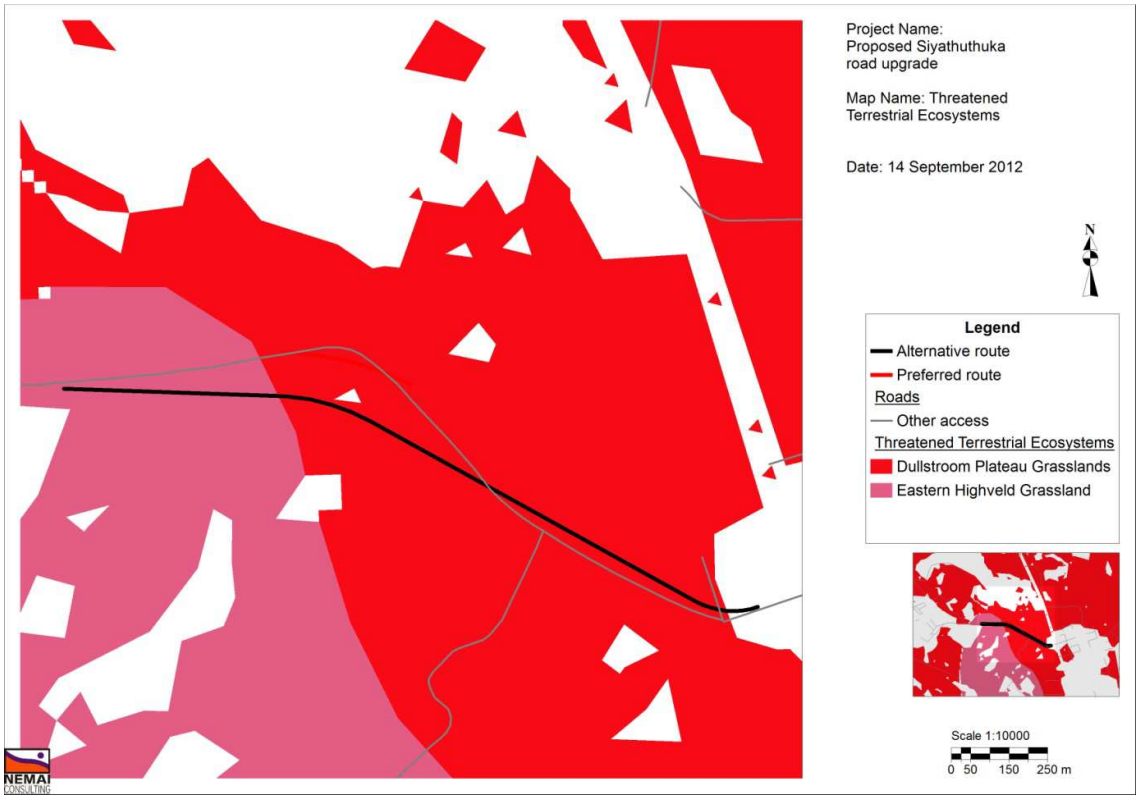


Figure 9. Threatened Terrestrial Ecosystems in the proposed Siyathuthuka road upgrade

The description of the three Threatened Terrestrial Ecosystems follows below:

6.1 Dullstroom Plateau Grasslands (MP4)

Grassland plateau occurs between Die Berg in the north and Belfast in the south (2530AA, 2530AC, 2530AD, and 2530CA). This ecosystem is delineated by breeding and feeding habitat for Cranes and Rudd's Lark. The Key biodiversity features include five mammal species such as Robust Golden Mole, Rough-haired Golden Mole, Cape Molerat, Oribi and Welwitch'siry Bat. Eight bird species including Blue Crane, Wattle Crane, Grey Crowned Crane, Blue Korhaan, Southern Bald Ibis, White-winged Flufftail, Yellowbreasted Pipit and Rudd's Lark occur on this ecosystem. Only one amphibian, *Bufo gariepensis nubicolus* was recorded in Dullstroom plateau grasslands. Twenty plant species including *Eucomis vandermerwei, Gladiolus cataractarum, Gladiolus malvinus, Nerine gracilis, Streptocarpus denticulatus and Watsonia occulta* were recorded on this ecosystem (Mpumalanga Tourism and Parks Agency & Department of Agriculture and Land Administration, 2007).

Conservation status

Dullstroom Plateau Grasslands has an ecosystem threat status of Endangered (EN) and approximately 5% of the ecosystem is protected in the Verloren Vlei Nature Reserve (Mpumalanga Tourism and Parks Agency & Department of Agriculture and Land Administration, 2007).

6.2 Eastern Highveld Grassland (Gm12)

Eastern Highland Grassland occurs in plains between Belfast in the east and the eastern side of Johannesburg in the west and extending southwards to Bethal, Ermelo and west of Piet Retief. It is recorded in slightly to moderately undulating plains, including some low hills and pan depressions. The vegetation is short dense grassland dominated by the usual highveld grass composition such as *Aristida, Digitaria, Eragrostis, Themeda* and *Tristachya*, with small, scattered rocky outcrops of wiry, sour grasses and some woody species, for example *Acacia caffra, Celtis africana, Diospyros lycioides* subsp *lycioides, Parinari capensis, Protea caffra, P. welwitschii* and *Rhus magalismontanum* (Mucina & Rutherford, 2006).

Conservation status

Eastern Highland Grassland has an ecosystem threat status of Vulnerable (Vu). Only a very small fraction of the ecosystem is protected in Nooitgedacht Dam Nature Reserve and

Jericho Dam Nature Reserves. The ecosystem is also found in private reserves such as Holkranse, Kransbank and Morgenstond (Mucina & Rutherford, 2006).

7. METHODOLOGY

The White Paper on the Conservation and Sustainable Use of South Africa's Biological Diversity (1997) and the National Environmental Management Act (No. 107 of 1998) specify that due care must be taken to conserve and avoid negative impacts on biodiversity, as well as the sustainable, equitable and efficient use of biological resources.

7.1 Flora

Flora assessment consisted of two complementary approaches:

- A desktop analysis of literature review, photographs, topographical maps, and Google Earth imagery; and
- Site visit was conducted in September 2012.

Satellite imagery of the area was obtained from Google Earth and was studied in order to get a three dimensional impression of the topography and land use and also to identify potential "hot-spots" or specialised habitats e.g. patches of undisturbed vegetation and wetlands. Information about the Red Data species that occur in the area was obtained from MPTA.

The Pretoria Computerised Information System (PRECIS) list of Red Data plants recorded in the 2530CA quarter degree grid square was obtained from South African National Biodiversity Institute (SANBI) (http://posa.sanbi.org/searchspp.php accessed on 14 September 2012). The list was consulted to verify the record of occurrence of the plant species seen in the vicinity of the proposed study area. The sites sampled are also only a very small portion of the whole grid and so habitats suitable for certain species in the PRECIS lists may not be present at the areas sampled. The vegetation map published in Mucina & Rutherford (2006) was consulted to identify vegetation units that are found in the study area. The desktop component of the study of the habitats of the red-data-listed and other species of conservation importance known to occur in the area was conducted before the site visit.

The habitats of the study areas were inspected in a random zigzag fashion, paying particular attention to areas that at first sight appeared to be sensitive. All general observations were noted such as trees, shrubs, grasses and herbs (forbs). The habitats suitable for Red Data listed species known to occur in the quarter degree grid squares were examined intensively for the presence of such species. Attention was also paid to the occurrence of alien species

and declared weeds. Field guides such as Pooley (1998), Pooley (2005), van Wyk *et al.,* (1997) and van Oudshoorn (1999) were utilised during the field work.

According to van Oudtshoorn, (1999), a grass species reacts to grazing in one of two ways: it can either become more or less abundant. **Table 2** describes the classification of grasses.

Table 2. Classification of grasses (van Oudtshoorn, 1999).

Class	Description	Examples
Decreasers	Grasses that are abundant in good veld, but that decrease in number when the veld is overgrazed or undergrazed.	*Themeda trianda, Digitaria eriantha*
Increaser 1	Grasses that are abundant in underutilised veld. These grasses are usually unpalatable, robust climax species that grow without any defoliation	*Hyperthelia dissoluta, Trachypogon spicatus*
Increaser 2	Grasses that are abundant in overgrazed veld. These grasses increase due to the disturbing effect of overgrazing and include mostly pioneer and subclimax species	*Aristida adscensionis, Eragrostis rigidor*
Increaser 3	Grasses that are commonly found in overgrazed veld. These are usually unpalatable, dense climax grasses	*Sporobolus africanus, Elionurus muticus*
Invaders	All plants that are not indigenous to an area. These plants are mostly pioneer plants and are difficult to eradicate	*Arundo donax*

Exotic and invasive plant species were categorised according to the framework laid out by The Conservation of Agricultural Resources Act (CARA) (Act 43 of 1983). CARA defines weeds as alien plants, with no known useful economic purpose that should be eradicated. Invader plants, also considered by the Act, can also be of alien origin but may have serve useful purposes as ornamentals, as sources of timber, or may have other benefits such as medicinal uses (Henderson, 2001). These plants need to be managed and prevented from spreading.

Alien and invasive plant species can be grouped three categories:

- Category 1 plants are weeds that serve no useful economic purpose and possess characteristics that are harmful to humans, animals or the environment. These plants need to be eradicated using the control methods stipulated in Regulation 15.D of the CARA.
- Category 2 plants are plants that are useful for commercial plant production purposes but are proven plant invaders under uncontrolled conditions outside demarcated areas.

- Category 3 plants are mainly used for ornamental purposes in demarcated areas but are proven plant invaders under uncontrolled conditions outside demarcated areas.

The planting of Category 2 and 3 plants should be confined to demarcated areas under controlled conditions of cultivation (Bromilow, 1995 & 2010).

7.2 Mammals

The majority of mammals are secretive, nocturnal, hibernators and/or seasonal. The distributional ranges and the presence of suitable habitats were used to deduce the presence or absence of these species based on field guides, scientific literature and databases. This can be done irrespective of season. The data sourced from MTPA was used to ascertain the Red Data mammals that are expected to occur in the 2530CA grid.

During the field visit assessment, the observed and derived presences of mammals associated with the recognized habitat types of the study site were recorded. This was done with due regard to the well recorded global distributions of Southern African mammals, coupled with the qualitative and quantitative nature of recognized habitats. The adjoining properties were also scanned for important fauna habitats.

During the site visits, mammals were identified by visual sightings through random transect walks. Terrestrial and arboreal rats, mice, squirrels, and opossums (non-volant small mammals) were sampled using LFAHD-P Sherman large folding aluminium heavy duty perforated traps (23x7.5x9cm/250grams) (**Figure 10**) that were set approximately 20 m apart and baited with oats and butter and were left overnight. Placement of traps were either on the ground near areas of potential foraging activity such as logs and base of trees, or on vines and low branches situated above the ground. In addition, mammals were also identified by means of spoor, droppings, or burrows. Locals were interviewed to confirm occurrences or absences of species.

Figure 10. Sherman traps used for small mammals such as rats and mice

The grassland on site offer suitable foraging habitat for numerous small mammals such as *Lepus saxatalis* (Scrub Hare), *Rhabdomys pumilio* (Four-striped Mouse) and *Mastomys coucha* (Southern Multimammate Mouse). During the visits, the study area was surveyed and assessed for the potential occurrence of Red Data species associated with the study area such Spotted-necked otter (*Lutra maculicollis*) and Southern African hedgehog (*Atelerix frontalis*).

7.3 Avifauna

The presence of suitable habitat was used to deduce the likelihood of presence or absence of species, based on scientific literature, field guides and databases.

The likely occurrence of key bird species was verified according to Southern African Bird Atlas Project 2 from the University of Cape Town's Animal Demographic Unit and also from the MTPA database for the grid 2530CA. However, the specific habitat(s) found on site may not suit the particular Red Data species, even though it has been recorded for the quarter degree. Red Data bird species were selected and categorised according to Barnes (2000).

Site visit was conducted to record the presence of bird species associated with the habitat systems on the study area and to identify possible sensitive areas. Birds were identified visually by call, roosting sites and feathers and by also using a 10X42 Bushnell Waterproof binocular and where necessary verified from *Sasol Birds of Southern Africa* (Sinclair *et al*.,

2005) and *The Chamberlain guide to birding Gauteng* (Marais & Peacock, 2008). The study area was surveyed on foot and in the process sightings were recorded through random transects walks. The adjoining properties were also scanned for important bird habitats. Wetland areas are considered suitable foraging areas for the African Grass-Owl.

7.4 Reptiles

The majority of reptiles are secretive, or seasonal, and as such distributional ranges and the presence of suitable habitats were used to deduce the presence or absence of these species based on scientific literature, field guides, atlases and databases.

A list of reptile species that could possibly occur within the study area was adopted from the South African Reptile Conservation Assessment (SARCA), within the Avian Demographic Unit (ADU) in University of Cape Town. The list includes the entire reptile species recorded in grid cell 2530CA. MTPA database was sourced to a certain the Red Data species that could be found in the area.

Reptile assessments were conducted during the day. During the field visit, the observed and derived presence of reptiles associated with the recognised habitat types of the study site were recorded. This was done with due regard to the known distributions of Southern African reptiles. Reptiles were identified by sightings during random transect walks. Possible burrows or other reptile retreats (stumps or rocks) were inspected for any inhabitants. Locals were interviewed to confirm occurrences or absences of species and the adjoining properties were also scanned for important reptiles' habitats.

7.5 Amphibians

Habitat degradation, due to alien plantation, was cited as the most pervasive threat facing amphibians and was listed for all species during the analysis for the frog atlas project (Minter, *et al*., 2004). During the visit, the observed and derived presence of amphibians associated with the recognised habitat types of the study site was recorded. This was done with due regard to the known distributions of Southern African amphibians.

The adjoining properties were scanned for important amphibian habitats. Amphibians were also identified by their vocalisations. A CD with frog calls by Du Preez & Carruthers (2009) was used to identify species by their calls when applicable. Sites were walked, covering as many habitats as possible.

8. RESULTS AND DISCUSSION

8.1 Flora

According to Rutherford & Westfall (1994), the study area falls within the grassland biome. Grasslands host a very high diversity of plant species, second only to the Cape Floral Kingdom (O' Connor & Bredenkamp, 1997).

8.1.1 Desktop results

The proposed road upgrade is located within the following quarter degree square in terms of the 1:50 000 grids of South Africa, namely 2530CA and the SANBI used this grid system as a point of reference to determine sensitive, Vulnerable, Orange and Red Data plant species which occurs in South Africa, or which could potentially occur within an area. **Table 3** and **Table 4** provide details of the Red Data plant species which have been recorded for this quarter degree square. The statuses allocated to the species are defined in **Table 5** below. It is, therefore, imperative, during the construction phase, that detailed searches for these rare/threatened and protected species are made during the appropriate time of year when plants are likely to be visible.

Table 3. Red Data Plant species recorded in grid 2530CA which could potentially occur in the study area (SANBI data).

Family	Species	Threat status	SA Endemic	Growth forms
Amaryllidaceae	*Crinum bulbispermum*	Declining	No	Geophyte
Apocynaceae	*Riocreuxia aberrans*	NT	Yes	Herb
Aquifoliaceae	*Ilex mitis var. mitis*	Declining	No	Shrub
Araceae	*Zantedeschia pentlandii*	VU	Yes	Geophyte
Asphodelaceae	*Aloe reitzii var. reitzii*	NT	Yes	Dwarf shrub
Asteraceae	*Callilepis leptophylla.*	Declining	No	Herb
Asteraceae	*Cymbopappus piliferus*	Threatened	Yes	Herb
Asteraceae	*Helichrysum homilochrysum*	Rare	Yes	Dwarf shrub
Fabaceae	*Pearsonia hirsuta.*	VU	Yes	Herb
Gesneriaceae	*Streptocarpus latens*	Rare	Yes	Herb
Gunneraceae	*Gunnera perpensa*	Declining	No	Herb
Hyacinthaceae	*Eucomis montana*	Declining	No	Geophyte
Iridaceae	*Gladiolus malvinus*	VU	Yes	Geophyte
Mesembryanthemaceae	*Khadia alticola*	Rare	Yes	Succulent
Mesembryanthemaceae	*Khadia carolinensis*	VU	Yes	Succulent
Proteaceae	*Protea parvula*	NT	No	Dwarf shrub
Rosaceae	*Prunus africana*	VU	No	Tree

Table 4. Definitions of Red Data status (Raimondo *et al.* 1999)

VU	Vulnerable	A taxon is **Vulnerable** when the best available evidence indicates that it meets any of the criteria any if the five IUCN criteria for Vulnerable and it is therefore considered to be facing a high risk of extinction in the wild.
NT	Near Threatened	A taxon is **Near Threatened** when available evidence indicates that it nearly meets any of the five IUCN criteria for Vulnerable, and is therefore likely to qualify for a threatened category in the near future.
	Rare	A taxon is **Rare** when it meets any of the four South African criteria for rarity, but is not exposed to any direct or plausible potential threat and doesn't not qualify for a category of threat according to five criteria.
	Declining	A taxon is **Declining** when it does not meet any of the five IUCN criteria and does not qualify for the categories Critically Endangered, Endangered, Vulnerable or Near Threatened, but there are threatening processes causing a continuing decline in the population.

Table 5. Red Data Plant species recorded in grid 2530CA which could potentially occur in the study area (MTPA data).

Farm Name	Scientific Name	Conservation RSA	Conservation MTPA	Endemic
Avontuur 319 JT	*Khadia carolinensis*	VU	VU	SA
	Kniphofia rigidifolia	LC	Rare	SA
Belfast	*Callilepis leptophylla*	Declining	Declining	FSA
	Eulophia parvilabris	LC	Rare	NOT
	Gunnera perpense	Declining	Declining	NOT
	Khadia carolinensis	VU	VU	SA
	Kniphofia rigidifolia	LC	Rare	SA
	Prunus africana	VU	VU	NOT
	Riocreuxia aberrans	NT	NT	SA
Belfast Dist.; N. Slopes of MT. At Saaihoek	*Zantedeschia pentlandii*	VU	VU	SA
Belfast Dist.; Near belfast, between rocks.	*Gladiolus malvinus*	VU	VU	SA
Belfast District: Mareskop	*Kniphofia triangularis subsp. obtusiloba*	Rare	Rare	SA
Belfast; near Belfast	*Centrostigma occultans*	LC	Rare	NOT
Bergendal 378 JT	*Kniphofia rigidifolia*	LC	Rare	SA
Blaauwboschkraal 346 JT	*Kniphofia triangularis subsp. obtusiloba*	Rare	Rare	SA
Doornhoek 324 JT	*Kniphofia rigidifolia*	LC	Rare	SA
Driefontein 377 JT	*Kniphofia rigidifolia*	LC	Rare	SA
Elandsfontein 322 JT	*Gladiolus malvinus*	VU	VU	SA
Geluk 348 JT	*Moraea robusta*	LC	Rare	SA
Lakenvalei 355 JT	*Boophane disticha*	Declining	Declining	NOT
	Eucomis autumnalis	Declining	Declining	FSA
	Eucomis montana	Declining	Declining	FSA
	Eucomis montana	Declining	Declining	FSA
	Eucomis montana	Declining	Declining	FSA
	Gladiolus malvinus	VU	VU	SA
	Khadia carolinensis	VU	VU	SA

Farm Name	Scientific Name	Conservation RSA	Conservation MTPA	Endemic
	Riocreuxia aberrans	NT	NT	SA
Paardeplaats 380 JT	*Streptocarpus latens*	Rare	Rare	SA
Tweefontein 357 JT	*Kniphofia rigidifolia*	LC	Rare	SA
	Aloe reitzii var. reitzii	NT	NT	SA
Vlakfontein 323 JT	*Kniphofia triangularis subsp. obtusiloba*	Rare	Rare	SA
	Helictotrichon natalense	VU	SA	SA
Vlakplaats 317 JT	*Streptocarpus latens*	Rare	Rare	SA
Wachteenbeetjeshoek 327 JT	*Gnidia variabilis*	VU	VU	SA
	Gladiolus malvinus	VU	VU	SA
Waterloo 367 JT	*Kniphofia rigidifolia*	LC	Rare	SA
Winnaarspoort 350 JT	*Gladiolus malvinus*	VU	VU	SA
	Gunnera perpense	Declining	Declining	NOT
Zwartkoppies 316 JT	*Kniphofia rigidifolia*	LC	Rare	SA

NOTE: VU=Vulnerable, NT=Near Threatened, LC=Least Concern

8.1.2 Plant communities recorded in the study area

The following plant communities were identified during the field visit and are described below.

