mineral resources

Department:
Mineral Resources
REPUBLIC OF SOUTH AFRICA

Umsimbithi Mining (Pty) Limited

DRAFT ENVIRONMENTAL IMPACT ASSESSMENT REPORT FOR THE PROPOSED ROAD DIVERSION AT WONDERFONTEIN MINE

Ref No.:30/5/1/2/2/359 MR

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Project No.: A0946

Report No.: JKC_1056

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OBJECTIVES OF THE ENVIRONMENTAL IMPACT ASSESSMENT PROCESS

The objective of the environmental impact assessment process is to, through a consultative process:

(a) determine the policy and legislative context within which the activity is located and document how the proposed activity complies with and responds to the policy and legislative context;

(b) describe the need and desirability of the proposed activity, including the need and desirability of the activity in the context of the development footprint on the approved site as contemplated in the accepted scoping report;

(c) identify the location of the development footprint within the approved site as contemplated in the accepted scoping report based on an impact and risk assessment process inclusive of cumulative impacts and a ranking process of all the identified development footprint alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects of the environment;

(d) determine the:

  (i) nature, significance, consequence, extent, duration and probability of the impacts occurring to inform identified preferred alternatives; and

  (ii) degree to which these impacts:

    (aa) can be reversed;

    (bb) may cause irreplaceable loss of resources, and

    (cc) can be avoided, managed or mitigated;

(e) identify the most ideal location for the activity within the development footprint of the approved site as contemplated in the accepted scoping report based on the lowest level of environmental sensitivity identified during the assessment;

(f) identify, assess, and rank the impacts the activity will impose on the development footprint of the approved site as contemplated in the accepted scoping report through the life of the activity;

(g) identify suitable measures to avoid, manage or mitigate identified impacts; and

(h) identify residual risks that need to be managed and monitored.

PROJECT DETAILS

Client Details	
Name of Project:	Wonderfontein Road Diversion Project
DMR reference:	30/5/1/2/2/359 MR
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Expertise of EAP:	**Jaco Kleynhans** – Professional Environmental Engineer, registered with ECSA (Engineering Council of South Africa, No. 940108). Jaco Kleynhans is a professional engineer, ECSA number 940108, and conducted closure cost assessments and practised environmental management for more than 24 years. During that period, he worked as an environmental manager at two large mines for 10 years where after he has been an environmental consultant. As environmental consultant he compiles and reviews various closure cost assessments and also conducted various due diligence assessments. Refer to **Annexure 1** for the Expertise and Curriculum Vitae of Jaco Kleynhans.

EXECUTIVE SUMMARY

Umsimbithi Wonderfontein Mine is authorised to expand its mining area in order to utilise the coal reserve located in the north-eastern region of the mining boundary. The existing P15-1 road however currently crosses over the coal reserve resulting in the sterilisation of the reserve along the alignment of the road. The mine therefore plans to permanently divert a section of the P15-1 road around the reserve so that the coal can be utilised.

The planned road diversion is located within the boundaries of Wonderfontein Mine within the jurisdictional area of Emakhazeni Local Municipality (ELM). The farm portions relevant to the application includes Portions 3, 7, 19, 22, 26, 44 and the Remaining Extent of the Farm Wonderfontein 428 JS. It is expected that the proposed road diversion will be 4.349 km in length and 8 m in width and will have a road reserve of 40 m. The construction phase will last between six to nine months.

The road diversion will require a General Authorisation for water uses and it triggers listed activity 6 of Regulation GN 984 of NEMA, December 2014 as amended in April 2017. An application for Environmental Authorisation was submitted to the Department of Mineral Resources (DMR) on 30 August 2019. An application for a General Authorisation will be submitted to the Department of Water and Sanitation (DWS).

Expected Impacts

The impacts associated with the road diversion will be determined during the EIA phase of the process. Two alternative locations for the road diversion were identified. A freshwater as well as a soil, land use, land capability and hydropedology assessment were both conducted in order to guide the selection of the final preferred location. The impacts that can be expected are: -

- Disturbance and compaction of soil, loss of soil and contamination due to hydrocarbon spills;
- Permanent loss of land use and land capability;
- Loss of fauna and flora habitat;
- Deterioration of wetland function;
- Contamination of surface water due to the generation of contaminated runoff;
- Deterioration of air quality due to the generation of dust; and
- An increase in traffic levels.

A Public Participation process was initiated and included the distribution of the consultation scoping report and a Background Information Document (BID). The project has been announced in the Middelburg Observer and a site notice has been placed at the activity boundary (next to the road at the proposed diversion). Further details of the Public Participation Process will be shared with the I&APs as the process continues.

DOCUMENT STRUCTURE

Number	Appendix 3 Description	Report Reference
3 (1)	An environmental impact assessment report must contain the information that is necessary for the competent authority to consider and come to a decision on the application, and must include—	
(a)	details of—	
(iii)	the EAP who prepared the report; and	Project Details – EAP Details
(iv)	the expertise of the EAP, including a curriculum vitae;	
(b)	the location of the development footprint of the activity on the approved site as contemplated in the accepted scoping report, including:	
(i)	the 21-digit Surveyor General code of each cadastral land parcel;	Section 2.2
(ii)	where available, the physical address and farm name; and	Section 2.1 Section 2.2
(iii)	where the required information in items (i) and (ii) is not available, the coordinates of the boundary of the property or properties;	N/A
(c)	a plan which locates the proposed activity or activities applied for as well as the associated structures and infrastructure at an appropriate scale, or, if it is—	Section 2.3
(i)	a linear activity, a description and coordinates of the corridor in which the proposed activity or activities is to be undertaken;	Section 2.1
(ii)	on land where the property has not been defined, the coordinates within which the activity is to be undertaken;	N/A
(d)	a description of the scope of the proposed activity, including—	
(i)	all listed and specified activities triggered and being applied for; and	Section 3
(ii)	a description of the associated structures and infrastructure related to the development;	Section 7
(e)	a description of the policy and legislative context within which the development is located and an explanation of how the proposed development complies with and responds to the legislation and policy context;	Section 4
(f)	a motivation for the need and desirability for the proposed development, including the need and desirability of the activity in the context of the preferred development footprint within the approved site as contemplated in the accepted scoping report;	Section 5
(g)	a motivation for the preferred development footprint within the approved site as contemplated in the accepted scoping report;	Section 6
(h)	a full description of the process followed to reach the proposed development footprint within the approved site as contemplated in the accepted scoping report, including:	

Number	Appendix 3 Description	Report Reference
(i)	details of the development footprint alternatives considered;	Section 6
(ii)	details of the public participation process undertaken in terms of regulation 41 of the Regulations, including copies of the supporting documents and inputs;	Section 12
(iii)	a summary of the issues raised by interested and affected parties, and an indication of the manner in which the issues were incorporated, or the reasons for not including them;	Section 12.5.3
(iv)	the environmental attributes associated with the development footprint alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects;	Section 8
(v)	the impacts and risks identified including the nature, significance, consequence, extent, duration and probability of the impacts, including the degree to which these impacts—	
(aa)	can be reversed;	Section 9.4 Section 9.5
(bb)	may cause irreplaceable loss of resources; and	
(cc)	can be avoided, managed or mitigated;	
(vi)	the methodology used in determining and ranking the nature, significance, consequences, extent, duration and probability of potential environmental impacts and risks;	Section 9.1 Section 9.2 Section 9.3
(vii)	positive and negative impacts that the proposed activity and alternatives will have on the environment and on the community that may be affected focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects;	Section 6
(viii)	the possible mitigation measures that could be applied and level of residual risk;	Section 9
(ix)	if no alternative development footprints for the activity were investigated, the motivation for not considering such; and	Section 6
(x)	a concluding statement indicating the location of the preferred alternative development footprint within the approved site as contemplated in the accepted scoping report;	Section 6
(i)	a full description of the process undertaken to identify, assess and rank the impacts the activity and associated structures and infrastructure will impose on the preferred development footprint on the approved site as contemplated in the accepted scoping report through the life of the activity, including—	
(i)	a description of all environmental issues and risks that were identified during the environmental impact assessment process; and	Section 9
(ii)	an assessment of the significance of each issue and risk and an indication of the extent to which the issue and risk could be avoided or addressed by the adoption of mitigation measures;	Section 9
(j)	an assessment of each identified potentially significant impact and risk, including—	

Number	Appendix 3 Description	Report Reference
(i)	cumulative impacts;	Section 9.5
(ii)	the nature, significance and consequences of the impact and risk;	Section 9.4 Section 9.5
(iii)	the extent and duration of the impact and risk;	
(iv)	the probability of the impact and risk occurring;	
(v)	the degree to which the impact and risk can be reversed;	
(vi)	the degree to which the impact and risk may cause irreplaceable loss of resources; and	
(vii)	the degree to which the impact and risk can be mitigated;	
(k)	where applicable, a summary of the findings and recommendations of any specialist report complying with Appendix 6 to these Regulations and an indication as to how these findings and recommendations have been included in the final assessment report;	Section 11
(l)	an environmental impact statement which contains—	
(i)	a summary of the key findings of the environmental impact assessment:	Section 10
(ii)	a map at an appropriate scale which superimposes the proposed activity and its associated structures and infrastructure on the environmental sensitivities of the preferred development footprint on the approved site as contemplated in the accepted scoping report indicating any areas that should be avoided, including buffers; and	Section 10
(iii)	a summary of the positive and negative impacts and risks of the proposed activity and identified alternatives;	Section 6
(m)	based on the assessment, and where applicable, recommendations from specialist reports, the recording of proposed impact management outcomes for the development for inclusion in the EMPr as well as for inclusion as conditions of authorisation;	Section 11
(n)	the final proposed alternatives which respond to the impact management measures, avoidance, and mitigation measures identified through the assessment;	Section 6 onwards
(o)	any aspects which were conditional to the findings of the assessment either by the EAP or specialist which are to be included as conditions of authorisation;	Section 15
(p)	a description of any assumptions, uncertainties and gaps in knowledge which relate to the assessment and mitigation measures proposed;	Section 13
(q)	a reasoned opinion as to whether the proposed 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;	Section 14
(r)	where the proposed activity does not include operational aspects, the period for which the environmental authorisation is required and the date on which the activity will be concluded and the post construction monitoring requirements finalised;	Section 17

Number	Appendix 3 Description	Report Reference
(s)	an undertaking under oath or affirmation by the EAP in relation to—	
(i)	the correctness of the information provided in the reports;	Section 20
(ii)	the inclusion of comments and inputs from stakeholders and I&APs;	
(iii)	the inclusion of inputs and recommendations from the specialist reports where relevant; and	
(iv)	any information provided by the EAP to interested and affected parties and any responses by the EAP to comments or inputs made by interested or affected parties;	
(t)	where applicable, details of any financial provision for the rehabilitation, closure, and ongoing post decommissioning management of negative environmental impacts;	Section 18
(u)	an indication of any deviation from the approved scoping report, including the plan of study, including—	
(i)	any deviation from the methodology used in determining the significance of potential environmental impacts and risks; and	Section 16
(ii)	a motivation for the deviation;	
(v)	any specific information that may be required by the competent authority; and	Section 19.1
(w)	any other matters required in terms of Section 24(4)(a) and (b) of the Act.	Section 19.2

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LIST OF ABBREVIATIONS

BID	Background Information Document
CBA	Critical Biodiversity Area
cm	Centimetre
CVB	Channel Valley-Bottom wetland
DAFF	Department of Agriculture, Forestry and Fisheries
DEA	Department of Environmental Affairs
DMR:	Department of Mineral Resources
DPW	Department of Public Works
DWAF	Department of Water Affairs and Forestry
DWS:	Department of Water and Sanitation
EA	Environmental Authorisation
EAP	Environmental Assessment Practitioner
EC	Electrical Conductivity
ECO	Environmental Control Officer
ECSA	Engineering Council of South Africa
EIA	Environmental Impact Assessment
EIAR:	Environmental Impact Assessment Report
EIS	Ecological Importance and Sensitivity
ELM	Emakhazeni Local Municipality
EMPr	Environmental Management Programme
ESA	Environmentally Sensitive Areas
FET:	Further Education and Training
GA	General Authorisation
GDP	Gross Domestic Product
GN:	Government Notice
GNR:	Government Notice Regulation
Ha	Hectares
HGM:	Hydrogeomorphic
HIA	Heritage Impact Assessment
HSS	Hillslope Seep wetland
I&APs:	Interested and Affected Parties
IDP:	Integrated Development Plans
IRR	Issue and Response Register
IUCMA	Inkomati-Usuthu Catchment Management Agency
IUCN	International Union for Conservation of Nature
JKC	Jaco-K Consulting (Pty) Ltd
kg:	Kilogram
km:	Kilometre

km^2:	Square kilometre
m:	Metre
mg:	Milligram
mm:	Millimetre
m^2:	Square metre
m^3:	Cubic metre
MAE	Mean Annual Evaporation
mamsl	Metres above mean sea level
MAP	Mean Annual Precipitation
MAR	Mean Annual Runoff
ME	Mitigation Efficiency
MPRDA	Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002)
MTPA	Mpumalanga Tourism and Parks Agency
N/A	Not Applicable
NAAQS:	Nation Ambient Air Quality Standards
NDM	Nkangala District Municipality
NEMA:	National Environmental Management Act, 1998 (Act No. 107 of 1998)
NEMBA:	National Environmental Management: Biodiversity Act, 2004 (Act No.10 of 2004)
NEMWA:	National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008)
NGO:	Non-government Organisation
NPD	National Development Plan
NHRA:	National Heritage Resources Act, 1999 (Act 25 of 1999)
NWA:	National Water Act, 1998 (Act 36 of 1998)
PCD	Pollution Control Dam
PES	Present Ecological State
PM:	Particulate matter
PM_{10}:	Thoracic particulate matter
$PM_{2.5}$:	Respirable particulate matter
POC	Probability of Occurrence
PPP:	Public Participation Process
RDL	Red Data Listed
RDSIS	Red Data Sensitivity Index Score
R.	Regulation
RE	Remaining Extent
REC	Recommended Ecological Category
RMO	Recommended Management Objective
S&EIR:	Scoping & Environmental Impact Reporting
SAHRA	South African Heritage Resources Agency
SANRAL	South African National Road Agency Ltd
SAS	Scientific Aquatic Services cc

SCC	Species of Conservational Concern
SO_4:	Sulphate
SR	Significance Rating
TDS	Total Dissolved Salts
TIA	Traffic Impact Assessment
TRAC	Trans African Concessions
WM	With Mitigation
WOM	Without Mitigation Measures
WMA:	Water Management Area
WSP	WSP Group Africa (Pty) Ltd
WUL:	Water Use Licence
WULA:	Water Use Licence Application

1 INTRODUCTION AND BACKGROUND

1.1 Background

Umsimbithi Wonderfontein Mine (hereinafter referred to as Wonderfontein Mine) is located within the Emakhazeni Local Municipality (ELM) and the Albert Luthuli Local Municipality Boundaries, within the greater jurisdictional areas of the Nkangala District Municipality (NDM) and the Gert Sibande District Municipality, respectively. Refer to **Figure 1**. The mine has been authorised to expand its mining area to utilise the coal reserve which is situated in the north-eastern region of the mining boundary. However, the existing P15-1 road, which is part of the R33 between Wonderfontein and Carolina, currently crosses over a large portion of the coal reserve resulting in the sterilisation of the reserve along the alignment of the road.

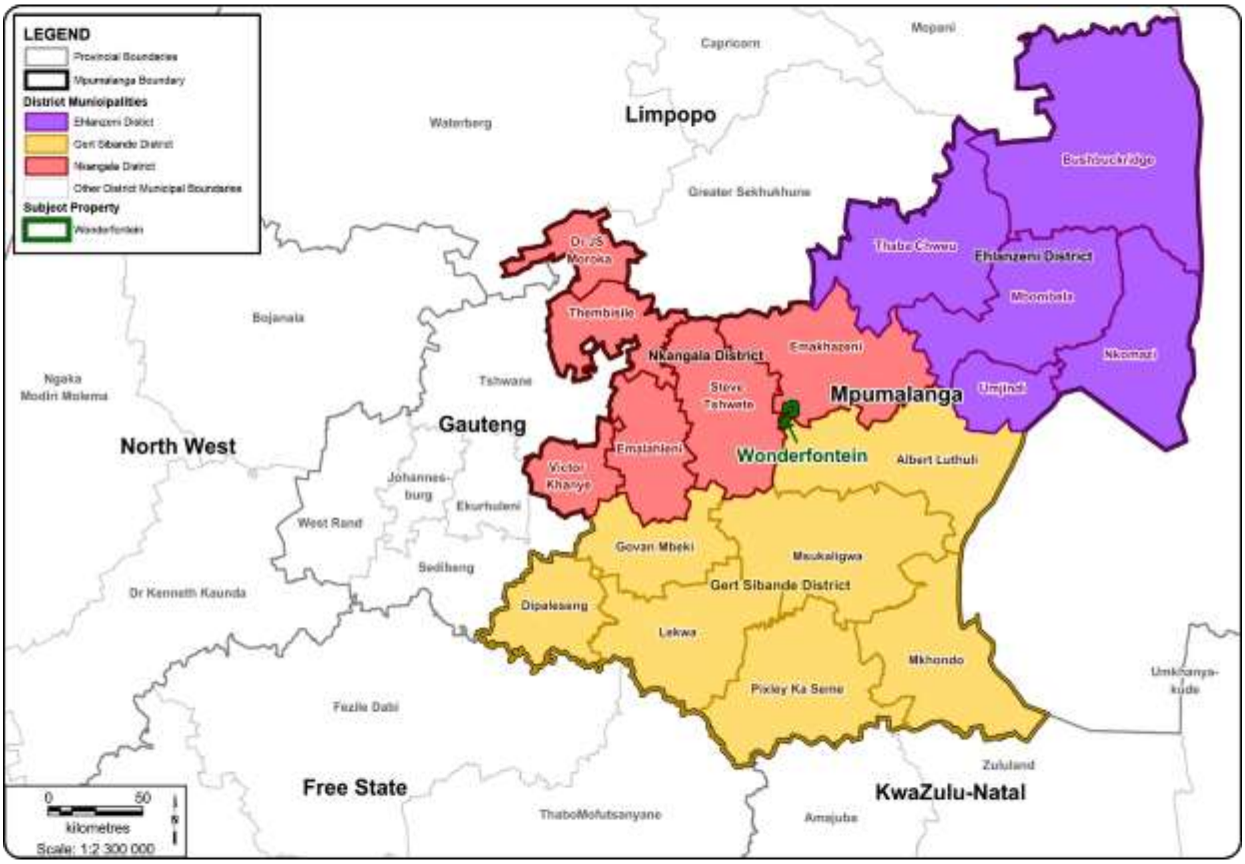

Figure 1: Regional locality of Wonderfontein Mine

In order to utilise the coal reserve, the mine plans to divert a section of the P15-1 road onto a more suitable path outside of the mining footprint ensuring that the least amount of environmental and socio-economic damage is caused. The road diversion will occur within the ELM which is located in the NDM area.

The planned road is expected to be 4.349 km in length and 8 m in width (two lanes that are 3.7 m wide each with 300 mm from the yellow line to the edge) and the road reserve will be 40 m. The construction phase is expected to last between six to nine months after which the diverted road will be permanent operation.

Critical biodiversity areas (CBA) are found within the study area, but the road reserve alignment was adjusted to avoid those sensitive areas.

Jaco – K Consulting has been appointed by Wonderfontein Mine to undertake the Scoping and Environmental Impact Reporting (S&EIR) process required in support of the Environmental Authorisation (EA) application for this road diversion. An environmental authorisation application, in terms of the National Environmental Act, Act 107 of 1998 (as amended) (NEMA), was submitted to the Department of Mineral Resources. The compilation of an Environmental Management Programme (EMP) and the Water Use Licence (WUL) application will all form part of the scope of the project as a whole.

2 LOCALITY OF THE PROJECT

2.1 Location

The portion of the P15-1 to be diverted occurs within the boundaries of Wonderfontein Mine. The mine is situated approximately 20km from Belfast, the town of Arnot lies about 12km to the south-west and Middelburg is approximately 40km to the west. **Figure 2** represents the regional setting of the coal mine.

Wonderfontein Mine is located in Mpumalanga, within the Emakhazeni Local Municipality (ELM) and the Albert Luthuli Local Municipality, within the greater jurisdictional area of Nkangala District Municipality (NDM) and the Gert Sibande District Municipality, respectively. The P15-1 road, however, is located within ELM and NDM only. The road diversion is going to occur in the north-eastern region within the mining rights boundary of Wonderfontein Mine.

The P15-1 road diversion will deviate around the coal reserve and will then reconnect with its current alignment (P15-1). The preferred road diversion (Alternative 1) is located on the right side of the coal reserve and is situated between its current alignment (P15-1) and the D1110 road. The R33 can be seen running along the eastern side of the mining boundary in **Figure 3**.

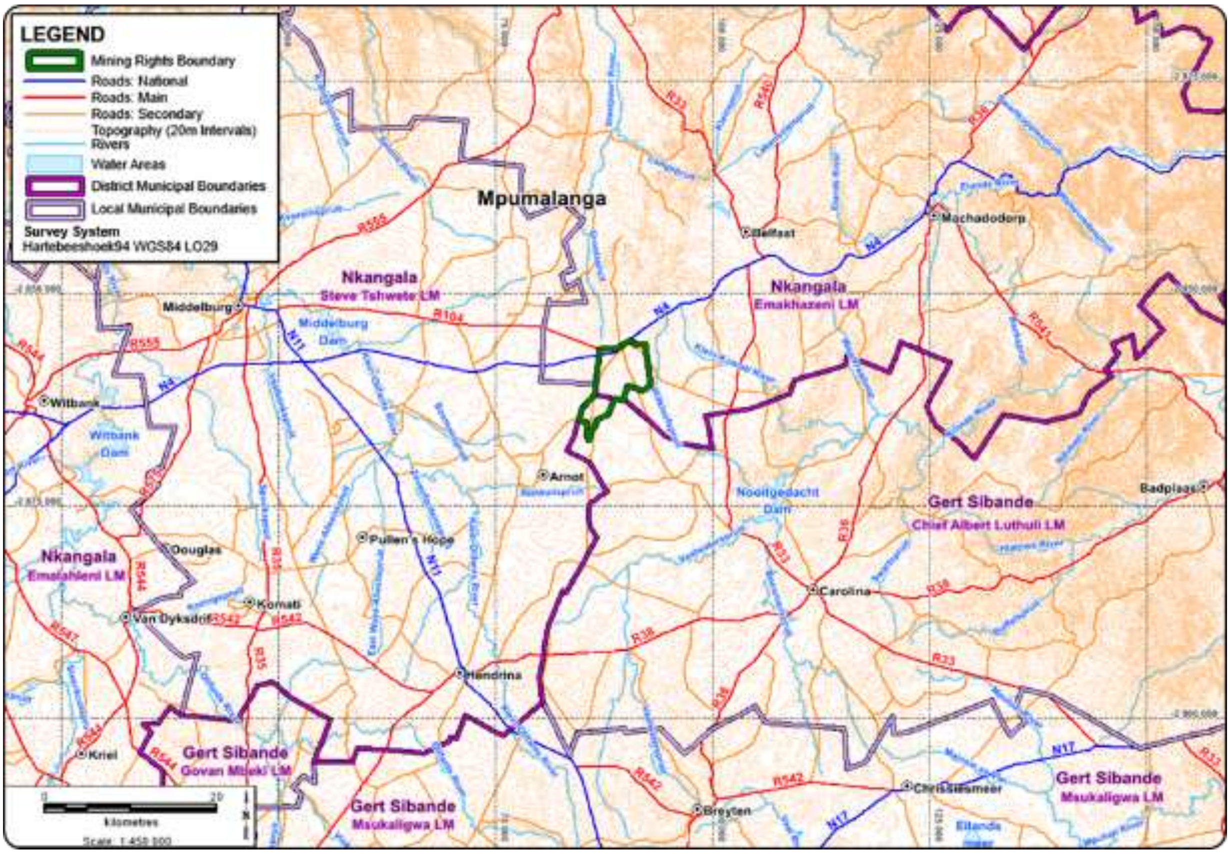

Figure 2: Regional locality of Wonderfontein Mine

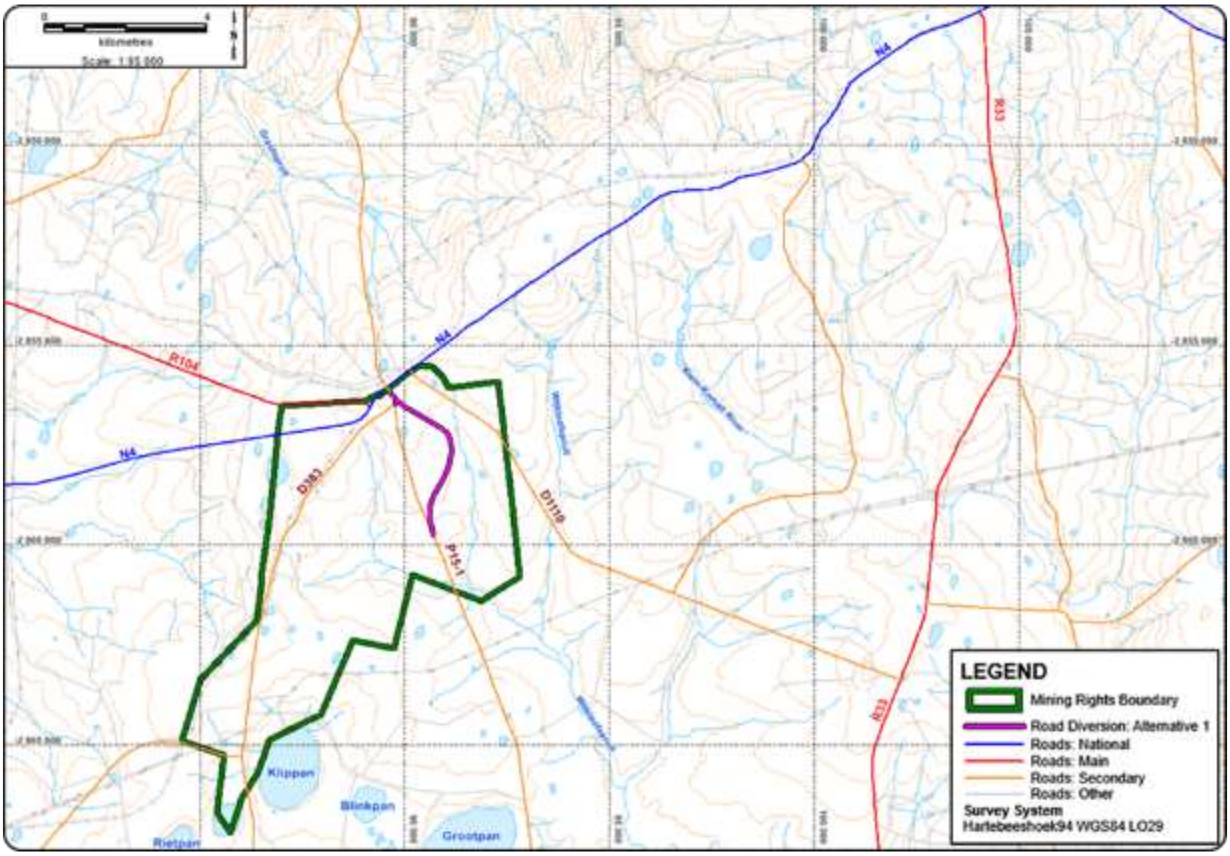

Figure 3: The preferred road diversion in relation to the R33

Figure 4 below represents the start and end co-ordinates of the current road alignment (indicated in Light Green in the figure) as well as co-ordinates of selected points along Alternative 1 (indicated in Purple) and Alternative 2 (indicated in Yellow). The preferred alternative (Alternative 1) is located on the eastern side of the coal reserve while Alternative 2 is located on the western side of the coal reserve. **Table 1** below indicates the start and end points for the current road alignment, Alternative 1 (preferred alternative) and Alternative 2.

Table 1: Start and End Co-ordinates of Current Alignment, Alternative 1 and Alternative 2

Current Road Alignment	Co-ordinate Label	Latitude	Longitude
Start Point	(A1-1)	25°48’41.06” S	29°53’40.08” E
End Point	(A1-4)	25°50’34.13” S	29°54’16.95” E
Alternative 1	**Co-ordinate Label**	**Latitude**	**Longitude**
Start Point	(A1-1)	25°48’41.06” S	29°53’40.08” E
End Point	(A1-4)	25°50’34.13” S	29°54’16.95” E
Alternative 2	**Co-ordinate Label**	**Latitude**	**Longitude**
Start Point	(A2-1)	25°48’58.41” S	29°53’43.59” E
End Point	(A2-4)	25°50’49.11” S	29°54’22.76” E

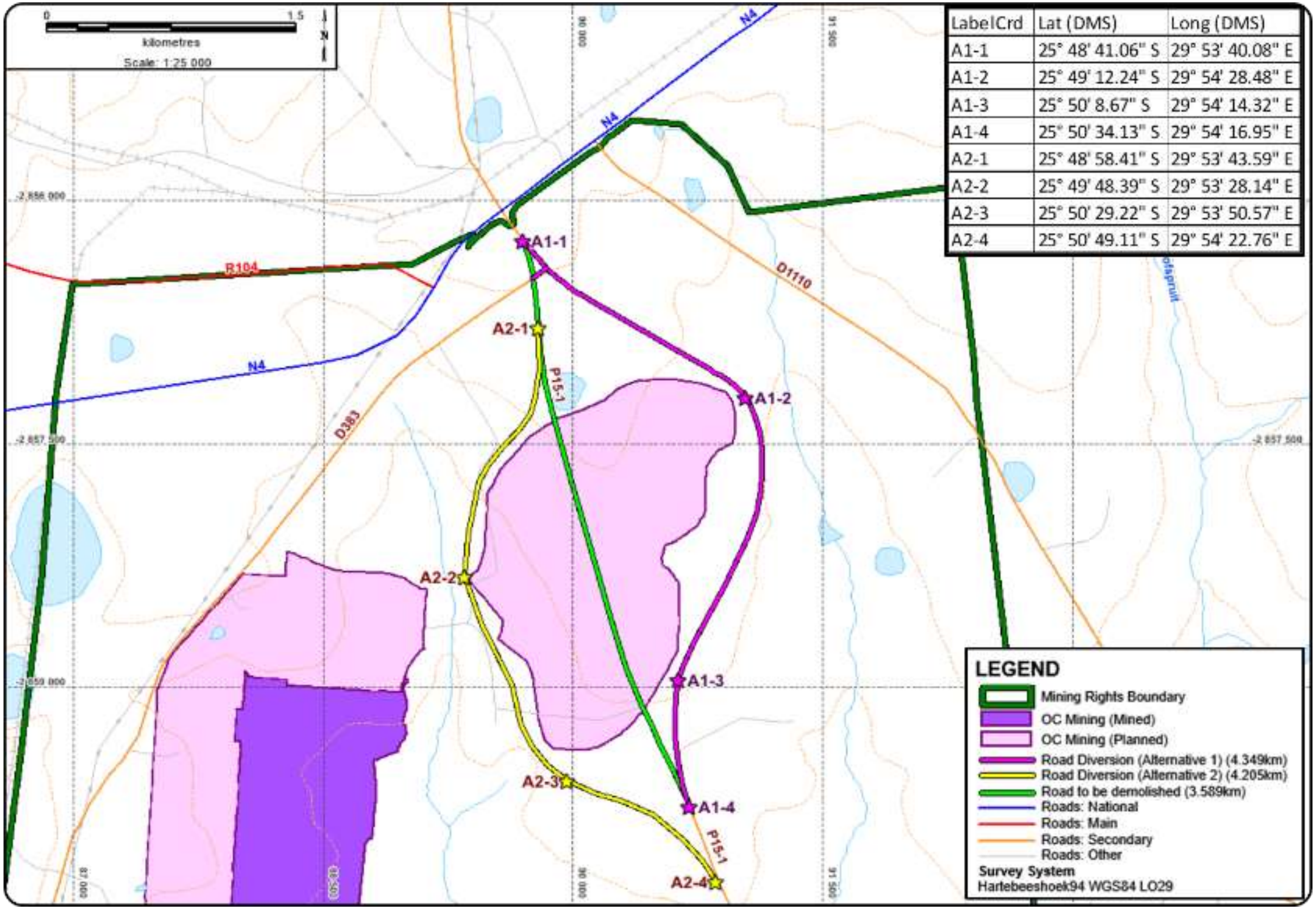

Figure 4: Co-ordinates of the two road diversion alternatives

2.2 Land tenure and use of affected and adjacent farms

The affected and adjacent farm portions are currently being utilised for mostly maize and soybean farming. As expected, it is historically a strong farming community. However, opencast and underground coal mining activities were previously conducted on neighbouring farms located to the east and south-east.