Natural grassland community

Open grasslands are generally transformed through overgrazing or are planted with pasture grasses for cattle fodder and grazing. Cows were observed grazing on this study area (**Figure 11**). Grasslands are rated as the second most important biome for conservation and are characterized by high species richness and high forb diversity (Emery *et al*. 2002). Grasslands are found within the Eastern Highveld Grasslands and the Lydenburg Montane Grasslands of the study area. The grasslands were found to be heavily fragmented and overgrazed. Initiatives like the Ekangala Grassland Biosphere programme seeks to establish and maintain a biosphere reserve geared at preserving the high altitude moist grasslands of Mpumalanga, KwaZulu-Natal and Free State Provinces (Emery *et al*. 2002).

Figure 11. Natural grassland in the study area

The natural vegetation is dominated by grass species reaching a height of ~2.1 m tall (*Cymbopogon excavatus* and *Hyparrhenia hirta*) while the herbaceous component (averaging 50 cm tall) comprises a cover of about 5%, with very few shrubs and trees. Dominant grass species are *Themeda triandra, Sporobolus africanus* and *Setaria sphacelata var. Sphacelata.* The herbaceous and shrub layers are dominated by *Berkheya setifera, Asparagus aethiopicus, Helichrysum aureonitens, Oxalis obliquifolia* and *Gnidia kraussiana*

as indicated in **Table 6.** The *Eucalyptus cinerea and Pinus patula* are invading the natural grasslands as indicated in **Figure 12**.

Table 6. Species found in the natural grassland community.

Scientific name	Common name	Ecological status	Form
Aristida junciformis	Ngongoni Three-awn	Exotic	Grass
Asparagus aethiopicus			Shrub
Berkheya setifera	Buffalo-tongue Berkheya	Medicinal	Herb
Conyza bonariensis		Weed	Herb
Ctenium concinnum	Sickle grass	Increaser 1	Grass
Cymbopogon excavatus	Broad-leaved Turpentine Grass	Increaser 1	Grass
Cynodon dactylon	Couch Grass	Increaser 2	Grass
Digitaria eriantha	Common Finger Grass	Decreaser	Grass
Eragrostis curvula	Weepong Love Grass	Increaser 2	Grass
Eragrostis plana	Tough love grass	Increaser 2	Grass
Eragrostis racemosa	Narrow Heart Love Grass	Increaser 2	Grass
Eragrostis superba	Saw-tooth love grass	Increaser 2	Grass
Gerbera piloselloides	Small yellow gerbera	Medicinal	Herb
Gnidia kraussiana	Lesser yellow head	Medicinal	Herb
Gomphrena celosioides	Batchelor's Button	Weed	Herb
Harpochloa falx	Caterpillar Grass	Increaser 1	Grass
Helichrysum aureonitens	Golden everlasting	Medicinal	Herb
Hibiscus trionum	Bladder Hibiscus	Medicinal	Herb
Hyparrhenia hirta	Common Thatching Grass	Increaser 1	Grass
Hypochaeris radicata	Hairy wild lettuce	Weed	Herb
Hypoxis costata			Herb
Melinis repens	Natal Red Top	Increaser 2	Grass
Moraea spathulata		Medicinal	Bulb
Oxalis obliquifolia	Oblique-leaved Sorrel		Herb
Panicum maximum	Guinea Grass	Decreaser	Grass
Pinus patula	Patula pine	Declared Invader (Category 2)	Tree
Pseudognaphalium luteo-album	Jersey Cudweed	Medicinal	Herb
Richardia brasiliensis	Tropical Richardia	Weed	Herb
Scadoxus puniceus	Blood lily	Medicinal	Herb
Setaria sphacelata var. Sphacelata	Common Bristle Grass	Decreaser	Grass
Solanum mauritianum	Bugweed	Declared Weed (Category 1)	Shrub
Sporobolus africanus	Ratstail Dropseed	Increaser 3	Grass
Stoebe vulgaris	Bankrupt bush		Shrub
Tagetes minuta	Tall Khaki Weed	Weed	Herb
Themeda triandra	Red Grass	Decreaser	Grass
Urochloa mossambicensis	Bushveld signal grass	Increaser 2	Grass

Figure 12. Invasion by *Eucalyptus cinerea* and *Pinus patula* on natural grasslands on the study area

Wetland vegetation community

This community consists of wetland species and is dominated by species such *Phragmites australis,* and *Typha capensis as* indicated in **Figure 13**. Wetlands are sensitive ecological systems which are important for biodiversity maintenance and for the ecosystem service that provide to society and they are known to reduce the severity of droughts and floods by regulating the flow of the streams as they purify water by trapping pollutants and control soil erosion (Pfab, 2009). Plant species recorded in this community are represents **Table 7**.

Figure 13. *Typha capensis* dominates the wetland vegetation.

Table 7. Species found in the wetland vegetation community.

Scientific name	Common name	Ecological status	Form
Andropogon appendicularis	Vlei Bluestream		Grass
Andropogon eucomis	Large Silver Andropogon		Grass
Asparagus aethiopicus			Shrub
Arundinella nepalensis	River Grass		Grass
Berkheya setifera	Buffalo-tongue Berkheya	Medicinal	Herb
Cynodon dactylon	Couch Grass	Increaser 2	Grass
Cyperus longus		Medicinal	Sedge
Cyperus sexangularis			Sedge
Eragrostis plana	Tough love grass	Increaser 2	Grass
Elionurus muticus	Wire Grass	Increaser 3	Grass
Gerbera piloselloides	Small Yellow gerbera	Medicinal	Herb
Hemarthria altissima	Swamp Grass		Grass
Hyparrhenia hirta	Common Thatching Grass	Increaser 1	Grass
Isolepis sp.			Sedge
Ischaemum fasciculatum			Grass
Imperata cylindrica	Cotton Wool Grass	Increaser 1	Grass
Kyllinga erecta			Sedge
Melinis repens	Natal Red Top	Increaser 2	Grass
Moraea spathulata		Medicinal	Bulb
Phragmites australis	Common reed	Decreaser	Reed
Paspalum dilatatum	Dallisgrass		Grass
Ranunculus multifidus	Common Buttercup		Herb
Setaria sphacelata var. *Sphacelata*	Common Bristle Grass	Decreaser	Grass

Scientific name	Common name	Ecological status	Form
Themeda triandra	Red Grass	Decreaser	Grass
Schoenoplectus corymbosus		Cultural-weaving	Reed
Typha capensis	Bulrush		Aquatic herb
Verbena bonariensis	Tall Verbena	Weed	Herb

8.1.3 Medicinal plants and Red Data Listed plant species

According to National Environmental Management Biodiversity Act 2004 (Act No 10 of 2004), there is a dire need to conserve biodiversity in each province and as such, natural or indigenous resources must be utilised sustainably. Along the proposed road upgrade there are a number of plants that are used to provide medicinal products and for which, in some cases, there is merit in protecting or translocating them before the proposed road upgrade commences. Recovery plans are designed to reverse the decline of a threatened or endangered species and eventually bring the population to a self-sustaining level.

No Red Data plant species were recorded in this study. This could be attributed to the fragmentation of natural habitats and overgrazing and illegal harvesting of medicinal species. The species that is being illegal harvested by sangomas or traditional healers in the study area was *Gnidia kraussiana* (Lesser Yellow Head) (**Figure 14**). According to Pooley (1998), this species is used in traditional medicine to treat stomach and chest pains, lumbago, toothache, snakebite and also to heal fractured limbs in stock. The other use of this species is to ensure easy childbirth during pregnancy.

Figure 14. Lesser Yellow Head recorded in the study area

Habitat available for sensitive or endangered species

Some of the sensitive or endangered species listed by MTPA and SANBI that likely to occur in the study area were *Prunus africana, Gunnera perpensa, Riocreuxia aberrans,* and *Aloe reitzii* var. *reitzii*.

Prunus africana (Red stinkwood) is confined to evergreen forests from near the coast to the mist belt and montane forests in KwaZulu-Natal, Eastern Cape, Swaziland, Mpumalanga, Zimbabwe and tropical Africa. It is a moderately fast-growing tree which is sensitive to heavy frost, preferring areas where there is regular rain; it will tolerate moderate frosts. According to Pooley (1998), the bark is used to treat chest pains. Unlikely to occur site.

Gunnera perpensa (River pumpkin) is an obligate wetland plant that grows in shallow water around the edge of pools in marshy areas or along streams. It cannot tolerate frost and even when growing in warm protective areas it will die back for the coldest months of the year. In South Africa, a decoction of the roots of *Gunnera perpensa* is used to expel the placenta after birth or to relieve menstrual pains (Ngwenya *et al*. 2003; Van Wyk & Gericke 2000; and Von Ahlenfeldt *et al*. 2003). Very likely to occur site.

Riocreuxia aberrans is restricted to quartzite ridges in the Ermelo and Belfast districts of Mpumalanga and has large attractive flowers and is the only species that tends to rather form a bush than being a climber. It flowers mainly in November to January at altitude 1900–2100 m (Pooley, 2005). Unlikely to occur site.

Aloe reitzii var. *reitzii* is a robust and spectacular aloe species which comes from the grassland areas of Mpumalanga but is restricted to a very small area in the vicinity of Belfast. This aloe is endemic to this area and occurs nowhere else in the world (http://www.plantzafrica.com/plantab/aloereitzii.htm). Unlikely to occur site.

While a search of likely habitat yielded no confirmed individuals of these species, the field survey was conducted slightly earlier than the known flowering period of these species and it is possible that individuals may have been present, but not detectable.

8.2 Fauna

This faunal survey focused mainly on mammals, and birds of the study area. The survey focused on the current status of threatened animal species occurring, or likely to occur within the study area, describing the available and sensitive habitats. Faunal data was obtained

during field surveys of the proposed transmission lines carried out on foot in accessible areas. The data was supplemented by previous surveys conducted in similar habitats, literature investigations, and historic data. Different habitats were explored to identify any sensitive or endangered species. Mammal names are as used by Stuart & Stuart, (1998), Skinner & Chimimba (2005), Friedmann & Daly (2004), bird names by Hockey *et al.* (2006); reptile names by Branch (1988, 2001) and Amphibians by du Preez & Carruthers (2009).

8.2.1 Mammals

According to O' Connor & Bredenkamp (1997), a high degree of endemism occurs with nearly half of South Africa's 34 endemic mammals found in the Grassland biome and several small and threatened mammals are also restricted to the biome.

Desktop results

Initially a desktop study was undertaken to gather background information regarding the site and its surrounding areas. Relevant authorities such as MTPA were consulted regarding conservational species lists as well as all the latest available literature utilised to gain a thorough understanding of the area and its surrounding habitats. This information and further literature reviews were then used to determine the potential biodiversity lists for the proposed road upgrade site and surrounding areas.

The potential Red Data mammal species list was compiled from a desktop survey from MTPA database (**Table 8**) for the grid 2530CA. This list is therefore based on all historical recordings of mammalian species relevant to the area. At present and considering the habitat degradation and generally poor state of ecological integrity, this is not thought to be a realistic list of potential species and therefore should be viewed with circumspect.

Table 8. Mammal species recorded in grid 2530CA (MTPA databse)

Farm name	Scientific Name	Common name	Conservation RSA	Conservation MTPA
Waterloo 367 JT	*Ourebia ourebi*	Oribi	EN	EN
Zwartkoppies 316 JT	*Leptailurus serval*	Serval	NT	NT
Avontuur 319 JT	*Chrysospalax villosus*	Rough-haired golden mole	VU	VU
Groenvlei 353 JT	*Amblysomus robustus*	Robust Golden Mole	VU	VU
	Amblysomus robustus	Robust Golden Mole	VU	VU
Paardeplaats 380 JT	*Amblysomus robustus*	Robust Golden Mole	VU	VU
	Amblysomus robustus	Robust Golden Mole	VU	VU
Wemmershuis 379 JT	*Amblysomus*	Robust	VU	VU

Farm name	Scientific Name	Common name	Conservation RSA	Conservation MTPA
	robustus	Golden Mole		
	Amblysomus robustus	Robust Golden Mole	VU	VU
Zwartkoppies 316 JT	*Amblysomus robustus*	Robust Golden Mole	VU	VU
	Amblysomus robustus	Robust Golden Mole	VU	VU

NOTE: VU=Vulnerable, NT=Near Threatened, EN=Endangered

Mammals recorded on site

Some small rodent species were observed on the study area but these species could not be verified due to the lack of close-up observation.

Two mammal species were recorded in the study area, as shown in **Table 9**. No sensitive or endangered mammals were recorded during the site visits. Evidence such as holes or diggings (**Figure 15**) and bones (skull) (**Figure 16**) were also observed during the survey.

Figure 15. Holes observed during the field survey

Figure 16. Head skull observed during the field survey

Table 9. Composition of the mammals that were recorded at the proposed road upgrade.

Common name	Species
Scrub Hare	*Lepus saxatilis*
Bushveld Gerbil	*Tatera leucogaster*

Mammal Habitat Assessment

The wetlands provide a good habitat for many mammals' species such as *Aonyx capensis* (Cape Clawless Otter) and *Atilax paludinosus* (Water mongoose). Good habitat cover is present at the site within all the wetlands and riparian zones and therefore a wide diversity of small mammalian species are expected to flourish. Even though good habitat cover exists, mammals are sensitive to disturbances and habitat destruction and degradation. The likelyhood of finding those species on the proposed road upgrade are low. The dam, river and wetlands do form an ecological corridor that highly-mobile species would utilize for migratory purposes, and therefore these wetlands promote ecological functionality. Care should be exercised in order to negate the negative ecological impacts through habitat fragmentation.

8.2.2 Avifauna

Grassland biome is considered as a home to 52 of the 122 Important Bird Areas (IBA) in South Africa, including the Endemic Bird Area with the highest global priority, which contains 10 of the 14 globally, threatened bird species found in South Africa (O' Connor & Bredenkamp, 1997). No IBA occurs in the study area and the nearest IBA (Steenkampsberg) is 1Km away from the proposed site (**Figure 17**). Numbers of bird species in Mpumalanga have declined mainly due to massive habitat transformation and degradation as well as increased levels of human disturbances, extensive habitat transformation due to mining, industrial, commercial and agricultural activities (Low & Rebelo, 1996). Human activity has transformed grasslands in South Africa to a point where few pristine examples exist. Factors such as agricultural intensification, intensive open cast mining, increased pasture management (overgrazing), decrease in grassland management due to frequent fires and land-use alteration (urbanisation) (Low & Rebelo, 1996). Continuing pressure on sensitive wetland and surrounding open grassland habitat are largely responsible for the decline of the avifaunal species (Low & Rebelo, 1996). More intensive surveys conducted over longer periods over several seasons are required in order to ascertain the current status of the threatened bird species on and surrounding the site.

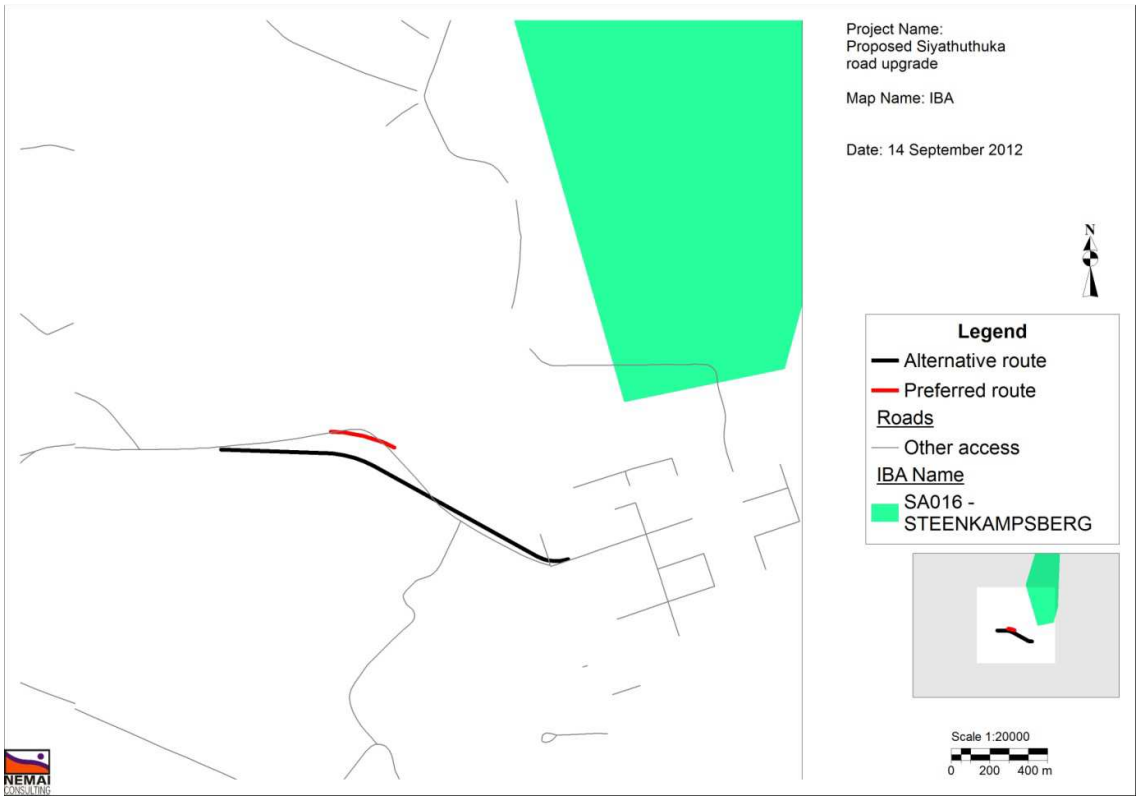


Figure 17. IBA near the proposed Siyathuthuka road upgrade

Desktop results

Observations regarding the number and diversity of bird species will provide valuable input to sound management practices for the ever-changing environment. A survey of the available habitat units applicable to the project area and cross-reference to a desktop study revealed that more RDL species were applicable to the study. **Table 10** indicates the Red Data bird species that were previously recorded in 2530CA by MTPA and **Appendix A** indicates bird species recorded by the Southern African Bird Atlas Project (SABAP) 1 in grid cell 2530CA.