The Wonderfontein Railway Station is located to the north-east of the mine and a community centre, commercial properties, businesses, farm hall, railway line station and grain silos are also present in the area. The Môrelig Combined School is located just west of the P15-1, south of the planned road diversion.

The farm portions most applicable to the road diversion are listed in **Table 2** below, with details of land ownership as well as the 21-digit Surveyor General Code for each cadastral land parcel. The Windeed Property Reports, indicating the property owners, are attached in **Annexure 2**. **Table 3** represents the landowners of the immediately adjacent properties.

Table 2: Owners and lessees of farms most applicable to the road diversion

FARM NAME & NO.	PORTION	OWNER (LESSEE)	TITLE DEED	21-DIGIT SURVEYOR GENERAL CODE	EXTENT (Ha)
Wonderfontein 428 JS	RE 3	Anna Catharina van Vreden	T42810/1988	T0JS00000000042800003	82.4565
Wonderfontein 428 JS	7	CorlouisBoerderye Pty Ltd	T486/2012	T0JS00000000042800007	238.2347
Wonderfontein 428 JS	19	HoogenoegBoerdery CC	T11209/1979	T0JS00000000042800019	82.4565
Wonderfontein 428 JS	22	CorlouisBoerderye Pty Ltd	T486/2012	T0JS00000000042800022	152.4898
Wonderfontein 428 JS	26	CorlouisBoerderye Pty Ltd	T486/2012	T0JS00000000042800026	238.2347
Wonderfontein 428 JS	44	SANRAL	T173982/2006	T0JS00000000042800000	2.44
Wonderfontein 428 JS	RE	Johan Steele Familie Trust	T11252/2013	T0JS00000000042800000	331.2379

Table 3: Owners and lessees of farms adjacent to the study area

FARM NAME	PORTION	REGISTERED OWNER
Wonderfontein 428 JS	Portion 9	Transnet Ltd
Wonderfontein 428 JS	Portion 17	NG Kerk Belfast
Wonderfontein 428 JS	Portion 20	CorlouisBoerderye (Pty) Ltd
Wonderfontein 428 JS	Portion 28	Transnet Ltd
Wonderfontein 428 JS	Portion 29	Transnet Ltd
Wonderfontein 428 JS	Portion 33	Transnet Ltd
Wonderfontein 428 JS	Portion 40	SANRAL
Wonderfontein 428 JS	Portion 41	SANRAL
Wonderfontein 428 JS	Portion 42	SANRAL
Wonderfontein 428 JS	Portion 53	Kiddiekat Trading 26 CC
Leeuwbank	Portion 2	Kiddiekat Trading 26 CC
Leeuwbank	Portion 3	CorlouisBoerderye (Pty) Ltd
Leeuwbank	Portion 16	BeesteBoerdery (Pty) Ltd
Kaalplaats	Portion 3	Steele Lynette
Kaalplaats	Portion 9	FrikgeoBoerdery (Pty) Ltd
Wonderfontein 428 JS	Portion 10	Steele Johannes Marthinus Stephanus
Wonderfontein 428 JS	Portion 49	Steelecoal (Pty) Ltd

Figure 5 below visually represents the location of the affected landowners in addition to the immediately adjacent landowners.

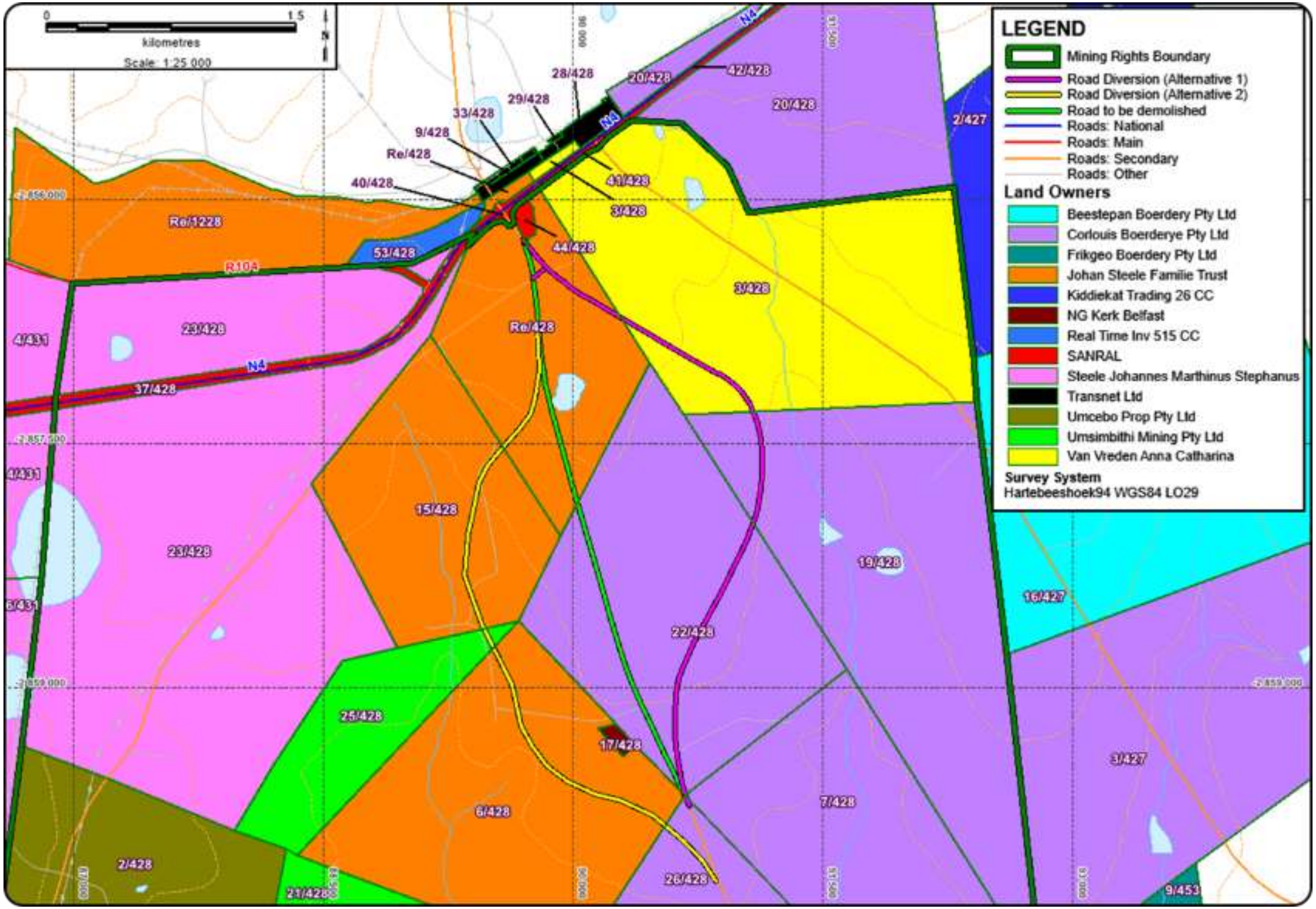

Figure 5: Property owners and adjacent land owners

2.3 Site layout

No infrastructure occurs within the study area and the only infrastructure expected to be constructed is the road and associated water management facilities. The site layout is discussed in more detail in **Section 7** of this report. Refer to **Figure 6** for the proposed site layout.

2.4 Servitudes

A powerline runs from the southern region of the mining boundary to the north-eastern region where the road diversion is expected to occur. Refer to **Figure 6**. Road reserves are also present along the R33 (Wonderfontein – Carolina) tar road as well as along the D383 (Wonderfontein – Hendrina) tar road. It is expected that these servitudes will not be affected during the construction of the road.

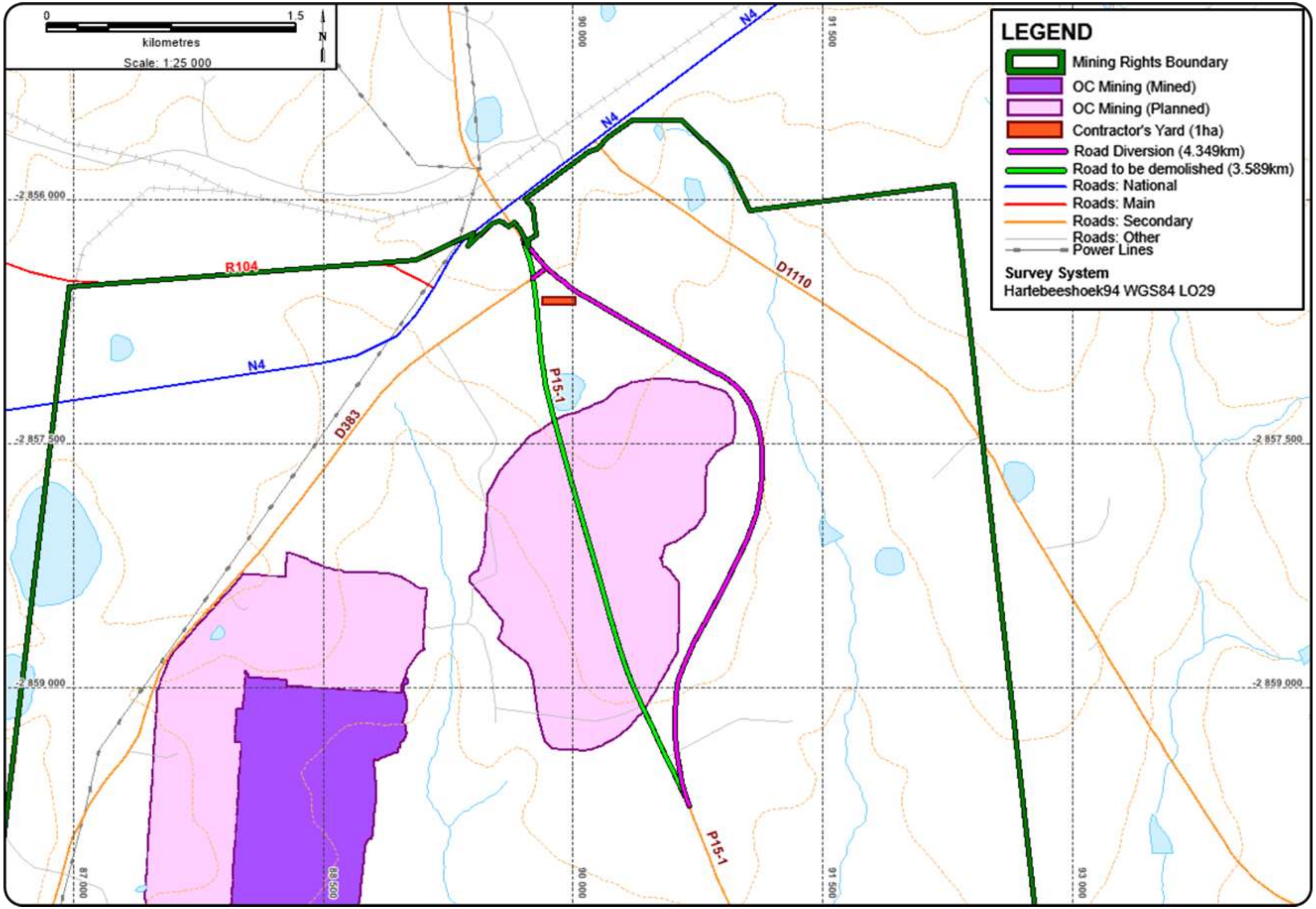

Figure 6: Site Layout and Servitudes Identified

3 APPLICABLE LEGISLATION

3.1 Listed and Specified Activities

Various listed activities, as defined in terms of Regulation 983 (Listing Notice 1), 984 (Listing Notice 2), and 985 (Listing Notice 3) of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) (published on 4 December 2014, as amended), were identified for the Wonderfontein Road Diversion Project. An application for Environmental Authorisation in terms of Section 24 of the NEMA will therefore be submitted to the Department of Mineral Resources (DMR). The activities identified are listed in **Table 4** below.

Table 4: Listed and specified activities

Name of activity	Aerial extent of the Activity (ha or m^2)	LISTED ACTIVITY Mark with an X where applicable	APPLICABLE LISTING NOTICE (GNR 983, GNR 984 or GNR 985)/ Not listed
Water Management Infrastructure (Road will be located within 500 m of a water course and will therefore need authorisation in terms of the National Water Act, Act No 36 of 1998).	34 792 m^2	X	Listing Notice 2 (GNR 984), Activity 6,
Construction of road diversion	34 792 m^2	X	Listing Notice 2 (GNR 984), Activity 27

4 POLICY AND LEGISLATIVE CONTEXT

This report presents the results of the EIA process to obtain environmental authorisation for the Wonderfontein Road Diversion. This report has been compiled in accordance with requirements from NEMA and the applicable regulations, as well as some of the requirements as set by the Mineral and Petroleum Resources Development Act (No 28 of 2002) (MPRDA), the National Environment: Waste Management Act (No 59 of 2008) (NEMWA) and the National Water Act (Act No. 36 of 1998) (NWA).

The compilation of an Environmental Management Programme (EMP) and environmental authorisations, including the Water Use Licence (WUL) application, will all form part of the scope of the project as a whole.

Various activities that require environmental authorisation were identified. An application for authorisation in terms of Section 24 of the NEMA will be submitted to DMR in 2019. The said activities, as defined in terms of Regulation 984of NEMA, published on 4 December 2014, as amended. A Scoping Report was submitted to satisfy the requirements in terms of NEMA. An EIA was conducted and an EMPr formulated for the activities associated with the road diversion at Wonderfontein Mine. The Scoping Report, EIA and the formulated EMPr was compiled in the format as outlined in Regulation 982 of NEMA.

Table 5 provides a description of the policy and legislative context that are or might be applicable to the proposed activity(-ies) and are to be considered in the assessment process for the proposed development. More detail is provided for each policy/guideline/act in **Table 6**.

Table 5: Applicable legislation and guidelines used to compile the report

APPLICABLE LEGISLATION AND GUIDELINES USED TO COMPILE THE REPORT	REFERENCE WHERE APPLIED
Environmental authorisation in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) and Government Notice Regulations 982 to 985 (8 December 2014).	The Scoping and Environmental Impact Assessment (S&EIA) Process is based on the principles of the NEMA and the EIA Regulations. The EIR layout is done according to the requirements set out in R 982 of NEMA. Refer to **Table 6** for more detail.
National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004), the Mpumalanga Nature Conservation Act, 1998 (Act No. 10 of 1998) and the National Forests Act, 1998 (Act No. 84 of 1998). Mining and Biodiversity Guideline, 2013	Should protected plant species be affected, permits will have to be obtained from the Mpumalanga Tourism and Parks Board Agency (MTPA) for their removal, relocation or destruction. Refer to **Table 6** for more detail.
National Environmental Management: Waste Act, 2004 (Act 59 of 2008). Other applicable Government Notice Regulations:	The Waste Act will not be triggered during this project but waste management has discussed in **Section 7**.

APPLICABLE LEGISLATION AND GUIDELINES USED TO COMPILE THE REPORT	REFERENCE WHERE APPLIED
Government Notice Regulation 921 of 29 November 2013 Government Notice Regulation 332 of 2 May 2014 Government Notice Regulation 632 of 24 July 2015 Government Notice Regulation 633 of 24 July 2015	
National Heritage Resources Act, Act No. 25 of 1999; Removal of Graves and Dead Bodies Ordinance (Ordinance No.7 of 1925); and MEC Local Government - Human Tissue Act 65 of 1983 and the Exhumation Ordinance 12 of 1980. The South African Heritage Resources Agency needs to approve a heritage assessment, to be conducted as part of the overall EIA process, in terms of the National Heritage Resources Act (No 25 of 1999).	Permits will be required for the destruction or removal of any heritage resources affected by the development; this will include all buildings and graves that will be impacted by this project.
National Environmental Management: Air Quality Act, 2004 (Act 39 of 2004)	Section 34 refers to noise control. Will be assessed in EIA and applied in the EMPr.
National Veld and Forest Fire Act, 1998 (Act No. 10 of 1998).	Chapter 4 Section 12: Places a duty on owners to prepare and maintain firebreaks. Will be applied in EIA and EMPr.
Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983).	Regulation 280 of 2001: Requires the landowner to manage agricultural resources, i.e. the removal of invasive species, protection of soils against water and wind erosion and the management of water resources.
Mpumalanga Roads Department & National Roads Agency / Roads Ordinance, 22 of 1957, and National Roads Act, 54 of 1972.	The design and construction of the proposed diverted road must abide with the National Road Traffic Act.
The National Water Act, 1998 (Act No 36 of 1998)	In terms of the Section 21 of the National Water Act, the developer must obtain water use licenses if any development takes place within and/or impact any water course and/or flood line.

The required Public Participation Process (PPP) will follow a single integrated process complying with the requirements of the above listed acts. **Table 6** provides a more detailed list of the applicable legislation and guidelines that have been or will be consulted throughout the entire project, as well as the applicability to the project.

Table 6: List of Applicable Legislation and Guidelines Consulted

	Legislation	Regulations / Guidelines	Description / Requirement	Project Implication
EIA Process and Listed Activities	**National Environmental Management Act, Act 107 of 1998**	Chapter 1 of NEMA	Sets out the principles of environmental management	Chapter 1 principles are to be considered during the environmental impact assessment process.
		Chapter 5 of NEMA	Integrated environmental management, provides information on environmental management tools that promote the implementation of principles set out in Chapter 1 of NEMA	Environmental management tools are to be considered during the EIA process for the project.
		GNR 982 of 2014 (Amended 13 July 2018)	Chapter 2: Timeframes Chapter 3: General requirements for applications Chapter 4: Application for environmental authorisation Chapter 5: Amendment, suspension, withdrawal and auditing of compliance with environmental authorisation and environmental management programme. Chapter 6: Public participation process Chapter 8: Transitional arrangements and commencement.	Scoping and Environmental Impact Assessment must be undertaken in accordance to Regulation 982.
		GNR 983 of 2014 Listing Notice 1 (Amended 13 July 2018)	Lists activities requiring a basic environmental assessment	Environmental authorisation must be obtained prior to commencement with listed activities. Activities listed in Appendix 1, but none of Listing Notice 1 applies to this project.
		GNR 984 of 2014 Listing Notice 2 (Amended 7 April 2017)	Lists Activities requiring an environmental impact assessment	Environmental authorisation must be obtained prior to commencement with listed activities. Activities listed in Appendix 1.
		GNR 985 of 2014 Listing Notice 3 (Amended 13 July 2018)	Lists activities that require a basic environmental assessment at specific identified geographical areas only.	Environmental authorisation must be obtained prior to commencement with listed activity. Activities listed in Appendix 1, but none of Listing Notice 3 applies to this project.
		GNR 805 of 2012	Integrated Environmental Management Guideline Series (Guideline 5) - Companion to the NEMA EIA Regulation, 2010.	Although based on the 2010 EIA regulations, the process to be followed still applies.
		GNR 806 of 2012	Integrated Environmental Management Guideline Series (Guideline 6) – Environmental Management Framework Regulations, 2010.	Although based on the 2010 EIA regulations, the process to be followed still applies.
		GNR 807 of 2012	Integrated Environmental Management Guideline Series (Guideline 7) – Public Participation in the Environmental Impact Assessment Process, 2010.	Although based on the 2010 EIA regulations, the process to be followed for public participation still applies.

	Legislation	Regulations / Guidelines	Description / Requirement	Project Implication
Water Uses and protection of water resource	**National Water Act, 36 of 1998**	Section 21 of NWA	Lists water uses that require a licence prior to commencement.	No Water Use Licence will be applied for, only a General Authorisation in terms of Section (c) and (i).
		GN 704 of 4 June 1999	Regulations on use of water for mining and related activities aimed at the protection of water resources.	No Water Use Licence will be applied for, only a General Authorisation in terms of Section (c) and (i).
		General Notice 509 of 26 August 2016	General Authorisation in terms of Section 39 of the National Water Act, 1998 (Act No. 36 of 1998) for water uses as defined in section 21(c) or section 21(i).	No Water Use Licence will be applied for, only a General Authorisation in terms of Section (c) and (i).
		Government Notice 1198 of 18 December 2009	General Authorisation in terms of Section 39 of the National Water Act, 1998 (Act No 36 of 1998) in terms of Section 21(c) and (i) for the purpose of rehabilitating a wetland for conservation purposes	No Water Use Licence will be applied for, only a General Authorisation in terms of Section (c) and (i).
		General Notice 538 of 2 March 2017	Revision of General Authorisations (GA) in terms of Section 39 of the NWA.	No Water Use Licence will be applied for, only a General Authorisation in terms of Section (c) and (i).
		GN R139 of 24 February 2012	Regulations regarding the safety of dams in terms of Section 123(1) of the National Water Act, 1998 (Act No. 36 of 1998). Application for a licence to construct and impound for a dam with safety risk.	No Water Use Licence will be applied for, only a General Authorisation in terms of Section (c) and (i).
Biodiversity	**National Environmental Management: Biodiversity Act, Act 10 of 2004**	GNR 151 published on 14 December 2007	Publication of critically endangered, vulnerable and protected species: No person may carry out a restricted activity involving a specimen of a listed threatened or protected species without a permit.	Permits will be obtained if required.
	National Forests Act, Act 84 of 1998	GN 835 published on 23 September 2010	List of Protected tree species under the Act: No person may carry out a restricted activity on any protected tree except if there is a licence granted by the minister.	Permits will be obtained if required.
	Mpumalanga Nature Conservation Act, Act 10 of 1998	Chapter 7	82 (1). No person shall remove an endangered species or rare species unless he or she is the holder of a permit which authorises him or her to do so.	Permits will be obtained if required.

	Legislation	Regulations / Guidelines	Description / Requirement	Project Implication
Waste Management	**National Environmental Management: Waste Act, Act 59 of 2008**	GNR 921 of 29 November 2013 (as amended 11 October 2017)	Lists waste management activities that require a waste management licence prior to construction and operation.	The Waste Act will not be triggered during this project but waste management has discussed in **Section 7**.
		Government Notice Regulation 632 of 24 July 2015	Regulations regarding the planning and management of residue stockpiles and residue deposits from prospecting, mining, exploration or production operation.	The Waste Act will not be triggered during this project but waste management has discussed in **Section 7**.
Heritage Resources	**National Heritage Resources Act, Act No. 25 of 1999.**	Section 35 & 36	35. (4) No person may, without a permit issued by the responsible heritage resources authority - (a) destroy, damage, excavate, alter, deface or otherwise disturb any archaeological or palaeontological site or any meteorite; (b) destroy, damage, excavate, remove from its original position, collect or own any archaeological or palaeontological material or object or any meteorite; (c) trade in, sell for private gain, export or attempt to export from the Republic any category of archaeological or palaeontological material or object, or any meteorite; or (d) bring onto or use at an archaeological or palaeontological site any excavation equipment or any equipment which assist in the detection or recovery of metals or archaeological and palaeontological material or objects, or use such equipment for the recovery of meteorites. 36. (3)(a): No person may, without a permit issued by SAHRA or a provincial heritage resources authority: (a): destroy, damage, alter, exhume or remove from its original position or otherwise disturb the grave of a victim of conflict, or any burial ground or part thereof which contains such graves; (b): destroy, damage, alter, exhume, remove from its original position or otherwise disturb any grave or burial ground older than 60 years which is situated outside a formal cemetery administered by a local authority; or	Permission to be obtained from the South African Heritage Resources Agency (SAHRA) for any proposed destruction, damaging, alteration, exhumation or removal of graves. Permits will be obtained if required.
		Section 34	No person may alter or demolish any structure or part of a structure which is older than 60 years without a permit issued by the relevant provincial heritage resources authority.	Permission to be obtained from the South African Heritage Resources Agency (SAHRA) for any proposed alteration or demolishing of any structure that is older than 60 years. Permits will be obtained if required.

	Legislation	Regulations / Guidelines	Description / Requirement	Project Implication
	Removal of Graves and Dead Bodies Ordinance (Ordinance No.7 of 1925)	Section 2(1)	Relocation of graves	Permits will be obtained if required.
	MEC Local Government - Human Tissue Act 65 of 1983 and the Exhumation Ordinance 12 of 1980		Exhumation of graves	Permits will be obtained if required.
Air and Noise	**National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004)**	Section 32, 33, 34 and 35	Measures for the control of dust in specified places or areas, either in general or by specified machinery or in specified instances; Steps that must be taken to prevent nuisance by dust; or Other measures aimed at the control of dust. If it is determined that a mine, having regard to its known ore reserves, is likely to cease mining operations within a period of five years, the owner of that mine must promptly notify the Minister in writing— (b) of any plans that are in place or in contemplation for— (i) the rehabilitation of the area where the mining operations were conducted after mining operations have stopped; and (ii) the prevention of pollution of the atmosphere by dust after those operations have stopped. Control noise in general, by specific machinery, activities or in specified places or areas; For determining definition for noise and maximum levels of noise. The Minister or MEC may prescribe measures for the control of offensive odours emanating from specified activities.	Applicant is to adhere to the national standards for dust, PM and noise.
		General Notice 275 of 3 April 2017	National Greenhouse Gas Emissions Reporting Regulations, 2016.	Adhere to reporting conditions and national standards regarding greenhouse gas emissions.

	Legislation	Regulations / Guidelines	Description / Requirement	Project Implication
Veld Fires	**National Veld and Forest Act 1998 (Act No. 84 of 1998)**	Chapter 4, Section 12	Places a duty on owners to prepare and maintain firebreaks. The procedure in this regard and the role of adjoining owners and the fire protection association are dealt with.	Current fire break plan must be maintained around the perimeter.
Land Use Management	**Conservation of Agricultural Resources Act,1983 (Act No 43 of 1983)**	GNR 1048 published on 25 May 1984 (as amended on 30 March 2001)	Requires the landowner to manage agricultural resources i.e. the removal of invasive species, protection of soils against water and wind erosion and the management of water resources.	An alien invasive species plan must be maintained for the processing plant; and the land use and soil management plan must also be maintained.
Traffic Management	**Mpumalanga Roads Department & National Roads Agency / Roads Ordinance, 22 of 1957, and National Roads Act, 54 of 1972**	Section 29	Permission (wayleave application) to establish new access road.	The design and construction of the proposed diverted road must abide with the National Road Traffic Act.

5 NEED AND DESIRABILITY OF THE PROJECT

Taking cognisance of the National Development Plan 2030 (NDP) and its critical success factors for the road to a worthy future for South Africa the following can be applicable to this project. They are:

1. A social compact to reduce poverty and inequality, and raise employment and investment.
2. A strategy to address poverty and its impacts by broadening access to employment, strengthening the social wage, improving public transport and raising rural incomes.
3. Boost private investment in labour-intensive areas, competitiveness and exports, with adjustments to lower the risk of hiring younger workers.
4. Interventions to ensure environmental sustainability and resilience to future shocks.
5. New spatial norms and standards – densifying cities, improving transport, locating jobs where people live, upgrading informal settlements and fixing housing market gaps.
6. Reduce crime by strengthening criminal justice and improving community environments.

Wonderfontein Mine works closely with provincial government structures in support of the NDP, and is committed to the above actions in the form of:

- Security of employment;
- Creation of short-term employment opportunities during construction;
- Human resource development;
- Human and community development;
- Strategic infrastructure;
- Environmental sustainability;
- Governance and policy; and
- Spatial equity.

The Guidelines on Need and Desirability published by the Department of Environmental Affairs (DEA, 2017) require the need for a development to be sustainable, in other words it should be ecologically sustainable as well as socially and economically justifiable. Refer to **Annexure 3** for the full assessment of the Need and Desirability Guidelines.

Ecological sustainability:

The road will be diverted in an area that is already ecological transformed due to agricultural activities. Sensitive and ecological intact areas will be avoided as much as possible and therefore this project will cause minimal environmental damage. It will also have a minimal footprint disturbance.

Social and economic justification:

Temporary employment opportunities will be created during the construction phase. Even though these new opportunities are short-term, they will still have beneficial social and economic impacts in terms of income and it will help improve the livelihoods of the surrounding community.

Even though no new long-term job opportunities will be created during this project, the diversion of the road is still vital in order to prevent the sterilization of the coal reserve. Diverting the road will also ensure that Wonderfontein Mine does not experience a shortage in coal and that it is able to continue meeting its supply agreements with companies such as Eskom.

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6 PROJECT ALTERNATIVES

6.1 Alternatives Considered

The alternatives considered are discussed in more detail below.

6.1.1 Location Alternatives

Two alternative locations for the proposed road diversion have been identified. The surrounding environment and socio-economic factors were taken into consideration when determining the alternative locations.

6.1.2 The Type of Activity to be Undertaken

The proposed activities that will be applied for include the diversion of the P15-1 road as well as associated water management infrastructures.

6.1.3 The Design or Layout of the Activity

Two possible locations have been considered for the road diversion; namely Alternative 1 and Alternative 2. A 500 m buffer "zone of investigation" was used to determine all watercourses occurring within the vicinity of both alternatives and a 32 m buffer was used to determine the boundaries of those watercourses. Refer to **Figure 7**. Both alternatives are described below:

Alternative 1

Alternative 1 is located on the eastern side of the coal reserve. It is approximately 4.349 km in length and stretches over portions 3, 19, 22 and the Remaining Extent of the Farm Wonderfontein 428 JS.

Numerous wetland systems are located within the vicinity of Alternative 1. However, the planned road has been positioned so that it does not traverse any surrounding wetland areas. The closest wetlands are located approximately 89 m and 88 m away, namely a Channelled Valley Bottom wetland (CVB 1) and a Hillslope Seep wetland (HSS 1), respectively. Refer to **Section 8.7** for more details on the wetlands.

Approximately 75.68% of the land is currently being utilised for agricultural purposes; soy beans are farmed on 52.68% of the land and 23% is used for maize production. 22.63% of the land is under grazing pressure and a tar road occurs on the remaining 1.69% of land. Due to the historical and on-going agricultural activities, the wetlands surrounding Alternative 1 are now classified as slightly modified and therefore any impacts that might occur to the wetlands will be of low significance.

Since Alternative 1 is located on the eastern side of the coal reserve, Wonderfontein Mine will have direct access to the coal reserve and therefore no road or wetland crossings will be required in this design.

The construction site of Alternative 1 will be accessed via the start (A1-1) and end (A1-4) points of the route. Refer to **Figure 4** for the locality of these points. The start point (A1-1) is located within close proximity of the SANRAL weighbridge; however, it is anticipated that construction will not cause an impact on the weighbridge.

Alternative 1 does not traverse or occur within the 32 m boundary of the surrounding wetlands and therefore proper water managements facilities can be constructed next to the road without further damaging the wetland systems.

Alternative 2

Alternative 2 is located on the western side of the coal reserve. It is approximately 4.205 km in length and occurs on Portions 6, 15, 25, 26 and the Remaining Extent of the Farm Wonderfontein 428 JS.

Alternative 2 traverses through two wetland systems; namely, a Channelled Valley Bottom wetland (CVB 2) as well as a Hillslope Seep wetland (HSS 4). Alternative 2 also occurs within the 32 m NEMA Zone of Regulation of Depression wetland 1.

CVB 2 and the associated HSS 4 are considered as largely natural as they both have a Present Ecological State (PES) of Category B and a Recommended Ecological Category (REC) of a B. Depression 1 has a PES of Category D and a REC of Category D and therefore is considered as largely modified.

Due to the locality of Alternative 2, Wonderfontein Mine will not have direct access to the coal reserve and therefore a road and wetland crossing will need to be constructed in order to access the coal. This could pose a threat to the local ecology as well as to road users. Furthermore, the construction of these additional structures makes Alternative 2 less financially justifiable when compared to Alternative 1.

Since Alternative 2 traverses the surrounding wetland systems, proper water management structures cannot be constructed as it will cause further damage to the systems.

It is expected that the potential socio-economic and environmental risks will be higher at Alternative 2 than at Alternative 1. As a result of this, Alternative 1 has been deemed the most favourable alternative.

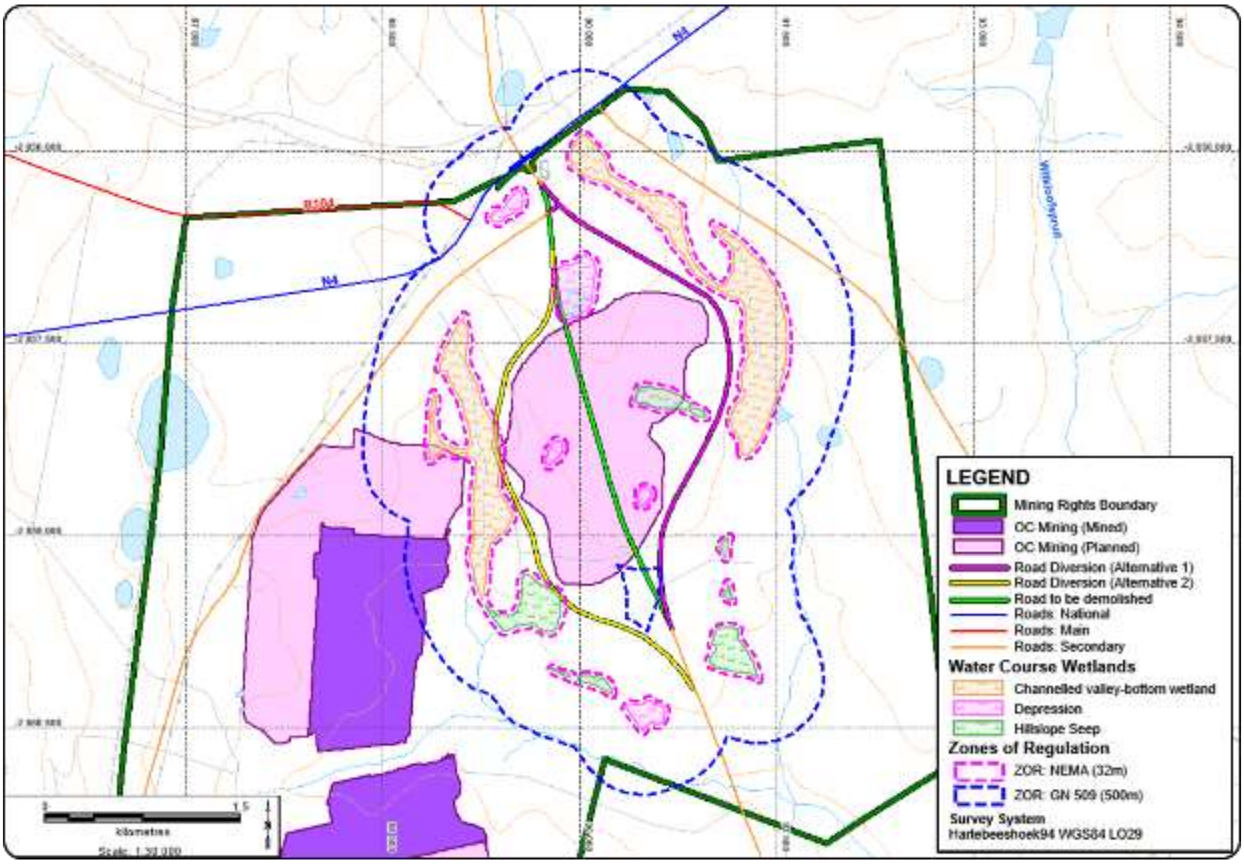


Figure 7: Watercourse systems occurring within the 500 m "zone of investigation".

6.1.3.1 Preferred Site Alternative

Alternative 1 was identified as the favourable road diversion alternative due to the following:

- Alternative 1 does not traverse any wetland systems and it does not occur within the 32 m boundary of the wetlands. Therefore, the potential risk to the environment is lower than at Alternative 2.
- The wetland impacts associated with Alternative 1 will be concentrated more on edge effect impacts rather than the direct impacts associated with Alternative 2.
- Alternative 2 will have a higher ecological impact than that of Alternative 1.
- Proper storm water management can be constructed next to Alternative 1 without impeding the wetlands in the area.
- If Alternative 2 is constructed, a road crossing will be required in order for Wonderfontein Mine to access the coal situated in the eastern region of the mine. Such a road crossing will pose significant risks to road users and additional structures make Alternative 2 less financially feasible than Alternative 1.

- Wetland crossings will not be required for Alternative 1 and therefore the cost associated with the construction of Alternative 1 will be less than the cost associated with Alternative 2.

Recommendations:

- In order to minimise the risk of sediment runoff, construction must be scheduled for the drier winter period.
- The areas that need to be cleared of vegetation should remain as small as possible in order to reduce the risk of further proliferation of alien vegetation and to retain a level of protection to the wetlands during construction.
- Non-essential activities, such as contractor laydowns, must remain outside the 32 m NEMA zone of regulation and as much alien vegetation should be cleared.
- Exposed soils must be protected for the duration of the construction period with a suitable geotextile in order to prevent erosion and sedimentation.
- Soils should not be stockpiled within close proximity of the of the wetlands and stockpiles may not exceed 2 m high.
- It is highly recommended that the proponent make provision for small scale rehabilitation of the reaches of the wetlands which may be directly impacted by construction activities.

6.1.4 The Technology to be used in the Activity

The 15-1 road is a provincial road and the re-alignment will be constructed in compliance with the requirements of the Mpumalanga Department of Public Works, Roads and Transport. Acceptable civil engineering road construction methods will be applied and no other technology was considered.

6.1.5 Land Use Alternatives

The project alternatives listed below were considered by Wonderfontein Mine.

6.1.5.1 Tourism

Majority of the land is currently being utilised for agricultural and grazing purposes. No potential for tourism was identified.

6.1.5.2 Residential

This is a short-term project and therefore, there is no requirement or potential to develop an additional residential area. Belfast is located approximately 20 km away and is within a comfortable travelling distance from the study area.

6.1.5.3 Agriculture

The land is currently being used for maize and soybean farming.

6.1.5.4 Mining

Mining will be conducted as per approved EMP and authorisations for this activity are already in place.

6.2 The Option of not Implementing the Activity

The "no-go" option means that the road diversion project is not authorised and as a result the diversion of the P15-1 road does not commence.

This will result in various socio-economic implications, such as:

- If the project is not authorised, the existing road (P15-1) will continue to be utilised and a 100 m buffer will be applied to the road so that mining of the coal reserve can commence. The 100 m buffer will however prevent the use of 37.06 ha of coal which in turn could lead to Wonderfontein Mine not being able to meet their contractual agreement with Eskom. Refer to **Figure 8**
- As a result of this, Eskom may experience an impact in electricity generation due to an already growing shortage of coal supply.
- A road crossing will have to be constructed in order to access the coal reserve located on the east of the P15-1 road, which will pose significant risks to road users.
- Temporary work opportunities will not be created during the construction phase which would have benefited the local community.

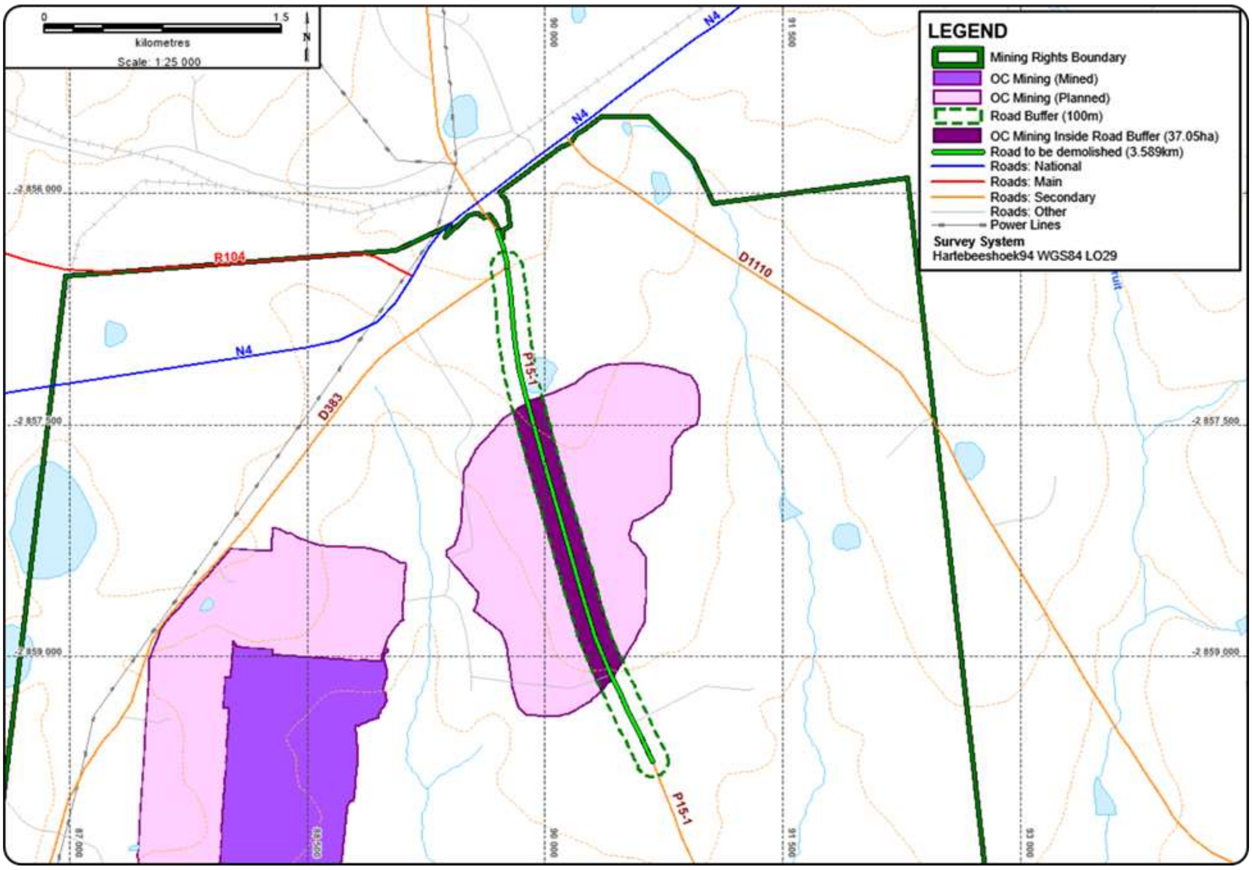


Figure 8: P15-1 road with a 100 m buffer resulting in the sterilisation of 37.05 ha of coal

6.3 Positive and Negative Impacts for Proposed Activity and Alternatives

The positive and negative impacts are identified and summarised in **Table 7** and **Table 8**.

Table 7: Positive and Negative Impacts – Site Layout

ASPECT	ALTERNATIVE 1	ALTERNATIVE 2
Geographical		
Topography	The impact on the topography will be negligible.	The impact on the topography will be negligible.
Geology	No impact on the geology.	No impact on the geology.
Physical		
Surface Water	Freshwater resources can be impacted through indirect impacts such as sedimentation. These impacts can be mitigated by proper designs and construction methods.	Freshwater resources can be impacted through indirect impacts such as sedimentation. These impacts can be mitigated by proper designs and construction methods.
Groundwater	Groundwater will not be impacted.	Groundwater will not be impacted.
Soils	Soils will be altered and affected, but proper construction of road can mitigate this. Due to the road remaining outside wetlands, it will be of less significance than Alternative 2.	Soils will be altered and affected, but proper construction of road can mitigate this
Land Use	The land use will be permanently changed from agriculture to road.	The land use will be permanently changed from agriculture and/or wetlands to road.
Air Quality	The dust impact will be negligible.	The dust impact will be negligible.
Biological		
Fauna	Disturbance to fauna will occur on a small scale.	Disturbance to fauna will occur on a small scale.
Flora	Disturbance to flora will occur on a small scale.	Disturbance to flora will occur on a small scale.
Wetlands (Aquatic)	Indirect impacts can influence wetlands however the road maintain a minimum 32 m buffer from wetlands.	The road diversion cross wetlands on multiple occasions and will have both direct and indirect impacts. In terms oi wetland preservation, it will not be the preferred option.
Social		
Visual	A small area will be disturbed and therefore the influence will be of little significance.	A small area will be disturbed and therefore the influence will be of little significance.
Noise	Noise will be generated on site with no significant difference between the alternatives.	Noise will be generated on site with no significant difference between the alternatives.
Relocation of Communities	Relocation of communities is not required as with both of the alternatives.	Relocation of communities is not required as with both of the alternatives.
Traffic	Construction vehicles will be of slight significance. Traffic is expected to increase slightly during operational phase.	Construction vehicles will be of slight significance. Traffic is expected to increase slightly during operational phase.
Economic		
Loss of employment	Not Applicable.	Not Applicable.
Creation of employment	Temporary construction employment will be created.	Temporary construction employment will be created.
Security of Employment	Both alternative road diversions will ensure that additional coal can be mined, therefore indirectly ensuring job security.	Both alternative road diversions will ensure that additional coal can be mined, therefore indirectly ensuring job security.

ASPECT	ALTERNATIVE 1	ALTERNATIVE 2
Revenue	Maximum revenue will be generated by this option.	Additional revenue will be generated by this option, but it will be far less than the other alternatives.
Financially justifiable	Alternative 1 will only require road construction with basic associated infrastructure to ensure that opencast mining can proceed in the area of the existing road.	Alternative 2 will require additional structures such as wetland crossings, ultimately presenting as being less financially justifiable as Alternative 1.
Heritage and Cultural		
Destruction of heritage structures	No heritage structures will be impacted	No heritage structures will be impacted.
Relocation of graves	Relocation of graves will not be required.	Relocation of graves will not be required.

Table 8: Positive and Negative Impacts Summary

ASPECT	ALTERNATIVE 1	ALTERNATIVE 2
Geographical		
Topography	NI	NI
Geology	NI	NI
Physical		
Surface Water	PNI	PNI
Groundwater	NI	NI
Soils	Y (-)	Y (-)
Land Use	Y (-)	Y (-)
Air Quality	NI	NI
Biological		
Fauna	Y (-)	Y (-)
Flora	Y (-)	Y (-)
Wetlands (Aquatic)	Y (-)	Y (-)
Social		
Visual	Y (-)	Y (-)
Noise	Y (-)	Y (-)
Relocation of Communities	NI	NI
Traffic	Y (-)	Y (-)
Economic		
Loss of employment	NI	NI
Creation of employment	Y (+)	Y (+)
Security if Employment	Y (+)	Y (+)
Revenue	Y (+)	Y (+)
Financially justifiable	Y (+)	Y (-)
Heritage and Cultural		
Destruction of heritage structures	PNI	PNI
Relocation of graves	NI	NI

Positive Impact	
Negative Impact	
No Impact (NI)	
Possible Negative Impact (PNI)	
Negative Impact (Can be mitigated to preferred impact significance) (Y*(-))	

6.4 Motivation for not considering Alternatives

Alternatives have been considered and therefore this section is not applicable.

6.5 Concluding Statement of Preferred Alternative

After carefully considering the physical, biological and socio-economic impacts, it was concluded that Alternative 1 is the best location for the road diversion. This selection was based on the most optimal financial benefits, security of employment, impacts on the environment and the viability of wetland offsetting.

7 PROJECT DESCRIPTION

7.1 Overview of the Project

Wonderfontein Mine has been authorised to utilise the coal reserve located in the north-eastern region of the mining boundary; however, the existing road alignment (P15-1) traverses the reserve resulting in the sterilisation of the coal along the alignment of the road. Wonderfontein Mine is therefore applying for General Authorisation to divert the P15-1 road around the coal reserve in order for mining to take place.

7.2 Activities

7.2.1 Activity 1: Construction of Road Diversion

The P15-1 road is going to be permanently diverted around the coal reserve onto a suitable path. The development footprint will be of minimal impact and the areas disturbed during the construction process will be rehabilitated.

7.2.2 Activity 2: Storm Water Management

Water management structures, such as minor and major drainage systems, will be constructed parallel to the diverted road in order to ensure adequate and effective drainage according to the requirements of the Mpumalanga Department of Public Works and Roads.

7.2.3 Activity 3: Contractor camp

A contractor yard will be developed where the contractor's equipment can be stored and where some offices in the form of park homes will be located. It must be noted that no workshops will be located in this area and all repairs and maintenance will be conducted off-site. Chemical toilets will be located in this area and a JoJo Tank for the storage of potable water obtained from Wonderfontein mine will be present. Waste skips will also be located in this area. Small sheds and car ports will also be constructed and a diesel tank with a storage well below 80 m^3 will located at this site.

The activity will include the clearing of the area and after construction the area will be rehabilitated.

7.3 Infrastructure

No existing infrastructure is present within the study area. The only infrastructure to be constructed is the diverted road, associated water management infrastructure and the contractor camp.

7.4 Roads

The existing P15-1 road currently crosses over the coal reserve and therefore the road is going to be permanently diverted around the reserve. The diverted road is going to be approximately 4.349 km in length and 8 m in width (two lanes that are each3.7 m in width with 300 mm from the yellow line to the edge). The planned road reserve is going to be 40 m.

7.5 Fencing

Fences will be erected to delineate the road reserve.

7.6 Workshop, Administration and Other Buildings

Employees and construction workers will commute to the site daily. No housing or recreational facilities will be constructed on the proposed site. As indicated previously park home offices will be located within the contractor yard, but no workshops will be located on site.

7.7 Water Supply

7.7.1 Potable Water

Potable water required for drinking purposes will be provided in the form of bottled water.

7.7.2 Process Water

Water will be supplied by Wonderfontein Mine for the duration of the construction period.

7.8 Disturbances of Water Courses

The surrounding watercourses will not be disturbed.

7.9 Water Management Infrastructure

Stormwater management facilities will be constructed as per the designs compiled by WSP. No other measures will be constructed. For more details on the designs, refer to **Annexure 4**.

7.10 Waste Management

7.10.1 Hazardous Waste Disposal

Oil and grease waste generated during maintenance and serves must be disposed of into sealed drums and collected regularly by an approved vendor. Any other contaminated waste (i.e. brake pads, filters, oil rags, etc.) must be disposed of into marked bins/skips for collection by a contractor for disposal at an approved hazardous waste facility.

7.10.2 Domestic Waste Disposal

Domestic waste (such as paper, cardboard, organic waste, etc.) generated at the study area must be collected by an appointed contractor and disposed of at an authorized site. A recycling initiative is recommended.

Categories of recycling include:

- Glass;
- Cans/tins;
- Paper;
- Cardboard;
- Plastic.

7.10.3 Non-hazardous Industrial Waste Disposal

Scrap metal will be temporarily stored before being sold to scrap dealers. Old tyres are recycled by approved vendors.

7.11 Energy Supply

Should electrical power be required, it will be provided by a diesel generator.

7.12 Motivation for the Project

7.16.1 Expenditure

Wonderfontein Mine has widely invested in the area's economy, greatly supplementing the existing agricultural local economy. Wonderfontein Mine has already invested in the area by facilitating public participation and by ensuring on-going monitoring of the effects of the mining activities on the surrounding environment. The mine also has a contractual obligation towards Eskom. Capital investments for the application and authorisations has been made.

7.16.2 Employment

Benefits of this project will include:

- Temporary employment opportunities will be created for the duration of the construction period, benefiting the local community.
- Diverting the road will ensure that additional coal be mined therefore indirectly ensuring job security for employees currently working at Wonderfontein Mine.
- Additional economic activities in the area.

7.16.3 Broad Based Black Economic Empowerment

A Social and Labour Plan has been approved by the DMR in which the relevant issues referring to Section 27(1) (b) of the National Water Act (Act no 36 of 1998) has been addressed. Community development will be aligned with the approved Social and Labour Plan.

Umsimbithi Mining (Pty) Ltd is an empowered mining company, owned by Umcebo Mining (Pty) Ltd and Lithemba Wonderfontein Coal (Pty) Ltd.

7.16.4 Environment

The planned activities are expected to have impacts on the environment. Various legislations including NEMA, the Water Act and the associated regulations, which have set principles, standards and norms, will all be used to depict how the developments should conducted in a responsible manner. The aim of this process is to quantify and qualify measures and practices which can be implemented and maintained so to ensure that the activity is conducted in a manner that it will cause the least possible impacts on the environment. The management, implementation and measurement of the measures and practices identified throughout all the phases is crucial in achieving the aim/objectives that will be set. To date, no impacts have been identified which cannot be managed or controlled and therefore the objectives of responsible environmental management will be able to be achieved.

8 BASELINE ENVIRONMENT

Unless stated otherwise, this section contains the baseline information from the Scoping Report for the Wonderfontein Mine EMP Amendment complied by JKC in 2014.

8.1 Geology

8.1.1 Regional Geology

The Wonderfontein Road Diversion occurs within the Springs-Witbank Coalfield which comprises sediments of the coal-bearing Ecca Group of the Karoo Sequence which was deposited on an undulating pre- Karoo floor. This resulted in an influence on the nature, distribution and thickness of many sedimentary formations, including coal seams.

The project study area occurs within the northern region of Wonderfontein Mine where the Dwyka Group (composed of shale and tillite), basalts and andesite igneous formations are found. The sequence typically comprises, from the base upwards, a diamictite of probable glacial origin, pro-glacial varved siltstone and pebbly mudstone, and paraglacial gravel and conglomerate, overlain by swamp, fluviodeltaic and shoreline deposits.

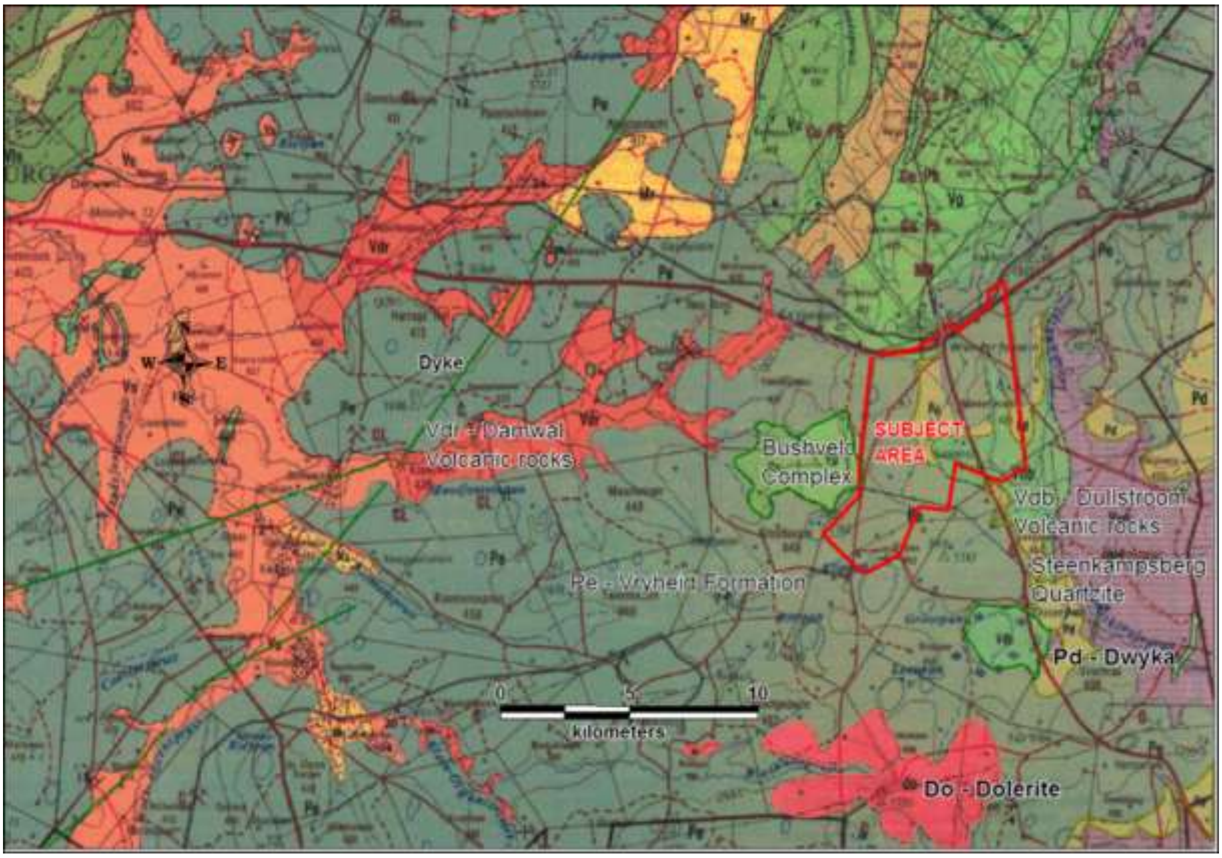


Figure 9: Regional geological map (scanned from the Council for Geoscience map)

8.1.2 Presence of Dykes, Sills and Faults

Dolerite and diabase dykes and sills of Karoo age occur in the surrounding area.

8.2 Climate

8.2.1 Regional Climate

Reference is made to the Surface Water Resources of South Africa, 1990, Water Research Commission. Climatological data has been recorded at Belfast, which has a similar altitude to the study area.

The proposed road diversion is situated in the Highveld and therefore falls within the summer rainfall region. A characteristic of this area is the regular thunderstorms during the summer.

The regional climate of this area falls within the Highveld climatic zone which can be described as sub-humid with summer rainfalls and cold winters. The subject area is located within quaternary catchment X11C of the Olifants WMA. The mean annual precipitation was recorded as 755 mm and it had an annual evaporation rate of 1975 mm.

Tables 9, 10, 11 and **13** indicate the rainfall, temperature and evaporation statistics whereas **Table 12** represents the wind speed and direction data. The statistics for the wind was obtained from the Witbank station. The relevant recording stations are given in the tables.

8.2.2 Mean Monthly and Annual Rainfall

Nooitgedacht Dam station (0517147) is the second nearest weather station to the road diversion site, with 48 years recorded daily data available up to date. Rainfall data from the Nooitgedacht Dam Station (0517147) was obtained from the Department of Water Affairs. Measurements of the weather station started in 1961 and the data obtained reflects measurements up to 28 February 2009.

The monthly rainfall, as a percentage of the mean annual precipitation (MAP), is presented in **Table 9**. The monthly distribution shows a relatively long rainfall season for Southern Africa, with six months receiving more than 50 mm. The period May to August is dry with only 40.8 mm of rainfall during these months. Most of the annual rainfall occurs during October to March. Based on these statistics, the peak rainfall month is November. The total mean annual precipitation (MAP) for the study area is 723.7 mm/a, Rainfall Zone X1A.

The project is located in the Mpumalanga Highveld. The rain occurs almost exclusively as showers (mild to heavy) and thunderstorms – mainly in summer (October to March). Heavy falls (100 mm plus) in a single 24-hour period are rare, but do occur.

Table 9: Monthly Average Precipitation (Nooitgedacht Dam Station 0517147)

Month	Rainfall (adjusted %)	Rainfall (mm)
January	17.05	123.4
February	12.51	90.5
March	10.52	76.1
April	5.87	42.5
May	2.18	15.8
June	1.23	8.9
July	1.05	7.6
August	1.18	8.5
September	4.10	29.7
October	10.79	78.1
November	17.38	125.8
December	16.14	116.8
Total	**100**	**723.7**

8.2.3 Maximum Rainfall Intensities

Table 10 below indicates the maximum 24-hour rainfall intensities per month. The highest maximum 24-hour rainfall intensity is in February, namely 88 mm, and the lowest is in June, 19 mm.

Table 10: Maximum Rainfall Intensities

Month	24 Hours (mm)
January	71
February	88
March	55
April	64
May	54
June	19
July	25
August	29
September	48
October	61
November	58
December	87

8.2.4 Mean Monthly Maximum and Minimum Temperatures

The area has a relatively warm Highveld temperature regime with temperatures reaching a maximum of over 30ºC during the summer months. **Table 11** below characterises the temperature regime of this area.

Table 11: Characterisation of temperature

Month	Daily Maximum (ºC)	Daily Minimum (ºC)	Highest Temp (ºC)	Lowest
January	27.2	13.7	32.0	9.1
February	26.8	13.4	30.8	9.0
March	26.8	11.4	30.2	6.4
April	23.9	7.4	27.9	1.4
May	21.3	2.2	26.1	-2.9
June	18.5	-1.8	22.4	-6.0
July	18.4	-1.7	23.0	-5.8
August	21.4	0.8	26.0	-4.1
September	24.0	5.3	29.2	-1.3
October	26.0	10.1	31.2	4.4
November	26.2	11.8	31.8	5.9
December	27.1	13.2	31.2	7.8

8.2.5 Mean Monthly Wind Direction and Speed

The following table, **Table 12**, presents average monthly wind direction and velocity for the Witbank region. The direction (N) is measured relative to north as the frequency per 1000 readings. The wind velocity (V) is measured in metres per second.