Table 10. Red Data bird species recorded in grid 2530CA (MTPA database)

Farm Name	Common Name	Scientific Name	Conservation MTPA	Endemic
Avontuur 319 JT	Southern Bald Ibis	*Geronticus calvus*	VU	RSA
	Wattled Crane	*Bugeranus carunculatus*	CR	
Belfast; Belfast	Eurasian Bittern	*Botaurus stellaris*	CR	
Bergendal 378 JT	Lanner Falcon	*Falco biarmicus*	NT	
De Goede Hoop 362 JT	Lanner Falcon	*Falco biarmicus*	NT	
Doornhoek 324 JT	Blue Crane	*Anthropoides paradiseus*	VU	
Elandsfontein 322 JT	Blue Crane	*Anthropoides paradiseus*	VU	
	Grey Crowned Crane	*Balearica regulorum*	VU	
	Southern Bald Ibis	*Geronticus calvus*	VU	RSA
	Southern Bald Ibis	*Geronticus calvus*	VU	RSA
	Wattled Crane	*Bugeranus carunculatus*	CR	
Elandskloof 321 JT	Denham's Bustard	*Neotis denhami*	VU	
Farrefontein 349 JT	Blue Crane	*Anthropoides paradiseus*	VU	
Groenvlei 353 JT	Blue Crane	*Anthropoides paradiseus*	VU	
	Grey Crowned Crane	*Balearica regulorum*	VU	
Lakenvalei 355 JT	African Marsh-Harrier	*Circus ranivorus*	VU	
	Barrow's (White-bellied) Korhaan	*Eupodotis senegalensis*	VU	RSA
	Blue Crane	*Anthropoides paradiseus*	VU	
	Blue Crane	*Anthropoides paradiseus*	VU	
	Denham's Bustard	*Neotis denhami*	VU	
	Grey Crowned Crane	*Balearica regulorum*	VU	
	Pallid Harrier	*Circus macrourus*	NT	
	Wattled Crane	*Bugeranus carunculatus*	CR	
	Wattled Crane	*Bugeranus carunculatus*	CR	
Langkloof 356 JT	Grey Crowned Crane	*Balearica regulorum*	VU	
Middelpunt 320 JT	African Marsh-Harrier	*Circus ranivorus*	VU	

Farm Name	Common Name	Scientific Name	Conservation MTPA	Endemic
	Blue Crane	*Anthropoides paradiseus*	VU	
	Blue Crane	*Anthropoides paradiseus*	VU	
	Chestnut-banded Plover	*Charadrius pallidus*	NT	
	Denham's Bustard	*Neotis denhami*	VU	
	Grey Crowned Crane	*Balearica regulorum*	VU	
	Rudd's Lark	*Heteromirafra ruddi*	CR	RSA
	Secretarybird	*Sagittarius serpentarius*	NT	
	Wattled Crane	*Bugeranus carunculatus*	CR	
	Wattled Crane	*Bugeranus carunculatus*	CR	
	White-winged Flufftail	*Sarothrura ayresi*	CR	
Moeilykheid 129 JT	Blue Crane	*Anthropoides paradiseus*	VU	
Ontevreden 358 JS	Wattled Crane	*Bugeranus carunculatus*	CR	
Tweefontein 357 JT	Denham's Bustard	*Neotis denhami*	VU	
Valkfontein 325 JT	Blue Crane	*Anthropoides paradiseus*	VU	
	Grey Crowned Crane	*Balearica regulorum*	VU	
Vlakplaats 317 JT	Wattled Crane	*Bugeranus carunculatus*	CR	
Waterval 351 JT	Blue Crane	*Anthropoides paradiseus*	VU	
	Blue Crane	*Anthropoides paradiseus*	VU	
Winnaarspoort 350 JT	Grey Crowned Crane	*Balearica regulorum*	VU	
	Blue Crane	*Anthropoides paradiseus*	VU	
	Blue Crane	*Anthropoides paradiseus*	VU	
Zwartkoppies 316 JT	Grey Crowned Crane	*Balearica regulorum*	VU	
	Wattled Crane	*Bugeranus carunculatus*	CR	
	Wattled Crane	*Bugeranus carunculatus*	CR	

NOTE: VU=Vulnerable, NT=Near Threatened, EN=Endangered, CR=Critically ENdangered

Field work results

Many avifaunal species are adaptable as they are habitat generalists and can therefore accommodate a certain degree of habitat degradation and transformation. Other species are extremely habitat specific and have to rely on certain habitat units for breeding, hunting or foraging and roosting. It is the survival of these species that become threatened as they cannot adapt to changes to the habitat. Habitat destruction is accredited as being the leading cause of species decline worldwide (Barnes, 2000). It is widely accepted that vegetation structure, rather than the actual plant species, influences bird species' distribution and abundance (Harrison *et al.,* 1997). Due to high levels of human disturbances; the site offers limited suitable habitat for any larger terrestrial birds such as Secretarybird as well as certain smaller raptor species. Within the vegetation types found in the study area and immediate surrounding areas, four major bird habitat systems were identified. A short description of each habitat type follows below:

Grassland: These open areas represent a significant feeding area for many bird species in the area (**Figure 18**). Areas of untransformed natural grassland have remained in the study area. The (Co- ordinated Road Count project) CAR data indicate that natural grassland remains the preferred habitat of large terrestrial birds in the Highveld (Young *et al.,* 2003). Several typical Red Data grassland species were recorded in the square grid by SABAP1, as indicated in **Appendix A**. It is therefore highly unlikely that these species could occur in the grassland remaining on the site due to human disturbance. The Blue Crane (*Anthropoides paradisea*), Grey Crowned Crane (*Balearica regulorum*) and Wattled Crane (*Bugeranus carunculatus*) are amongst the RDL species recorded from the area that readily utilize this habitat unit. Non-threatened species that may from time to time frequent the grassland habitat in the study area are Swainson's Spurfowl (*Pternistis swainsonii)*, African Pipit (*Anthus cinnamomeus)*, Cape Longclaw (*Macronyx capensis)*, several cisticola species, Long-tailed Widowbird (*Euplectes progne)*, Rufous-naped Lark (*Mirafra Africana)*, and Black-shouldered Kite (*Elanus caeruleus)* (Harrison *et al*., 1997). Open grasslands not associated to wetland habitat also form an important habitat unit support a diversity of species that also include various RDL species.

Figure 18. Natural grassland areas on site

Dams: The dam near the proposed alternative route represents a part of the study area, as shown in **Figure 19** as a variety of non Red Data species such as ducks, coots and geese are utilising this dam. Dams are extremely important sources of water for most bird species and will be regularly utilised not only as a source of drinking water and foraging areas, but also for bathing. Greater and Lesser Flamingos are extremely unlikely to use this dam due to high disturbance levels.

Figure 19. The dam near the proposed alternative route presents a feeding area for species such as Red Knobbed coots

This dam has undoubtedly benefited the colonisation and range expansion of many waterbird species that favour open water habitat and provides a refuge for waterbird species during prolonged periods of drought.

Wetlands and rivers: The study area includes one of the significant sensitive faunal habitats such as wetland, which believed could be suitable habitats for birds. Wetlands (**Figure 20**) are of particular importance for birds in the study area and also essential breeding grounds for many threatened cranes and other waterbirds. The marshland vegetation of the pans and surrounding dense *Themeda triandra* grasslands offers favourable roosting and possible nesting habitat for African Grass Owls but the human presence could be a deterrent. Areas with reeds, sedges or grassy tangles are suitable for Common Waxbills (*Estrilda astrilda)* and various warblers (Marais & Peacock, 2008). Plant species such as Common reed provides nesting and roosting sites for bird species.

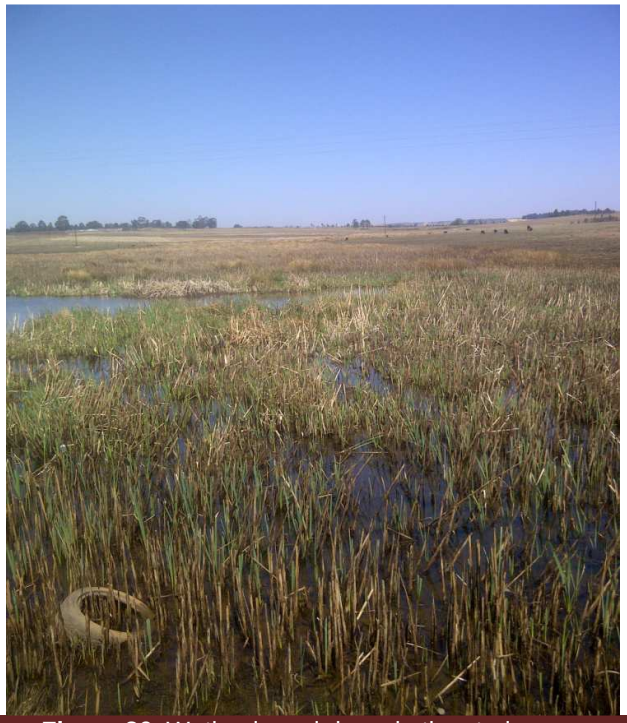


Figure 20. Wetlands and rivers in the study area

Bird species observed in the study area

A comprehensive bird species list requires intensive surveys compiled over several years. Twenty four (24) bird species (**Table 11**) were recorded during the field survey. Species recorded were common and widespread and typical of grassland environment.

Table 11. Bird species recorded during the survey.

Species number	Common name	Scientific name
8	Dabchick	*Tachybaptus ruficollis*
62	Grey Heron	*Ardea cinerea*
71	Cattle Egret	*bubulus ibis*
94	Hadeda ibis	*Bostrychia hagedash*
104	Yellowbilled Duck	*Anas undulata*
116	Spurwinged Goose	*Plectropterus gambensis*
227	Common Moorhen	*Gallinule chloropus*
228	Redknobbed Coot	*Fulica cristata*
240	African jacana	*Actophilornis africanus*
249	Three-banded plover	*Charadrius pallidus*
258	Blacksmith Lapwing (Plover)	*Vanellus armatus*
349	Rock pigeon	*Columba guinea*
352	Red-eyed Dove	*Streptopelia semitorquata*
355	Laughing Dove	*Streptopelia senegalensis*
476	Lesser Honeyguide	*Indicator minor*
520	White-throated Swallow	*Hirundo albigularis*
526	Greater Striped Swallow	*Hirundo cucullata*
	Eastern long-billed lark	*Certhilauda semitorquata*

Species number	Common name	Scientific name
548	Pied crow	*Corvus albus*
568	Red-eyed Bulbul	*Pycnonotus nigricans*
732	Common fiscal (Fiscal Shrike)	*Lanius collaris*
758	Commom (Indian) Myna	*Acridotheres zeylonus*
814	Southern Masked-Weaver	*Ploceus velatus*
832	Long-tailed Widowbird	*Euplectes progne*

Habitat requirements for red data bird species

MTPA provided a list of RDL bird species which could occur in the study area (**Table 10**) and species such as Blue Crane, Grey Crowned Crane, Southern Bald Ibis, Wattled Crane, and Denham's Bustard have all been recorded near the study area.

Blue cranes are under threat in South Africa and there are only around 25 000 left in the country and of the remaining population, almost half are found in the Overberg in the Western Cape. As a result, South Africa's national bird is listed as Vulnerable on the International Union for Conservation of Nature's Red Data List of Threatened Species. The threats associated to the survival of this species include illegal trade, power-line collisions, poisonings and habitat loss (Barnes, 2000). Blue cranes are unlikely to occur on site.

The Grey Crowned Crane is globally restricted to Africa, with its distribution not having changed much over the last century. The loss of wetland breeding habitat, direct poisoning of birds in agricultural lands and the removal of chicks from the wild has led to this species' reduction in population size. Although this species remains abundant over much of its range, it faces widespread degradation of its historic breeding and feeding habitats. This has occurred particularly through the alteration of wetland habitats, by draining and damming, for intensive farming and the loss of surrounding grassland habitat by agriculture and forestry plantations. Despite this they have adapted well to the intensified commercial agricultural practices and are often seen feeding in agricultural drylands throughout the year (http://www.kzncrane.co.za/greycrane.htm). The Grey Crowned Cranes are unlikely to occur on site.

The Southern Bald Ibis is a large bird found in open grassland or semi-desert in the mountains of southern Africa. It is endemic to the Great Escarpment from the Limpopo Province through Swaziland and Mpumalanga to eastern Free State, Lesotho and KwaZulu-Natal. It generally prefers high-altitude sour, treeless grassland or recently burnt, ploughed or heavily grazed fields. It breeds colonially on and amongst rocks and on cliffs. It is

threatened by commercial afforestation, intensive agriculture, acid rain, open-cast mining and human interference at breeding colonies (Sinclair *et al.*, 2002). The Southern Bald Ibis are unlikely to occur on site.

According to Johnsgard (1983), the Wattled Crane is the most wetland-dependent of Africa's cranes. Consequently, the loss and degradation of wetland habitats constitute the most important threats to this species. The decline of the species in South Africa is mainly due to the loss of wetlands to intensified agriculture, dam construction, industrialization, and other pressures. Collisions with power lines and human disturbance at or near breeding sites pose additional threats. These threats are further compounded by a naturally low reproductive potential, the lowest of all crane species. The Wattled Cranes are unlikely to occur on site.

Denham's Bustard is a large bird in the bustard family and breeds in much of sub-Saharan Africa. It is a species of open ground, including agricultural land, grassland, flood-plains and burnt fynbos. The conversion of grassland to agriculture is a greater threat to the survival of this species in South Africa (Sinclair *et al.*, 2002). Denham's Bustard species are unlikely to occur on site.

No RDL species were observed during the brief field survey. High levels of human activities occur on site and limit the presence of any RDL species that could be found on site.

8.2.3 Reptiles

According to O' Connor & Bredenkamp (1997), the grassland biome houses 22% of South Africa's endemic reptiles.

Desktop results

The Field Guide to the Snakes and other Reptiles of Southern Africa (Branch, 2001) and South African Red Data Book Reptiles (Branch, 1988) were books used to ascertain which reptile species could be found in the study area. **Table 12** and **Table 13** listed reptile species for the grid 2530CA based on South African Reptile Conservation Assessment (SARCA) and MTPA

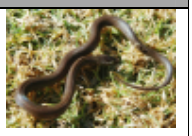
Table 12. Reptiles species recorded in 2530CA (MTPA database)

Farm name	Common Name	Scientific name	Conservation RSA	Conservation MTPA
Avontuur 319 JT	Many-spotted Snake	*Amplorhinus multimaculatus*	LC	NT
	Highveld grass	*Chamaesaura*	NT	VU

Farm name	Common Name	Scientific name	Conservation RSA	Conservation MTPA
	lizard	*aenea*		
Belfast	Short-headed legless sjink	*Acontias breviceps*	LC	VU
	Giant legless skink	*Acontias plumbeus*	LC	NT
	Many-spotted Snake	*Amplorhinus multimaculatus*	LC	NT
	Highveld grass lizard	*Chamaesaura aenea*	NT	VU
Lakenvalei 355 JT	Highveld grass lizard	*Chamaesaura aenea*	NT	VU
Schoongezicht 364 JT	Many-spotted Snake	*Amplorhinus multimaculatus*	LC	NT

NOTE: VU=Vulnerable, NT=Near Threatened, LC=Least Concern

Table 13. Reptile species recorded in grid 2530CA (SARCA, ADU).

Family	Common Name	Scientific name	Picture
Colubridae	Brown House Snake	*Boaedon capensis*	
Atractaspididae	Black-headed Centipede-eater	*Aparallactus capensis*	
Viperidae	Rhombic Night Adder	*Causus rhombeatus*	
Agamidae	Southern Rock Agama	*Agama atra*	

Reptile species observed in the study area

Searching for reptiles took place through turning over rocks and logs along the proposed road upgrade, although this did not yield much data. Sites were walked, covering as many habitats as possible. Habitat characteristics were surveyed to note potential occurrences of reptiles.

Wetland habitat is traditionally rich in reptile (snake) diversity and densities due to the habitat unit supporting a high abundance of prey species such as frogs, birds and small mammals. Habitat cover is also greater within wetland habitat. Species are also very often “forced” into

wetland and riparian zones due to the lack of suitable habitat elsewhere within catchment areas that have been transformed such as in large agricultural regions (Ross & Ross, 2009).

Reptile lists require intensive surveys conducted for several years. Reptiles are extremely secretive and difficult to observe during field surveys. The majority of reptile species are sensitive to severe habitat alteration and fragmentation. No reptile species were observed during the field survey. The indiscriminate killing of snake species as well as the illegal collecting of certain species for private and the commercial pet industry reduces reptile populations especially snake populations drastically (Jacobsen, 2005). The frequent burning of the site has also a high impact on reptiles. Fires during the winter months will severely impact on the hibernating species, which are extremely sluggish. Fires during the early summer months destroy the emerging reptiles as well as refuge areas increasing predation risks (Jacobsen, 2005).

Habitat available for sensitive or endangered reptile species

According to Branch (2001), Many-spotted Snake is an unusual, secretive snake that is found in isolated populations in the cool, moist eastern regions while the Highveld grass lizard is restricted to the eastern escarpment grasslands with an isolated population in the Winterberg.

Natural grassland systems are therefore the identified unit most important to the conservation of these species. The presence of feral cats on and surrounding the site and high levels of human presence and disturbances has a detrimental impact on remaining reptile species especially snake species in the area.

8.2.4 Amphibians

Amphibians are an important component of South Africa's exceptional biodiversity (Siegfried, 1989) and are worthy of both research and conservation effort. Deforestation, wetland draining and pollution are immediately obvious causes. But other, more fundamental, man-made impacts are causing population declines in 'pristine' habitats such as national parks and remote rainforests (Carruthers, 2001).

Desktop results

There are 15 species known to occur in grassland areas, with one species of conservational concern, namely Giant bullfrog (*Pyxicephalus adspersus).* According to the South African Frog Atlas Project, which falls within the Avian Demography Unit, University Of Cape Town, no data was recorded for the grid 2530CA but Minter *et. al.,* (2004) has recorded amphibian species which occur in grassland areas, as indicated in **Table 14.**

Table 14: Potential amphibian species biodiversity list based on the historical recording of species from the region (*adapted from* Minter, *et al.,* 2004).