Table 12: Wind direction and velocity (N/V) (Witbank Region)

Month	N	NE	E	SE	S	SW	W	NW
Jan	161/3.0	287/3.2	109/3.7	48/4.5	44/3.1	92/3.3	122/3.6	96/3.3
Feb	142/2.9	295/3.2	141/3.9	60/4.2	44/3.1	74/3.4	112/3.4	101/2.9
Mar	152/2.8	304/3.3	139/3.4	63/3.5	36/3.1	54/3.1	100/3.4	104/2.9
Apr	170/2.7	211/3.3	87/3.4	39/3.0	47/3.2	95/3.4	149/3.6	146/2.8
May	172/2.6	166/2.9	67/3.0	51/3.3	59/3.4	89/3.7	162/3.9	167/2.9
Jun	146/2.5	149/3.0	86/3.2	43/3.2	54/3.6	117/3.0	157/3.8	166/2.7
Jul	162/2.5	184/2.9	79/3.4	53/4.2	51/3.9	99/3.9	142/3.6	153/2.8
Aug	174/5.4	180/3.4	83/3.2	40/4.4	40/3.5	86/4.1	141/4.1	182/3.0
Sep	197/3.2	223/3.8	84/4.0	41/3.9	27/3.5	70/3.9	131/4.3	171/3.3
Oct	190/3.4	243/3.7	83/4.3	42/3.6	33/3.6	71/3.6	142/4.0	160/3.8
Nov	174/3.2	225/3.6	92/4.1	40/3.9	28/3.1	68/3.1	185/3.8	154/3.5
Dec	180/3.1	254/3.4	95/4.0	40/4.0	34/3.0	69/3.3	154/3.4	135/3.3
Ave	188/2.0	227/3.3	95/3.7	47/3.8	41/3.3	82/3.8	141/3.8	146/3.1

8.2.6 Mean Monthly Evaporation

The proposed road diversion project lies within Evaporation Zone 5A of the Surface Water Resources of South Africa 1990.

The information represented in **Table 13** was obtained from the Nooitgedacht dam monitoring station and indicates that the summer months of September to March constitute 68% of the mean annual evaporation. The total mean annual evaporation (MAE) for the site is 1759 mm/a, Evaporation Zone 5 as calculated for 48 years.

The monthly evaporation figures as measured at the Nooitgedacht Dam Station X1E003 are as follows:

Table 13: Monthly Average Evaporation (mm) for the Nooitgedacht Dam Station X1E003

Month	Evaporation (mm)
January	198.4
February	170.1
March	166.9
April	126.6
May	110.5
June	108.3
July	98.0
August	124.0
September	150.4
October	167.1
November	166.7
December	189.4
Total Annual	**1776.4**

8.2.7 Incidence of Extreme Weather Conditions

Frost: The lowest temperature of –12.4 °C was recorded during 1926. An average of between 120 and 150 days of frost occurs between April and September.

Hail: An average of 2.8 days per year is associated with hail, with the most significant hail event being recorded on 26/12/1940.

Drought: The lowest annual rainfall, recorded during the 53-year rainfall record, was 24 mm.

High winds: The highest wind speed recorded from 1962 to 1988 was 5.7 m/sec (SE) during September.

8.3 Topography

The project area is characterised by undulating, rolling hills and is without any prominent topographical landforms. The highest point in this catchment is 1762.8 mamsl, with the topography generally sloping towards the Blesbokspruit. The site itself is representative of the local topography and is slightly undulating with its highest point in the eastern corner. A tributary of the Blesbokspruit runs along the route of Alternative 1, almost bisecting the coal reserve area which is to be mined.

8.4 Soils

A Soil, land capability, land use and hydropedology assessment was compiled by Rehab Green Monitoring Consultants CC (2019) for JKC. Refer to **Annexure 6**. The soils were classified according to the Taxonomic System for South Africa (Soil Classification, A Taxonomic System for South Africa, 1991). The sections below were obtained from the report.

8.4.1 Dominant Soil Types

A total of four (4) homogeneous soil units, based on dominant soil form, effective soil depth, internal drainage, terrain unit and slope percentage were identified during field observations and are symbolised as Hu1, Hu2, Cv3 and Av1. Refer to **Table 14**.

.

Table 14: Detailed soil legend

SOIL LEGEND									
Soil Type Code	**Dominant Soil Form and Family**	**Effective soil Depth (mm)**	**Clay % A-horizon B-horizon**	**Texture Class**	**Summarized Description of Dominant Soil Form**	**Agricultural Potential**	**Land Capability**	**Area (ha)**	**Area (%)**
Hu1	Hutton 2100	1400-1600	A: 15-20 B: 15-30	Sandy loam	Very deep, red, well-drained, situated on gentle midslopes (2-3% slopes).	High	Arable	7.35	44.43
Hu2	Hutton 2100	900-1200	A: 12-18 B: 15-25	Sandy loam	Deep, red, well-drained, situated on gentle crests and footslopes (1-3% slopes).	High	Arable	1.42	8.60
Cv3	Clovelly 2100	600-1000	A: 10-15 B: 12-18	Loamy sand	Moderately deep, yellow brown, well-drained, situated on gentle midslopes (2-3% slopes).	Moderate	Arable	5.76	34.79
Av1	Avalon 2100	700-1000	A: 10-14 B: 12-18	Loamy sand	Moderately deep, yellow brown, moderately well-drained, underlain by soft plinthite, situated on gentle midslopes (2-4% slopes).	Moderate	Arable	2.01	12.18
							TOTAL	16.54	100.00

8.4.2 Soil Chemistry

A sample of the A-horizon of different soil types was taken at two locations; namely P8 and P19.The analytical results are shown in **Table 15** below.

Table 15: Soil Chemical analyses

Samp. Point	Soil Form	Horizon	Depth	K	Ca	Mg	Na	*Titrate Acid	*Acid saturate	Rs (resistance)	P (Bray1) mg/kg	pH (H_2O)
				mg/kg	mg/kg	mg/kg	mg/kg					
				Ammonium acetate				Cmol (+)/kg	%	ohm		
Undisturbed red sandy clay soils												
P8	Hutton	A	0 - 200	60	458	105	3.4	-	-	2300	41.3	5.86
P19	Clovelly	A	0 - 200	53	458	85	3.5	-	-	2960	62.6	5.97
Average				**57**	**458**	**95**	**3.45**	-	-	**2630**	**52**	**5.92**
*****Analyses done when pH is below 5.5												

The average concentration values, highlighted in green in **Table 15**, were compared to the fertility guidelines as seen in **Table 16**. According to **Table 16**, the average K, Ca and Mg values are considered as low to moderate and indicated a fairly fertile chemical status. The average Na levels are low and this indicates that there is no accumulation of sodium in the soil profile and implies an absence of sodic soil conditions. The high resistance value of 2630 ohms confirms the low salt concentrations. The average P concentration of 52 mg/kg is high and is an indication that there is a build-up of fertilisers in the soil. The average ration of Ca to Mg is 2.9 and indicates sufficient concentrations of Ca to buffer the destabilisation of Mg on soil structure.

Table 16: Soil fertility compared to broad fertility guidelines

Element or measurement	Unit	Guidelines Low	Guidelines High	Current status rating Median value	Current status rating Rating	Preferred status
Potassium (K)	mg/kg	<40	>250	**57**	Low to moderate	80-150
Calcium (Ca)		<200	>3000	**458**	Low to moderate	600-1000
Magnesium (Mg)		<50	>250	**95**	Low to moderate	80-150
Ca:Mg (cmol(+)/kg)	Ratio	<2	>4	**2.9**	Ideal	2-4
Acid saturation	%	<10	>30	**-**	-	<20
Sodium (Na)	mg/kg	<50	>200	**3.45**	Low (positive in terms of sodicity)	<50
Resistance	ohm	<200	>300	**2630**	High (positive in terms of salinity)	>300
Phosphorus (P)	mg/kg	<5	>35	**52**	High	*10-20 **30-50
pH(H_2O)	Very acid Acid Moderately acid Neutral Moderately alkaline	<=4.9 5.0-5.9 6.0-6.8 6.8-7.2 7.2-8.1		**5.92**	Acid to moderately acid	5.8-6.8

		Guidelines		Current status rating		Preferred status
Element or measurement	Unit	Low	High	Median value	Rating	
	Alkaline		>=8.2			
* pastures ** crop farming						

8.4.3 Land Capability

The land capability, prior to the road diversion project, was determined by soil specialists and the results are shown in **Table 17** below. The soil types are grouped into land capability classes and a broad description of the soil group is provided. **Table 17** also provides the number of units per land capability as well as the area and percentage comprised by each land capability class.

All of the soil types identified within the study area were classified as arable with moderate to high agricultural potential. No soil types occurred within the grazing, wetland or wilderness land capability classes.

Table 17: Land capability and wetland classes

LEGEND: LAND CAPABILITY AND WETLAND DELINEATION						
Land Capability Code	Land Capability Class	*Soil Types	Broad Soil Description	Unit Count	Area (ha)	Area (%)
A	Arable	Hu1, Hu2, Cv3 and Av1	Moderately deep to very deep yellow brown and red, loamy sand to sandy clay loam soils	1	16.54	100.0
G	Grazing	-	-	0	0	0
W	Wetland	-	-	0	0	0
WDN	Wilderness	-	-	0	0	0
			Total	**1**	**16.54**	**100.0**

8.4.4 Land Use

The localities and extent of the land use practices were also surveyed during the time of the soil assessment. From the results, as seen in **Table 18** below, it was observed that majority of the study area is being utilised for agricultural purposes. The production of maize occurs on 23% (3.81 ha) of the study area and soybeans are cultivated on 52.68% (8.72 ha) of the study area. Grazing occurs on 22.63% (3.75 ha) of the study area footprint and a tar road is situated on the remaining 1.69% (0.28 ha) of the study area.

Table 18: Current land uses

LEGEND – PRE-MINING LAND USE				
Land Use Code	**Pre-mining Land Use**	**Unit Count**	**Area (ha)**	**Area (%)**
M	Maize	2	3.81	23.00
SB	Soybeans	2	8.72	52.68
G	Grazing	2	3.75	22.63
R	Tar road	1	0.28	1.69
	TOTAL	**7**	**16.56**	**100.0**

8.4.5 Hydropedology

There are three hydropedological zones into which the hydropedological behaviour of soil can be classified; namely,

- Recharge zone – characterised by vertical infiltration through the soil profile and weathered subsoil strata as well as the lateral flow at the bedrock interface during the rainy season.
- Interflow zone – characterised by the lateral flow in higher permeable layer(s) in the soil profile underlain by lower permeable soil/subsoil material.
- Responsive zone – characterised by saturated and near saturated conditions of the soil profile for most of the year and exfiltration of upslope interflow during the rainy season.

Table 19 categorises each soil type found within the study area according to its hydropedology; namely, a recharge, interflow or responsive soil. It also describes the waterflow pathways of each soil type. The planned road diversion occurs within the recharge hydropedological zone. The interflow and responsive zones are not intersected anywhere. Therefore, the planned road diversion will not cause a reduction in water quality to the nearby wetlands via lateral flow within the soil profile.

Table 19: Soil types and water flow pathways within hydropedological pathways

Legend: Soil types within hydropedological zones intersected by proposed open pit and infrastructure areas						
Hydropedological zones	**Soil Type Code**	**Dominant Soil Form and Family**	**Summarized description of dominant soil type**	**Wetland/ Terrestrial zone**	**Wetness indicators (wetness within 500 mm)**	**Water flow pathways**
Recharge soils	**Hu1**	Hutton 2100	Moderately deep to very deep, red to dark red, well-drained, sandy loam to clay loam soils, underlain by highly weathered rock. Situated on gently sloping crests, midslopes and footslopes (1-3% slopes).	Terrestrial	Well-drained soil profile - no signs of wetness	Mainly vertical through soil profile and weathered subsoil strata to flow limiting bedrock. Lateral flow at interface of bedrock and weathered subsoil strata
	Hu2					
	Cv3	Clovelly 2100	Moderately deep, yellow brown, well-drained, loamy sand to sandy loam soils, situated on gentle midslopes (2-3% slopes).			
	Av1	Avalon 2100	Moderately deep, yellow brown, moderately well-drained, loamy sand to sandy loam soils underlain by soft plinthite, situated on gentle midslopes (2-4% slopes).	Terrestrial	Well-drained upper soil profile - Signs of wetness below 500 mm in plinthic horizon	Mainly vertical through soil profile and weathered subsoil strata to flow limiting bedrock. Somewhat restricted in soft plinthic B2-horizon. Lateral flow at interface of bedrock and weathered subsoil strata.
Interflow soils	None	-	-	-	-	-
Responsive soils	None	**-**	-	-	-	-
*Dominant soil form and family						

8.5 Ecology

8.5.1 Flora

The site falls within the Grassland Biome and the Mesic Highveld Grassland bioregion. Recent vegetation classifications describe the vegetation of the area as that belonging to the Rand and Eastern Highveld Grassland vegetation types (Mucina & Rutherford, 2006). Regarding the vegetation at the site, it is evident that the site falls within the Eastern Highveld Grassland and the Eastern Freshwater Wetland vegetation types.

During field visits, it was noticed that majority of the assessment site has been transformed for the farming of maize and soybeans. Some areas within the assessment site, that would have been home to terrestrial grasslands, have not been cultivated due to a very stony substrate. These areas are now being utilised as grazing lands for livestock.

For descriptive purposes, the assessment site has been broken down into several habitats based on the dominant floral species.

Farmland

A large portion of the assessment site is agricultural land. The most abundant crop is soybean (Glycine max) butmaize (*Zea mays*) is also cultivated. While most of the farmland is currently being used as growing fields, a few fields have been abandoned, resulting in them being invaded by exotic species, especially *Tagetes minuta*, *Bidens formosa*, *Bidens pilosa* and *Datura sp*.

Scattered throughout the assessment site were the residences of the farmers who manage these agricultural lands. Within the residences, the exotic grass species *Pennisetum clandestinum* dominated the area. These areas also had a woody species component; however, the vast majority of these species are exotic, e.g. *Pinus sp*., *Eucalyptus camaldulensis* and *Acacia mearnsii*.

Transformed grasslands

Certain portions of the assessment site have not been used for the cultivation of crops. In these areas, the top soil is sand but it becomes fairly rocky and stony underneath this layer. This would make ploughing, planting and harvesting crops more difficult and therefore these areas have rather been used as grazing lands for livestock. Here, the vegetation is dominated by grass and forb species that are commonly found in sandy, disturbed and overgrazed areas. Examples of these species include *Hyparrhenia dissoluta*, *Eragrostis rotifer*, E. *gummiflua*, *E. curvula*, *Pogonarthria squarrosa*, *Aristida congesta* and *Stoebe vulgaris*.

Wetlands

Wetland systems were found in the area surrounding the assessment site and will be discussed in more detail in **Section 8.7**.

Some portions of the permanent and seasonal zones of the wetlands have been degraded; however, majority are still in relatively good condition and are dominated by species such as *Typha capensis, Phragmites australis, Imperata cylindrica, Andropogon sp., Cyperus sp.* and *Agrostis lachnantha*. These wetlands should therefore be considered as ecologically sensitive. The temporary zones have been degraded by the presence of livestock, encroachment of maize and soybean farming and the presence of invasive exotic species. These have all resulted in a homogenous vegetation pattern, being almost completely dominated by *Eragrostis plana.* Care should be taken during the construction phase to minimise the impact to the wetland habitats found within the proposed development site.

8.5.1.1 Floral Species of Conservation Concern (SCC)

No red data floral species were found during the site visit. However, it is suggested that the wetland areas are conserved so to ensure that there is sufficient habitat for Red Data Listed (RDL) species with a high Probability of Occurrence (POC) within the area and to ensure the on-going survival of these species.

8.5.1.2 Intruder or Exotic Species

Numerous exotic species were found throughout the site. *Tagetes minuta* and *Bidens formosa* have infested abandoned agricultural fields. Where these abandoned fields have encroached into a wetland, exotic species such as *Bidens formosa* and *Pennisetum clandestinum* have invaded and degraded the wetland.

Other exotic species encountered include *Pinus sp., Acacia mearnsii* and *Eucalyptus camaldulensis*. These species are generally encountered close to human residences and wetlands. It is recommended that alien vegetation and invasive species be removed as part of the landscaping activities to be completed once the civil works have drawn to a conclusion.

8.5.2 Fauna

8.5.2.1 Mammals

During the field visit, a yellow mongoose (*Cynictus penicillata*), scrub hare (*Lepus saxatalis*), Grey Duiker (*Sylvicapra grimmia*), Steenbok (*Raphicerus campestris*) and Blue Wildebeest (*Connochaetes taurinus*) were directly observed, while evidence of porcupine (*Hystrix* *africaeaustralis*) was indirectly observed. Under the International Union for Conservation of Nature (IUCN), these species are designated as least concern, a category that is made up of widespread and abundant taxa.

Portions of the assessment site are still in relatively good condition and therefore are likely to support a wide diversity of mammal species.

8.5.2.2 Birds

In general, the majority of the birds observed within the assessment site were in the agricultural fields and wetlands. The maize lands were dominated by Helmeted Guineafowl, Swainson's Francolin and Red-billed Quelea, while the wetlands were home to species such as Orange-throated Longclaw, Marsh Owl, Egyptian Goose, Spur-winged Goose, Black-headed Heron, Blacksmith Plover and Red-knobbed Coot. The majority of the birds observed during the field visits were all common species, the exception being a Southern Bald Ibis, which is a Red Data species, falling into the vulnerable category. This bird was seen within the Wonderfontein Wetland system.

8.5.2.3 Reptiles

No reptile species were observed during the assessment but this is probably more due to their cryptic nature than the lack of available habitat. The majority of the assessment took place during cooler periods when these species are less active. This could have also contributed to the absence of species observed during the assessment.

8.5.2.4 Amphibians

No amphibian species were directly observed but species were heard calling. Given the presence of the wetlands, the assessment site is likely to support an abundance of frog species. However, the majority of listed frog species in the 2003 Mpumalanga State of Environment Report are not likely to be found at the assessment site because the site falls out of the boundaries of their historical distribution. The exception is the Giant Bullfrog, whose distribution just extends to include the assessment site. By conserving the wetland habitats on the subject property, adequate protection of the habitat for these species will be afforded.

8.5.2.5 Invertebrates

During the field assessment it was found that the study area had an abundance of insects but a low diversity of families was represented. The most prevalent species were members of the Grasshopper family, *Acrididae*, and the Foam/lubber grasshopper family, *Pyrgomorphidae*, which is to be expected given the presence of grasslands and agricultural lands on the property.

Other common insects that were observed include a variety of butterflies from the *Nymphalide* and *Pieridae* families as well as Ants, Honey bees, Ladybirds and Houseflies. In addition, the presence of the wetlands means that insects with aquatic stages in their life cycle were common, particularly the dragonfly family *Libellulidae*, the damselfly family *Coenagrionidae*, and the Hemipteran family *Gerridae*.

8.5.2.6 Endangered or rare Species

Thirty-one species (12 mammals, 16 birds, one invertebrate, one amphibian and one reptile) were found to have a POC of 60% or greater within the assessment site (refer to **Table 20**). Only one of these species were observed within the study area; namely, the Southern Bald Ibis. The thirty-one species identified were used to calculated the RDSIS for the assessment site. The results for the RDSIS assessment provided a medium score of 51% which indicates fair importance to listed species conservation within the region.

Table 20: Species observed on site

Scientific Name	Common Name	IUCN Red List Status
Mammals		
Rough-haired golden mole	*Chrysospalax villosus rufus*	EN
Hottentot golden mole	*Amblysomus hottentotus*	VU
Oribi	*Ourebia ourebi*	VU
Forest shrew	*Myosorex varius*	DD
Reddish-grey musk shrew	*Crocidura cyanea*	DD
Swamp musk shrew	*Crocidura mariquensis*	DD
Geoffroy's horseshoe bat	*Rhinolophus clivosus*	NT
Schreiber's long-fingered bat	*Miniopterus schreibersii*	NT
Temminck's hairy bat	*Myotis tricolor*	NT
Bushveld gerbil	*Tatera leucogaster*	DD
Water rat	*Dasymys incomtus*	NT
Spotted-necked otter	*Lutra maculicollis*	NT
Avifauna		
Bald Ibis	*Geronticus calvus*	VU
Botha’s Lark	*Spizocorys fringillaris*	EN
Blue Crane	*Anthropoides paradiseus*	VU
Striped Flufftail	*Sarothrura affinis*	VU
Blue Korhaan	*Eupodotis caerulescens*	VU
Stanley’s Bustard	*Neotis denhami*	VU
African Marsh Harrier	*Circus ranivorus*	VU
Grass Owl	*Tyto capensis*	VU
Melodious lark	*Mirafra cheniana*	NT
Lesser Flamingo	*Phoenicopterus minor*	NT
Black stork	*Ciconia nigra*	NT

Lanner falcon	*Falco biarmicus*	NT
Half-collared kingfisher	*Alcedo semitorquata*	NT
Greater flamingo	*Phoenicopterus ruber*	NT
Yellow-billed stork	*Mycteria ibis*	NT
Secretary bird	*Saffitarius serpentarius*	NT
Reptile		
Striped harlequin snake	*Homoroselaps dorsalis*	NT
Amphibian		
Giant bullfrog	*Pyxicephalus adspersus*	VU
Invertebrate		
Marsh Sylph	*Metisella meninx*	VU

EN = Endangered, VU = Vulnerable, DD = Rare and Data Deficient, NT = Near Threatened

8.6 Surface Water

The road diversion is located in the X11C Quaternary Sub-catchment in the upper reaches of the Komati River Primary Catchment area. The X11C Quaternary Sub-catchment drains directly into the Nooitgedacht Dam. The following formal rivers have been identified within a broader area of the road diversion study area:

Table 21: Formal rivers downstream from the road diversion study area

Item	River Name	River Length
1	Blesbokspruit	5 km
2	Witkloofspruit	15.5 km

The Wonderfontein Road diversion study area drains towards two (2) tributaries (labelled in this report as Stream 1 and Stream 4) of the Blesbokspruit River. The Blesbokspruit River then discharges into Witkloofspruit River which is a tributary of the Nooitgedacht Dam. The following table summarises the characteristics of these two streams:

Table 22: Receiving streams from the road diversion study area

Stream Name	Length	Slope (average)	Catchment Area
Stream 1	6.1 km	1: 80	14.55 km^2
Stream 4	2.5 km	1: 185	5.51 km^2

8.6.1 Surface Water Quantity

8.6.1.1 Mean Annual Runoff

The study area is located within the Hydro Zone P. There are no river gauge stations in the rivers/streams located in the project area (in quaternary Sub-catchment X11C). The only registered river stream gauge station is located approximately 28 km downstream at the Nooitgedacht Dam. Readings from this station are not only limited to discharge from the Wonderfontein Site quaternary Sub-catchment area X11C but also inflows from the Komati river and from other rivers in quaternary sub-catchments X11A and X11B, with the most inflows originating from the X11A (Komati River) catchment area.

The following information was obtained from the Surface Water Resources of South Africa (Volume VI, Water Research Commission, 1990) regarding the Quaternary Sub-catchment X11C:

Table 23: Quaternary Sub-catchment X11C

Catchment Area	Forest Area	MAP (mm/a)	MAE (mm/a)	MAR (mm/a)	MAR ($10^6 m^3/a$)
319 km^2	5 km^2	716	1450	45	14.2

The Mean Annual Runoff (MAR) (mm) for X11C Quaternary sub-catchment is provided by the Water Resource Commission and was recorded as 45 mm/a relating to a total annual volume of 14.2 mil m^3/a.

The MAR of the natural streams surrounding the Wonderfontein road diversion study area is reflected in the following table:

Table 24: Natural Streams MAR (mil m^3/a)

Stream Name	Catchment Area	MAR (million m^3)	% of Quaternary Catchment X11C
Stream 1	14.55 km^2	0.655	4.61 %
Stream 4	5.51 km^2	0.248	1.73 %

The above table reflects the proportional runoff from the two streams surrounding the Wonderfontein Road diversion study area within the Quaternary Sub-catchment X11C which has a catchment area of 319 km^2 and a MAR of 14.2 mil m^3

8.6.1.2 Flood peaks and Volumes

The calculated 24-hour maximum storm precipitation for various recurrence intervals for the chosen weather station (Nooitgedacht Dam Station) is reflected in the table below.

Table 25: Flood peaks

1:2	1:10	1:20	1:50	1:100	1:200	1:500	1:1000	1:10000
43 mm	79 mm	93 mm	111 mm	124 mm	137 mm	155 mm	168 mm	212 mm

Table 26 below represents a summary of the flood peak discharge for various recurrence intervals for the two streams occurring within the project area:

Table 26: Results of Flood Peak Runoff (m^3/s) for streams surrounding the road diversion study area

Stream Name	1:2	1:5	1:10	1:20	1:50	1:100
Stream 1	24	41	57	69	93	119
Stream 4	62	108	152	184	247	314

The following table reflects a summary of the flood discharge volumes for various recurrence intervals for the two streams occurring within the project area:

Table 27: Results of Flood Volumes (mil m^3) for streams surrounding the road diversion study area

Stream Name	1:2	1:5	1:10	1:20	1:50	1:100
Stream 1	0.19	0.32	0.44	0.53	0.72	0.92
Stream 4	0.30	0.52	0.72	0.87	1.18	1.51

8.6.2 Surface Water Quality

Water samples were collected around the study area at five different points throughout 2018. The purpose of water sampling is to gather some baseline information prior to the proposed operations. A summary of the results can be viewed in **Table 28** below while **Figure 10** represents the locality of the monitoring points. It should be noted that two points (namely, UW-S10 and UW-S11) will be added for the duration of the construction period of the road. There is no baseline data for these monitoring points as water samples have not yet been collected.

Table 28: Surface water qualities for Wonderfontein Mine

Analysis Results mg/l	UW-S03	UW-S04	UW-S06	UW-S08	UW-C01
pH-Value at 25 ° C	7.771	7.79	7.12	7.732	8.25
Electrical Conductivity (EC) at 25 °C	19.389	98.69	18.28	20.98	128.77
Total Dissolved Solids at 180°C	138.72	785.18	127.17	154.18	1035.72
Total Alkalinity	45.389	70.15	47.04	44.22	153.71
Chloride (Cl)	19.14	38.52	17.02	21.51	6.58
Sulphate (SO4)	10.832	400.91	22.38	11.20	608.60
Fluoride	0.098	0.31	0.32	0.27	0.20
Nitrate (NO3)	0.50	0.42	0.01	0.71	4.13
Calcium (Ca)	9.70	85.49	11.40	9.62	181.70
Magnesium (Mg)	6.383	45.99	7.34	6.19	70.62
Sodium	12.19	47.83	11.72	12.94	30.32
Potassium (K)	5.34	19.54	3.22	5.51	10.89
Aluminium (Al)	0.74	1.44	0.006	0.90	0.001
Iron (Fe)	0.29	1.01	2.134	0.35	0.001
Manganese (Mn)	0.0008	1.18	0.56	0.01	0.65
Ammonium (NH4)	0.102	0.15	0.30	0.01	0.44

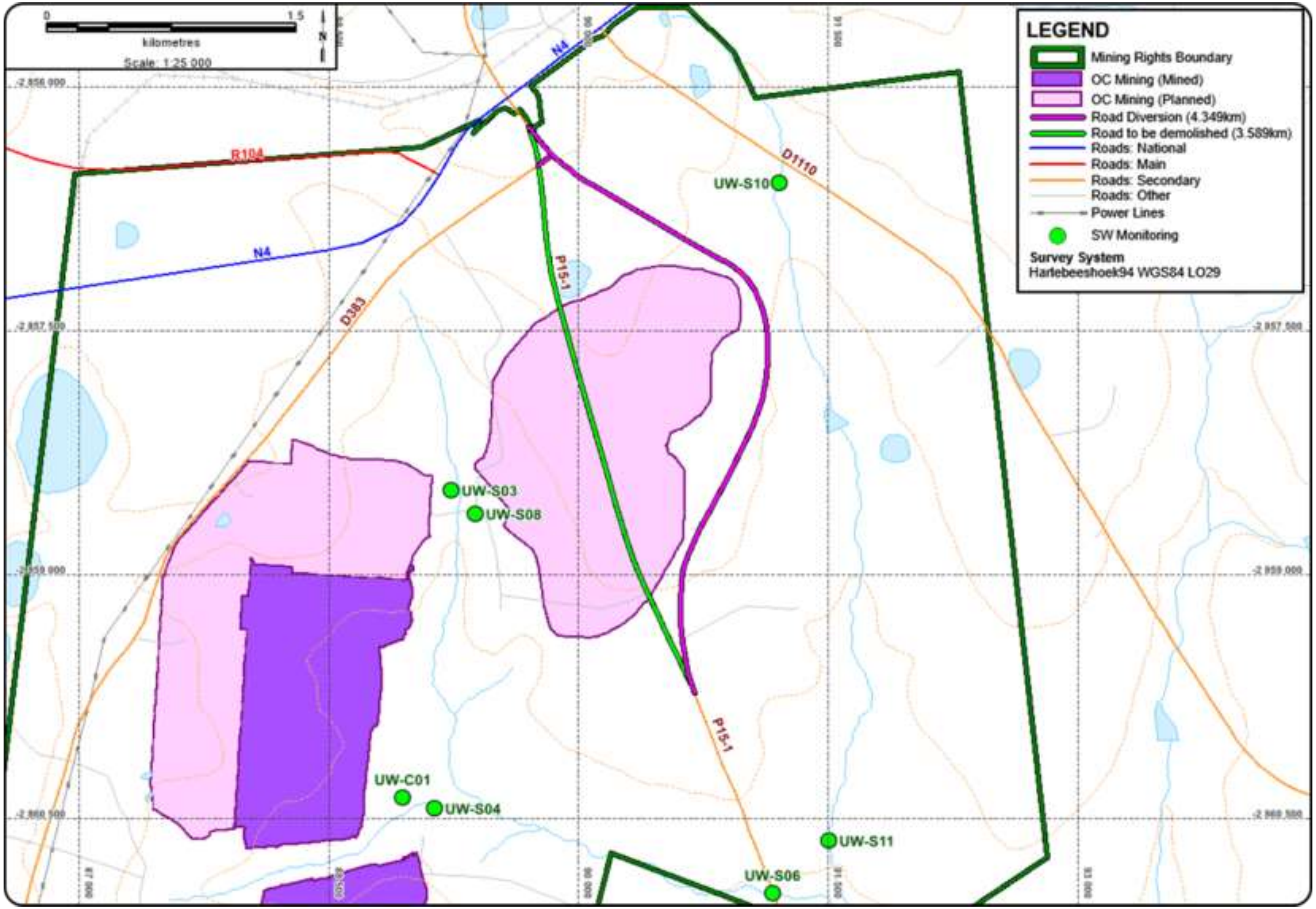


Figure 10: Surface water monitoring points within the road diversion study area

UW-S03 and UW-S04 are two monitoring points that are both located within or near a dam. The quality of water at UW-S03 during 2018 was generally good; however, monitoring point UW-S04 experienced elevated levels in metals such as Iron, Aluminium, Magnesium and Manganese as well as elevated levels of Sulphate, TDS, EC and Ammonia.

UW-S06 is a downstream point in the Blesbokspruit River. The sample was taken at the bridge on the R33 road to Carolina. It is also clear that the water quality is very good, except for elevated levels of Fe and Mn. This could be due to the natural geology of the area causing elevated metal concentrations in the water. The water quality of the Nooitgedacht Dam is shown in **Table 29** below.

UW-S08 is a point located below UW-S03 and also experienced good water quality with only high levels in Mn and Fe.

UW-C01 is located in an opencast PCD and this monitoring point experienced extremely high levels of Sulphate and Nitrate which could be attributed to the contamination from mining activities.