English name	Scientific name	Red Data Listed status
Common platanna	*Xenopus laevis*	
Bubbling kassina	*Kassina senegalensis*	
Bushveld rain frog	*Breviceps adspersus*	
Giant bullfrog	*Pyxicephalus adspersus*	Vulnerable
Tremolo sand frog	*Tomopterna cryptotus*	
Knocking sand frog	*Tomopterna krugerensis*	
Natal sand frog	*Tomopterna natalensis*	
Raucous toad	*Amietophrynus rangeri*	
Guttural toad	*Amietophrynus gutturalis*	
Red toad	*Schismaderma carens*	
Common river frog	*Amietia angolensis*	
Striped stream frog	*Strongylopus fasciatus*	
Striped grass frog	*Ptychadena porosissima*	
Boettger's caco	*Cacosternum boettgeri*	
Snoring puddle frog	*Phrynobatrachus natalensis*	

Amphibian species recorded on site

Wetlands and associated moist grasslands form a significant proportion of habitat types within the survey area. The incorporation of this habitat unit and the associated good habitat cover due to the increase vegetation cover means that amphibian species should be present in high abundance. Maybe due to timing of survey, no amphibian species were recorded or observed during the field assessment.

Habitat available for sensitive or endangered species

The Giant Bullfrog has a potential to occur in the study area and is currently assigned a Near-Threatened status, according to IUCN Red List category (Minter *et al*., 2004). There are wetlands in the area that could serve as potential breeding sites of this species. There is a moderate likelihood that this species occurs in the vicinity of the study area, although there were no records in the grid 2530CA during the South African Frog Atlas Project (Minter *et al.,* 2004). Bullfrogs are explosive breeders that emerge from their underground burrows in years of sufficient rainfall and return to their burrows soon after breeding (Cook, 2007). It is

possible that they may already have been hibernating at the time of the survey. Explosive breeding frogs utilise ephemeral pans or inundated grasslands for their short duration reproductive cycles. Giant Bullfrog usually breeds within the grassland biome, but also has been shown to breed within savanna wetlands. In order to conserve this species, appropriate conservation buffer zones should be implemented surrounding all suitable wetland habitat units. The presence of amphibians is also generally regarded as an indication of intact ecological functionality and therefore construction activities within these habitat units should be undertaken in an ecologically-sensitive manner.

9. ECOLOGICAL SENSITIVITY ANALYSIS OF THE STUDY AREA

The objective of the ecological sensitivity analysis is to specify the location and extent of all sensitive areas on the proposed routes that must be protected from transforming land uses.

The following criteria were used to identify sensitive areas within the study area (**Figure 21**):

- Important Bird Area;
- Threatened Terrestrial Ecosystems;
- Rivers and wetlands and
- Terrestrial Biodiversity Assessment.

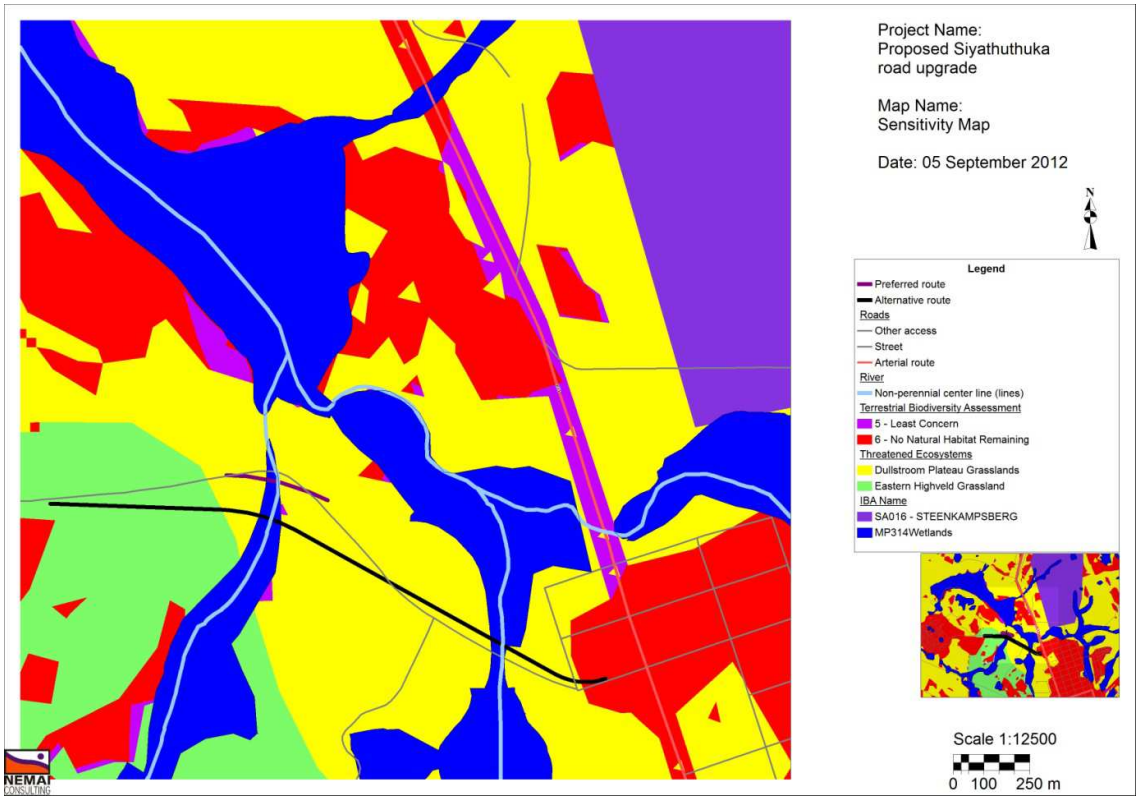


Figure 21. Sensitivity Map of the proposed Siyathuthuka road upgrade

10. ENVIRONMENTAL IMPACT ASSESSMENT

10.1 Methodology

All impacts are analysed in the section to follow (**Table 15**) with regard to their nature, extent, magnitude, duration, probability and significance. The following definitions apply:

Nature (/Status)
The project could have a positive, negative or neutral impact on the environment.

Extent
- Local – extend to the site and its immediate surroundings.
- Regional – impact on the region but within the province.
- National – impact on an interprovincial scale.
- International – impact outside of South Africa.

Magnitude
Degree to which impact may cause irreplaceable loss of resources.
- Low – natural and social functions and processes are not affected or minimally affected.
- Medium – affected environment is notably altered; natural and social functions and processes continue albeit in a modified way.
- High – natural or social functions or processes could be substantially affected or altered to the extent that they could temporarily or permanently cease.

Duration
- Short term – 0-5 years.
- Medium term – 5-11 years.
- Long term – impact ceases after the operational life cycle of the activity either because of natural processes or by human intervention.
- Permanent – mitigation either by natural process or by human intervention will not occur in such a way or in such a time span that the impact can be considered transient.

Probability
- Almost certain – the event is expected to occur in most circumstances.
- Likely – the event will probably occur in most circumstances.
- Moderate – the event should occur at some time.
- Unlikely – the event could occur at some time.
- Rare/Remote – the event may occur only in exceptional circumstances.

Significance
Provides an overall impression of an impact's importance, and the degree to which it can be mitigated. The range for significance ratings is as follows-
0 – Impact will not affect the environment. No mitigation necessary.
1 – No impact after mitigation.
2 – Residual impact after mitigation.
3 – Impact cannot be mitigated.

10.2 Assessment of Environmental Impacts and Suggested Mitigation Measures

Only the environmental issues identified during the appraisal of the receiving environment and potential impacts are assessed below (**Table 15**). Mitigation measures are provided to prevent (first priority), reduce or remediate adverse environmental impacts.

Table 15. Recommended mitigation measures with significance rating before and after mitigation for the proposed Siyathuthuka road upgrade

FLORA **PRE – CONSTRUCTION PHASE**					
Impact	Nature	Description		Mitigation	
Direct	Negative	Search and Rescue		A qualified and / or appropriately experienced Botanist or an experienced person who knows specific vegetation types well should mark any species of conservation importance and other medicinal plants when the route is pegged.	
Without Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Medium	Medium-term	Almost certain	2
With Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Low	Short-term	Likely	1

FLORA **PRE – CONSTRUCTION PHASE**			
Impact	Nature	Description	Mitigation
Direct	Negative	Site preparation	During site preparation topsoil must be removed and stored separately

FLORA PRE – CONSTRUCTION PHASE					
Impact	Nature	Description		Mitigation	
				from organic material and spoil material for use in the rehabilitation phase. It should be protected from wind and rain, as well as contamination from diesel, concrete or wastewater. Records of all environmental incidents must be maintained and a copy of these records must be made available to authorities on request throughout the project execution.	
Without Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	High	Medium-term	Likely	2
With Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Medium	Short-term	Likely	2

FLORA PRE – CONSTRUCTION PHASE

Impact	Nature	Description		Mitigation	
Direct	Negative	Establishment of Site Camps		A suitable position for the construction camp to be selected, in consultation with the Environmental Control Officer (ECO). The positioning of the site camp must not be near any sensitive areas such as wetlands, but rather be positioned in areas that are already disturbed.	
Without Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	High	Medium-term	Likely	2
With Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Medium	Medium-term	Likely	1

FAUNA **PRE – CONSTRUCTION PHASE**			
Impact	Nature	Description	Mitigation
Direct	Positive	Search and Rescue	A qualified and / or appropriately experienced Zoologist or an experienced person who knows the animals in the region well will identify any possible Red Data

FAUNA PRE – CONSTRUCTION PHASE					
Impact	Nature	Description		Mitigation	
				fauna on site and the necessary permits to relocate fauna will be obtained if avoidance is not possible. Training of construction workers to recognise threatened animal species will reduce the probability of fauna being harmed unnecessarily.	
Without Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Medium	Medium-term	Likely	2
With Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Low	Medium-term	Likely	1

FAUNA PRE – CONSTRUCTION PHASE			
Impact	Nature	Description	Mitigation

FAUNA PRE – CONSTRUCTION PHASE					
Impact	Nature	Description		Mitigation	
Direct	Negative	Site preparation		During site preparation special care must be taken during the clearing of the works area to minimise damage or disturbance of roosting and nesting sites. Before construction commences, all sensitive habitats, such as rivers and wetlands must be clearly demarcated with fencing or orange mesh netting. Barricading measures to be utilised should not restrict the movement of the fauna in the area.	
Without Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	High	Medium-term	Likely	2
With Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Medium	Medium-term	Likely	1

FAUNA PRE – CONSTRUCTION PHASE					
Impact	Nature	Description		Mitigation	
Direct	Negative	Disturbance to animals on site		Stringent and dedicated control not to disturb animals on site.	
Without Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	High	Medium-term	Likely	2
With Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Medium	Medium-term	Likely	1

FLORA CONSTRUCTION PHASE			
Impact	Nature	Description	Mitigation
Direct	Negative	Destruction of species of conservation importance and their natural habitats	The removal of any plant material from site, including flowers or bulbs is strictly prohibited unless unavoidable and essential for the purposes of construction. The contractor for vegetation clearing must have the knowledge to be able to identify different

FLORA CONSTRUCTION PHASE					
Impact	Nature	Description		Mitigation	
				species, declared weeds and alien species.	
Without Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	High	Medium	Likely	2
With Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Medium	Medium	Likely	2

FLORA CONSTRUCTION PHASE			
Impact	Nature	Description	Mitigation
Direct	Negative	Vegetation and soil disturbance around construction sites due to general construction activities	Minimise topsoil disturbance as far as possible. Level and landscape disturbed topsoil areas to facilitate plant succession. Erosion control measures, such as stone packing, brush packing and

FLORA CONSTRUCTION PHASE					
Impact	Nature	Description		Mitigation	
				reseeding, should be included on disturbed areas.	
Without Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	High	Medium-term	Likely	2
With Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Medium	Medium-term	Likely	1

FLORA CONSTRUCTION PHASE			
Impact	Nature	Description	Mitigation
Direct	Negative	Soil contamination, vegetation loss and vegetation disturbance due to fuel and chemical spills.	Employ on site personnel responsible for preventing and controlling potential soil pollution through fuel and oil leaks and spills. Make sure construction vehicles are maintained and serviced to prevent oil and fuel leaks.

FLORA CONSTRUCTION PHASE					
Impact	Nature	Description		Mitigation	
				Emergency on-site maintenance should be done over appropriate drip trays and all oil or fuel must be disposed of according to waste regulations. Drip-trays must be placed under vehicles and equipment when not in use. Containers containing potential contaminating substances must be kept on drip-trays or tarpaulins in case of spills.	
Without Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	High	Medium-term	Likely	2
With Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Medium	Medium-term	Likely	1

FLORA CONSTRUCTION PHASE

Impact	Nature	Description		Mitigation	
Direct	Negative	Loss of aesthetic value and sense of place.		Ensure that development designs compliment the natural surroundings in order to preserve a sense of place.	
Without Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Medium	Medium-term	Likely	2
With Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Medium	Medium-term	Likely	1

FLORA **CONSTRUCTION PHASE**			
Impact	Nature	Description	Mitigation
Direct	Negative	Vegetation disturbance in and around construction camps.	Fencing of construction camps. No equipment or personnel will be allowed outside of the fenced construction servitude. Level and landscape disturbed topsoil areas to facilitate plant succession and to match surrounding topography. Erect construction camps on

FLORA CONSTRUCTION PHASE					
Impact	Nature	Description		Mitigation	
				previously disturbed areas and on level surfaces only.	
Without Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Medium	Medium-term	Likely	2
With Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Medium	Medium-term	Likely	1

FLORA CONSTRUCTION PHASE			
Impact	Nature	Description	Mitigation
Direct	Negative	Vegetation and habitat disturbance due to the accidental introduction of alien species.	Promote awareness of all personnel. After construction programme monitoring and control of alien weeds and invaders through hand removal; slashing (annuals) or chemical control (perennials).

FLORA CONSTRUCTION PHASE					
Impact	Nature	Description		Mitigation	
Without Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	High	Medium-term	Likely	2
With Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Medium	Medium-term	Likely	1

FLORA CONSTRUCTION PHASE			
Impact	Nature	Description	Mitigation
Direct	Negative	Vegetation and habitat disturbance due to pollution and littering during construction phase.	Employ personnel on site responsible for preventing and controlling of litter. Promote housekeeping with daily clean-ups on site. Before construction commences, construction workers should be educated with regards to littering, *ad hoc* veld fires, and dumping. Fires must be limited to designated

FLORA CONSTRUCTION PHASE					
Impact	Nature	Description		Mitigation	
				areas and monitored closely.	
Without Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Medium	Medium-term	Likely	2
With Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Medium	Medium-term	Likely	1

FLORA CONSTRUCTION PHASE					
Impact	Nature	Description		Mitigation	
Direct	Negative	Damage to plant life outside of the proposed road upgrade area		Measures must be taken to penalise construction workers who damage plants intentionally or remove plants accidentally without reporting the incident.	
Without Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Medium	Medium-term	Likely	2

FLORA CONSTRUCTION PHASE					
Impact	Nature	Description		Mitigation	
With Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Medium	Medium-term	Likely	2

FLORA CONSTRUCTION PHASE					
Impact	Nature	Description		Mitigation	
Direct	Negative	Vegetation disturbance due to increased dust during construction phase.		Wetting down of work areas can be used to reduce dust levels but not to a degree that causes runoff and contamination. Cultivate awareness among personnel to limit excessive and unnecessary dust.	
Without Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Medium	Medium-term	Likely	2
With Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Medium	Medium-term	Likely	1

FAUNA CONSTRUCTION PHASE			
Impact	Nature	Description	Mitigation
Direct	Negative	Disturbance to animals	Animals residing within the designated area shall not be unnecessarily disturbed. Before construction starts, construction workers must be educated with regards to littering and poaching. The Contractor and his/her employees shall not bring any domestic animals onto site. Photographs of sensitive animals must be displayed in the construction camp to heighten awareness of the creatures. Toolbox talks should be provided to contractors regarding disturbance to animals. Particular emphasis should be placed on talks regarding snakes.

FAUNA CONSTRUCTION PHASE					
Impact	Nature	Description		Mitigation	
Without Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Medium	Medium-term	Likely	2
With Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Medium	Medium-term	Likely	1

FAUNA CONSTRUCTION PHASE			
Impact	Nature	Description	Mitigation
Direct	Negative	Removal of vegetation	Leave as much of the natural vegetation intact as possible in order to maintain ecological corridors for the movement of species. Make an effort to increase the natural areas around sensitive features such as rivers and wetlands. In areas where there are nesting sites for birds, vegetation should not be disturbed, particularly near

FAUNA CONSTRUCTION PHASE					
Impact	Nature	Description		Mitigation	
				rivers and dam. All soils should be stored and managed correctly for rehabilitation to maintain natural habitats for animals. Construction activities should be limited to daylight hours, in order to minimise impacts on nocturnal fauna	
Without Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	High	Medium-term	Likely	2
With Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Medium	Medium-term	Likely	2

FAUNA CONSTRUCTION PHASE			
Impact	Nature	Description	Mitigation

FAUNA CONSTRUCTION PHASE					
Impact	Nature	Description		Mitigation	
Direct	Negative	Transportation of materials		Construction trucks should travel at a maximum speed of 10Km/h on site in order to avoid unnecessary killings of animals found on site. Loose material such as sand and gravel must be covered with tarpaulins during transport.	
Without Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Medium	Medium-term	Likely	2
With Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Medium	Medium-term	Likely	1

FAUNA CONSTRUCTION PHASE			
Impact	Nature	Description	Mitigation
Direct	Negative	Allow for safe animal passage through and specifically out of the construction site.	Construction areas must be fenced using palisades for the migration of small faunal species out of the construction zone. This excludes

FAUNA CONSTRUCTION PHASE					
Impact	Nature	Description		Mitigation	
				areas where animal activity could be hazardous where such areas should be appropriately blocked off. Site camps should be placed in areas that do not impact on animal movement corridors.	
Without Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Medium	Medium-term	Likely	2
With Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Medium	Medium-term	Likely	1

FAUNA CONSTRUCTION PHASE			
Impact	Nature	Description	Mitigation
Direct	Negative	To protect and maintain habitats of sensitive species.	Important sensitive habitats such as rivers and wetlands need to be preserved in order to protect species that utilise these areas as their preferred habitats. A buffer-

FAUNA CONSTRUCTION PHASE					
Impact	Nature	Description		Mitigation	
				zone around sensitive areas (wetlands) must be demarcated with hazard tape or orange mesh netting to prevent accidental disturbance.	
Without Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Medium	Medium-term	Likely	2
With Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Medium	Medium-term	Likely	2

FLORA OPERATIONAL PHASE			
Impact	Nature	Description	Mitigation
Direct	Negative	The construction of the proposed Siyathuthuka road upgrade may affect biodiversity through the encroachment of exotic vegetation following soil disturbance, in addition the maintenance of the area would disturb naturalised species within the area.	Encroachment of alien vegetation should be monitored regularly and controlled; the area must be kept clear of all invader plants as per the Conservation of Agricultural Resources Act, 1983 (Act No 43 of

FLORA OPERATIONAL PHASE					
Impact	Nature	Description		Mitigation	
				1983). Rehabilitation measures must be employed until such a time as indigenous species are established.	
Without Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Medium	Medium-term	Likely	2
With Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Medium	Medium-term	Likely	1

FLORA/FAUNA OPERATIONAL PHASE			
Impact	Nature	Description	Mitigation
Direct	Negative	Ongoing impacts that will affect faunal biodiversity	Ecologically sensitive areas (such as rivers and wetlands) should be retained as prohibited areas to workers. Workers and machinery to remain inside construction footprint. All

FLORA/FAUNA OPERATIONAL PHASE					
Impact	Nature	Description		Mitigation	
				labourers to be informed of disciplinary actions for the wilful damage to plants and animals. Cut material emanating from bush clearing should be removed from the site. If it is to remain within the site, it should not be stacked, but spread out so that it remains close to the ground. This will enhance grass growth and microbial interaction that will enhance decomposition. By spreading the cut material, the risk of damage caused from fires that burn with too much heat, which will damage natural plant life and sterilize seedbeds can be avoided (Vosloo, 2004).	
Without Mitigation	Extent	Magnitude	Duration	Probability	Significance
	Local	Medium	Medium-term	Likely	2
With Mitigation	Extent	Magnitude	Duration	Probability	Significance

FLORA/FAUNA OPERATIONAL PHASE					
Impact	Nature	Description		Mitigation	
	Local	Medium	Medium-term	Likely	1

11. CONCLUSION

According to Mpumalanga Biodiversity Conservation Plan (MBCP) Terrestrial Biodiversity Assessment (Lötter, 2007), the site is classified as “least concern” and “no natural habitat remaining”. The proposed road upgrade falls within the grassland biome and Dullstroom Plateau Grasslands (Endangered) and Eastern Highland Grassland (Vulnerable) are listed as the two threatened terrestrial ecosystems occurring on site.