Table 29: Nooitgedacht Dam Water Quality

Parameter	Value
pH value at 25°C	7.88
Conductivity in mS/m	17.5
Total Dissolved Solids	122
Total Acidity as CaCO3 to pH 8.3	<2
Calcium as Ca	12.8
Magnesium as Mg	7.56
Sodium as Na	10.3
Potassium as K	2.53
Sulphate as SO4	23.5
Chloride as Cl	10
Fluoride as F	<0.20
Iron as Fe	<0.01
Manganese as Mn	<0.01
Aluminium as Al	0.04
Nitrate & Nitrite as N	<0.1
Total Alkalinity as CaCO3	56

8.6.3 Drainage density

The drainage density is the total length of the streams and rivers in the study area divided by the total area of each catchment. The following table reflects the catchment areas of Stream 1 and Stream 4 with their stream lengths as well as the drainage density:

Table 30: Natural Stream Drainage Densities (km/km^2)

River Name	Catchment Area	Stream Length	Drainage Density
Stream 1	14.55 km^2	6.1 km	0.4192
Stream 4	5.51 km^2	2.5 km	0.45

8.6.4 Surface water use

The surface water in the study area is used for domestic use, irrigation and by livestock.

8.6.5 Water authority

The Department of Water and Sanitation: Mpumalanga Regional Office, Nelspruit.

8.7 Wetlands

A wetland is defined by the National Water Act (Act no. 36 of 1998) as, *"land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil".*

This section contains information from the Freshwater Ecological Assessmentthat was conducted by Scientific Aquatic Services in April 2019 for the proposed Wonderfontein road diversion. Refer to **Annexure 5** for the full report.

According to a Freshwater Ecological Assessment (SAS, 2019), numerous wetlands were found within the study area, including channelled valley bottom (CVB) wetlands, hillslope seep (HSS) wetlands and depressions. These wetlands have all been impacted upon to some degree by historical or ongoing agricultural activities. It can be seen in many areas, that agricultural fields have encroached onto the wetland boundaries. In addition, roads such as the N4 and the Wonderfontein Road have also been found to traverse some of the wetlands. In general, the hydrological and geomorphological functioning of these wetlands have largely been impacted due to the conversion of natural areas to agricultural fields.

8.7.1 Watercourse System Characterisation

Numerous wetlands were identified within the study area; namely, channelled valley bottom (CVB) wetlands, hillslope seep (HSS) wetlands and depressions. **Figure 11** represents the location of these wetlands in relation to the proposed road diversion and **Figure 12** represents the distance from the wetlands identified to Alternative 1 (preferred alternative)

All the wetland systems identified within the 500 m buffer "zone of investigation" have been classified as inland systems; a system that has no existing connection to the ocean but is permanently or periodically saturated or inundated with water. The wetlands are located within the Highveld Aquatic Ecoregion and the suitable wetland vegetation group (WetVeg) is the Mesic Highveld Grassland Group 4. **Table 31** below represents the characterisation of the wetlands.

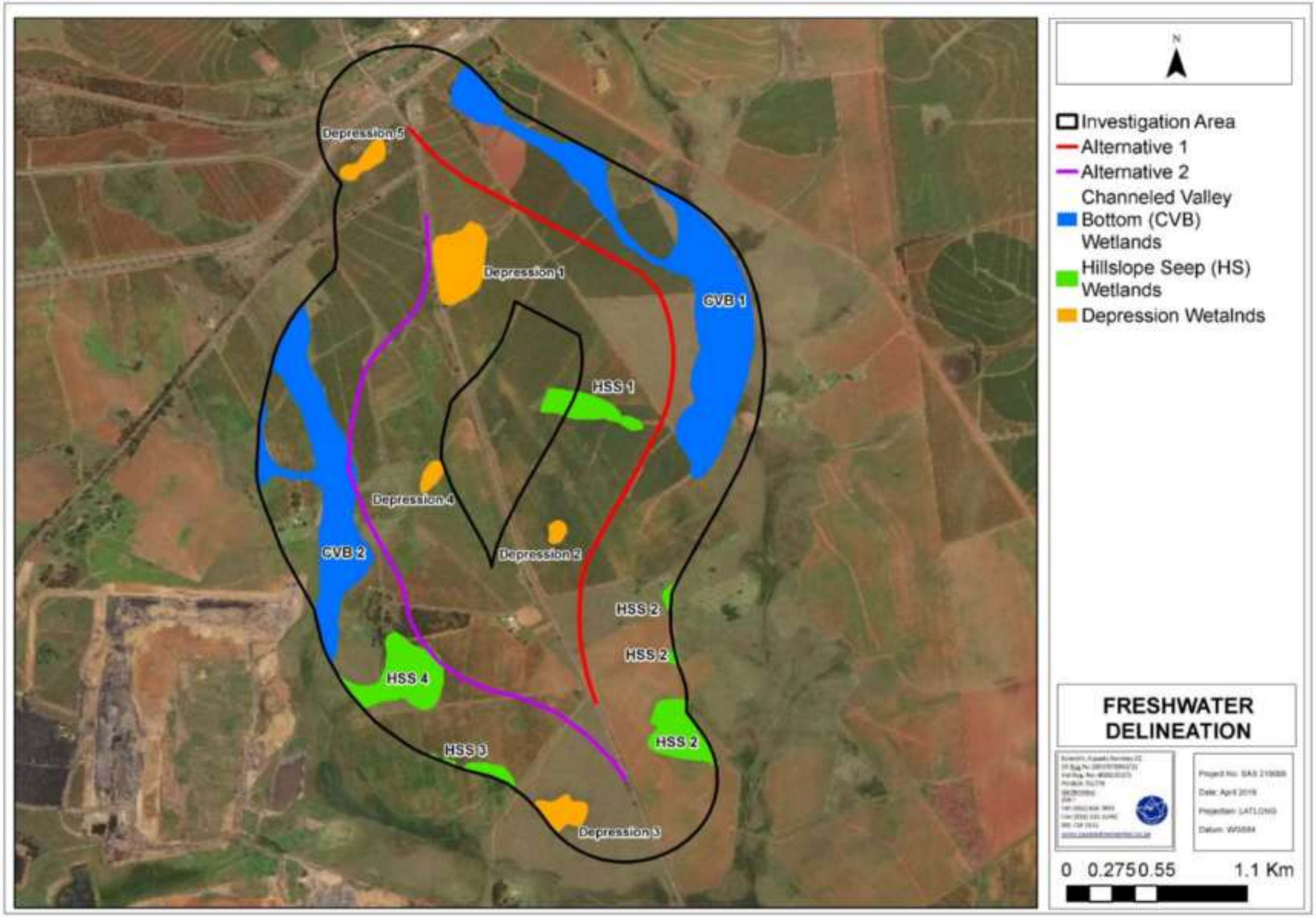


Figure 11: The location of the watercourse systems associated with the proposed road diversion project (SAS, 2019)

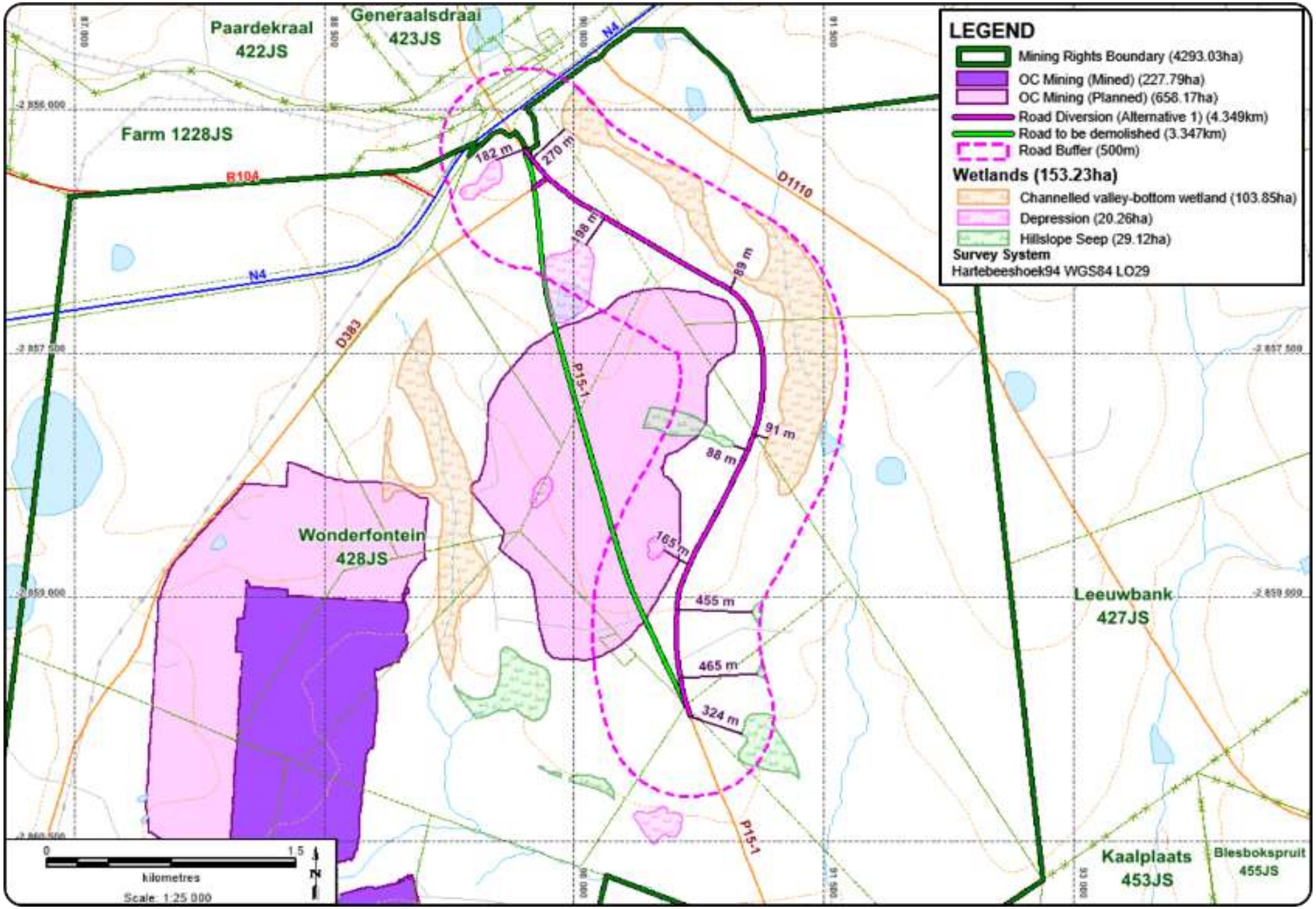


Figure 12: Distances from the identified wetlands to Alternative 1 (preferred alternative)

Table 31: Characterisation of the watercourses identified within the investigation area (SAS, 2019)

Wetlands within the Study area	
Level 3: Landscape Unit	
Valley floor	The base of a valley, situated between two distinct valley side-slopes.
Slope	An included stretch of ground that is not part of a valley floor, which is typically located on the side of a mountain, hill or valley.
Plain	An extensive area of low relief. These areas are generally characterised by relatively level, gently undulating or uniformly sloping land with a very gentle gradient that is not located within a valley. Gradient is typically less than 0.01 or 1:100.
Level 4: HGM Type	
Channelled valley bottom	A valley bottom wetland with a river channel running through it.
Hillslope Seep	A wetland area located on (gently to steeply) sloping land, which is dominated by the colluvial (i.e. gravity-driven), unidirectional movement of material down-slope. Seeps are often located on the side-slopes of a valley, but they do not, typically, extend into a valley floor.
Depression	A wetland or aquatic ecosystem with closed (or near-closed) elevation contours, which increases in depth from the perimeter to a central area of greatest depth and within which water typically accumulates, including pans.

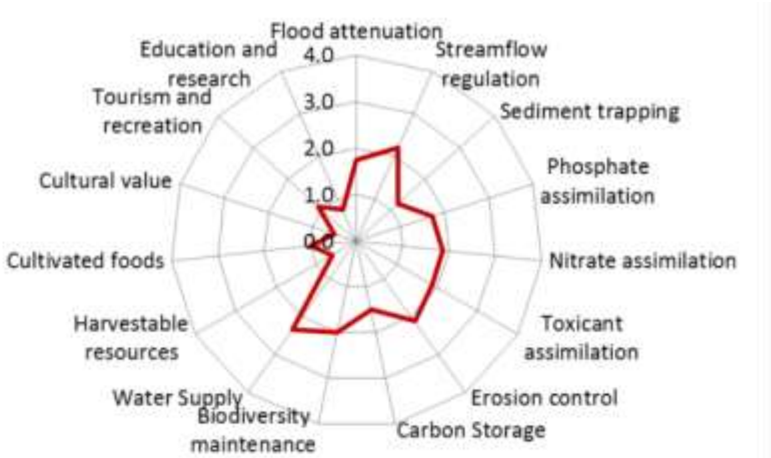
8.7.2 Field Verfication Results

Various assessments were undertaken in order to determine the following:

- The Present Ecological State (PES), including aspects such as geomorphology, vegetation and hydrology.
- The service provision of the watercourses, which includes biodiversity maintenance, flood attenuation, streamflow regulation and assimilation.
- The Ecological Importance and Sensitivity(EIS) which was determined using the results of PES and service provision.
- A suitable Recommended Ecological Category (REC) will be determined, in order to guide the management of the watercourses with the aim of enhancing the ecological integrity of the watercourses.

The results are presented in a “dashboard” style. **Table 32** presents the results of CVB 1 (Channelled Valley Bottom 1) while the results of CVB 2 and the associated wetland HSS 4, are presented in **Table 33**. **Table 34** and **Table 35** present the results of HSS 1 and depression 1, respectively.

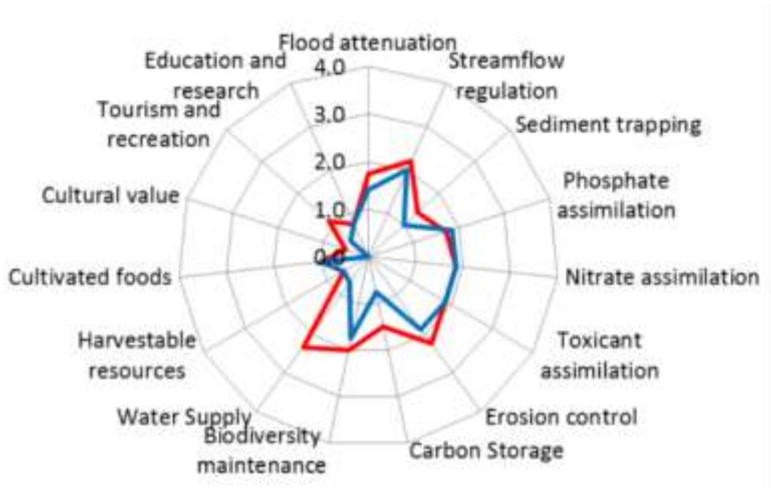
Table 32: Summary of the assessment of channelled valley bottom (CVB) 1 (SAS, 2019)

<table>
<tr><th colspan="2">Ecological & socio-cultural service provision graph:

</th></tr>
<tr><td>PES Discussion</td><td>PES Category: C (Moderately modified)
The hydrological processes of the wetland and natural wetland vegetation have undergone the most significant impacts, although the geomorphological processes have also been modified. Modifiers include aspects such as an artificial impoundment (in-stream dam) constructed within the wetland system, encroachment of cultivated fields into the wetland boundary, as well as grazing of cattle resulting in trampling within the wetland. Invasion of alien floral species, as well as areas of erosion within the active channel of the wetland were noted. The overall PES of the system is considered to be category C, as a moderate change in ecosystem processes and loss of natural habitats has taken place, but the natural habitat remains predominantly intact.</td></tr>
<tr><td>Ecoservice provision</td><td>Intermediate
Despite the moderately decreased ecological integrity of the system, the wetland retains capacity to function at an intermediate level in terms of the provision of ecological services such as streamflow regulation, erosion control, and the supply of water for human use, in particular, the provision of water for agricultural use.</td></tr>
<tr><td>EIS discussion</td><td>EIS Category: C (Moderate)
The results of the EIS assessment indicate that the wetland is deemed of moderate ecological importance and sensitivity (Category C). This is largely attributable to the hydro-functional importance of the system, primarily due to the ability of the system to attenuate floods, control erosion and regulate streamflow. Characteristics of the wetland such as moderately high surface roughness due to extensive vegetation cover aid in the provision of these services.</td></tr>
</table>

<table>
<tr><td rowspan="1">REC Category</td><td colspan="3">REC Category: C (Moderately modified)
RMO: C (Maintain)
The recommended management objective (RMO) for the wetland based on the PES and EIS scores is to maintain an ecological category of C. No further degradation should be permitted and thus, mitigation measures should be implemented during all phases of the proposed road diversion to minimise the risk of further negative impacts on the wetland.</td></tr>
<tr><td colspan="4">Watercourse Drivers</td></tr>
<tr><td colspan="2">a. Hydrology
It is likely that the wetland system is largely driven by recharge from the greater catchment upstream of this point. The hydrological processes of the wetland have been modified by the construction of an instream impoundment located within the wetland, as well as runoff from the surrounding cultivated fields.</td><td colspan="2">b. Water quality
The water quality of the wetland is most likely impacted by agricultural runoff and runoff from the N4 and surrounding informal roads, likely contaminated with fertilizers and hydrocarbons.</td></tr>
<tr><td colspan="2">c. Topography: Geomorphology and sediment balance
The surrounding cultivated fields and road infrastructure traversing the wetland, has significantly altered the geomorphology of the wetland system. Windblown dust and surface soil runoff from the surrounding informal roads and crop fields (especially after harvesting of crops, when the fields are bare) are likely to increase the sediment load of the wetland.</td><td colspan="2">d. Habitat and biota
The surrounding cultivated fields, which have encroached up to the wetland boundary in some places, as well as trampling and grazing by livestock has resulted in the removal of natural wetland vegetation. Habitat provision is therefore considered to be altered (especially due to the invasion of some alien vegetation species), resulting in a lowered species diversity. Despite this, some areas of the wetland have extensive vegetation cover and therefore provides some foraging and breeding habitat for avifaunal and mammalian species.</td></tr>
<tr><td colspan="4">Possible significant impacts, Business case, Conclusion and Mitigation requirements</td></tr>
<tr><td colspan="4">The CVB wetland will not be traversed by the proposed road diversion; although, it is anticipated that the construction of alternative 1 will possibly result in impacts to this wetland. However, the risk significance of impacts to CVB 1 as a result of the construction of road diversion alternative 1 are likely to be of low significance. Despite this, appropriate mitigation measures must be implemented to ensure that further impacts to the wetland are mitigated.</td></tr>
</table>

Table 33: Summary of the assessment of channelled valley bottom (CVB) 2 and the associated hillslope seep (HSS) wetland (HSS 4), (SAS, 2019).

Ecological & socio-cultural service provision graph (red = CVB 2; blue = HHS 4):

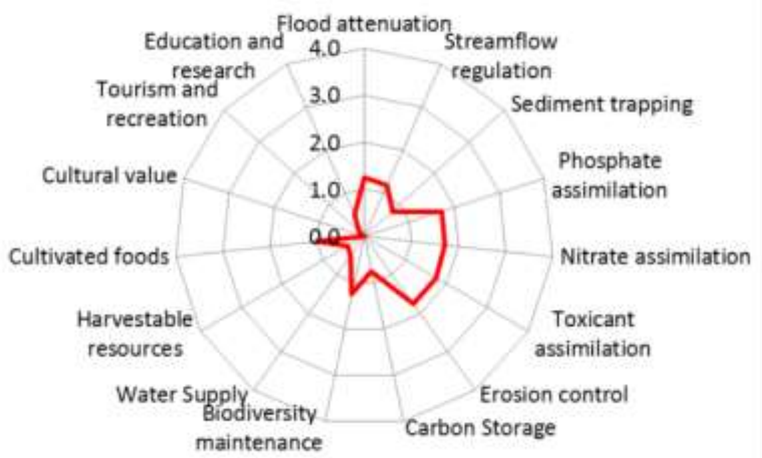


PES Discussion	**PES Category: B (Small modification)** Despite the existing modifiers, (such as encroachment of cultivated fields, existing mining activities adjacent to the wetland, the construction of an instream impoundment and proliferation of invasive plant species) this wetland system comprising CVB 2 and HHS 4 is considered largely natural as a slight change in ecosystem processes is discernible and a small loss of natural habitats and biota may have taken place. The natural wetland vegetation has undergone the most significant impacts, although the geomorphological and hydrological processes of the wetland system have also been modified. Thus, the overall PES of the system is considered to be category B, as a small change in ecosystem processes and loss of natural habitats has taken place.
Ecoservice provision	**Intermediate** The wetland system functions at an overall intermediate level in terms of ecoservices. The CVB wetland is anticipated to provide a higher level of ecoservices than the HSS wetland. This is particularly evident when comparing ecoservices such as erosion control and the provision of water for human (agricultural use) use. Additional ecoservices provided by the wetland system include that of flood attenuation and biodiversity maintenance. Characteristics of the wetland system, such as the largely natural condition of the wetland, aid
EIS discussion	**EIS Category: C (Moderate)** The results of the EIS assessment indicate that the wetland is deemed to be of moderate ecological importance and sensitivity (Category C) on a landscape scale, as well as due to the hydro-functional importance of the system, primarily due to the ability of the system to attenuate floods, control erosion and regulate streamflow.

<table>
<tr><td>REC Category</td><td>REC Category: B (Moderately modified)
RMO: B (Maintain)
The recommended management objective (RMO) for the wetland system based on the PES and EIS scores is to maintain an ecological category of B. No further degradation should be permitted and thus, mitigation measures should be implemented during all phases of the proposed road diversion to minimise the risk of further negative impacts on the wetland system.</td></tr>
<tr><td colspan="2">Watercourse Drivers</td></tr>
<tr><td>a. Hydrology
It is likely that the wetland system is largely driven by recharge from the greater catchment upstream of this point. The hydrological processes of the wetland have been modified by the construction of an instream impoundment located within the wetland, as well as runoff from the surrounding cultivated fields.</td><td>b. Water quality
The water quality of the wetland is most likely impacted by agricultural and road runoff from the N4 and surrounding informal roads, likely contaminated with fertilizers and hydrocarbons.</td></tr>
<tr><td>c. Topography: Geomorphology and sediment balance
The surrounding cultivated fields and road infrastructure traversing the wetland, has significantly altered the geomorphology of the wetland system. Windblown dust and surface soil runoff from the surrounding informal roads and crop fields (especially after harvesting of crops, when the fields are bare) are likely to increase the sediment load of the wetland.</td><td>d. Habitat and biota
The surrounding cultivated fields, which have encroached up to the wetland boundary in some places, as well as trampling and grazing by livestock has resulted in the removal of natural wetland vegetation. Habitat provision is therefore considered to be altered (especially due to the invasion of some alien vegetation species), resulting in a lowered species diversity. Despite this, some areas of the wetland have extensive vegetation cover and therefore provides some foraging and breeding habitat for avifaunal and mammalian species.</td></tr>
<tr><td colspan="2">Possible significant impacts, Business case, Conclusion and Mitigation requirements</td></tr>
<tr><td colspan="2">The CVB wetland will not be traversed by the proposed road diversion; although, it is anticipated that the construction of alternative 1 will likely result in impacts to this wetland. However, the risk significance of impacts to CVB 1 as a result of the construction of road diversion alternative are likely to be of low significance. Despite this, appropriate mitigation measures must be implemented to ensure that further impacts to the wetland are mitigated. The alignment of the road diversion must be optimised to remain outside of the delineated wetlands and ideally the associated 32m zone of regulation as defined by NEMA.</td></tr>
</table>

Table 34: Summary of assessment of hillslope seep (HSS) 1 (SAS, 2019).

Ecological & socio-cultural service provision graph:

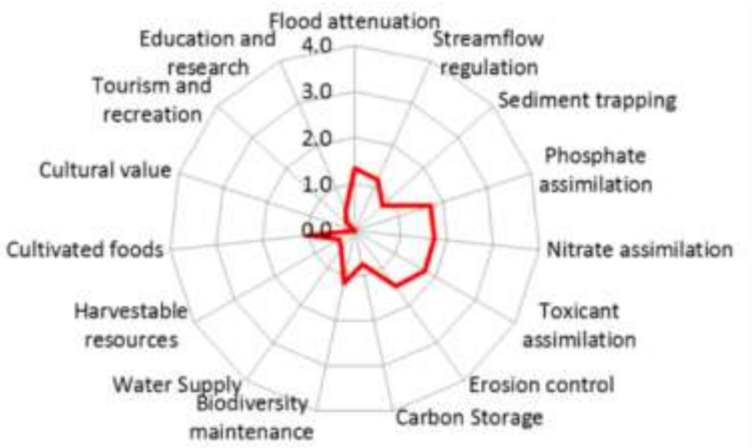


PES Discussion	**PES Category: D (Largely modified)** The hillslope seep wetlands are considered to be largely modified; however, the result of the PES assessment was bordering on Category C (moderately modified). The geomorphological processes and natural wetland vegetation have undergone the most significant impacts. Modifications to these seeps can mainly be attributed to vegetation removal with the related invasion of alien species.
Ecoservice provision	**Moderately low** As a result of the wetland having an overall reduced ecological integrity, functioning is considered to be at an overall moderately low level. Some ecoservices such as the assimilation of phosphates nitrates and toxicants are provided at an intermediate level; however, this is likely as a result of the extent of these sources within the wetland's catchment. The wetland is not considered important for education and research, or for tourism and recreation.
EIS discussion	**EIS Category: C (Moderate)** The results of the EIS assessment indicate that the wetland is deemed to be of moderate ecological importance and sensitivity (Category C). This is largely attributable to the hydro-functional importance of the system, primarily due to the ability of the system to assimilate nitrates, phosphates and toxicants.
REC Category	**REC Category: D (Largely modified)** **RMO: D (Maintain)** The recommended management objective (RMO) for the wetland based on the PES and EIS scores is to maintain an ecological category of D. No further degradation should be permitted and thus, mitigation measures should be implemented during all phases of the proposed road diversion to minimise the risk of further negative impacts on the wetland.

Watercourse Drivers	
a. Hydrology Runoff from the surrounding area, mainly dominated by cultivated fields, enters the wetland. Thus, modifications to the hydrological processes of the wetland are attributed to increased runoff from the surrounding cultivated fields.	**b. Water quality** It is considered likely that some contamination of the water quality of the wetland may occur during rainfall events, in terms of excess nutrients being transported from adjacent agricultural land into the wetland, as well as possible contaminated runoff (sediment and hydrocarbons).
c. Topography: Geomorphology and sediment balance The greatest impact on the wetland in terms of geomorphological processes is altered sediment regime and loss of habitat due to the surrounding cultivated fields. Windblown dust and surface soil runoff from the surrounding informal roads and cultivated fields (especially after harvesting of crops, when the fields are bare) are likely to increase the sediment load of the wetland.	**d. Habitat and biota** The surrounding cultivated fields, which have encroached up to the wetland boundary, has resulted in the removal of natural wetland vegetation. Habitat provision is therefore considered to be altered (additionally due to the invasion of some alien vegetation species).
Possible significant impacts, Business case, Conclusion and Mitigation requirements	
Although neither of the road diversion alternatives are proposed to traverse this wetland, it is still considered imperative that suitable mitigation measures, are strictly adhered to in order to minimise the impacts associated with the proposed road diversion and decrease the significance of cumulative impacts on the wetland.	

Table 35: Summary of the assessment of depression 1 (SAS, 2019).

Ecological & socio-cultural service provision graph:



PES Discussion	**PES Category: D (Largely modified)** The hydrological processes and natural wetland vegetation have undergone the most significant impacts; however, the geomorphological processes of the wetland have also been modified. Modifications to the wetland are mainly attributed to vegetation removal within the wetland as a result of encroachment of cultivated fields and the construction of the existing Wonderfontein Road, and the related invasion of alien species.
Ecoservice provision	**Moderately low** As a result of the wetland having an overall reduced ecological integrity, functioning is considered to be at an overall moderately low level. Some ecoservices such as the assimilation of phosphates nitrates and toxicants are provided at an intermediate level; however, this is likely as a result of the extent of these sources within the wetland's catchment. The wetland is not considered important for education and research, or for tourism and recreation.
EIS discussion	**EIS Category: C (Moderate)** The results of the EIS assessment indicate that the wetland is deemed to be of moderate ecological importance and sensitivity (Category C). This is largely attributable to the hydro-functional importance of the system, primarily due to the ability of the system to assimilate nitrates, phosphates and toxicants.
REC Category	**REC Category: D (Largely modified)** **RMO: D (Maintain)** The recommended management objective (RMO) for the wetland based on the PES and EIS scores is to maintain an ecological category of D. No further degradation should be permitted and thus, mitigation measures should be implemented during all phases of the proposed road diversion to minimise the risk of further negative impacts on the wetland.

<table>
<tr><th colspan="2">Watercourse Drivers</th></tr>
<tr><td>a. Hydrology
Runoff from the greater catchment contributes to the hydrological functioning of the wetland, predominantly during high rainfall periods. Runoff from the surrounding cultivated fields enters the wetland and thus alters the hydrological processes of the wetland.</td><td>b. Water quality
The water quality of the wetland is most likely impacted by runoff containing nutrients and fertilizers from the surrounding cultivated fields.</td></tr>
<tr><td>c. Topography: Geomorphology and sediment balance
The greatest impact on the wetland in terms of geomorphological processes is altered sediment regime and loss of habitat due to the surrounding cultivated fields. Windblown dust and surface soil runoff from the surrounding informal roads and cultivated fields (especially after harvesting of crops, when the fields are bare) are likely to increase the sediment load of the wetland.</td><td>d. Habitat and biota
The surrounding cultivated fields, which have encroached up to the wetland boundary, have resulted in the removal of natural wetland vegetation. However, the wetland is well vegetated and therefore has the potential to provide habitat for a variety of avifaunal species.</td></tr>
<tr><th colspan="2">Possible significant impacts, Business case, Conclusion and Mitigation requirements</th></tr>
<tr><td colspan="2">The depression wetland falls within the 32m zone of influence of the construction of road diversion alternative 2. Despite this, significant impacts to the wetland are not anticipated to occur as the proposed road diversion does not traverse the wetland, while the existing Wonderfontein Road acts as a catchment divide between the wetland and the proposed road diversion. However, due to the proximity of the proposed road diversion alternative 2 to the wetland, care must still be taken to ensure the edge effects from the road diversion are managed appropriately.</td></tr>
</table>

8.7.3 River Diversions

No river diversions are required for this project.

8.8 Groundwater

8.8.1 Hydrocensus

Hydrocensus information of external groundwater users found within the project area was gathered during the period of 16/04/2008 to 28/05/2008. All hydrocensus information is summarised in **Tables 36** to **Table 38**. A total of ten hydrocensus boreholes are included in this report.