Wetlands do occur and therefore form important refugia for a diversity of species within the area. Precautions should be taken on natural vegetation on the proposed development to cause as little damage as possible during the construction phase. Care must be taken to minimize or prevent negative impacts on vegetation, especially in sensitive areas such as rivers and wetlands. All flora species of conservation importance that are found during the construction should be removed from site and should be utilised during rehabilitation. Only indigenous plant species, preferably species that are indigenous to the natural vegetation of the area, should be used for rehabilitation and where possible, trees naturally growing on the site should be retained as part of the landscaping. Measures to ensure that these trees survive the physical disturbance from the development should be implemented.

The local people also hunt in and around the proposed road upgrade. As a result very few wild animals were expected to occur on site. The very low numbers of actual wild animal sightings confirmed this. The land use is primarily for grazing and the potential for wild animals to occur on site is very low. Only two mammals were observed in the area. Animal life in this area is poorly represented, this is possibly due to the fact that the habitat has been fragmented by anthropogenic activities which include cows that feed on the area and the threats posed to these animals by people who hunt in the areas. Observations of faunal species were poor, but the site has shown to support a high diversity of bird species (especially on the nearby dam). Many faunal species from within the area are dependent on wetland and riparian habitats. No Red Data fauna species were recorded during field survey even though suitable habitats were encountered.

According to the legislation, any activities that are contemplated that could affect the wetlands requires authorisation (Section 21 of the National Water Act 1998 (Act No 36 of 1998). In addition they are also regarded as sensitive habitats in the National Environmental Management Biodiversity Act (Act 10 of 2004) implying that they are afforded a higher level of protection. Once delineated, these wetland areas must be considered to be sensitive and appropriate buffer zones are required to protect them from any development impacts.

Of the two options investigated, the alternative route will traverse two wetlands whilst the preferred option which realigns the road to a lesser extent will only cross one wetland and for this reason, the preferred option is chosen as it will have less impact on the wetlands. The Dullstroom Plateau Grasslands will be highly impacted should the alternative option be considered.

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Appendix A:

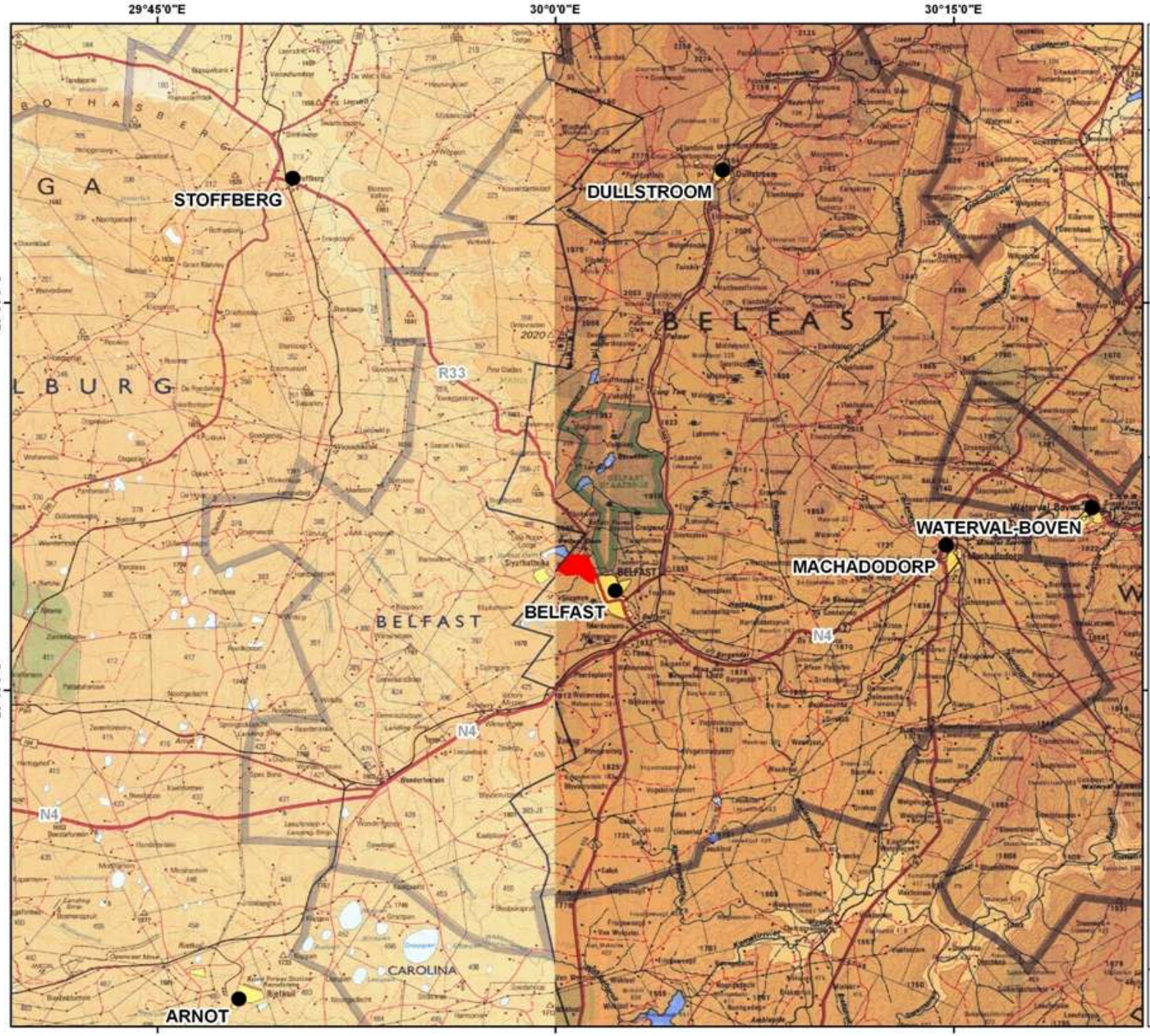
Red Data bird species recorded in grid 2530CA (Steenkampsberg 2530CA (SA016)

Common Name	Scientific Name
Black-headed Heron	*Ardea melanocephala*
Little Egret	*Egretta garzetta*
Yellow-billed Egret	*Egretta intermedia*
Cattle Egret	*Bubulcus ibis*
White Stork	*Ciconia ciconia*
Hadeda Ibis	*Bostrychia hagedash*
Spur-winged Goose	*Plectropterus gambensis*
Egyptian Goose	*Alopochen aegyptiacus*
Black-shouldered Kite	*Elanus caeruleus*
Jackal Buzzard	*Buteo rufofuscus*
Steppe Buzzard	*Buteo vulpinus*
Helmeted Guineafowl	*Numida meleagris*
Cape Turtle-Dove	*Streptopelia capicola*
Rufous-naped Lark	*Mirafra africana*
Barn Swallow	*Hirundo rustica*
White-throated Swallow	*Hirundo albigularis*
Greater Striped Swallow	*Hirundo cucullata*
Banded Martin	*Riparia cincta*
Fork-tailed Drongo	*Dicrurus adsimilis*
Black-headed Oriole	*Oriolus larvatus*
Cape Crow	*Corvus capensis*
Dark-capped Bulbul	*Pycnonotus tricolor*
Buff-streaked Chat	*Oenanthe bifasciata*
Anteating Chat	*Myrmecocichla formicivora*
African Stonechat	*Saxicola torquatus*
Zitting Cisticola	*Cisticola juncidis*
Desert Cisticola	*Cisticola aridulus*
Neddicky	*Cisticola fulvicapilla*
Cape Wagtail	*Motacilla capensis*
African Pipit	*Anthus cinnamomeus*
Common Fiscal	*Lanius collaris*
Red-backed Shrike	*Lanius collurio*
Olive Bush-Shrike	*Telophorus olivaceus*
Common Myna	*Acridotheres tristis*
Cape Glossy Starling	*Lamprotornis nitens*
Pied Starling	*Spreo bicolor*
Amethyst Sunbird	*Chalcomitra amethystina*
House Sparrow	*Passer domesticus*
Southern Red Bishop	*Euplectes orix*
Yellow Bishop	*Euplectes capensis*
Red-collared Widowbird	*Euplectes ardens*

Common Name	Scientific Name
Long-tailed Widowbird	*Euplectes progne*
Red-headed Finch	*Amadina erythrocephala*
Common Waxbill	*Estrilda astrild*
Pin-tailed Whydah	*Vidua macroura*
Cape Canary	*Serinus canicollis*

Appendix 1: Maps

Topographical and Google Earth Maps



PROJECT:

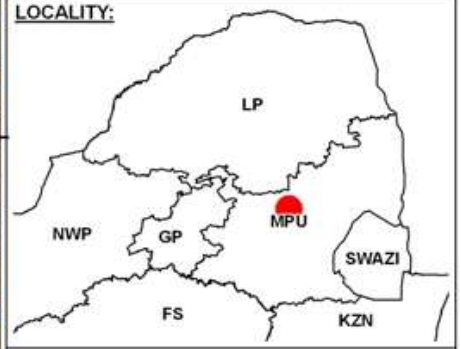
MPUMALANGA HIGH ALTITUDE TRAINING CENTRE

Wetland Survey - culverts

MAP REF: Locality

DATE: SEPT 2012

LOCALITY:



Legend

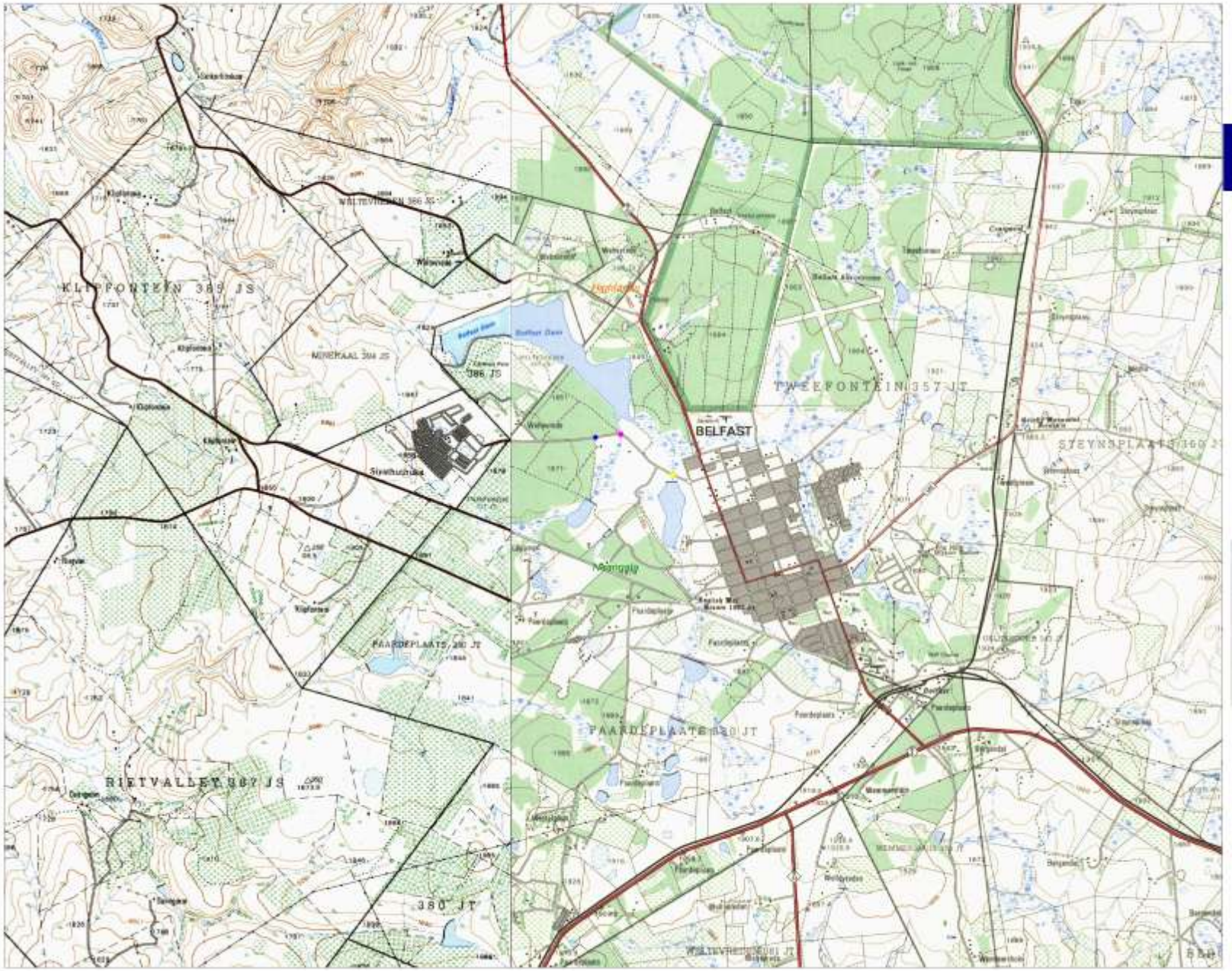
Survey area

N

1:250,000

10 5 0 10 km

ENVIROSS CC
PO Box 369, Wendywood, 2144.
t/f: 011 706 9753
e-mail: admin@enviross.co.za



Siyathuthukela Road Upgrade

Site Layout Plan

N

Legend

- Local municipalities
- District municipalities
- Provinces
- End Point
- Start Point
- Culvert 1
- Culvert 2

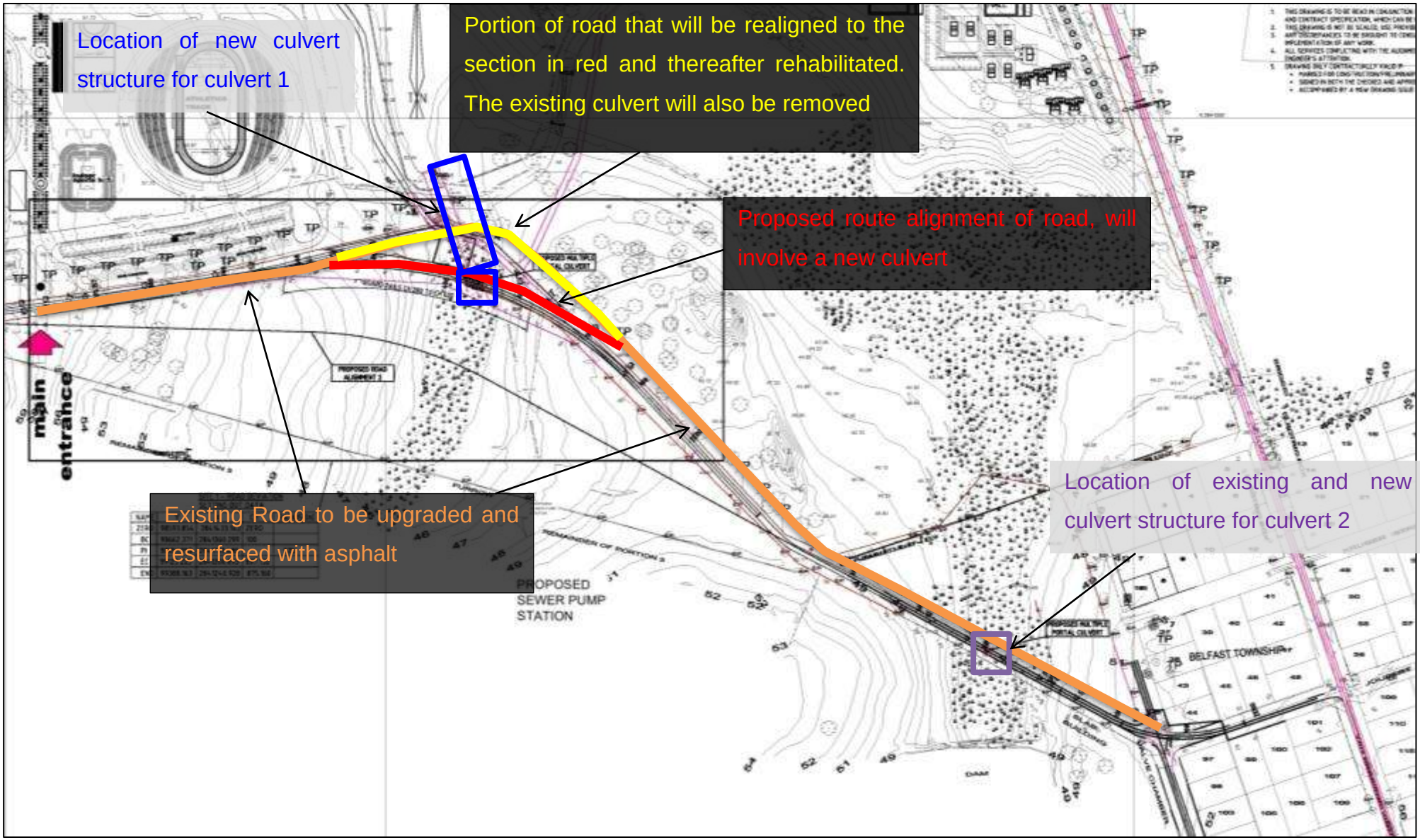
NEMAI CONSULTING

Scale 1:50000

0 0.6 1.5 km


Belfast Dam
Existing portion of Siyathuthuka Road that will be upgraded
Location of culvert 1
Siyathuthuka
Joubert St
Belfast
R33
Location of culvert 2
Vermooten St
R540
Image © 2012 DigitalGlobe
© 2012 AfriGIS (Pty) Ltd.
Image © 2012 GeoEye
Google earth
Imagery Date: 4/14/2012
2002
25°40'30.05" S 30°00'55.64" E elev 6071 ft
Eye alt 26926 ft

Site Layout – Alternative 1



Map showing the proposed upgrade and realignment (MSW, 2012)

Site Layout – Alternative 2

NOTES

1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT DRAWINGS AND CONTRACT SPECIFICATION, WHICH CAN BE MADE AVAILABLE ON REQUEST.
2. THIS DRAWING IS NOT BE SCALED, USE PROVIDED DIMENSION.
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5. DRAWING ONLY CONTRACTUALLY VALID IF:
   - MARKED FOR CONSTRUCTION/PRELIMINARY/INFORMATION.
   - SIGNED IN BOTH THE CHECKED AND APPROVED BOXES.
   - ACCOMPANIED BY A MSW DRAWING ISSUE SHEET.

LEGEND

- DENOTES FENCING
- DENOTES EDGE OF GRAVEL ROAD
- DENOTES EDGE OF TAR
- DENOTES ROAD CENTRE LINE
- SB — DENOTES SIGN BOARD
- DENOTES MANHOLE
- DENOTES LAMP POST
- EP — DENOTES ELECTRIC POLE
- DENOTES TELEPHONE POLE
- DENOTES GATE
- DENOTES WETLANDS

REVISIONS

MARK	BY	DATE	REVISION DESCRIPTION
00	VDL	08.08.2012	CONCEPT DRAWING

ASSOCIATED DRAWINGS

DRAWING NUMBER	DRAWING DESCRIPTION

CLIENT
MPUMALANGA PROVINCIAL GOVERNMENT
PO Box 1243
Nelspruit
1200.
Tel: +27 13 766 5242.
Fax: +27 13 766 8253/5591

idt

SABS ISO 9001
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Masetlaoka Scott Wilson
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P.O. Box 2486 Rivonia, 2128
Tel: +27 11 805 1663
Fax: +27 11 805 0995
email: admin@msw.za.com

PROJECT:
MPUMALANGA HIGH ALTITUDE TRAINING CENTRE

	BY	SIGN		APPROVED		PAPER SIZE	A0
DRAWN	VDL		SIGN				
CHECKED						DATE DRN	JUNE. 2012
DESIGNED	KML		DATE			SCALE	1:2000

DRAWING TITTLE:
ACCESS PREPARATORY ROAD DEVIATION
ROAD OPTION 2 GENERAL LAYOUT

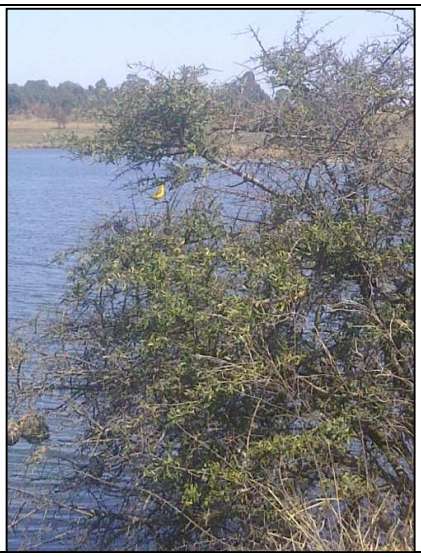
DRAWING NUMBER
MSW - 1280 - DWG - 74 - 00
ISSUER | JOB NUMBER | TYPE | DRAWING NUMBER | REVISION

16 August 2012 12:37:44

Z:\Projects\MS1280 Proposed New Sports Academy, Belfast Mpumalanga\A - Pre- Contract\7 - Drawings\702 - Internal Drawings\In Progress\DETAILED DESIGN\FOR IAN\OPTION 2 LAYOUT.dwg

Appendix 2: Site Photographs

Please note that all images were taken from the western side of the Siyathuthuka Road

	
Photographer facing West of the Siyathuthuka Road	Photographer facing North of the Siyathuthuka Road
	
Photographer facing South, at the beginning of the proposed upgrade	Photographer facing East of the Siyathuthuka Road

	
Photographer facing North West	Photographer facing North East
	
Photographer facing South West	Photographer facing South East

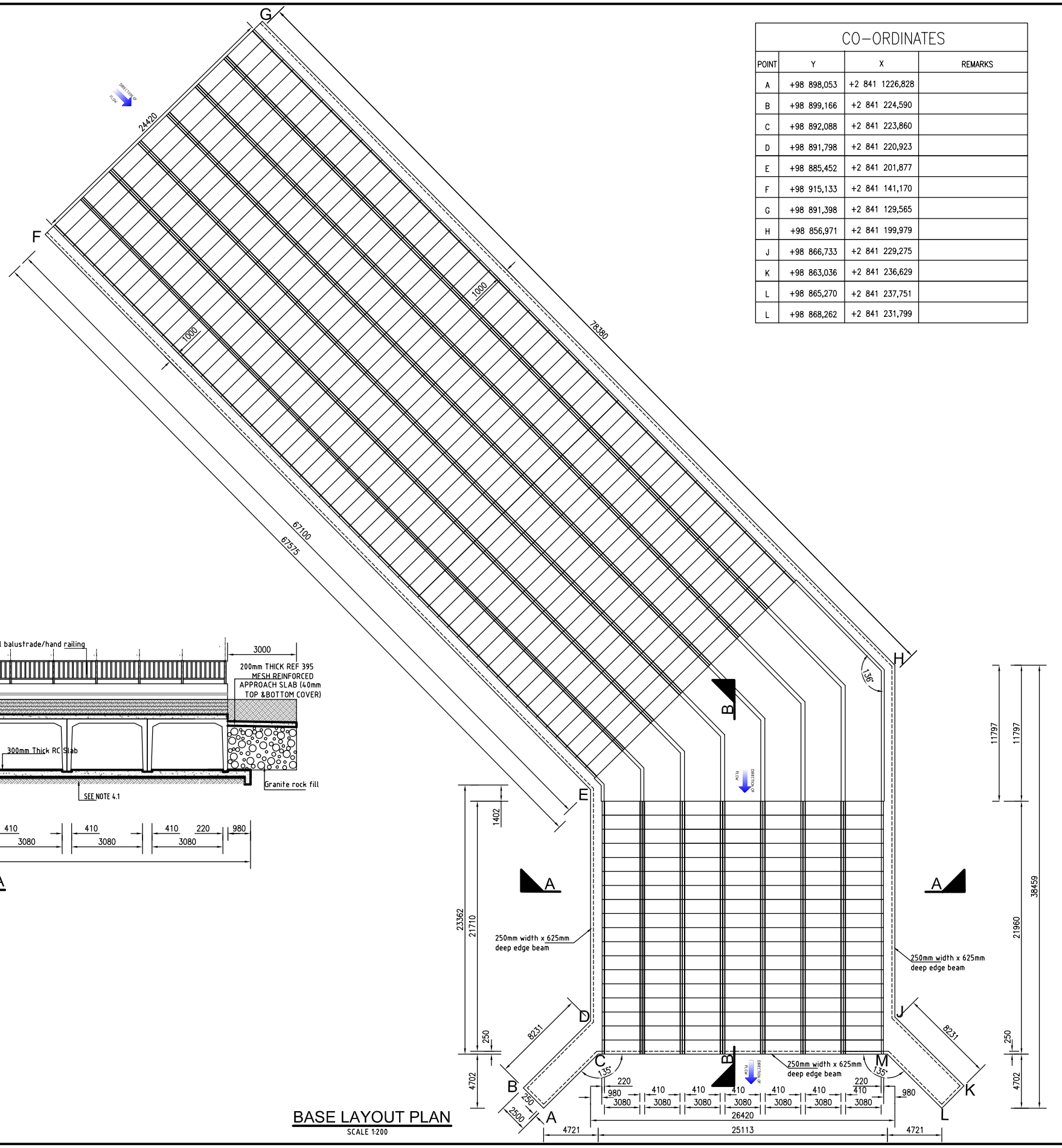
Pictures of Culvert 1

Pictures of Culvert 2

Appendix 3: Facility Illustration

Culvert 1

SECTION A - A
SCALE 1:100



BASE LAYOUT PLAN
SCALE 1:200

CO-ORDINATES			
POINT	Y	X	REMARKS
A	+98 898,053	+2 841 1226,828	
B	+98 899,166	+2 841 224,590	
C	+98 892,088	+2 841 223,860	
D	+98 891,798	+2 841 220,923	
E	+98 885,452	+2 841 201,877	
F	+98 915,133	+2 841 141,170	
G	+98 891,398	+2 841 129,565	
H	+98 856,971	+2 841 199,979	
J	+98 866,733	+2 841 229,275	
K	+98 863,036	+2 841 236,629	
L	+98 865,270	+2 841 237,751	
L	+98 868,262	+2 841 231,799	

NOTES

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   - ACCOMPANIED BY A MSW DRAWING ISSUE SHEET.

GENERAL NOTES:

1.0 GENERAL DESIGN NOTES
1.1 STRUCTURAL SYSTEM:
SEVEN BARREL RECTANGULAR INSITU CONCRETE CULVERT
1.2 CODES OF PRACTICE:
a) TMH7 PART 2&3-HIGHWAYS BRIDGES AND CULVERTS IN SOUTH AFRICA.
b) SANS 1200 LE - STORMWATER DRAINAGE.
1.3 METHOD OF ANALYSIS:
LINEAR ELASTIC ANALYSIS AND LIMIT STATE DESIGN METHODS
2.0 DESIGN LOADINGS
2.1 PERMANENT LOAD (UNIT WEIGHTS):
- BACKFILL 20.0kN/m³
- REINFORCED CONCRETE 25kN/m³
2.2 VERTICAL EARTH PRESSURE:
- 10ρgh x 10^{-3} AS PER TMH 7 PART 2: 2.3.3
2.3 TRANSIENT VERTICAL:
- NONE
2.4 RESTRAINT ACTION:
- TMH7 PART 2, SECTION 4 FOR IN-SITU CONCRETE.
2.5 HYDRAULIC DATA:
- CATCHMENT AREA = km²
- PEAK DISCHARGE FOR 1:50 YEAR RECURRENCE INTERVAL = m³/s
- DESIGN FLOOD LEVEL = VARIES
3.0 QUALITY AND PROPERTIES OF MATERIALS:
- SAFE BEARING CAPACITY OF FOUNDING MATERIAL
DENSE TO VERY DENSE RESIDUAL GRANITE = 200 kPa
- BACKFILL MATERIAL
GRANULAR MATERIAL WITH Ø ≥ 32°
- CONCRETE CLASSES AND YOUNG MODULUS CLASS
MASS CONCRETE 15/19
CONCRETE SCREED 15/19
REINFORCED CONCRETE 30/19 30 MPa
- COEFFICIENT OF THERMAL EXPANSION OF CONCRETE α_t^1 = 12 x 10^{-6}/°C
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YIELD STRESS FOR:
HOT-ROLLED MILD STEEL PLAIN ROUND BARS (R-BARS) 250 MPa
HOT-ROLLED HIGH-YIELD STRESS STEEL DEFORMED BARS (Y-BARS) 450 MPa
4.0 CONSTRUCTION REQUIREMENTS
4.1 FOUNDATION CONDITIONS:
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4.2 SURFACE FINISHES:

TYPE OF SURFACE	FORMED SURFACES	UNFORMED SURFACES
UNEXPOSED TO VIEW	CLASS F1	CLASS U1
EXPOSED TO VIEW	CLASS F2	CLASS U2
TOP OF INVERT SLAB	N/A	CLASS U2

4.3 EXPOSED CORNERS:
ALL VISIBLE SHARP CORNERS (INCLUDED ANGLE < 120°) TO BE CHAMFERED 25 x 25 UNLESS OTHERWISE INDICATED.
4.4 CONCRETE COVER:

PART OF STRUCTURE	MIN. COVER OVER
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HEADWALLS, EARWINGS, WINGWALLS AND RETAINING WALLS	40mm

4.5 JOINTS AND SUBSURFACE DRAINAGE:
MOVEMENT JOINTS WHERE APPLICABLE TO BE FORMED USING CLOSED CELL POLYETHYLENE 'JOINEX' OR APPROVED EQUIVALENT. JOINT SEALANT TO BE FORMEX 22DS100 HIGHWAY SEALANT OR APPROVED EQUIVALENT. 100mm DIA. F.C. WEEPHOLES WITH DRAINAGE STRIPS ON THE FACE AS DETAILED.
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REVISIONS

MARK	BY	DATE	REVISION DESCRIPTION
00	KCH	04.07.12	CONCEPT DRAWING

ASSOCIATED DRAWINGS

DRAWING NUMBER	DRAWING DESCRIPTION

CLIENT
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email: admin@msw.za.com

PROJECT:
MPUMALANGA HIGH ALTITUDE TRAINING CENTRE

DRAWING TITLE:
CULVERT CHAINAGE 1240
BASE LAYOUT PLAN

	BY	CHECKED	APPROVED	PAPER SIZE	A1
DRAWN	KCH		SIGN		
-				DATE DRN	JUNE 2012
DESIGNED	BMU		DATE	SCALE	1:100

DRAWING NUMBER
MSW - 1280 - DWG - 204 - 00
ISSUER JOB NUMBER TYPE DRAWING NUMBER REVISION

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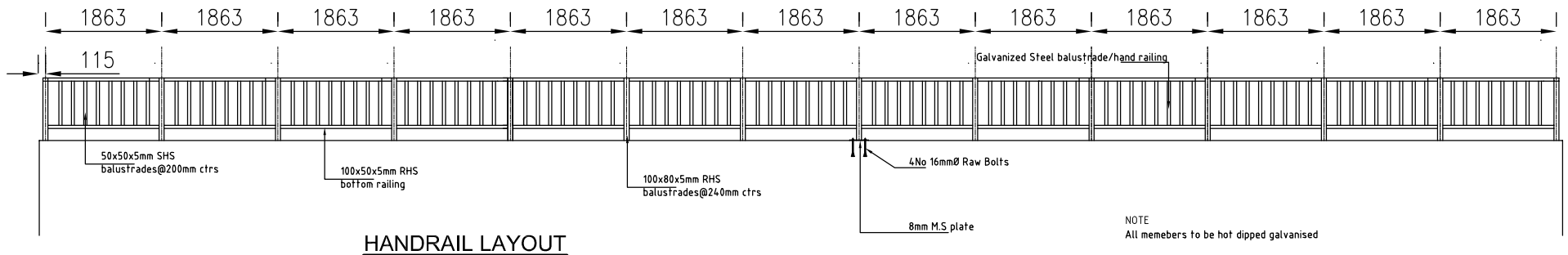
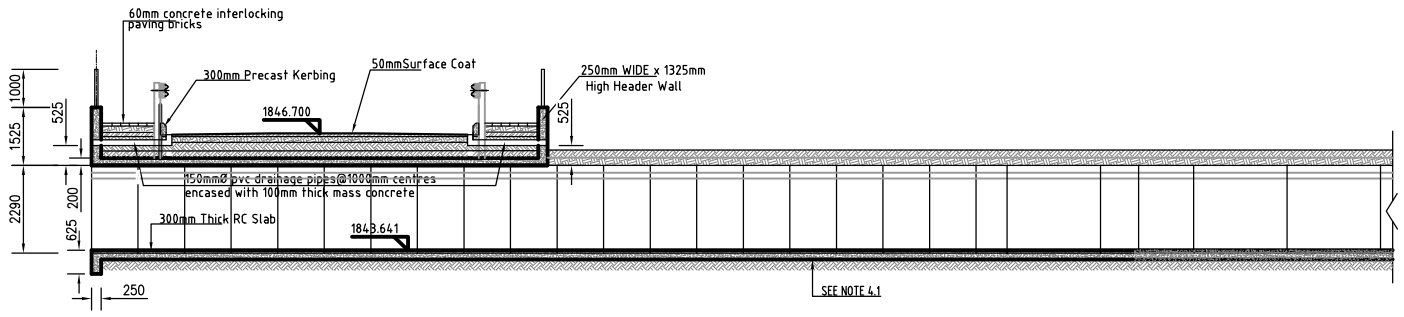
13 August 2012 12:08:50 PM

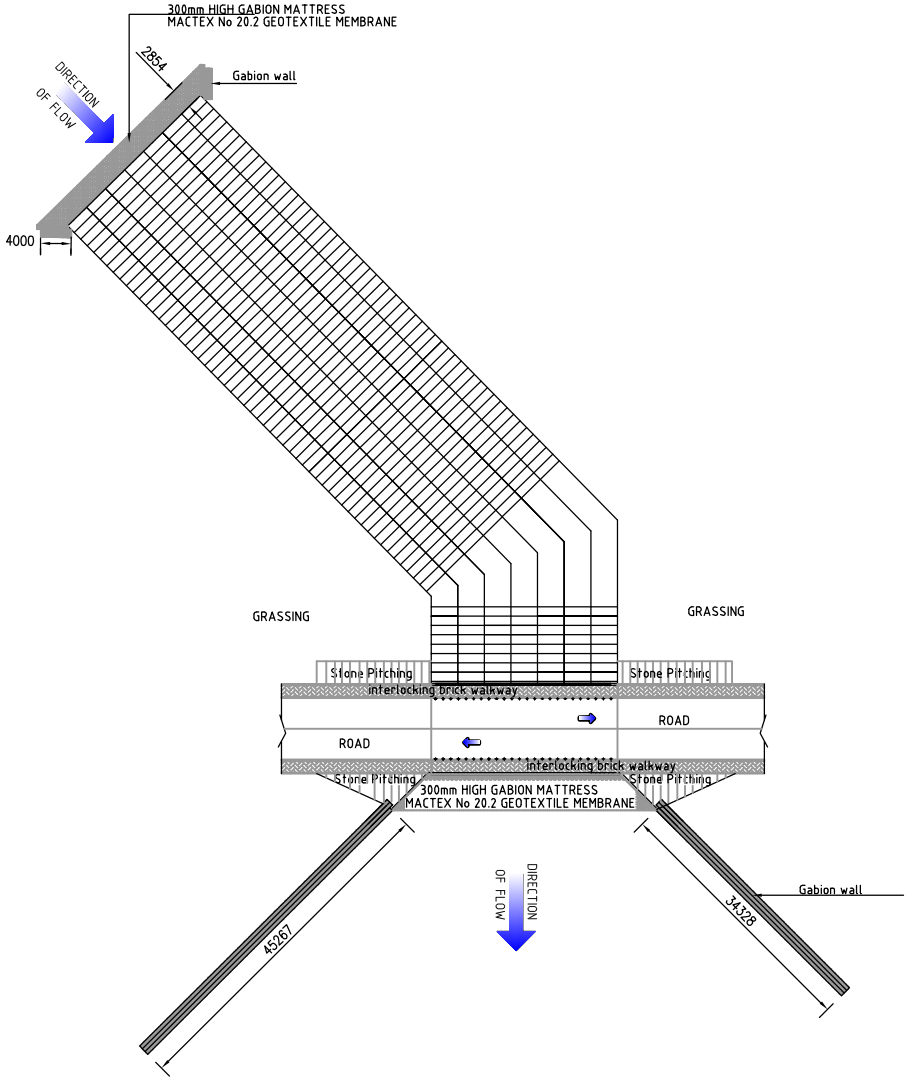


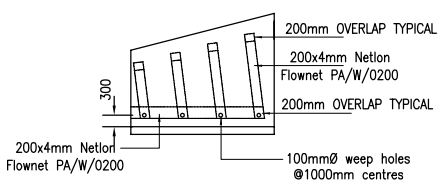
NOTE
All memebers to be hot dipped galvanised