Table 36: Hydrocensus owner information

<table>
<tr><th>Map Nr</th><th>Name of Owner</th><th>Address</th><th>Contact Person</th><th>Phone Numbers</th><th>Farm Name</th><th>Farm Number</th><th>Portion Number</th></tr>
<tr><td>WFN-1</td><td>Môrelig Combined School</td><td>PO Box 15, Wonderfontein</td><td>Principal S Maseko</td><td>O72 158 5540</td><td>Wonderfontein</td><td>428 JS</td><td>17</td></tr>
<tr><td>WFN-13</td><td rowspan="2">Johan Steele Familie trust</td><td rowspan="2"></td><td rowspan="2">JMS Steele</td><td rowspan="2">083 654 6076</td><td>Wonderfontein</td><td>428 JS</td><td>RE</td></tr>
<tr><td>WFN-14</td><td>Wonderfontein</td><td>428 JS</td><td>RE</td></tr>
</table>

Map Nr	Name of Owner	Address	Contact Person	Phone Numbers	Farm Name	Farm Number	Portion Number
WFN-20	AC van Vreden	PO Box 3, Wonderfontein	Danie van Wyk	082 702 4724	Wonderfontein	428 JS	3
WFN-24	AC van Vreden	PO Box 3, Wonderfontein	Danie van Wyk	082 702 4724	Wonderfontein	428 JS	3
WFN-25	Corlouis Boerdery	PO Box 19, Wonderfontein	Louis Bezuidenhout	073 305 8574	Wonderfontein	428 JS	22
WFN-26					Wonderfontein	428 JS	22
WFN-27					Wonderfontein	428 JS	22
WN-F1	Johan Steele Familie trust		JMS Steele	083 654 6076	Wonderfontein	428 JS	6

Table 37: Hydrocensus location information

Map Nr	Map ID	GPS Long (WGS 84)	GPS Lat (WGS 84)	Elevation (m)	Topography	Site Type	Information Source	Site Status	Site Purpose	User Consumer	User Application	Equipment
WFN-1	2529 DD	29.89946	25.83822	1743.00	F	B	G	G	P	N	DA	S
WFN-13	2529 DD	29.89538	25.82240	1761.00	S	B	G	G	P	N	DA	H
WFN-14	2529 DD	29.89419	25.81504	1785.00	F	B	G	U	P	N		WP
WFN-20	2529 DD	29.90427	25.81463	1762.00	S	B	G	U	P	N		WP
WFN-24	2529 DD	29.90954	25.81382	1754.00	R	B	G	U	P	N		N
WFN-25	2529 DD	29.90485	25.82568	1750.00	S	B	G	U	P	N		N
WFN-26	2529 DD	29.90489	25.83696	1738.00	F	B	G	G	P	N	DA	H
WFN-27	2529 DD	29.90980	25.83779	1721.00	S	B	G	G	P	N	AD	WP
WN-F1	2529 DD	29.89380	25.83898	1729.00	S	F	G	G	P	N	AS	N

Table 38: Hydrocensus – water related information

Map Nr	BH Diameter (m)	Collar Height (m)	Depth (m)	Yield (L/s)	Abstract Yield (L/s)	Date	Time	Water level (m)	Sampled (Y/N)	Casing Type	Comments: P=People; LSU=Large Stock; SSU=Small Stock; D=Dairy; G=Garden; N=Nursery
WFN-1	165	0.00	?	?	?	20080416	09:10	Closed	Y	S	P=590. Position approx. BH covered with soil.
WFN-13	165	0.15	?	?		20080507	11:50	7.25	N		
WFN-14	165	0.20	?	?		20080507	12:03	2.58	N		To be used
WFN-20	165		30.0	?		20080507	13:25	Closed	N	S	

Map Nr	BH Diameter (m)	Collar Height (m)	Depth (m)	Yield (L/s)	Abstract Yield (L/s)	Date	Time	Water level (m)	Sampled (Y/N)	Casing Type	Comments: P=People; LSU=Large Stock; SSU=Small Stock; D=Dairy; G=Garden; N=Nursery
WFN-24	165		?	?		20080507	13:41	0.00	N	S	Artesian water @ 0.01 l/s
WFN-25	165		?	?		20080507	10:18	Closed	N	S	To be used
WFN-26	165		?	?		20080507	10:05	Closed	N	S	
WFN-27	165	0.15	40.0	0.14		20080507	09:45	Closed	Y		P=20. LSU=400
WN-F1		0.00	1.0	5.00		20080416	09:51	0.00	Y		Also sampled for isotope studies (Ithemba Labs)
				7.5		20090225					

8.8.2 Groundwater Use

The groundwater in the area is mostly used for domestic purposes and livestock watering.

8.8.3 Groundwater Quality

The Wonderfontein groundwater quality database (consisting of drilled hydrogeological boreholes and hydrocensus information) was scrutinised to compile a background groundwater quality profile; see **Table 39**.

Table 39: Background inorganic groundwater quality and SAWQG-DU

	Background Water Quality Range	SA Water Quality Guidelines for Domestic Use, 1996 [effect at higher concentration]	
		Target Water Quality Range	Critical Values
pH	6.0-8.5	(<5.5&>9.5) & (<6.0&>9.0)	<4 &>11
EC (mS/m)	3.5-39	70 [salty taste – no effect]	450
TDS (mg/l)	16-193	450 (= EC x 6.5)	3000
Ca (mg/l)	<24	32 [slight scaling problems]	80
Mg (mg/l)	<11	30 [slight scaling problems]	200
Na (mg/l)	<47	100 [slightly salty]	600
K (mg/l)	<10	50 [undesirable for infants or renal disease]	400
Total Alkalinity (mg/l)	6-100	No standards	No Standard
Cl (mg/l)	<12	100 [corrosion increase]	600 [objectionable salty taste, corrosion]
SO_4 (mg/l)	<22	200 [slight taste, tendency for diarrhoea]	600 [pronounced salty/bitter taste, diarrhoea]
NO_3-N (mg/l)	<6	6 [rare instances of methaemoglobinaemia]	20
Fe (mg/l)	<1	0.1 [slight taste, slight plumbing deposits]	10
Mn (mg/l)	<0.5	0.05 [slight staining]	20

	Background Water Quality Range	SA Water Quality Guidelines for Domestic Use, 1996 [effect at higher concentration]	
		Target Water Quality Range	Critical Values
Al (mg/l)	<0.05	0.15 [slight colour effect in assoc. with iron or manganese]	0.5
F (mg/l)	<0.77	1 [slight mottling of dental enamel in sensitive individuals]	8

8.9 Air Quality

The potential for dust pollution exists because in order to build a new road, a layer of topsoil will need to be removed which will result in the formation of dust. An access road will be used by construction vehicles in order to reach the study area which could also be a form of dust pollution.

8.10 Sites of Archaeological and Cultural Interest

According to the Historical Impact Assessment conducted by APelser Archaeological Consulting in February 2013 for Wonderfontein Colliery, graves or heritage buildings were not identified within the vicinity of the project area.

8.11 Sensitive Landscapes

The wetland areas are classified as sensitive landscape areas. Refer to **Section 8.7** of this document. In addition to the wetlands, the very high potential soils (Hu1 and Hu2) within a favourable climate are of the most productive soils in the country and are regarded as irreplaceable.

8.12 Traffic

The following section contains information abstracted from the Traffic Impact Assessment conducted by WSP Group Africa (Pty) Ltd (WSP) in January 2018 for the Mpumalanga Department of Public Works, Roads and Transport. Refer to **Annexure 7** for the full report.

According to the Traffic Impact Assessment (2018), WSP was appointed to determine the possible impacts that the proposed road diversion may cause on the mobility and safety on the surrounding road network (refer to **Figure 13** for the location of the surrounding roads). Possible mitigation measures for the anticipated impacts were also identified.

The road environment can be described as rural, with agricultural and mining activities in the immediate vicinity. Existing traffic consists of a mix of light vehicles, farm vehicles and heavy vehicles. Traffic volumes are relatively light with no apparent significant capacity or safety problems. The P15-1 road consists of two lanes and has a designated speed limit of 100 km/h.

A 13-hour traffic count survey was done on Thursday, 22 June 2017 at the following key intersections:

- N4/P15-1 (4-legged, priority controlled); and
- P15-1/D383 (T-intersection, stop controlled on D383 approach).

Traffic volumes from the following two intersections were interpolated from the intersections of N4/P15-1 and P15-1/D383:

- P15-1/Access road to Wonderfontein mass control site (T-intersection, stop controlled on Wonderfontein mass control site access road approach); and
- N4/D1110/filling station access road (4-legged, priority controlled).

Common peak hours were determined (the busiest hours) for the AM and PM periods and were found to be:

- Weekday AM peak hour 08:00 – 09:00
- Weekday PM peak hour 15:15 – 16:15

The count survey completed on 22 June 2017 represented the following results:

N4 Freeway

The road intersects with P15-1 to form a four-legged priority-controlled intersection with stop controls on P15-1 approaches. Traffic volumes on this road at its intersection with P15-1 are in order of 784 (around 20% heavy vehicles) and 1105 (around 16% heavy vehicles) vehicles per hour (total for both directions) during weekday morning and afternoon peak hours, respectively.

P15-1

This road intersects with the N4 freeway to form a four-legged priority-controlled intersection with stop controls on its approach. Traffic volumes on this road at its intersection with the N4 are in order of 129 (around 36% heavy vehicles) and 200 (22% heavy vehicles) per hour (total for both directions) during typical weekday morning and afternoon peak hours, respectively.

D383

The road intersects with P15-1 to form a priority-controlled T-intersection with a stop control on its approach. Traffic volumes on this road at its intersection with P15-1 are in the order of 148 (around 48% heavy vehicles) and 157 (38% heavy vehicles) vehicles per hour (total for both directions) during typical weekday and afternoon per hours, respectively.

D1110

This road is a gravel road and intersects with the N4 freeway to form a four-legged priority-controlled intersection with stop controls on its approach.

The existing 2017 weekday morning and afternoon peak hour traffic volumes will thus be subjected to a 3% annual growth rate over a period of five (5) years to a future 2022 horizon year.

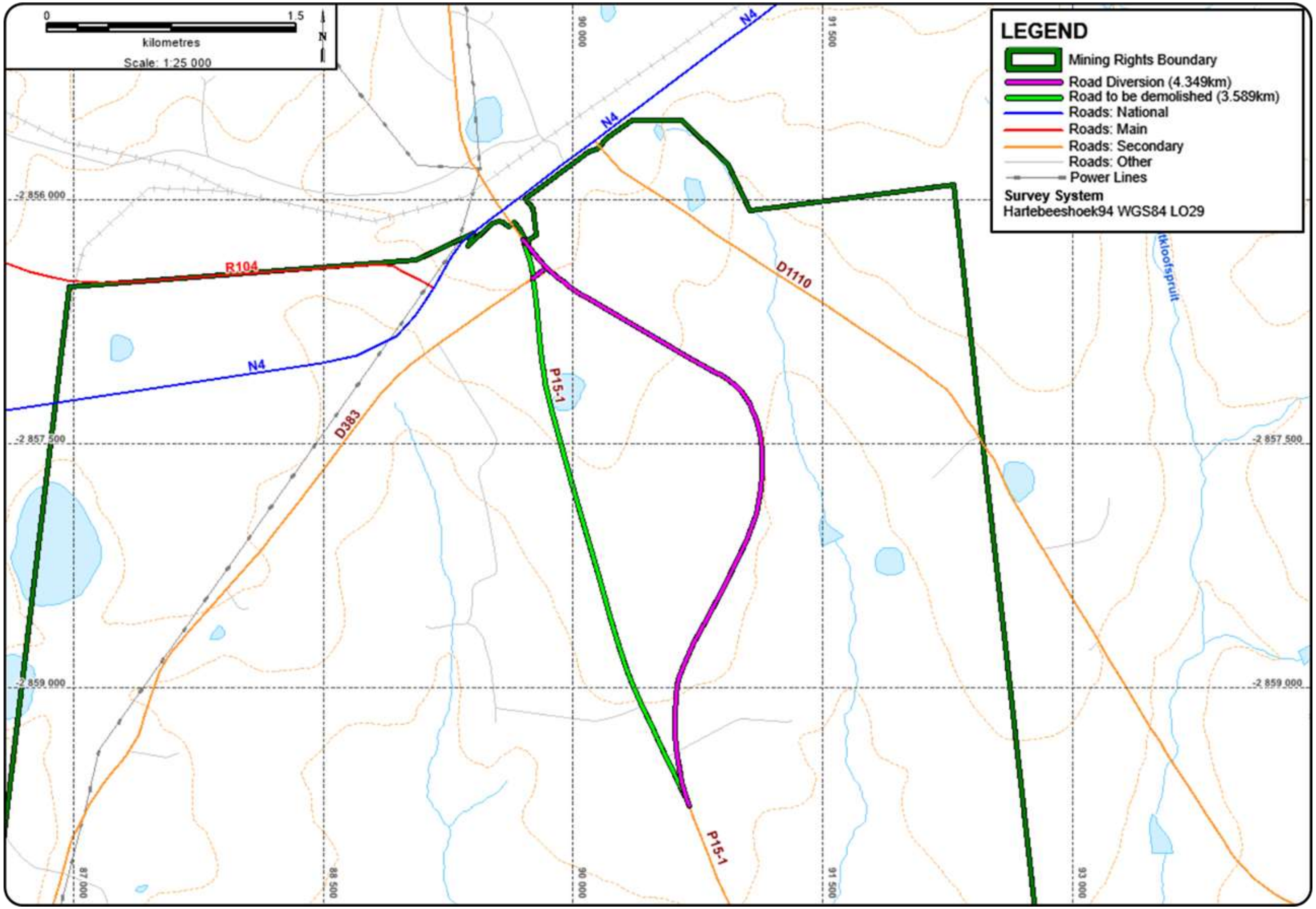


Figure 13: The road network occurring within the study area

8.13 Regional Socio-economic Structure

The following information was obtained from the Emakhazeni Local Municipality 2018/2019 Integrated Development Plan (2018) and the Nkangala District Municipality Integrated Development 2013/2014 Integrated Development Plan (2013)

8.13.1 Population density, growth and location

The project is set to take place within the Emakhazeni Local Municipality (ELM) which occurs within the Nkangala District Municipality (NDM). According to the 2011 Census, the total population within the NDM was 1.35 million people. The population growth rate within the NDM was 2.50% between the years of 2001 and 2011 and the NDM experienced an average annual growth rate of 2.07% per annum during these years. It is expected that the NDM will experience a growth rate of 2.12% p.a. between 2012 and 2017 (NDM IDP, 2013/14). This is much higher than that of the Mpumalanga Province and the national total.

According to the Emakhazeni Local Municipality IDP (2018/19), a total of 48 149 people are residing within the local district, within eight different wards. The population experienced an increase of 0.4% from 47 216 in 2011 to 48 149 in 2016. This increased figure now means Emakhazeni makes up a total of 3.3% of Nkangala's total population. The density within the ELM during 2011 was 10 people/km^2 (Census 2011). The Black African population within the ELM slightly increased from 87.2% in 2011 to 89.4% in 2016. There was a decrease in the White, Coloured and Indian populations, with the Coloured and Indian population being in the minority (Emakhazeni IDP, 2018/19).

Location and setting

The Emakhazeni Local Municipality is located at the centre of Mpumalanga, covering 4 736 km^2 (Census, 2011). The project occurs within the north-eastern region of the Wonderfontein Colliery which is situated in an agricultural hub in the Highveld region of Mpumalanga province. It has high-value agricultural land, an above-average rainfall and relatively higher agricultural yields compared to the surrounding areas. Farms are generally used intensively for dry-crop agricultural and stock farming, producing mostly products such as maize, soybeans and potatoes.

8.13.2 Major economic activites and sources of employment

According to the NDM (2013/14) IDP, the district is referred to as a resource-based economy as the district relies much on the economy's natural resources. The Emakhazeni IDP (2018/19) states that the largest employing industries within Emakhazeni include:

- Trade (including tourism)
- Community/government services
- Agriculture
- Construction and mining industries

As was mentioned, the closest towns where residential and business activities occur are Carolina and Belfast, which are located approximately 30 km to the south-east and north-east from the study area, respectively. The only business activities in close proximity to the proposed study area is the Wonderfontein filling station, situated adjacent to the N4 highway. Travelers on route to Mpumalanga low-veld or to Swaziland mainly use this filling station. Behind the filling station is a cooperative, selling mainly farm products for use by the local farmers. Other than the agricultural production, these are almost the only economic activities in the area.

Opencast and underground mining occur within the immediate vicinity of the study area. And on a regional scale, the area further to the south and west of Wonderfontein mine is already known for the large scale of opencast coal mining fields.

8.13.3 Unemployment estimate for the area

The Emakhazeni Local Municipality had 31,270people aged between 15 and 64 years. Of these, 13,671 were employed, 4780 were unemployed, 1574 were discouraged work seekers and 11 243 were not economically active. In 2011, the unemployment rate for Emakhazeni was 25.9%. In 2016, the population between the ages of 15 and 64 was 32,666and the unemployment rate was recorded as 22.8%. There was a 3.1% increase in employment during those years. Unemployment opportunities are unfavourable for females (29.2%) when compared to the males (19.9%) in the municipal district.

8.13.4 Education

The Emakhazeni IDP (2018/19) stated that in 2016, of the total 48,149 individuals aged 20 years and older living in ELM, approximately 9,677 individuals have had no prior schooling.

However, since 2011, the matric pass rate in ELM has continued its steady performance within the top 5 in the Nkangala region as well as in the entire province. It should be noted that the performance improved from 74.8% in 2011 to 87.0% in 2015 but decreased to 84.5%. in 2016. The municipality achieved the 5th highest admission rate to a university degree in 2015 but this declined in 2016 to 11th highest in the province.

For the 2017 academic year, ELM was ranked 18th in the province and 2nd in the District. Of the 435 students that wrote the final exams, a total of 355 students passed earning the municipality a total pass rate of 81.6%. When compared to the pass rate of 2016, a 2.9% decrease is noticed. The municipality is working towards achieving the obligation of the National Development Plan 2030 vision of achieving a 90% pass rate.

8.13.5 Social Infrastructure

The closest towns in the area are Carolina and Belfast. Both have primary and high schools and have a strong farming community and some mining to an extent. Other than that, Middelburg and Witbank (40 minutes and one-hour drive respectively) are situated within a comfortable travelling distance from the study area.

9 ENVIRONMENTAL IMPACT ASSESSMENT

9.1 Impact Assessment Method

A formalised method was used to assess the potential impacts that the Wonderfontein Road Diversion may have on the environment. A typical risk assessment process was undertaken where the significance of the impacts was determined. Once the significance of the impacts was known, it was then re-evaluated taking into consideration the proposed mitigation/management measures. This enabled an understanding of the overall impact after mitigation/management measures were implemented. The process that was undertaken is described in the section below.

According to the NEMA Regulations, "*significant impact means an impact that by its magnitude, duration, intensity or probability of occurrence may have a notable effect on one or more aspects of the environment*". In line with the Regulations and based on the qualitative findings of the activities undertaken, each potentially significant impact has been assessed with regards to:

- the nature and status of the impact;
- the extent and duration of the impact;
- the probability of the impact occurring;
- the effect of significance on decision-makings;
- the weight of significance; and
- the mitigation efficiency.

9.2 Impact Significance

Nature and Status

The "nature" of the impact describes what is being affected and how. The "status" is based on whether the impact is positive (P), negative (N) or neutral (NT).

Spatial Extent

"Spatial Extent" defines the spatial or geographical scale of the impact.

Category	Rate	Descriptor
Site	1	Site of the proposed development
Local	2	Beyond immediate boundary.
Regional	3	Provincial region.

Category	Rate	Descriptor
National	4	South Africa.
International	5	Beyond the boundaries of South Africa.

Duration

"Duration" gives the temporal scale of the impact.

Category	Rate	Descriptor
Temporary	1	Construction phase / 0-1 years
Short Term	2	1 – 5 years
Medium Term	3	5 – 15 years
Long Term	4	Where the impact will cease after the operational life of the activity either because of natural process or by human intervention
Permanent	5	Where mitigation either by natural processes or by human intervention will not occur in such a way or in such a time span that the impact can be considered as transient

Probability

The "probability" describes the likelihood of the impact actually occurring.

Category	Rate	Descriptor
Unlikely	1	Where the impact may occur in exceptional circumstances only.
Low	2	Where the possibility of the impact materialising is low.
Probable	3	Where there is a distinct possibility that the impact will occur.
Highly Probable	4	Where it is most likely that the impact will occur.
Definite	5	Where the impact will occur regardless of any prevention measures.

Magnitude

“Magnitude" defines the intensity of the impact on the environment, whether the impact is destructive or benign.

Category	Rate	Descriptor
Low	1	Where the impact affects the environment in such a way that natural, cultural and social functions and processes are not affected. Localised impact and a small percentage of the population is affected.
Low to Moderate	2	Where the impact affects the environment in such a way that natural, cultural and social functions and processes are affected to a limited extent.
Moderate	3	Where the affected environment is altered in terms of natural, cultural and social functions and processes continue albeit in a modified way.

Category	Rate	Descriptor
High	4	Where natural, cultural or social functions or processes are altered to the extent that they will temporarily or permanently cease.
Very High	5	Where natural, cultural or social functions or processes are altered to the extent that they will permanently cease.

Reversibility

"Reversibility" defines whether the aspect or environment, which has been affected by the activity, can be restored or recovered.

Category	Rate	Descriptor
Very High	1	Intensity of the impact is low and the receiving environment has the capacity, resources and mechanisms to mitigate or optimize the impact.
High	2	Intensity of the impact is low to moderate and the receiving environment has the capacity, resources and mechanisms to mitigate or optimize the impact.
Moderate	3	Impact is moderate, and the receiving environment has some mechanisms to mitigate or optimize the impact, as well as resources that can be called upon.
Moderate to Low	4	Potential for mitigation/optimisation is limited because of the severity of the impact and a lack of capacity/resources and coping mechanisms in the receiving environment.
Low	5	Potential for mitigation/optimisation is highly / severely limited because of the severity of the impact and a lack of capacity/resources and coping mechanisms in the receiving environment.

Impact significance without mitigation (WOM)

Following the assignment of the necessary weights to the respective aspects, criteria are summed and multiplied by their assigned weightings, resulting in a value for each impact (prior to the implementation of mitigation measures).

Equation 1:

Consequence = Extent + Duration + Magnitude+ Reversibility

Equation 2:

Impact Significance = Probability x Consequence

Effect of significance on decision-makings

Significance is determined through a synthesis of impact characteristics as described in the above paragraphs. It provides an indication of the importance of the impact in terms of both tangible and intangible characteristics. The significance of the impact "without mitigation" is the prime determinant of the nature and degree of mitigation required.

Rating	Rate	Descriptor
Negligible	0	The impact is non-existent or insignificant, is of no or little importance to decision making.
Very Low	1-19	The impact is limited in extent, even if the intensity is major; the probability of occurrence is low, and the impact will not have a significant influence on decision making and is unlikely to require management intervention bearing significant costs.
Low	20 – 38	The impact is of importance. However, through the implementation of the correct mitigation measures such potential impacts can be reduced to acceptable levels. The impact and proposed mitigation measures can be considered in the decision-making process
Moderate	39 – 59	The impact is significant to one or more affected stakeholders, and its intensity will be medium or high; but can be avoided or mitigated and therefore reduced to acceptable levels. The impact and mitigation proposed should have an influence on the decision.
High	60 -79	The impact is of major importance but through the implementation of the correct mitigation measures, the negative impacts will be reduced to acceptable levels.
Very High	≥ 80	The impact could render development options controversial or the entire project unacceptable if it cannot be reduced to acceptable levels; and/or the cost of management intervention will be a significant factor and must influence decision-making.
Positive	-	Impact has a positive effect.

Mitigation

"Mitigation" is a broad term that covers all components of the "mitigation hierarchy" defined hereunder. It involves selecting and implementing measures, amongst others, to conserve biodiversity and to protect the users of biodiversity and other affected stakeholders from potentially adverse impacts as a result of mining or any other land use. The aim is to prevent adverse impacts from occurring or, where this is unavoidable, to limit their significance to an acceptable level. Offsetting of impacts is considered to be the last option in the mitigation hierarchy for any project.

The mitigation hierarchy in general consists of the following, in order of which impacts should be mitigated:

- **Avoid/prevent impact:** can be done through utilising alternative sites, technology and scale of projects to prevent impacts. In some cases, if impacts are expected to be too high, the "no-go" option should also be considered, especially where it is expected that the lower levels of mitigation will not be adequate to limit environmental damage and eco-service provision to suitable levels;
- **Minimise (reduce) impact:** can be done through utilisation of alternatives that will ensure that impacts on biodiversity and eco-services provision are reduced. Impact minimisation is considered an essential part of any development project;

- **Rehabilitate (restore) impact:** is applicable to areas where impact avoidance and minimisation are unavoidable; where an attempt to re-instate impacted areas and return them to conditions which are ecologically similar to the pre-project condition or an agreed post project land use is needed, for example arable land. Rehabilitation can however not be considered as the primary mitigation toll since, even with significant resources and effort, rehabilitation usually does not lead to adequate replication of the diversity and complexity of the natural system. Rehabilitation often only restores ecological function to some degree to avoid ongoing negative impacts and to minimise aesthetic damage to the setting of a project. Practical rehabilitation should consist of the following phases in best practice:
    - *Structural rehabilitation*, which includes physical rehabilitation of areas by means of earthworks, potential stabilisation of areas as well as any other activities required to develop a long term sustainable ecological structure;
    - *Functional rehabilitation*, which focuses on ensuring that the ecological functionality of the ecological resources on the subject property supports the intended post closure land use. In this regard special mention is made of the need to ensure the continued functioning and integrity of wetland and riverine areas throughout and after the rehabilitation phase;
    - *Biodiversity reinstatement*, which focuses on ensuring that a reasonable level of biodiversity, that supports the local post-closure land uses, is re-instated. In this regard special mention is made of re-instating vegetation to levels which will allow the natural climax vegetation community to be suitable for supporting the intended post closure land use;
    - *Species reinstatement* which focuses on the re-introduction of any ecologically important species which may be important for socio-cultural reasons, ecosystem functioning reasons and for conservation reasons. Species re-instatement need only occur if deemed necessary;
- **Offset impact:** refers to compensating for latent or unavoidable negative impacts on biodiversity. Offsetting should take place to address any impacts deemed to be unacceptable which cannot be mitigated through the other mechanisms in the mitigation hierarchy. The objective of biodiversity offsets should be to ensure no net loss of biodiversity. Biodiversity offsets are considered to be a last resort to compensate for residual negative impacts on biodiversity.

According to the DMR (2013), "Closure" refers to the process that ensures mining operations are closed in an environmentally responsible manner, usually with the dual objectives of ensuring sustainable post-mining land uses and remedying any negative impacts on the biodiversity and ecosystem services.

When considering biodiversity conservation initiatives, the significance of *residual impacts* should be identified on a regional as well as a national scale. If the residual impacts lead to irreversible loss or irreplaceable biodiversity, the residual impacts are considered to be of very high significance and when residual impacts are considered to be of very high significance, offset initiatives are not considered an appropriate way to deal with the magnitude and/or significance of the biodiversity loss. If the residual biodiversity impacts were determined to be of medium to high significance, an offset initiative may be investigated. If the residual biodiversity impacts are considered to be of low significance then no biodiversity offset is required.

Impact significance with mitigation (WM) measures

In order to gain a comprehensive understanding of the overall significance of the impact after implementation of the mitigation measures, it is necessary to re-evaluate the impact.

Mitigation Efficiency (ME)

The most effective means of deriving a quantitative value of mitigated impacts is to assign each significance rating value without mitigation (WOM) a mitigation effectiveness (ME) rating. The allocation of such a rating is a measure of the efficiency and effectiveness, as identified through professional experience and empirical evidence of how effectively the proposed mitigation measures will manage the impact. Thus, the lower the assigned value the greater the effectiveness of the proposed mitigation measures and subsequently, the lower the impacts with mitigation.

Equation 2:

Significance Rating (WM) = Significance Rating (WOM) x Mitigation Efficiency (ME)

Mitigation Efficiency is rated out of 1 as follows:

Category	Rate	Descriptor
Very Low	1	Mitigation cannot make a difference to the impact
Low	0.8	Mitigation will minimize impact slightly
Moderate	0.6	Mitigation will minimize impact to such an extent that it becomes within acceptable standards
High	0.4	Mitigation will minimize impact to such an extent that it is below the maximum acceptable standards

Category	Rate	Descriptor
Very High	0.2	Mitigation will minimize impact to such an extent that it becomes insignificant

It is important to note that, for positive impacts, the Mitigation Efficiency will change to be greater than 1. For example, if the Mitigation Efficiency for a positive impact is Moderate, the rate used will be 1.6 instead of 0.6 to indicate that the proposed measures will result in an even higher positive impact.

Summary of the significance rating methodology

Extent	Duration	Magnitude	Probability	Reversibility	Significance Rating (SR - WOM) Pre-mitigation	Mitigation Efficiency (ME)	Significance Rating (SR-WM) Post Mitigation
Site (1)	Temporary (1)	Low (1)	Unlikely (1)	Very High (1)	Very Low (0 – 19)	Very High (0.2)	Very Low (0 – 19)
Local (2)	Short Term (2)	Low to Moderate (2)	Low (2)	High (2)	Low (20 – 38)	High (0.4)	Low (20 – 39)
Regional (3)	Medium Term (3)	Moderate (3)	Probable (3)	Moderate (3)	Moderate (39 – 59)	Moderate (0.6)	Moderate (40 – 59)
National (4)	Long Term (4)	High (4)	Highly Probable (4)	Moderate to Low (4)	High (60 – 79)	Low (0.8)	High (60 – 79)
International (5)	Permanent (5)	Very High (5)	Definite (5)	Low (5)	Very High (≥ 80)	Very Low (1.0)	Very High (≥ 80)

9.3 Water Balance

Water will only be needed during the construction of the road, for example for the conduction of dust suppression. It is estimated that not more than 150 m^3 per day will be required and that will be obtained from the Wonderfontein Mine.

9.4 Impacts and Risks Identified

Only a summary of the mitigation measures is provided below. A more comprehensive list of the mitigation measures will be provided in the EMPr section.

9.4.1 Activity 1:Road Diversion

Table 40: Road Diversion Impact Discussion

Activity	Direct Impacts	Edge Effect Impacts	Indirect Impacts
Freshwater - Construction			
Impacts as a result of site preparation	➢ Vehicular movement and access to the site, and the removal of natural wetland vegetation and associated disturbances to soils within the project area could lead to: ➢ Exposure of soils, leading to increased runoff from cleared areas and erosion of the wetlands, and thus increased the potential for sedimentation of the wetlands; ➢ Increased sedimentation of the wetlands leading to changes in instream habitat, potentially smothering biota, altering surface water quality, and potentially leading to areas within the wetlands becoming more suited to terrestrial vegetation; ➢ Impacts on the hydrological processes supporting the wetlands locally and downstream; ➢ Soil compaction; ➢ Decreased ecoservice provision; ➢ Proliferation of alien vegetation as a result of disturbances; ➢ Vegetation degradation, and the subsequent loss of habitat for wetland species; and ➢ Soil and stormwater contamination from oils and hydrocarbons.	➢ Runoff with high sediment loads deposited into the wetlands, smothering the vegetation and thus altering the habitat of the wetlands; and ➢ Soil compaction due to vehicular movement leading to alterations of runoff patterns into the wetlands.	➢ Runoff with high sediment loads deposited into the wetlands, smothering the vegetation and thus altering the habitat of the wetland; and ➢ Loss of catchment yield resulting from wetlands alteration and/or losses, leading to reduction in volume of water entering the wetlands.

<table>
<tr><th>Activity</th><th>Direct Impacts</th><th>Edge Effect Impacts</th><th>Indirect Impacts</th></tr>
<tr><th colspan="4">Freshwater – Operation</th></tr>
<tr><td>Impacts caused by the operation of the road diversion</td><td>N/A</td><td colspan="2">➢ Compaction of soils due to vehicular movement;
➢ Latent impacts of vegetation losses;
➢ Increased runoff volumes and formation of preferential surface flow paths as a result of compacted soils, leading to alteration of hydrological recharge paths;
➢ Contamination of soil and surface water due to soil and hydrocarbon spills;
➢ Proliferation of alien vegetation as a result of disturbances; and
➢ Increased sedimentation and erosion.</td></tr>
<tr><th colspan="4">Fauna and Flora – Construction and Operational</th></tr>
<tr><td>Loss of species diversity and impact on ecology.</td><td colspan="3">➢ Disturbance to soils due to construction and operational activities leading to altered habitats;
➢ Increased introduction and proliferation of alien plant species and further transformation of natural habitats;
➢ Excavation of soils leading to increased runoff and sedimentation of downslope habitat;
➢ Runoff/disposal of construction materials from the proposed infrastructure into the surrounding habitat leading to surface hardening and limiting recruitment of new vegetation;
➢ Collision of faunal species with vehicles;
➢ Loss of habitat connectivity due to the placement of the new road;
➢ Potential ineffective rehabilitation post construction leading to proliferation of alien plant species in the disturbed areas;
➢ Potential erosion stemming from bare soil areas leading to sedimentation of downslope faunal habitat;
➢ Potential generation of dust may impact the rate of photosynthesis of floral species;
➢ Potential hunting/trapping/killing of faunal species by personnel.</td></tr>
<tr><th colspan="4">Soil, Land Use and Land Capability</th></tr>
<tr><td colspan="4">Potential compaction, sterilisation, erosion and hydrocarbon spills in soils. The land use and land capability will permanently change to a road structure.</td></tr>
<tr><th colspan="4">Noise – Construction</th></tr>
<tr><td colspan="4">Noise will be generated during the construction phase (through construction activities and earthworks associated with construction); however, it is expected that the noise generated will not have a significant impact on the noise levels in the area.</td></tr>
<tr><th colspan="4">Air Quality – Construction</th></tr>
<tr><td colspan="4">Particulate matter ($PM_{2.5}$ and PM_{10}), dust fallout and gas emissions will be generated during the construction phase. However, due to the size of the project, it is anticipated that the impacts on the air quality within the region will be of little significance.</td></tr>
<tr><th colspan="4">Traffic – Operation</th></tr>
<tr><td colspan="4">The existing 2017 weekday morning and afternoon peak hour traffic volumes are subjected to a 3% annual growth rate over a period of five years.</td></tr>
<tr><th colspan="4">Social Aspects – Construction</th></tr>
<tr><td colspan="4">Môrelig Combined School may be impacted by the noise and traffic generated during the construction process. The SANRAL weighbridge is located within close proximity of the access point (A1-1) to the construction site. however, it is predicted that the construction activities will be of little impact to the weighbridge.</td></tr>
</table>

Table 41: Impact Assessment – Road Diversion

Impact Phase: C = Construction, O = Operational, D = Decommissioning, Clo = Post-closure/Closure	Nature	Duration	Extent	Magnitude	Reversibility	Probability	Impact significance	Mitigation efficiency	Impact Significance (Post Mitigation)	Summary of Mitigation Measures
Soil, Land Use and Land Capability										
Compaction and sterilisation of undisturbed topsoil underneath tar road (C, O).	N	Long Term	Site	High	Low	Definite	High	Negligible	Very Low	Contain tar road extent to the smallest required size. Remove tar road as soon as it is not used anymore (if ever). After which the soil should then be ameliorated according to soil chemical analysis taken after replacement and the footprint should be re-vegetated with a grass seed mixture.
The contamination of topsoil due to hydrocarbon and chemical compound spills as well as spills of tar, concrete and paint (C, O).	N	Medium Term	Site	Moderate	Low	Probably	Low	Negligible	Very Low	Prevent any spills from occurring as far as possible. If a spill does occur, it should be cleaned up immediately and reported to the appropriate authorities. Contaminated soils should be disposed of at a suitable disposal facility. All vehicles should be serviced in a correctly bunded area. Leaking vehicles will have drip trays placed underneath them until repaired.
Cease in land capability at road footprint during road construction and operation (C, O).	N	Long Term	Site	Very High	Low	Definite	High	Very low	Low	No mitigation of loss of land capability is possible during the construction and operational phase, as the land is being changed from agricultural to a structure that prohibits any land capability.
Cease in current land use at road footprint during road construction and operation (C, O).	N	Long Term	Site	Very High	Low	Definite	High	Very low	Low	No mitigation of change in current land use is possible during the construction and operational phase as the land use is changed from agriculture to a structure that prohibits any other land use.
Cease in agricultural production at road footprint during road construction and operation (C, O).	N	Long Term	Site	Very High	Low	Definite	High	Very low	Low	No mitigation of loss in agricultural production is possible during the construction and operational phase as the land use is change from agriculture to a structure that prohibits any agriculture.

Impact Phase: C = Construction, O = Operational, D = Decommissioning, Clo = Post-closure/Closure	Nature	Duration	Extent	Magnitude	Reversibility	Probability	Impact significance	Mitigation efficiency	Impact Significance (Post Mitigation)	Summary of Mitigation Measures
Flora										
Site preparation, as a part of the construction activities, leading to the proliferation of alien vegetation species as well as a disturbance to wetland vegetation (C).	N	Long Term	Site	Moderate	Moderate to Low	Probable	Low	Moderate	Very Low	All development footprint areas are to remain as small as possible and vegetation clearing to be limited to what is absolutely essential. As much indigenous vegetation needs to be retained.
Excavation for road layer works leading to increased alien vegetation proliferation (C).	N	Long Term	Site	Moderate	Moderate to Low	Probable	Low	Moderate	Very Low	During excavation activities, the vegetation should be removed up to a depth of 150 mm and be stockpiled outside the appropriate setback area. The vegetation must be kept moist until it can be used to rehabilitate the area.
Rehabilitation of portions of wetlands impacted by construction (C, O).	N	Long Term	Site	High	Moderate to Low	Highly Probable	Moderate	Moderate	Low	Re-seed with indigenous species as soon as construction is completed.
Fauna										
Impact on Habitat for Faunal Species (C).	N	Permanent	Site	Low to Moderate	Moderate to Low	Definite	Moderate	Moderate	Low	Edge effect control needs to be implemented to ensure no further degradation and potential loss of faunal and floral SCC outside of the proposed project footprint area.
Direct loss of faunal species (C)	N	Long Term	Site	Moderate	Moderate to Low	Highly probable	Moderate	High	Low	No wild animals may under any circumstance be handled, removed or be interfered with by construction workers.
Disturbances to faunal communities (O).	N	Permanent	Site	Moderate	Moderate	Highly Probable	Moderate	Moderate to High	Low	Trapping, collecting or hunting of faunal species is prohibited.
Direct loss of faunal species (O)	N	Long Term	Site	Moderate	Moderate to Low	Definite	Moderate	High	Low	No wild animals may under any circumstance be handled, removed or interfered with by construction workers.

Impact Phase: C = Construction, O = Operational, D = Decommissioning, Clo = Post-closure/Closure	Nature	Duration	Extent	Magnitude	Reversibility	Probability	Impact significance	Mitigation efficiency	Impact Significance (Post Mitigation)	Summary of Mitigation Measures
Freshwater Resources& Hydropedology										
Excavation for road layer works leading to altered runoff patterns and increased erosion and sedimentation of the wetland (C).	N	Long Term	Local	Moderate	High	Probable	Low	Moderate	Very Low	Limit vehicle/construction equipment activity within the freshwater region to what is absolutely necessary. Maintain sedimentation/erosion by ensuring that sediment control devices are in place prior to the start of excavation. Sediment devices should be maintained. Refuelling of vehicles needs to take place outside of the freshwater resources and associated buffer zones.
Site preparation prior to commencement of construction leading to exposure of soil resulting in increased runoff, erosion and sedimentation of the wetlands (C).	N	Long Term	Local	Moderate	High	Probable	Low	Moderate	Very Low	The development footprint areas are to remain as small as possible and vegetation clearing is to be limited to what is absolutely needed. As much indigenous vegetation should be retained. The wetlands and the applicable 32 m zone of regulation should be clearly demarcated and marked as a “no-go” area and where no construction activities are planned.
Construction of the road diversion resulting in the altered runoff patterns, leading to increased erosion and sedimentation of the wetland (C).	N	Long Term	Local	Moderate	High	Probable	Low	Moderate	Very Low	Silt traps should be installed at the construction area. This will limit the sediment load entering the wetland. Restrict construction activities to the drier months as far as possible.
The contamination of surface water due to hydrocarbon spills and leaks from construction equipment and vehicles (C, O).	N	Long Term	Local	High	High	Probable	Low	Moderate	Very Low	Limit vehicle/construction equipment activity within the wetlands to what is absolutely necessary. Refuelling of the vehicles is to take place outside of the wetlands and associated 32 m NEMA zone of regulation, on sealed surfaces.

Impact Phase: C = Construction, O = Operational, D = Decommissioning, Clo = Post-closure/Closure	Nature	Duration	Extent	Magnitude	Reversibility	Probability	Impact significance	Mitigation efficiency	Impact Significance (Post Mitigation)	Summary of Mitigation Measures
Rehabilitation activities of portions of the wetlands impacted by construction.	N	Long Term	Local	High	High	Probable	Low	Moderate	Very Low	Limit vehicle/machinery activity within the freshwater resources to what is absolutely necessary. Maintain sediment/ erosion control devices to minimise risk of sedimentation of downstream areas. The duration of the impacts must be minimised.
Air Quality										
Deterioration of air quality caused by vehicle emissions (C, O).	N	Long Term	Regional	Low to Moderate	High	Highly Probable	Moderate	High	Very Low	Vehicles and machinery must be maintained and serviced on a regular basis.
Deterioration of air quality as a result of particulate matter and dust fallout (C, O).	N	Long Term	Regional	Low to Moderate	High	Definite	Moderate	High	Low	Conduct dust suppression regularly, especially during dry conditions.
Noise										
Generation of additional noise during construction (C).	N	Short Term	Local	Low	Moderate	Probable	Low	Moderate	Very Low	Restrict construction to daylight hours.
Noise associated with vehicle and heavy machinery movement (C, O).	N	Long Term	Local	Low	Moderate	Probable	Low	Moderate	Very Low	Vehicles and machinery must be serviced on a regular basis.
Traffic										
Increase in traffic levels due to the planned P15-1 road diversion.	N	Long Term	Local	Moderate	High	Definite	Moderate	High	Very Low	Intersections within the road network will require upgrades and configurations. Construction vehicles should avoid travelling during peak hour traffic. Road signages need to be in place, such as ones indicating that construction is in progress as well as ones indicating the speed limits that need to be adhered to within the construction zone.

Impact Phase: C = Construction, O = Operational, D = Decommissioning, Clo = Post-closure/Closure	Nature	Duration	Extent	Magnitude	Reversibility	Probability	Impact significance	Mitigation efficiency	Impact Significance (Post Mitigation)	Summary of Mitigation Measures
Social										
Impact on Môrelig Combined School though the generation of noise and an increase in traffic.	N	Short term	Local	Moderate	Moderate	Highly Probably	Moderate	Moderate	Low	Construction vehicles and machinery must be serviced on a regular basis. A traffic plan should be communicated with the school on a weekly basis. Road signages need to be in place, such as ones indicating that construction is in progress as well as ones indicating the speed limits that need to be adhered to within the construction zone.

9.4.2 Activity 2: Storm Water Management

Table 42: Storm Water Management Impact Discussion

Activity	Direct Impacts	Edge Effect Impacts	Indirect Impacts
Freshwater - Construction			
Development of stormwater management systems.	➢ Loss of catchment yield resulting from stormwater containment, leading to reduction in volume of water entering the wetlands, leading to loss of recharge of the wetlands.	➢ Loss of catchment yield resulting from stormwater containment, leading to: ○ Increased flood peaks as a result of formalisation and concentration of surface runoff in clean water diversion structures; ○ Potential for erosion, leading to sedimentation of the wetlands; ○ Reduction in volume of water entering the wetlands, leading to loss of recharge of the wetlands; ○ Altered vegetation community structure and diversity due to moisture stress and changes to goods and service provision.	➢ Loss of catchment yield resulting from stormwater containment, leading to: ○ Potential for erosion, leading to sedimentation of the wetlands; ○ Limited reduction in volume of water entering the wetlands, leading to loss of recharge of the wetlands which may affect small portions of the wetlands; ○ Altered vegetation community structure and diversity due to moisture stress in some localized areas.
Air Quality – Construction			
Dust will be generated through the removal of vegetation, earthworks and by construction vehicles on haul roads. The air quality will also be impacted through gas emissions emitted by construction vehicles. However, due to the size of the project, it is anticipated that these impacts will be of little significance to the air quality within the region.			
Noise - Construction			
Noise will be generated during the construction phase (through construction activities and earthworks associated with construction); however, it is expected that the noise generated will not have a significant impact on the noise levels in the area.			
Freshwater – Operational			
Operation and maintenance of the stormwater management systems associated with the proposed road diversion.	➢ Loss of catchment yield due to stormwater containment is expected to occur, which could lead to the following impacts: ○ Increased flood peaks into the wetlands as a result of formalisation and concentration of surface runoff; ○ Potential for erosion of terrestrial areas as a result of the formation of preferential flow paths, leading to sedimentation of the wetlands; ○ Reduction in volume of water entering the wetlands, leading to loss of recharge (and thus potential desiccation) of the wetland systems; ○ Erosion and sedimentation build-up within the system; and ○ Altered vegetation communities due to moisture stress.	N/A	➢ The spread of alien invasive species due to the incorrect management and maintenance of the systems.

Table 43: Impact Assessment – Water Management Infrastructure

Impact Phase: C = Construction, O = Operational, D = Decommissioning, Clo = Post-closure/Closure	Nature	Duration	Extent	Magnitude	Reversibility	Probability	Impact significance	Mitigation efficiency	Impact Significance (Post Mitigation)	Summary of Mitigation Measures
Freshwater Resources										
Construction of minor and major drainage systems parallel to the road diversion (C).	N	Short Term	Site	Moderate to Low	High	Probable	Low	Moderate	Very Low	Construct drainages systems according to specialist designs. Limit the footprint area of the proposed activity to what is absolutely essential.
Presence of minor and major drainage systems around the road diversion (O).	N	Long Term	Local	Moderate	Moderate	Highly Probable	Moderate	Moderate	Low	Ensure that the drainage systems are properly maintained.
Air Quality										
Deterioration of air quality caused by vehicle emissions (C).	N	Long Term	Regional	Low to Moderate	High	Highly Probable	Moderate	High	Very Low	Vehicles and machinery must be maintained and serviced on a regular basis.
Deterioration of air quality as a result of particulate matter and dust fallout (C).	N	Long Term	Regional	Low to Moderate	High	Definite	Moderate	High	Low	Conduct dust suppression regularly, especially during dry conditions.
Noise										
Generation of additional noise during construction (C).	N	Short Term	Local	Low	Moderate	Probable	Low	Moderate	Very Low	Restrict construction to daylight hours.
Noise associated with vehicle and heavy machinery movement (C).	N	Long Term	Local	Low	Moderate	Probable	Low	Moderate	Very Low	Vehicles and machinery must be serviced on a regular basis.

9.4.3 Activity 3: Contractor's Yard

Table 44: Contractor's Yard Impact Discussion

<table>
<tr><th>Activity</th><th>Direct Impacts</th><th>Edge Effect Impacts</th><th>Indirect Impacts</th></tr>
<tr><th colspan="4">Freshwater - Construction</th></tr>
<tr><td>Impacts as a result of site preparation</td><td>➢ Vehicular movement and access to the contractor's yard, and the removal of natural wetland vegetation and associated disturbances to soils within the project area could lead to:
o Exposure of soils, leading to increased runoff from cleared areas and erosion of the wetlands, and thus increased the potential for sedimentation of the wetlands;
o Increased sedimentation of the wetlands leading to changes in instream habitat, potentially smothering biota, altering surface water quality, and potentially leading to areas within the wetlands becoming more suited to terrestrial vegetation;
o Impacts on the hydrological processes supporting the wetlands locally and downstream;
o Soil compaction;
o Decreased ecoservice provision;
o Proliferation of alien vegetation as a result of disturbances;
o Vegetation degradation, and the subsequent loss of habitat for wetland species; and
o Soil and stormwater contamination from oils and hydrocarbons.</td><td>➢ Runoff with high sediment loads deposited into the wetlands, smothering the vegetation and thus altering the habitat of the wetlands; and
➢ Soil compaction due to vehicular movement leading to alterations of runoff patterns into the wetlands.</td><td>➢ Runoff with high sediment loads deposited into the wetlands, smothering the vegetation and thus altering the habitat of the wetland; and
➢ Loss of catchment yield resulting from wetlands alteration and/or losses, leading to reduction in volume of water entering the wetlands.</td></tr>
<tr><th colspan="4">Freshwater – Operation</th></tr>
<tr><td>Impacts caused by the operation of the contractor's yard</td><td>N/A</td><td colspan="2">➢ Compaction of soils due to vehicular movement;
➢ Latent impacts of vegetation losses;
➢ Increased runoff volumes and formation of preferential surface flow paths as a result of compacted soils, leading to alteration of hydrological recharge paths;
➢ Contamination of soil and surface water due to soil and hydrocarbon spills;
➢ Proliferation of alien vegetation as a result of disturbances; and
➢ Increased sedimentation and erosion.</td></tr>
</table>

Activity	Direct Impacts	Edge Effect Impacts	Indirect Impacts
Fauna and Flora – Construction and Operational			
Loss of species diversity and impact on ecology.	➢ Disturbance to soils due to construction and operational activities leading to altered habitats; ➢ Increased introduction and proliferation of alien plant species and further transformation of natural habitats; ➢ Excavation of soils leading to increased runoff and sedimentation of downslope habitat; ➢ Runoff/disposal of construction materials from the proposed infrastructure into the surrounding habitat leading to surface hardening and limiting recruitment of new vegetation; ➢ Collision of faunal species with vehicles; ➢ Loss of habitat connectivity due to the placement of the new road; ➢ Potential ineffective rehabilitation post construction leading to proliferation of alien plant species in the disturbed areas; ➢ Potential erosion stemming from bare soil areas leading to sedimentation of downslope faunal habitat; ➢ Potential generation of dust may impact the rate of photosynthesis of floral species; ➢ Potential hunting/trapping/killing of faunal species by personnel.		
Soil, Land Use and Land Capability			
Potential compaction, sterilisation, erosion and hydrocarbon spills in soils.			
Noise – Construction			
Noise will be generated during the construction phase (through construction activities and earthworks associated with construction); however, it is expected that the noise generated will not have a significant impact on the noise levels in the area.			
Air Quality – Construction			
Particulate matter ($PM_{2.5}$ and PM_{10}), dust fallout and gas emissions will be generated during the construction phase. However, due to the size of the project, it is anticipated that the impacts on the air quality within the region will be of little significance.			

Table 45: Impact Assessment – Contractor's Yard

Impact Phase: C = Construction, O = Operational, D = Decommissioning, Clo = Post-closure/Closure	Nature	Duration	Extent	Magnitude	Reversibility	Probability	Impact significance	Mitigation efficiency	Impact Significance (Post Mitigation)	Summary of Mitigation Measures
Soil, Land Use and Land Capability										
Compaction and sterilisation of undisturbed (C, O).	N	Long Term	Site	High	Low	Definite	High	Negligible	Very Low	Contain contractor yard footprint to the smallest required size. Remove contractor yard as soon as it is not used anymore. After which the soil should then be ameliorated according to soil chemical analysis taken after replacement and the footprint should be re-vegetated with a grass seed mixture.
The contamination of topsoil due to hydrocarbon and chemical compound spills (C, O).	N	Medium Term	Site	Moderate	Low	Probably	Low	Negligible	Very Low	Prevent any spills from occurring as far as possible. If a spill does occur, it should be cleaned up immediately and reported to the appropriate authorities. Contaminated soils should be disposed of at a suitable disposal facility. All vehicles should be serviced in a correctly bunded area. Leaking vehicles will have drip trays placed underneath them until repaired.
Cease in land capability at contractor's yard footprint (C, O).	N	Temporary	Site	High	Moderate	Definite	Moderate	Moderate	Low	Remove contractor yard once the road has been constructed. Rehabilitate the disturbed area and re-seed with an indigenous plant species.
Cease in current land use at contractor's yard footprint (C, O).	N	Temporary	Site	High	Low	Definite	High	Low	Low	Remove contractor yard once the road has been constructed. Rehabilitate the disturbed area and re-seed with an indigenous plant species.
Cease in agricultural production at contractor's yard footprint (C, O).	N	Temporary	Site	High	Low	Definite	High	Low	Low	Remove the contractor yard once the road has been constructed. Rehabilitate the disturbed area and re-seed with an indigenous plant species.
Flora										

Impact Phase: C = Construction, O = Operational, D = Decommissioning, Clo = Post-closure/Closure	Nature	Duration	Extent	Magnitude	Reversibility	Probability	Impact significance	Mitigation efficiency	Impact Significance (Post Mitigation)	Summary of Mitigation Measures
Site preparation, as part of construction activities, leading to the removal of vegetation(C).	N	Temporary	Site	Moderate	Moderate to Low	Probable	Low	Moderate	Very Low	Contractor yard area is to remain as small as possible and vegetation clearing is to be limited to what is absolutely essential. As much indigenous vegetation needs to be retained. The vegetation should be removed up to a depth of 150 mm and should be stockpiled outside the appropriate setback area. The vegetation must be kept moist until it can be used to rehabilitate the area.
Site preparation, as a part of construction activities, leading to the proliferation of alien vegetation species (C).	N	Temporary	Site	Moderate	Moderate to Low	Probable	Low	Moderate	Very Low	Contractor yard area is to remain as small as possible and vegetation clearing is to be limited to what is absolutely essential. As much indigenous vegetation needs to be retained.
Fauna										
Impact on Habitat for Faunal Species (C).	N	Temporary	Site	Low to Moderate	Moderate to Low	Definite	Moderate	Moderate	Low	Edge effect control needs to be implemented to ensure no further degradation and potential loss of faunal and floral SCC outside of the proposed project footprint area.
Direct loss of faunal species (C)	N	Temporary	Site	Moderate	Moderate to Low	Highly probable	Moderate	High	Low	No wild animals may under any circumstance be handled, removed or be interfered with by construction workers.
Disturbances to faunal communities (O).	N	Temporary	Site	Moderate	Moderate	Highly Probable	Moderate	Moderate to High	Low	Trapping, collecting or hunting of faunal species is prohibited.
Direct loss of faunal species (O)	N	Temporary	Site	Moderate	Moderate to Low	Definite	Moderate	High	Low	No wild animals may under any circumstance be handled, removed or interfered with by construction workers.
Freshwater Resources & Hydropedology										

Impact **Phase:** **C = Construction,** **O = Operational,** **D = Decommissioning,** **Clo = Post-closure/Closure**	**Nature**	**Duration**	**Extent**	**Magnitude**	**Reversibility**	**Probability**	**Impact significance**	**Mitigation efficiency**	**Impact Significance (Post Mitigation)**	**Summary of Mitigation Measures**
Site preparation prior to commencement of construction leading to exposure of soil resulting in increased runoff, erosion and sedimentation of the wetlands (C).	N	Temporary	Local	Moderate	High	Probable	Low	Moderate	Very Low	The contractor yard footprint is to remain as small as possible and vegetation clearing is to be limited to what is absolutely needed. As much indigenous vegetation should be retained. The wetlands and the applicable 32 m zone of regulation should be clearly demarcated and marked as a “no-go” area and where no construction activities are planned.
Construction of the contractor’s yard resulting in the altered runoff patterns, leading to increased erosion and sedimentation of the wetland (C).	N	Temporary	Local	Moderate	High	Probable	Low	Moderate	Very Low	Silt traps should be installed at the construction area. This will limit the sediment load entering the wetland. Restrict construction activities to the drier months as far as possible.
The contamination of surface water due to hydrocarbon spills and leaks from construction equipment and vehicles (C, O).	N	Temporary	Local	High	High	Probable	Low	Moderate	Very Low	Limit vehicle/construction equipment activity within the wetlands to what is absolutely necessary. Refuelling of the vehicles is to take place outside of the wetlands and associated 32 m NEMA zone of regulation, on sealed surfaces.
Rehabilitation activities of portions of the wetlands impacted by construction.	N	Temporary	Local	High	High	Probable	Low	Moderate	Very Low	Limit vehicle/machinery activity within the freshwater resources to what is absolutely necessary. Maintain sediment/ erosion control devices to minimise risk of sedimentation of downstream areas. The duration of the impacts must be minimised.
Air Quality										
Deterioration of air quality caused by vehicle emissions (C, O).	N	Long Term	Regional	Low to Moderate	High	Highly Probable	Moderate	High	Very Low	Vehicles and machinery must be maintained and serviced on a regular basis.

Impact Phase: C = Construction, O = Operational, D = Decommissioning, Clo = Post-closure/Closure	Nature	Duration	Extent	Magnitude	Reversibility	Probability	Impact significance	Mitigation efficiency	Impact Significance (Post Mitigation)	Summary of Mitigation Measures
Deterioration of air quality as a result of particulate matter and dust fallout (C, O).	N	Long Term	Regional	Low to Moderate	High	Definite	Moderate	High	Low	Conduct dust suppression regularly, especially during dry conditions.
Noise										
Generation of additional noise during construction (C).	N	Short Term	Local	Low	Moderate	Probable	Low	Moderate	Very Low	Restrict construction to daylight hours.
Noise associated with vehicle and heavy machinery movement (C, O).	N	Long Term	Local	Low	Moderate	Probable	Low	Moderate	Very Low	Vehicles and machinery must be serviced on a regular basis.

9.4.4 Socio-economic and Heritage Impacts

It is not possible to always predict what activities will have an impact on the socio-economic environment or cultural/heritage aspects. As a result of this, the cultural and heritage as well as socio-economic mitigation measures will not be discussed per activity but in general.

Socio-economic impacts:

Impacts identified during construction

The Môrelig Combined School is located within the vicinity of the construction activities and therefore could be impacted through traffic movement, noise and dust.

Temporary employment during construction

It is predicted that temporary employment opportunities will be created during the construction phase, which will last approximately six to nine months. This will have a positive impact on the wage earnings in the construction sector.

Security of employment and household income

As mentioned above, employees will be securely employed for the duration of the construction period (six to nine months). The diversion of the P15-1 road will also allow mining to commence at the north-eastern coal reserve which will ensure the future security of employment for employees working at Wonderfontein Mine and perhaps allow additional employment.

Expanded timeframe for the generation of revenue and contribution towards the GDP

The diversion of the P15-1 road will ensure that additional coal can be mined at Wonderfontein Mine and therefore this project will indirectly expand the revenue for approximately five years as well as allow continued subsequent contribution to the Gross Domestic Product of the Local, Provincial and National Economy.

Impacts related to archaeological and cultural interest:

According to the HIA conducted by APelser Archaeological Consulting in February 2013 for Wonderfontein Colliery, no heritage resources (historical remains or graves) occur within the vicinity of the planned road diversion. However, in the event that any archaeological artefacts are unearthed during construction, SAHRA must be notified, all development activities must be ceased and an archaeologist should be called in to determine proper mitigation measures.

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Table 46: Impact Assessment for Socio-economic and Heritage

Impact Phase: C = Construction, O = Operational, D = Decommissioning, Clo = Post-closure/Closure	Nature	Duration	Extent	Magnitude	Reversibility	Probability	Impact significance	Mitigation efficiency	Impact Significance (Post Mitigation)	Summary of Mitigation Measures
Archaeological and Cultural Interest										
Encountering graves/archaeological artefacts during construction (C).	N	Permanent	Site	Moderate	Low	Unlikely	Very Low	Low	Very Low	If any graves or archaeological artefacts are exposed during construction, SAHRA must be notified. All development activities must be stopped and an archaeologist should be called in to determine proper mitigation measures.
Socio-economic										
Creation of temporary employment during construction (C).	P	Short Term	Local	High	Low	Definite	High	-	-	Source the maximum number of employees from the local area for temporary and permanent job opportunities.
Generation of revenue and GDP contribution (O).	P	Long Term	Local	Very High	Low	Definite	Very High	-	-	Optimize local involvement in on-mine business opportunities to maximize local economic growth.
Human resource development and community investment (C).	P	Long Term	Local	High	Low	Highly Probable	High	-	-	Optimize local involvement during the construction of the road diversion to maximize local economic growth.
The Môrelig Combined School could be impacted through noise and air pollution (C)	N	Short Term	Local	Moderate	Moderate	Probable	Low	Moderate	Low	Restrict construction to daylight hours. Conduct dust suppression regularly, especially during dry conditions. Vehicles and machinery must be maintained and serviced on a regular basis.

Impact Phase: C = Construction, O = Operational, D = Decommissioning, Clo = Post-closure/Closure	Nature	Duration	Extent	Magnitude	Reversibility	Probability	Impact significance	Mitigation efficiency	Impact Significance (Post Mitigation)	Summary of Mitigation Measures
The Môrelig Combined School could be impacted through traffic movement during the construction phase (C)	N	Short Term	Local	Moderate	Moderate	Highly Probable	Moderate	Moderate	Low	A Traffic Management Plan needs to be discussed with the school on a weekly basis. Temporary construction measures need to be in place; such as signages indicating that construction is in process and signages indicating the speed limits that need to be adhered to.

9.5 Cumulative and Latent Impacts

9.5.1 Terrestrial Ecology

Possible latent impacts were identified which may result from the proposed road diversion at Wonderfontein Mine.

Table 47: Terrestrial Cumulative Impacts

Impact Phase: C = Construction, O = Operational, D = Decommissioning, Clo = Post-closure/Closure	Nature	Duration	Extent	Magnitude	Reversibility	Probability	Impact significance	Mitigation efficiency	Impact Significance (Post Mitigation)	Summary of Mitigation Measures
Destruction of ecologically intact, irreplaceable habitat (C, O).	N	Permanent	Local	Moderate	Moderate to Low	Probable	Moderate	Moderate	Low	Development footprint must be kept as small as possible.
Permanent loss of habitat earmarked for conservation (C, O).	N	Permanent	Local	High	Moderate to Low	Probable	Moderate	Moderate	Low	
Permanent loss of and altered species diversity (C, O).	N	Permanent	Local	High	Moderate to Low	Probable	Moderate	Moderate	Low	Trapping and hunting of faunal species are prohibited.
Alien floral invasion (C, O).	N	Permanent	Local	Very High	Moderate to Low	Probable	Moderate	Moderate	Low	Development and implement alien invasive management program.
Permanent loss of floral and faunal SCC and suitable habitat (C, O).	N	Permanent	Local	Low to Moderate	Moderate to Low	Probable	Moderate	Moderate	Low	If any SCC species are encountered, they should be relocated by qualified specialist after permit is obtained from MTPA.

9.5.2 Air Quality

Due to the size of the Wonderfontein Road Diversion Project, it is expected that the dust generated during the construction phase will not have a significant impact on the air quality within the region.

Table 48: Air Quality Cumulative Impacts

Impact Phase: C = Construction, O = Operational, D = Decommissioning, Clo = Post-closure/Closure	Nature	Duration	Extent	Magnitude	Reversibility	Probability	Impact significance	Mitigation efficiency	Impact Significance (Post Mitigation)	Summary of Mitigation Measures
The proposed project has the means to contribute to air quality deterioration through activities such as the generation of dust as well as the release of carbon dioxide and other greenhouse gasses. (C, O).	N	Short Term	Local	Low to Moderate	Moderate to High	Definite	Moderate	Moderate	Low	Dust suppression must be conducted on-site. Vehicles, machinery and equipment must be maintained and serviced regularly.