HANDRAIL LAYOUT
SCALE 1:50

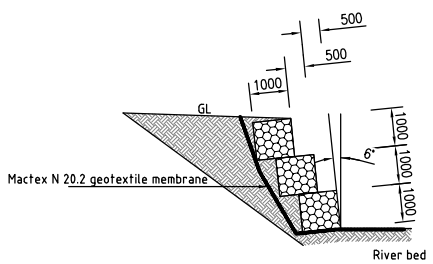


SECTION B - B
SCALE 1:100





FLOWNET ARRANGEMENT
SCALE 1:100



GABION WALL DETAIL
SCALE 1:100

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MARK	BY	DATE	REVISION DESCRIPTION
00	KCH	04.07.12	CONCEPT DRAWING

ASSOCIATED DRAWINGS

DRAWING NUMBER	DRAWING DESCRIPTION

Untitled
CLIENT
MPUMALANGA PROVINCIAL GOVERNMENT

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PROJECT:
MPUMALANGA HIGH ALTITUDE TRAINING CENTRE

	BY	CHECKED	APPROVED		PAPER SIZE	A1
DRAWN	KCH		SIGN			
-					DATE DRN	JUNE 2012
DESIGNED	BMU		DATE		SCALE	1:100

DRAWING TITLE:
CULVERT CHAINAGE 1240
GENERAL LAYOUT PLAN & SECTION DETAILS

DRAWING NUMBER
MSW - 1280 - DWG - 206 - 00
ISSUER JOB NUMBER TYPE DRAWING NUMBER REVISION

Z:\Projects\MS1280 Proposed New Sports Academy, Belfast Mpumalanga\A - Pre- Contract\7 - Drawings\702 - Internal Drawings\In Progress\MSW-1280-DWG-200\MSW-1280-DWG-204-00.dwg

13 August 2012 12:13:17 PM

13 August 2012 12:19:01 PM

NOTES

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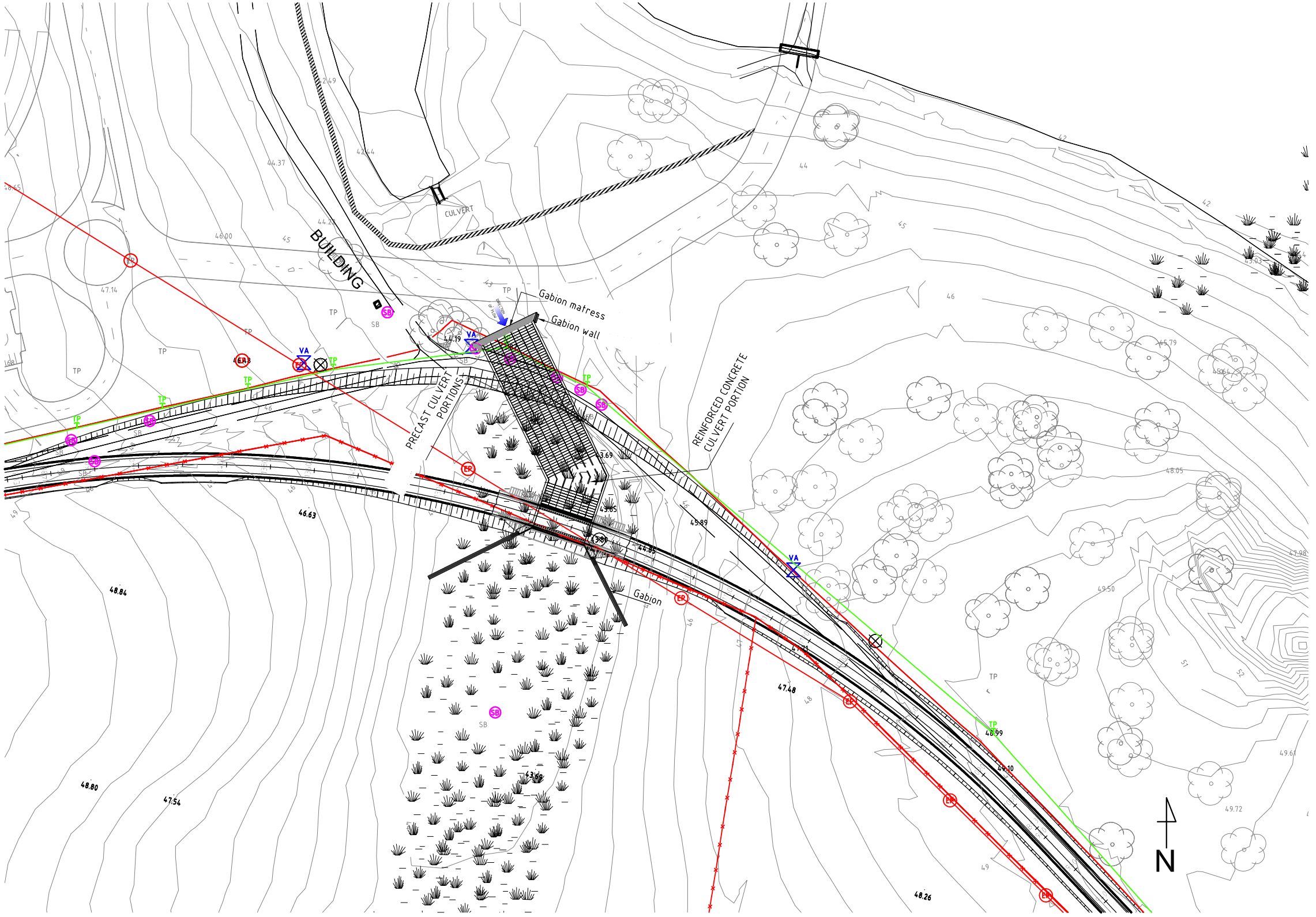

REVISIONS

MARK	BY	DATE	REVISION DESCRIPTION
00	KCH	08.08.2012	CONCEPT DRAWING

ASSOCIATED DRAWINGS

DRAWING NUMBER	DRAWING DESCRIPTION

CLIENT

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	BY	CHECKED	APPROVED	PAPER SIZE	A1
DRAWN	KCH		SIGN		
-				DATE DRN	AUG. 2012
DESIGNED	BMU		DATE	SCALE	AS SHOWN

DRAWING TITLE:
CULVERT CHAINAGE 1240
SITE LAYOUT

DRAWING NUMBER

MSW	1280	DWG	207	00
ISSUER	JOB NUMBER	TYPE	DRAWING NUMBER	REVISION

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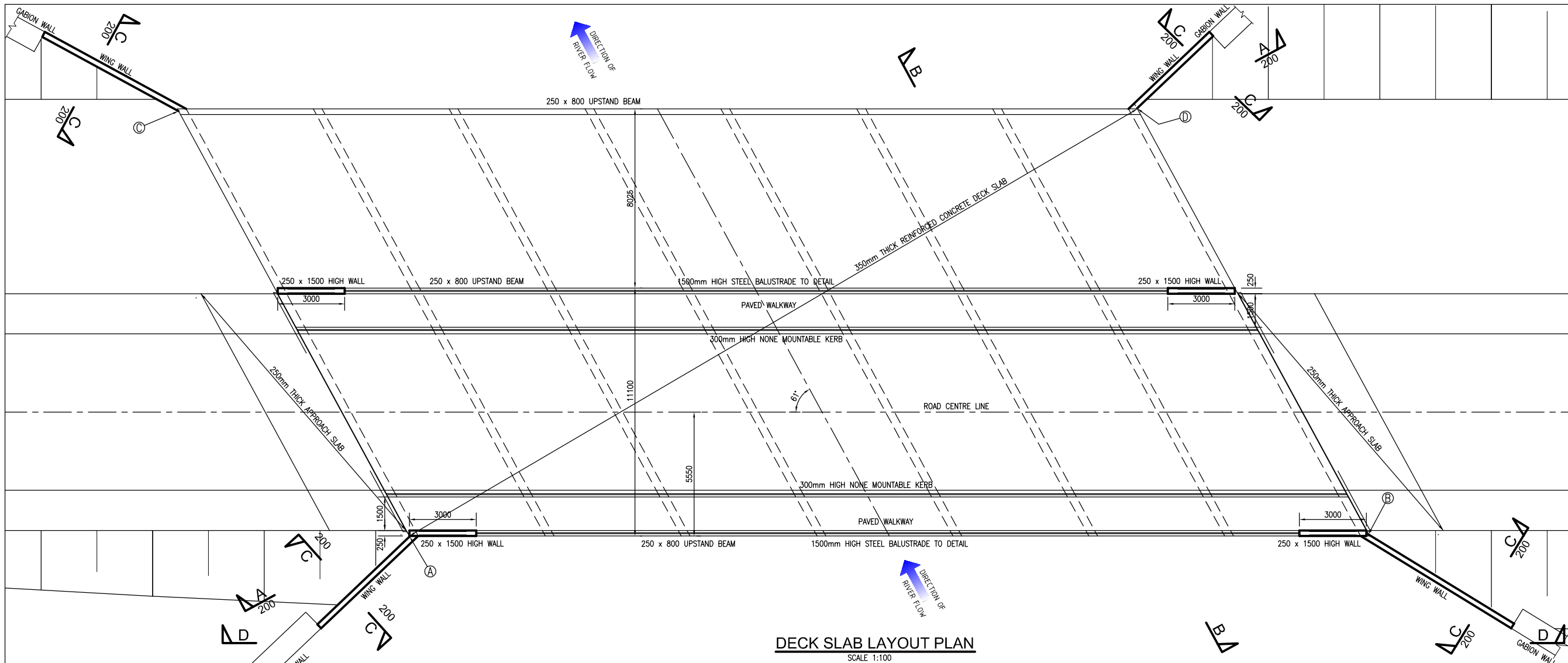

DECK SLAB LAYOUT PLAN
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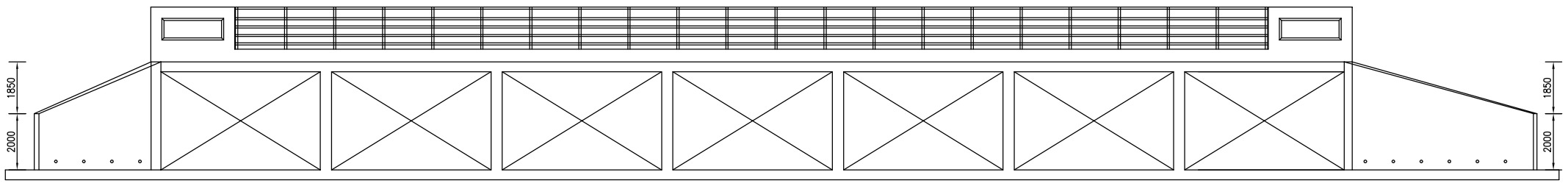

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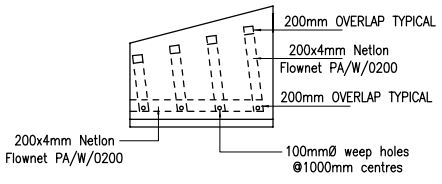

FLOWNET ARRANGEMENT
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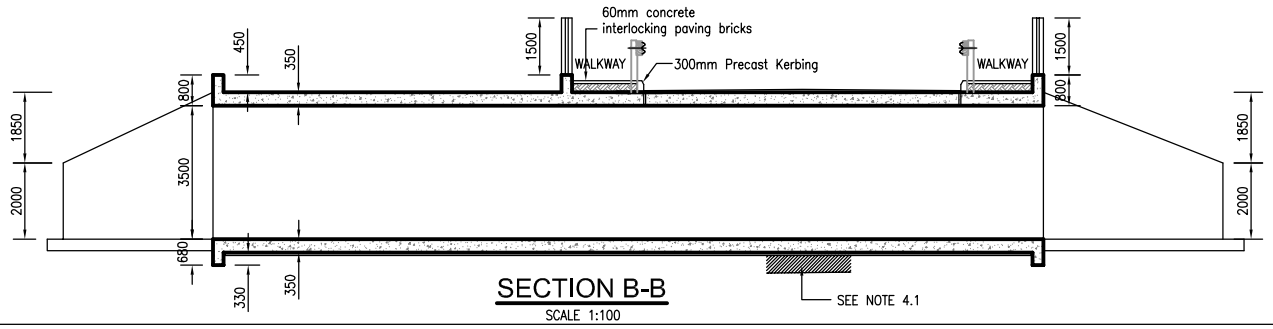

SECTION B-B
SCALE 1:100

GENERAL NOTES:

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REVISIONS			
MARK	BY	DATE	REVISION DESCRIPTION

ASSOCIATED DRAWINGS	
DRAWING NUMBER	DRAWING DESCRIPTION

CLIENT
MPUMALANGA PROVINCIAL GOVERNMENT
PO Box 437
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1050.
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Fax: +27 13 249 2050

idt
independent development trust

SABS ISO 9001
"An SABS ISO 9001 Quality Management System Certified Company"

Masetlaoka Scott Wilson
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Fax: +27 11 805 0992
email: admin@msw.za.com

PROJECT:
MPUMALANGA HIGH ALTITUDE TRAINING CENTRE

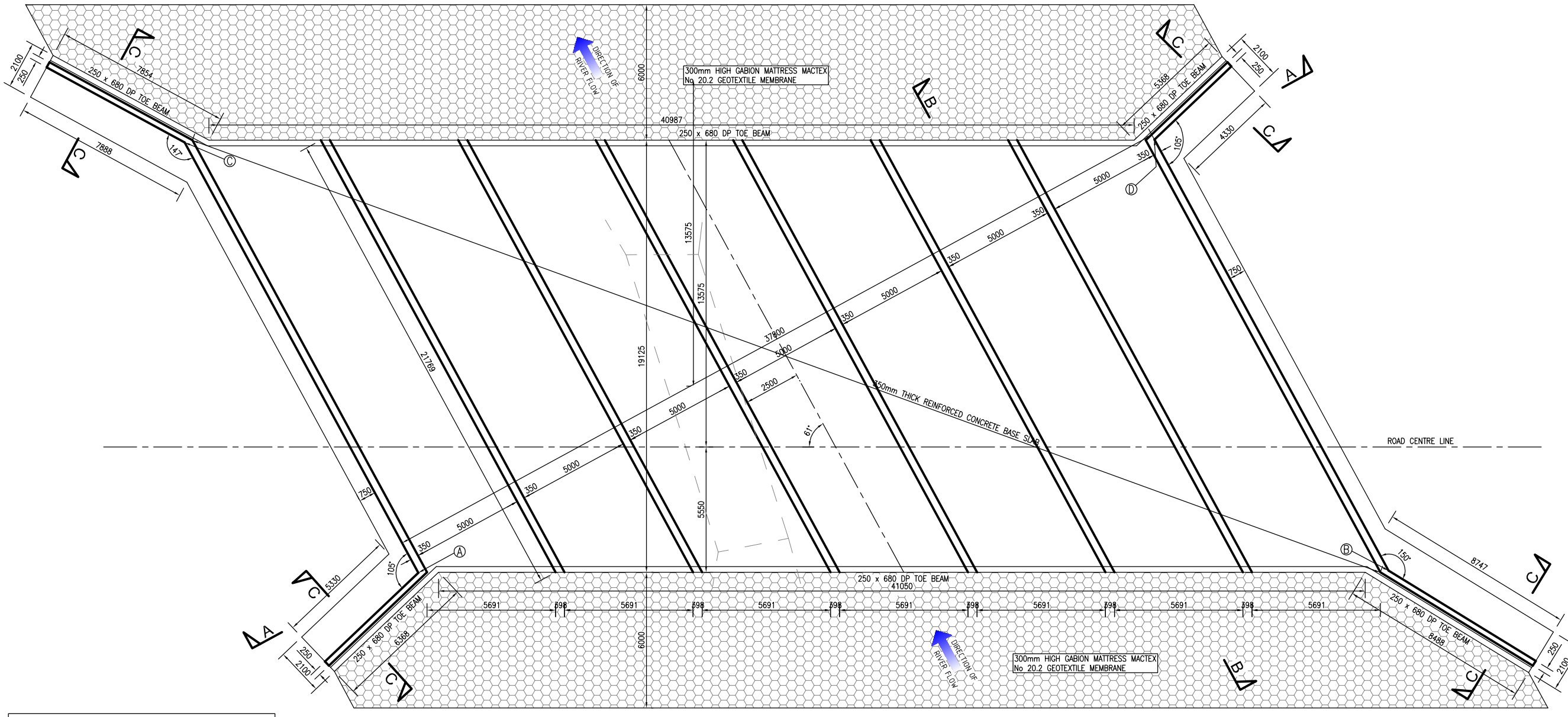
	BY	CHECKED	APPROVED	PAPER SIZE	A1
DRAWN	JND		SIGN		
-				DATE DRN	JUNE 2012
DESIGNED	BMU		DATE	SCALE	AS SHOWN

DRAWING TITLE:
ACCESS PREPAROTARY ROAD
CULVERT @ CHAINAGE 400 DECK LAYOUT

DRAWING NUMBER
MSW - 1280 - DWG - 201 - 00
ISSUER | JOB NUMBER | TYPE | DRAWING NUMBER | REVISION

Z:\Projects\MS1280 Proposed New Sports Academy, Belfast Mpumalanga\A - Pre- Contract\7 - Drawings\702 - Internal Drawings\In Progress\MSW-1280-DWG-200\MSW-1280-DWG-200-00.dwg

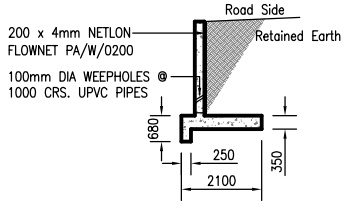
8/13/2012 12:29 PM



BASE SLAB LAYOUT PLAN

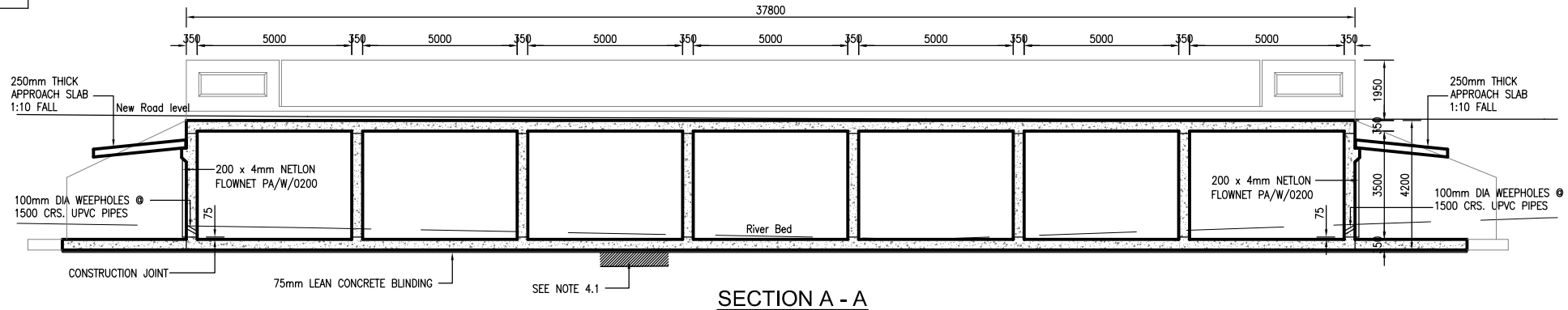
SCALE 1:100

CO-ORDINATES			
POINT	Y	X	REMARKS
A	+98 211,732	+2 841 1710,686	
B	+98 173,932	+2 841 731,030	
C	+98 211,732	+2 841 689,290	
D	+98 173,932	+2 841 709,625	



SECTION C-C

SCALE 1:100



SECTION A - A

SCALE 1:100

GENERAL NOTES:

1.0 GENERAL DESIGN NOTES

1.1 STRUCTURAL SYSTEM:
SEVEN BARREL RECTANGULAR INSITU CONCRETE CULVERT

1.2 CODES OF PRACTICE:
a) TMH7 PART 2&3-HIGHWAYS BRIDGES AND CULVERTS IN SOUTH AFRICA.
b) SANS 1200 LE - STORMWATER DRAINAGE.

1.3 METHOD OF ANALYSIS:
LINEAR ELASTIC ANALYSIS AND LIMIT STATE DESIGN METHODS

2.0 DESIGN LOADINGS

2.1 PERMANENT LOAD (UNIT WEIGHTS):
- BACKFILL 20.0kN/m³
- REINFORCED CONCRETE 25kN/m³

2.2 VERTICAL EARTH PRESSURE:
- $10\rho gh \times 10^{-3}$ AS PER TMH 7 PART 2: 2.3.3

2.3 TRANSIENT VERTICAL:
- NONE

2.4 RESTRAINT ACTION:
- TMH7 PART 2, SECTION 4 FOR IN-SITU CONCRETE.

2.5 HYDRAULIC DATA:
- CATCHMENT AREA = km²
- PEAK DISCHARGE FOR 1:50 YEAR RECURRENCE INTERVAL = m³/s
- DESIGN FLOOD LEVEL = VARIES

3.0 QUALITY AND PROPERTIES OF MATERIALS:
- SAFE BEARING CAPACITY OF FOUNDING MATERIAL
DENSE TO VERY DENSE RESIDUAL GRANITE = 200 kPa
- BACKFILL MATERIAL
GRANULAR MATERIAL WITH Ø ≥ 32°
- CONCRETE CLASSES AND YOUNG MODULUS CLASS
MASS CONCRETE 15/19
CONCRETE SCREED 15/19
REINFORCED CONCRETE 30/19 30 MPa
- COEFFICIENT OF THERMAL EXPANSION OF CONCRETE $\alpha_t^1 = 12 \times 10^{-6}$/°C
- SHRINKAGE DEFORMATION $\varepsilon_{cs} = 300 \times 10^{-6}$
- REINFORCEMENT TO SABS 920 (1985) AND SABS 1024 (1991) E MODULUS 200 GPa
YIELD STRESS FOR:
HOT-ROLLED MILD STEEL PLAIN ROUND BARS (R-BARS) 250 MPa
HOT-ROLLED HIGH-YIELD STRESS STEEL DEFORMED BARS (Y-BARS) 450 MPa

4.0 CONSTRUCTION REQUIREMENTS

4.1 FOUNDATION CONDITIONS:
UNSUITABLE FOUNDING MATERIALS TO BE REMOVED TO A DEPTH SPECIFIED ON SITE. REPLACED WITH APPROVED MATERIAL COMPACTED IN 150mm LAYERS TO 95% MOD. AASHTO DENSITY OR MASS CONCRETE AS DIRECTED BY THE ENGINEER. WHERE SPECIFIED, FOUNDATION DOWELS SHOULD BE INSTALLED ONLY AFTER PLACING OF FINAL CONCRETE SCREED.

4.2 SURFACE FINISHES:

TYPE OF SURFACE	FORMED SURFACES	UNFORMED SURFACES
UNEXPOSED TO VIEW	CLASS F1	CLASS U1
EXPOSED TO VIEW	CLASS F2	CLASS U2
TOP OF INVERT SLAB	N/A	CLASS U2

4.3 EXPOSED CORNERS:
ALL VISIBLE SHARP CORNERS (INCLUDED ANGLE < 120°) TO BE CHAMFERED 25 x 25 UNLESS OTHERWISE INDICATED.

4.4 CONCRETE COVER:

PART OF STRUCTURE	MIN. COVER OVER
FOUNDATIONS AND INLERT SLAB	40mm
HEADWALLS, EARWINGS, WINGWALLS AND RETAINING WALLS	40mm

4.5 JOINTS AND SUBSURFACE DRAINAGE:
MOVEMENT JOINTS WHERE APPLICABLE TO BE FORMED USING CLOSED CELL POLYETHYLENE 'JOINEX' OR APPROVED EQUIVALENT. JOINT SEALANT TO BE FORNEX 220S100 HIGHWAY SEALANT OR APPROVED EQUIVALENT. 100mm DIA. P.C. WEEPHOLES WITH DRAINAGE STRIPS ON THE FACE AS DETAILED.

4.6 BACKFILLING:
BACKFILLING AGAINST OR OVER IN-SITU STRUCTURAL MEMBERS SHALL NOT COMMENCE UNTILL THE CONCRETE CUBE STRENGHT HAS REACHED 30 MPa. BACKFILLING FOR ALL ELEMENTS SHALL BE PLACED SIMULTANEOUSLY ON BOTH SIDES OF THE CULVERT IN 150mm COMPACTED LAYERS. COMPACTION OF LAYERWORKS WITHIN 450mm ABOVE CULVERT SHALL BE DONE USING SMALL MACHINERY. MATERIALS FOR BACKFILLING TO PORTALS TO COMPLY WITH THE REQUIREMENTS OF SANS 1200 DB, AND SANS 1200 LE, CLAUSE 5,4.

4.7 EMBANKMENT PROTECTION:
RENO MATTRESS PROTECTION IF SHOWN IS SUBJECT TO SITE CONDITIONS AND ENGINEER'S APPROVAL.

4.8 THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT SERVICES, ARCHITECTURAL AND SPECIALISTS DRAWINGS. ANY DISCREPANCIES IN DIMENSIONS OR DETAILS ON OR BETWEEN THESE DRAWINGS SHOULD BE DRAWN TO THE ATTENTION OF THE ENGINEER FOR CLARIFICATION.

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DRAWING TITLE:
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CULVERT @ CHAINAGE 400 LAYOUT

DRAWING NUMBER
MSW - 1280 - DWG - 200 - 00
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Appendix 4: CVs of EAPs

PERSONAL DATA	**DHANASHREE NAIDOO**
Company	Nemai Consulting
Position in firm	Project Manager
Nationality	South African
Languages	English and Afrikaans

EDUCATION

- BSc Chemical Engineering – University of Natal. Professionally registered Engineer with ECSA
- Currently registered with Wits University to complete a Masters Degree in Bio-Medical Engineering
- Internationally accredited environmental auditor.
- Unisa – Studying French
- Social and Institutional Development Certificate – University of Pretoria
- Completed a course on Agenda 21 by DEAT
- Public participation certificate – University of Pretoria.
- Social Impact Assessment Certificate –University of Potchefstroom

EXPERIENCE AND KEY QUALIFICATIONS

(A) Management

1) Managed the EMP study for the Maputo Corridor in Mozambique. This involved co-ordinating the construction programme, the Social investigation, the Environmental study and working with the South African and Mozambican Environmental Departments, the various Contractors and the Trans African Consortium. This was the largest project in both countries to be designed in accordance to ISO 14001 standards.
2) Project managed the environmental programmes for 70 Build, Operate, Train and Transfer (BoTT) projects in the Northern Province. This was an initiative programme from the then Kadar Asmal Projects. Prepared business plans and area development plans for METSICO, the consortium appointed by DWAF to facilitate the projects.

(B) EIA's, SIA's and EMPs'

1) EIA for Soweto-Parktown Bus Rapid Transit (BRT) development, including upgrade of 9 sections of road, for the Johannesburg Development Agency.
2) EIA for upgrade of road from Pokeng to Sun City.
3) EIA for North South Link Road in Greater Alex for City of Johannesburg Metropolitan Municipality.
4) EIA for the upgrade of Hendrik Verwoerd Drive as part of the revitalisation of the Randburg area for the Johannesburg Development Agency.
5) EIA for the construction of the Northern Gateway for the Johannesburg Development Agency

6) Boksburg Cason Pipeline –Completed detailed EIA for the construction of a 13 km pipeline.
7) Bethal Pipeline – EIA on a pipeline in Bethal. Pipeline goes through very sensitive environments.
8) EIA for filling station in Weltevreden Park
9) Cement Mortar Lining – EIA for the cement mortar lining of a 30 km pipeline in Zonkesizwe and Vosloorus
10) Total Gas holding facilities, Senegal – Completed Environmental Impact Assessment Study for the existing infrastructure as well as a new gas sphere.
11) EIA and SIA of 30km long pipeline in Germiston.
12) EIA, SIA and EMP for 13km long pipeline in Boksburg. Responsible for the relocation of informal dwellers on the servitude in Villa Liza. Instrumental in rezoning the servitude area as public open space so that the community of Villa Liza and Windmill Park ext 2 can now use the land for recreational purposes. This is a novel approach.
13) EIA for Casino Development in Queenstown. Involved details Social Impact Assessment study of the project on the community and EIA because the casino is to be located in the De Lange Nature Reserve.
14) EIA for Cast Iron Pipe Factory in Pretoria. Was successful in getting the Client, Stanton from the UK, an exemption on the project.
15) EIA and EMP for pipeline for Hartbeespoortdam Local Town Council
16) EIA, EMP and SIA for toll Facilities, Boardwalk and Parking Area for Hartbeespoortdam Local Town Council
17) EIA and EMP for water reticulation project in Piet Gouws.
18) I was employed by the Inspectorate Division in Gauteng for the period from January 2000 to March 2000 as a Senior Environmental Officer.
19) EMP and social survey for the Witbank to Maputo Toll road on the Mozambican side.

"I Dhanashree Naidoo confirm that the above CV is an accurate description of my experience and qualifications.

Signed .....

D. Naidoo

.....

Date

PERSONAL DATA	CIARAN CHIDLEY
Nationality	South African
Languages	English and Afrikaans
Current Position	Project Manager

EDUCATION AND PROFESSIONAL QUALIFICATIONS

- Registered Professional Engineer with the Engineering Council of South Africa – Reg. no. 980360
- B.Sc (Eng) Civil Engineering – University of the Witwatersrand
- B.A. Economics, Philosophy – University of South Africa
- Master of Business Administration – University of the Witwatersrand
- Certified training as an Occupational Health and Safety Officer.

Frances Baard District Municipality EMF and SEMP	• Specialist contributor for the economic, GIS and development aspects of the Frances Baard Municipality Environmental Management Framework and SEMP. The FBDM is centred around Kimberley in the Northern Cape. The EMF spatially represented and controlled areas for development. This was supported by a Strategic Environmental Management Plan.
Namakwa District Municipality EMF and SEMP	• Project leader for the development of the Namakwa District Municipality Environmental Management Framework. The NDM is the largest District in the country andf is located in the Northern Cape. The EMF spatially represented and controlled areas for development. This was supported by a Strategic Environmental Management Plan.
Hazelmere Dam Raising EIA	• Project leader of the raising of the Hazelmere Dam EIA. The project involved the raising of the dam by 7m to increase the dam yield. The EIA involved the review of various specialist disciplines including flora, fauna, heritage, visual, operational rules and a social impact assessment. Comprehensive public participation was conducted for the project including the conducting of focus groups sessions and open days.
EMF for the Jukskei River Catchment	• Responsible for economic and riverine structure aspects of the EMF. The Jukskei River is the largest river running through the city of Johannesburg and is extensively degraded due to urban development. The EMF recommended measures to be taken to manage the river, both in its riverine health and structure
Empangeni Richards Bay Waste Water Link	• Project leader of the EIA for a new waste water pipeline linking Empangeni's Industrial areas to the Richards Bay Main Outfall. The pipe length was 20 kilometres. The EIA included route review, flora and fauna specialist studies and risk assessment across a road bridge crossing. A public participation campaign was conducted along the route and yielded co-operation with all affected landowners. Was involved in negotiations for crop compensation.

Phokeng to Sun City Road	• Project leader for the widening and re-routing of the main transport link between Rustenburg and Sun City. The road width was doubled along its length and re-routed around the town of Boshoek. The EIA involved extensive consultations with landowners landowners regarding environmental impacts and expropriation processes. The re-routing of the road around Boshoek was highly controversial and necessitated a comprehensive socio-economic study. Additional specialist studies involved flora, fauna and heritage. Applications were also made to DME for permissions to create and use borrow pits.
Gauteng Department of Housing EIAs	• Project leader for all the EIAs conducted for Housing Developments in Tshwane during a three year period. The project involved EIAs for 32 sites and included the conducting and oversight of specialist studies ranging from socio-economic, flora, fauna, heritage, visual impacts, noise impacts and traffic studies. The projects all involved Public Participation and liaison with community structures.
Fairbreeze C Ext Public Participation	• Project leader for the Public Participation campaign for the EIA required for the establishment of a Mineral Sands Mine adjacent to Mtunzini, Kwa-Zulu Natal. The project was controversial and a series of 12 public meetings were necessary for the project. Impacts and mitigations formed an important part of the process and as such close liaison with the various specialists was necessary. In this cae, the specialist studies were geology, geo-hydrology, water resources, avi-fauna, heritage, socio economic, noise, visual, operational rules and traffic.
Fairbreeze C Ext Socio-Economic Study Public Participation	• Conducted the Socio-Economic specialist study for the project. The study presented the socio-economic status quo of the area, generated impacts that the mine would have on the community and suggested mitigation measures. The report was included in the final EIA for the mine.
ERPM Mine Water	• Project leader for a project that identified the various sources of the ground water reporting to the ERPM Mine. The Mine is one of the lowest in a chain of gold mines along the so called Main Reef of the Witwatersrand, As such, mine water from “higher” mines decant though existing mine workings to reach ERPM, a distance of 50 kms. The report demonstrated that water was indeed reporting from other mines and from surface holings considerable distances away from the mine. The report was used to justify the sharing of pumping costs incurred by ERPM to keep their works free of water.

I, undersigned certify that to the best of my knowledge and belief this data correctly describes me, my qualification and my experience.

Signature of Staff Member ***Date: 20 September 2010***

Personal Details

Name and Surname	: Manogrie Chetty
Date of birth	: 05 June 1984
Occupation	: Senior Environmental Officer
Qualification	: Bsc (Hons) Biological Sciences
Nationality	: South Africa
Name of Firm	: Nemai Consulting
Years with the firm	: 2 months

EDUCATION AND PROFESSIONAL QUALIFICATIONS

Highest Qualification	Institution	Date
Bsc Biological Sciences	University of Kwa-Zulu Natal	2002-2005
BSc (Hons) Biological Sciences	University of Kwa-Zulu Natal	2006
MSC-CW Environmental Sciences	University of Kwa-Zulu Natal	2008 to Present

RELEVANT EXPERIENCE

- ECO monitoring audits for the eThekwini Municipality Sapref Substation (November 2011 – February 2012).
- ECO monitoring audit and reports for the construction of the FFS Small Depot (December 2008 – June 2009).
- ECO monitoring audit and reports for the Fernleigh housing development (October 2008 – March 2009).
- EMPr for the Rehabilitation of the Ogunjini Water Treatment Plant within the eThekwini Municipality (January 2012).
- EMPr for the Fraser informal settlement proposed sewerage treatment scheme within the eThekwini Municipality (May 2011).
- BAR and EMP for the construction of a taxi holding area in Brookside, PMB (February 2011).
- EIR and EMPr for the reconstruction of the salt rock hotel (May 2012).
- BAR and EMPr for the Tongaat Hulett Developments sewage options for the uMhlatuzana catchment (January 2011).
- EIR, EMPr and the rehabilitation plan for the application submitted to DME for the proposal to continue the mining of gravel by Stockville Quarries (January 2011).
- EIR and EMPr for the Lulubush Wildlife Estate (January 2011).
- Scoping report for the construction of a 2500m^2 processing facility to remove contaminants from waxy oil at FFS (December 2010).
- EIR and EMP for the construction of a petroleum product tank storage facility at FFS Refiners (Pty) Ltd (December 2010).
- Environmental Impact Report (EIR) and Environmental Management Programme (EMPr) for the Burlington extension subsidy housing development (November 2010).
- EMPr for use of the Durban International Old Airport Site as a Vehicle Storage Depot,

Remainder of Durban Airport No 14263 (October 2010).

- Presentation of the NEMA 2010 EIA Regulations for Tongaat Hulett Developments (September 2010).
- BID for the Roseneath Gardens Housing Development (July 2010).
- Preliminary Environmental Assessment Report for the proposed upgrade of low cost housing units in Sim Place, KZN (July 2010).
- EIR and EMP for the proposed construction of a pressure reducing station for the Phoenix area gas supply (May 2010).
- EMP for the rezoning of 34 Old Main Road, Hillcrest, KZN (April 2010).
- Scoping Report for the proposed construction of a pressure reducing station for the Phoenix area gas supply (January 2010).
- Scoping Report for the Burlington extension subsidy housing development (December 2009).
- Scoping Report for the Tshelimnyama Housing Development (October 2009).
- BID for the Ntuzuma – E housing development (October 2009).
- BAR for the construction of a garden refuse transfer station for Ntuzuma A (site 7), KZN (September 2009).
- Feasibility report for the proposed lead recovery process as an upgrade to the existing de-silverising process at the Associated Additives site (September 2009).
- BAR for the construction of a garden refuse transfer station for Umlazi – BB (site 7) and Umlazi – V (site 8), KZN (July 2009).
- BAR for the construction of a torbanite pilot plant at FFS Refiners, PMB (June 2009).
- Environmental Management Plan (EMP) for the rezoning application for 27 Old Main Road, Gillits, KZN (May 2009).
- Scoping Report for the construction of a new lead recycling plant at 245 Lansdowne Road (March 2009).
- Basic Assessment Report (BAR) for the construction of a Heavy Metal Free (HMF) stabilizer plat at the Associated Additives site in Durban (April 2009).

Declaration:

I confirm that the above information is an accurate description of my experience and qualifications.

Manogrie Chetty

Senior Environmental Officer