10 ENVIRONMENTAL IMPACT STATEMENT

10.1 Impacts on Soils, Land Use and Land Capability

The land capability and land use of the project area will permanently change with the diversion of the P15-1 road. These impacts cannot be mitigated and therefore the impacts are considered of high significance. The soils within the study area will also be impacted; however, with the correct mitigation measures, the impacts can be correctly controlled.

10.2 Impacts on Terrestrial Biodiversity

The main impacts on the terrestrial biodiversity are a result of construction activities. The road development will lead to a loss of vegetation, disturbances to faunal species and the proliferation of alien species.

10.3 Impacts on Aquatic Environments

The biggest concern for the surrounding aquatic environments is the increased risk of sedimentation, pollution as a result of seepage and contaminated runoff as well as the alteration of the natural environment which may lead to alien species proliferation in the riparian zones.

10.4 Impacts on Groundwater

It is anticipated that the groundwater will not be impacted during the construction and operational phase as the groundwater level will not be breached.

10.5 Impacts on Air Quality

Pollutants associated with the construction and operational phase of the proposed development are typically vehicles emissions, $PM_{2.5}$, PM_{10} and dust fallout.

10.6 Impacts related to Noise

The noise impacts resulting from the activities are expected to be low when mitigation measures are implemented.

10.7 Impacts on Traffic

The existing 2017 weekday morning and afternoon peak hour traffic volumes will be subjected to a 3% annual growth rate over a period of five years.

10.8 Socio-economic Impacts

The Môrelig Combined School is located within close vicinity of the study area and therefore could be impacted during the construction period. The development of the road diversion will create temporary job opportunities for the duration of the construction period.

10.9 Impacts on Archaeological and Cultural Interest

No graves or historical buildings were found during the site visit conducted in February 2013 by APelser Archaeological Consulting. However, in the event that any graves or archaeological artefacts are exposed during construction, SAHRA must be notified, all development activities must be ceased and an archaeologist should be called in to determine proper mitigation measures.

10.10 Impacts related to Health and Safety

The operation of machinery and heavy-duty vehicles both on-site and off-site may increase risks to personal health and safety. Occupational risks that affect the workforce include professionally trained, skilled and unskilled staff. Risks that are specifically related to the presence of heavy mechanised vehicles and excavation machinery which are aggravated by poor visibility as a result of increased dust.

The operation of machinery and heavy-duty vehicles both on-site and off-site may increase risks to personal health and safety. Occupational risks that affect the workforce include; professionally trained, skilled and unskilled staff. Risks that are specifically related to the presence of heavy mechanised vehicles and excavation machinery which are aggravated by poor visibility as a result of increased dust.

10.11 Community Perceptions and Responses

Community perceptions and concerns regarding the effects of the proposed project may in themselves constitute a social impact. If community members believe that the project will have a negative effect on their lives, regardless of whether or not this perception is justified, they are likely to be extremely resistant to the proposed development. This constitutes a source of social risk to the project, which should be addressed by allaying unjustified community fears regarding the project and instituting appropriate mitigation measures to address realistic concerns.

10.12 Final Site Map

The final site map is attached on larger scale in **Annexure 9**.

11 SUMMARY OF SPECIALIST STUDIES

The following table lists the specialist studies that were undertaken as part of this EIA process to assess the possible impacts that will be caused by the proposed road diversion at Wonderfontein Mine. References have been included to some of the specialist recommendations and where these have been included in the EIAR as well as the EMPr.

Table 49: Summary of specialists' recommendations

Recommendation of specialist reports	Specialist recommendations included, amendments and reference where included in EIAR	Reference to the applicable section of the report where the specialist recommendations have been included
Freshwater Ecological Assessment (Attached as Annexure 5)		
• Based on the findings of the freshwater ecological assessment and the results of the risk assessment, it is in the opinion of the ecologists that the proposed road diversion poses both direct and indirect risks to the wetlands associated with the proposed road diversion. • Alternative 1 is surrounded by CVB 1 which has a PES category of C and a REC category of C as well as HSS 1 which has a PES category of D and REC category of D. Both of these wetlands are considered as moderately to largely modified. • CVB 2 and HHS 4 occur within the vicinity of Alternative 2and both of these wetlands have a PES category of B and a REC category of B, and thus both these wetlands are considered as largely natural. Depression 1 also surrounds Alternative 2 and is classified as largely modified. • Alternative 1 is not proposed to traverse any wetlands. Alternative 2, however, traverses both CVB 2 and HHS 4 and occurs within the 32 m zone of regulation of Depression 1. Therefore, the potential risk to the freshwater environment posed by Alternative 1 is lower than that of Alternative 2, as evidenced by the lower risk matrix. • Thus, Alternative 1 is the preferred alternative from a freshwater resource management perspective. Providing that a clear, well-conceived and ecologically sensitive site development plan, the proposed mitigation measures as well as general good construction practices are adhered to, as these are essential if the significance of the impacts are to be reduced. • From a freshwater resource point of view, it is in the opinion of the specialist that the proposed road diversion is considered acceptable, with the provision that strict adherence to mitigation measures is enforced, in order to ensure that the ecological integrity of the freshwater environment is not further compromised.	Recommendations of aspects that should receive adequate attention as stated in the specialist study were included in the EIAR/EMPr. No amendments were made as to what the specialist recommended.	Section 6 – EIAR Section 8.6 & 8.7 - EIAR Section 9 – EIAR Section 5 – EMPr Section 7 – EMPr
Soil, land capability, land use and hydropedology assessment (Attached as Annexure 6)		
• The extent of the tar road should be contained to the smallest required size. • If ever the tar road is not used anymore, then the road should be removed. After removal of the road, the surface should be thoroughly cleaned and non-soil materials should be removed to a suitable disposal facility. The soil should then be ameliorated according to the soil chemical analysis of samples taken after replacement. The footprint should then be re-vegetated with a grass seed mixture. Ripping to be done when the soil is dry to maximise the loosening effect of ripping and reduce re-compaction. The cleaned footprint should be deep cross-ripped to alleviate compaction caused during construction of the road and traffic thereafter.	Recommendations of aspects that should receive adequate attention as stated in the specialist study were included in the EIAR/EMPr. No amendments were made as to what the specialist recommended.	Section 6 – EIAR Section 8.4 – EIAR Section 9 - EIAR Section 5 – EMPr Section 7 – EMPr

Recommendation of specialist reports	Specialist recommendations included, amendments and reference where included in EIAR	Reference to the applicable section of the report where the specialist recommendations have been included
• Prevent any spills from occurring as far as possible. If a spill occurs it is to be cleaned up immediately and reported to the appropriate authorities. Contaminated soil should be disposed at a suitable disposal facility • All vehicles are to be serviced in a correctly bunded area or at an off-site location. Leaking vehicles will have drip trays place under them where until repaired. • Mitigation of land capability loss during decommissioning/rehabilitation phase includes: - Closure plan to specify clear targets on medium to long term post mining land capability influencing possible land uses. - Soil quality to be investigated through representative sampling and laboratory analysis, analytical results evaluated by a qualified expert, and soil fertility to be corrected prior to establishing vegetation on rehabilitated soil.		
Traffic Impact Assessment (Attached as Annexure 7)		
• As a result of the planned diversion of the P15-1, some of the background traffic volumes will be rerouted. • From the analysis carried out, it was found that the impact of the rerouted background traffic volumes on the surrounding road network can be mitigated by means of existing intersections improvements and proposed new intersection configurations. • From a traffic and transportation engineering point of view, the proposed intersection upgrades and configurations are regarded as feasible and are therefore recommended to be constructed to the design standards of the Mpumalanga Department of Public Works, Roads and Transport.	Recommendations of aspects that should receive adequate attention as stated in the specialist study were included in the EIAR/EMPr. No amendments were made as to what the specialist recommended.	Section 8.12 – EIAR Section 9 – EIAR Section 10 – EIAR Section 5 – EMPr Section 7 - EMPr

12 PUBLIC PARTICIPATION

The PPP is an important part of the EIA process, ensuring all project stakeholders are informed and have an opportunity to contribute to the process. The guidelines for engagement with project stakeholders and public participation during the EIA process are stipulated in Section 24 (5) and regulation 39-44 of GNR 982 of NEMA. The Public Participation Report is attached as **Annexure 8**.

12.1 Objectives of the Public Participation Process

The objectives of the Wonderfontein Road Diversion Project are to:

- Comply with national legislation;
- Establish and manage good relationships with key stakeholder groups;
- Encourage involvement and participation in the EIA process; and
- Obtain and utilise local knowledge.

Note that a single, consolidated stakeholder engagement process is undertaken for this project, adhering to the PPP requirements of all three acts, including the requirements from the following acts:

- the NEMA;
- the MPRDA; and
- the NWA.

A list of Interested and Affected Parties (I&APs), including landowners, lawful occupiers and others that have registered as I&APs has been compiled and regularly updated throughout the process.

A PPP has been initiated as part of the Wonderfontein Road Diversion and is undertaken as per GNR 982 of NEMA.

As part of this PPP the details of the I&APs were registered and included in the database. Individuals and groups who requested to be registered as I&APs have been registered.

12.2 General Public Participation Approach

The PPP for the project has been undertaken in accordance with the NEMA Regulations and timeframes; however, the principles of the PPP are governed by the NEMA: EIR regulations. The aim of the PPP conducted throughout the entire S&EIR of the project was primarily to ensure that:

- Any potential stakeholders and I&APs are identified and consulted with;
- Information containing all relevant facts in respect of the application is made available to identified stakeholders and I&APs;
- Participation is facilitated in such a manner that all potential stakeholders and I&APs are provided with a reasonable opportunity to comment on the application and identify issues to be addressed throughout the S&EIR process; and
- Comments received from stakeholders and I&APs are recorded.

The PPP activities undertaken during the S&EIR of this project are discussed in the sections below.

12.3 Stakeholder Engagement and Consultation Process

12.3.1 One-on-One Consultations

Where required, one-on-one consultation meetings will be scheduled to address any issues and concerns raised regarding this proposed project. No one-on-one meetings have been held up to date. A site visit was conducted on the 19 September 2019.

12.3.2 Advertisements

A notice providing a brief description of the project and inviting I&APs to register on the stakeholder database was placed in a local newspaper, namely the Middelburg Observer, on 13 September 2019. Refer to **Appendix 1-3** of the Public Participation Report (**Annexure 8**) for the proof of advertisement.

12.3.3 On-Site Notices

An on-site notice was placed at the activity boundary (next to the road at the proposed diversion) at coordinates 25°48’50.5”S and 29°53’42.3”E on 9 September 2019.Refer to **Appendix 1-4** of the Public Participation Report (**Annexure 8**) for the proof of the on-site notice.

12.3.4 Background Information Document

The directly affected, surrounding landowners and registered I&APs were informed of the Wonderfontein Mine Road Diversion by way of distributing a Background Information Document (BID) to these parties. The BID was distributed to everyone listed in the current database by means of e-mail. Refer to **Appendix 1-2** of the Public Participation Report (**Annexure 8**) for the proof of distribution of the BID.

Through this process, the identified I&APs were afforded the opportunity to gain background knowledge of the proposed project and to raise their initial concerns.

12.4 Registration of I&APs

Existing databases

This is an on-going process and stakeholders are welcome to register throughout the process. The placement of site notices and advertising in Middelburg Observer afforded the general public the opportunity to register as I&APs and to participate in the process. As depicted in the BID, all landowners, lawful occupiers, municipal ward councillors and relevant organs of state will be contained in the I&AP register throughout the life of the project. However, as stipulated in the BID, other parties need to register to remain on the I&AP database.

After the conclusion of the announcement phase, the I&AP register was compiled and is attached as **Appendix 1-1** of the public Participation Report (**Annexure 8)**.

12.4.1 Notification of Relevant Authorities

The following governmental departments and non-governmental organisations (NGOs) were notified about the project during the PPP:

- Department of Mineral Resources (DMR);
- Mpumalanga Tourism and Parks Agency (MTPA);
- Department of Public Works (DPW);
- Inkomati-Usuthu Catchment Management Agency (IUCMA)
- Emakhazeni Local Municipality (ELM); and
- Department of Agriculture, Forestry and Fisheries (DAFF)

12.5 Access and Opportunity to Comment

12.5.1 Availability of the Consultation Scoping Report and Final Scoping Report Submission

The Consultation Scoping Report was made available for comments over a period of 30 days from 09 September 2019 until 10 October 2019. It was made available via email to all I&APs in possession of an email address.

Hard copies of the consultation scoping report were issued to the relevant organs of the state including the following:

- DMR;
- MTPA;
- DPW;

- IUCMA;
- ELM; and
- DAFF

Annexure 8 also includes proof that the hard copies of the draft consultation scoping report were distributed to the parties indicated above as well as proof of inviting comments on the consultation report. The final scoping report, submitted to the DMR, has also been attached to **Annexure 8**.

12.5.2 Availability of the EIR and EMPr

The Consultation EIAR and EMPr will be made available in a similar manner as the Scoping Report and will be distributed for comments and inputs from 13 March 2020 for a period of 30 days.

The notice of availability of the following was communicated:

- Notice of availability through letters to all registered I&APs and an electronic copy will be sent to those who have the resources to receive the documents in that manner.
- Availability of hard copy reports at specified locations (similar as for the Scoping Report).
- Availability of CD's with reports at specified locations or on request.

12.5.3 Issues and Concerns Raised

Any comments received on the EIAR and EMPr were included in the Issue and Response Register (IRR). All the issues and responses made to date are included in **Table 50**.

All issues/comments raised throughout the course of the project were (and will continue to be) recorded in an IRR (**Table 50**) that will be updated on a regular basis and will be included as part of the Final EIAR. Hence, issues and concerns raised to date were noted in the IRR (also attached as **Annexure 8**).

12.5.4 Public Review of the EIR and EMPr

A public meeting regarding the Draft EIAR and EMPr will be held during the commenting period (between 13 March and 14 April 2020) if requested by the IA&Ps.

Table 50: Issue and Response Register

COMMENTS	STAKEHOLDER	RESPONSE	PHASE
We are at this stage unable to give comprehensive comments as we do not know as yet what the final route of the road will be.	MJ Mojapelo Public Infrastructure Department Public Works, Roads and Transport 10 September 2019	Noted	Environmental Authorisation
Please note that currently, the affected road, P 15-1(R33), now falls under the jurisdiction of the South African Roads Agency Limited (SANRAL)	MJ Mojapelo Public Infrastructure Department Public Works, Roads and Transport 10 September 2019	Noted	Environmental Authorisation
This letter serves to inform you that your application for and Environmental Authorisation lodged is hereby acknowledged.	Ms MC Mutengwe Mine Environmental Management Department Mineral Resources 11 September 2019	Noted with thanks.	Environmental Authorisation
Kindly be informed that the above-mentioned application has not yet been evaluated. Once the evaluation is concluded, you shall be informed in due course of the outcome thereof. Notwithstanding this, you are reminded that all documents must be submitted in accordance with the timeframes stipulated on the NEMA: EIA Regulations, 2014	Ms MC Mutengwe Mine Environmental Management Department Mineral Resources 11 September 2019	Noted	Environmental Authorisation

The property on which the Môrelig School is located belongs to the Dutch Reformed Church. Want to know if the school is in danger.	Gert Kleinhans Chairman for Dutch Reformed Church Belfast 13 September 2019	The school will not be directly impacted by the road diversion; therefore, no direct danger is expected. Measures will be in place to ensure the safety of all road users and/or pedestrians. Mitigation measures will be implemented during the all the phases of the project to ensure the safety of both the surrounding land owners/users as well as the environment.	Draft Scoping Report
The MTPA has no objection to this proposal and support the preferred option, alternative 1 such as is indicated in your report in page 37, figure 8.	Mr. JJ Eksteen Manager Scientific Services Mpumalanga Tourism and Parks Agency 7 October 2019	Noted	Draft Scoping Report
The information from the Mpumalanga Biodiversity Sector Plan, Figure 1 Terrestrial biodiversity assessment and the figure 2 freshwater assessment indicates the Protected Area, the CBA irreplaceable areas and the ESA wetlands that must be avoided.	Mr. JJ Eksteen Manager Scientific Services Mpumalanga Tourism and Parks Agency 7 October 2019	The roads will not impede any of the wetlands and migration measures will be recommended to avoid disturbance as far as possible to adjacent wetlands.	Draft Scoping Report
The company responsible for the construction of the road diversion must be mindful of the numerous seepage areas and rainwater drainage lines. Prevention of siltation of the freshwater systems during construction is important.	Mr. JJ Eksteen Manager Scientific Services Mpumalanga Tourism and Parks Agency 7 October 2019	An extensive list of mitigation measures will be developed for the construction of the road, this will include the prevention of siltation.	Draft Scoping Report
Your cooperation will be appreciated.	Mr JJ Eksteen Manager Scientific Services Mpumalanga Tourism and Parks Agency 7 October 2019	Noted	Draft Scoping Report
From TRAC's side the planned diversion of the P15/1 Carolina road is problematic.	Mrs. Carla Davis Traffic Engineer Trans African Concession	The concerns specified are noted. Various steps have been taken to consult with the responsible	Draft Scoping Report

	9 October 2019	authority of the road. It is important to note that a detailed consultation process will be undertaken during the EIA Phase and a meeting can be scheduled to discuss the concerns. The draft documents will also provide more detail.	
We require consultation with the appointed design engineers and our engineers to discuss a suitable/ acceptable alternative route and access to the N4 Toll Route.	Mrs. Carla Davis Traffic Engineer Trans African Concession 9 October 2019		Draft Scoping Report
Kindly provide details of the road design consultants to enable further discussions with them on the alignment and access.	Mrs. Carla Davis Traffic Engineer Trans African Concession 9 October 2019		Draft Scoping Report
TRAC is the concessionaire appointed by SANRAL for the N4 Toll Road operations, maintenance and upgrading.	Mrs. Carla Davis Traffic Engineer Trans African Concession 9 October 2019		Draft Scoping Report
TRAC objects against the proposed deviation of the road as per the BID.	Mrs. Carla Davis Traffic Engineer Trans African Concession 9 October 2019		Draft Scoping Report
The route bypasses the existing Load Control Centre / lay-bye. The existing intersection already has safety issues due to the high number of coal trucks. We need to be consulted regarding a proposed alignment and improvements to the N4 intersection at Wonderfontein with Carolina Road.	Mrs. Carla Davis Traffic Engineer Trans African Concession 9 October 2019		Draft Scoping Report
This serves to inform you that the department is in support of the impact assessment phase.	Mr. TP Nyoni Head: Co-Operative Governance and Traditional Affairs 2 October 2019	Noted	Draft Scoping Report
The application must comply with all provision of the municipal Spatial Planning and Land Use	Mr. TP Nyoni	Noted	Draft Scoping Report

Management By-law and town planning scheme.	Head: Co-Operative Governance and Traditional Affairs 2 October 2019		
All other law that may be triggered by the proposed use must be complied with the relevant departments.	Mr. TP Nyoni Head: Co-Operative Governance and Traditional Affairs 2 October 2019	Noted	Draft Scoping Report
The applicant must take responsibility for engaging in interested and affected parties and that the application proceeds to a full Environmental Impact Assessment to expedite more accurate analysis and impact.	Mr. TP Nyoni Head: Co-Operative Governance and Traditional Affairs 2 October 2019	Noted	Draft Scoping Report
Kindly note that the above-mentioned road belongs to the department of Public Works, Roads and Transport.	Walter Mtshweni Deputy Manager: PMU Emakhazeni Local Municipality 10 Oct 2019	Further communications will follow between Department of Public Works, Roads and Transport and the applicant to resolve any queries.	Draft Scoping Report
The proposed project will affect SANRAL Roads. SANRAL should be contacted to discuss implications.	Ms Victoria Bota Environmental Coordinator SANRAL 16 Oct 2019	Meeting was scheduled.	Draft Scoping Report
The Department has evaluated the submitted SR and Plan of the study for environmental Impact Assessment and is satisfied that the documents comply with the minimum requirements of Appendix 2(2) of the National Environmental Management Act, 1998 (as amended) (NEMA) Environmental Impact Assessment (EIA) Regulations, 2014. The SR is hereby accepted by the Department in terms of Regulation 22(a) of the NEMA EIA Regulations, 2014.	Mrs. MC Mutengwe Department Mineral Resources Mine Environmental Management: Mpumalanga Region 7 Jan 2020	Noted	Final Scoping Report

You may proceed with the environmental impact assessment process in accordance with the task contemplated in the Plan of study for environmental Impact Assessment as required in terms of NEMA EIA Regulations, 2014.	Mrs. MC Mutengwe Department Mineral Resources Mine Environmental Management: Mpumalanga Region 7 Jan 2020	Noted	Final Scoping Report
Please ensure that comments from all relevant stakeholders are submitted to the Department with the Environmental Impact Assessment Report (EIAR). This includes but is not limited to the Provincial Heritage Authority, Department of Agriculture, Forestry and Fisheries (DAFF), Department of Water and Sanitation (DWS), Mpumalanga Parks Agency and the local Municipality. Proof of correspondence with the various stakeholders must be included in the EIAR.Should you be unable to obtain comments, proof of the attempts that were made to obtain comments should be submitted to the Department.	Mrs. MC Mutengwe Department Mineral Resources Mine Environmental Management: Mpumalanga Region 7 Jan 2020	All proof of submissions and comments received will be included in the Public Participation Report as annexures.	Final Scoping Report
It should be noted that the Department requires the following to be provided/included and form part of the final EIR and EMPr to be submitted: • Financial provision calculations must be provided for the proposed activities. • The plan to be submitted must depict the location and aerial extent of all proposed mining activities. • A map at an appropriate scale which superimposes the proposed activity and its associated structures and infrastructures on the environmental sensitivities of the preferred site indicating	Mrs. MC Mutengwe Department Mineral Resources Mine Environmental Management: Mpumalanga Region 7 Jan 2020	Noted	Final Scoping Report

any areas that should be avoided, including buffers. All maps must be visible in A3 with clear legend. • Public Participation Process must be transparent and all comments received during the process must be incorporated into the comments and response report of the final EIAR. • Traffic impact assessment study must be conducted and recommendation must be incorporated in the EIA/EMPr to be submitted. • Proof of correspondence with the various stakeholders must be included in the EIAR. Should you be unable to obtain comment, proof of the attempts that were made to obtain comments should be submitted to the Department. • All comments from interested and affected parties must be adequately addressed in the final environmental Impact Report. • Furthermore, it must be reiterated that, should an application for Environmental Authorisation be subjected to any permits or authorisations in terms of the provisions of any Specific Environmental Management Acts (SEMAs), proof of such application will be required. • Any other matters required in terms of Appendix 4 (3) and Appendix 4 (1) of the EIA Regulation 2014.			
The applicant is hereby reminded to comply with the requirements of regulation 3 of the EIA regulations, 2014 with regards to the time and	Mrs. MC Mutengwe Department Mineral Resources	Noted	Final Scoping Report

period allowed for complying with the requirements of the Regulations.	Mine Environmental Management: Mpumalanga Region 7 Jan 2020		
Please be ensured that the EIAR includes the A3 size locality map of the area and illustrates the exact location of the proposed development. The map must be of acceptable quality and as a minimum, have the following attributes, maps are related to one another, co-ordinates, legible legends, indicate alternative, scale and vegetation types of the study area.	Mrs. MC Mutengwe Department Mineral Resources Mine Environmental Management: Mpumalanga Region 7 Jan 2020	Noted	Final Scoping Report
Your attention is brought to Section 24F of the NEMA which stipulates "that no activity may commence prior to an environmental authorisation being granted by the competent authority".	Mrs. MC Mutengwe Department Mineral Resources Mine Environmental Management: Mpumalanga Region 7 Jan 2020	Noted	Final Scoping Report
The Traffic Impact Assessment was done in 2017, is that the final report?	Mrs. Carla Davis Traffic Engineer TRAC 12 Feb 2020	The report was done on Scoping Report Level. An updated study will be done during the EIA phase. Updated data and maps will be made available for comment during this phase.	Pre-EIA Phase
The intersection is dangerous and causes safety issues.	Mrs. Carla Davis Traffic Engineer TRAC 12 Feb 2020	Whether the alignment of the new road is done or not, it will not change traffic density. The diversion will not be the cause of accidents that happen at the current intersection. An upgrade needs to be done by SANRAL to address this.	Pre-EIA Phase
Concerns raised regarding the increase in traffic during the construction phase. Where will the trucks come from? What impact will it have on the N4?	Mrs. Carla Davis Traffic Engineer TRAC 12 Feb 2020	The impact the construction vehicles will have during construction phase is limited. Especially if compared to the trucks already using the road. This will be investigated and included in the EIA.	Pre-EIA Phase
How will the construction trucks access the new alignment?	Mrs. Carla Davis Traffic Engineer	The current road will still be in service during the construction phase. More information on routes and	Pre-EIA Phase

	TRAC 12 Feb 2020	what level of traffic construction will generate will be available in the EIA.	
Traffic from Carolina will be affected.	Mrs. Carla Davis Traffic Engineer TRAC 12 Feb 2020	The road construction will take place while the existing road is still in service, therefore impact on traffic will be limited.	Pre-EIA Phase
It was suggested that WSP make use of the Butterfly Intersection design. From a safety point of view, it will be the best option.	SANRAL 12 Feb 2020	This is already being implemented on other projects and will also be included in this design.	Pre-EIA Phase
It was unclear whether the diversion will be permanent or not.	SANRAL 12 Feb 2020	The road will be permanently diverted.	Pre-EIA Phase
It is not permitted to mine within 100m from a road.	SANRAL 12 Feb 2020	Original plans in the approved EMP did not include mining over the road. Therefore, the need to now apply for an Environmental Authorisation for the diversion.	Pre-EIA Phase
SANRAL would suggest a storage lane into the weighbridge from the Carolina direction.	SANRAL 12 Feb 2020	Our designs include double lanes to accommodate traffic that needs to turn. Usually our designs include a dedicated right turn lane.	Pre-EIA Phase
Existing road is a two-lane road and you will be building it as a four lane?	SANRAL 12 Feb 2020	The road leading to the weighbridge has already been doubled up. From this point up to the new proposed road it will also be double lanes.	Pre-EIA Phase
The P15-1 is a provincial road and SANRAL has no jurisdiction there. The N4 does fall under their jurisdiction and that will be where their interest lies.	SANRAL 12 Feb 2020	Noted	Pre-EIA Phase
A portion of land that the diversion will have an impact on will need to be bought from SANRAL and an alternative piece of land should be donated to them.	SANRAL 12 Feb 2020	Alternatives will be looked at on how the design can be adjusted to not impact on this piece of land.	Pre-EIA Phase
Updated plans must be circulated.	SANRAL 12 Feb 2020	Updated plans will be made available in the Draft EIA documentation but will be distributed to this meeting sooner if available.	Pre-EIA Phase
Concerns were raised about the impact on the weighbridge. The site/portion on which the	SANRAL 12 Feb 2020	Noted	Pre-EIA Phase

weighbridge is belongs to SANRAL. Therefore, SANRAL is also affected as a land owner.			
Is the realignment affecting the weighbridge side and will a portion of land belonging to SANRAL be affected?	SANRAL 12 Feb 2020	Dxf files can be provided to confirm the impacts. Final designs will be available in the EIA.	Pre-EIA Phase
Are you starting after the access of the weighbridge?	SANRAL 12 Feb 2020	Yes	Pre-EIA Phase
Need to confirm that the designs do not overlap on our property to the weighbridge side. Or that the realignment does not overlap on our road reserve.	SANRAL 12 Feb 2020	Final designs will be made available.	Pre-EIA Phase
If the re-alignment overlaps on our area of jurisdiction, it will need to be approved by SANRAL.	SANRAL 12 Feb 2020	Agreed	Pre-EIA Phase
How will you tie in with the current road without affecting the weighbridge during construction?	SANRAL 12 Feb 2020	Note that the current plans do not include upgrades recently done. The road was upgraded and widened so we do not foresee the diversion impacting on the weighbridge.	Pre-EIA Phase
Formal comments will be submitted during the comment period of the EIA phase.	SANRAL 12 Feb 2020	Noted	Pre-EIA Phase
Does your activity not require an amendment? Explain DMR Authorisations.	SANRAL 12 Feb 2020	The activity constitutes a new listed activity, as it was not previously applied for, therefore it cannot be an amendment and must be a new Environmental Authorisation Application.	Pre-EIA Phase
Concerns about mining companies that goes ahead with road constructions even though it was not agreed to by SANRAL or TRAC.	TRAC 12 Feb 2020	This meeting is to consult with all involved and to look at an option that all parties can agree on. SANRAL and TRAC will be notified of all available documents and future meetings for them to comment on and or attend.	Pre-EIA Phase
Is the decision to mine the road based on economics on the mines side?	SANRAL 12 Feb 2020	Yes	Pre-EIA Phase

13 DESCRIPTION OF ANY ASSUMPTIONS, UNCERTAINTIES AND GAPS IN KNOWLEDGE

13.1 Assumptions, Limitations and Uncertainties

According to the other specialists, the underlying assumptions used in their studies are sufficiently adequate.

13.1.1 Freshwater Ecological Impact Assessment

The following assumptions and limitations are applicable to this report:

- The determination of the watercourse boundaries and the assessment thereof, is confined to the watercourses associated within the zone of influence (32 m radius) of the proposed road diversion alternatives. All watercourses identified within 500 m of the proposed road diversion alternatives were delineated in fulfilment of GN509 as it relates to the National Water Act, 1998 (Act No. 36 of 1998) on a desktop level, however these watercourses were not assessed in detail. The general surroundings were considered in the desktop assessment of the proposed road diversion;
- The watercourse delineations as presented in the report are regarded as a best estimate, based on the site conditions present on the time of the assessment. The assessment was conducted in April 2019 (Autumn). Global Positioning Systems (GPS) technology is inherently inaccurate and some inaccuracies due to the use of the handheld GPS instrumentation may occur, if more accurate assessments are required, the watercourses will need to be surveyed and pegged according to the surveying principals;
- Freshwater and terrestrial zones create transitional areas where an ecotone is formed as vegetation species change from terrestrial to obligate/facultative species. Within this transitional zone, some variation of opinion on the watercourse boundary may occur. However, if the DWAF (2008) method is followed, all assessors should get largely similar results; and
- With the ecology being dynamic and complex, certain aspects (some of which may be important) may have been overlooked. It is, however, expected that the watercourses associated with the proposed development have been accurately assessed and considered, based on the field observations undertaken and the consideration of existing studies in terms of the freshwater ecology.

13.1.2 Soil, Land Capability and Land Use Assessment

The location and extent of the proposed study area was obtained from Jaco K via email in electronic format and was assessed accordingly.

13.1.3 Traffic Impact Assessment

The traffic impact assessment reflects information collected during the site survey and cannot predict all the traffic volumes that may be encountered. It should however be noted that the P15-1 is a provincial road and the design of the re-alignment corresponds with their requirements.

14 REASONED OPINION AS TO WHETHER THE PROPOSED ACTIVITY SHOULD OR SHOULD NOT BE AUTHORISED

14.1 Reasons why the Activity Should be Authorized or Not

This application should be authorised based on the following:

- The diversion of the P15-1 road will allow the north-eastern coal reserve to be mined out which will allow Wonderfontein Mine to continue meeting their contractual agreement with Eskom. This will ensure that Eskom continues generating the electricity that is used in South Africa.
- Temporary employment opportunities will be created during the construction phase.
- Diverting the road will result in future security of employment for Wonderfontein employees and contractors.
- All aspects have been closely considered and investments have been made to have top specialists working on the development of this project.
- Benefits will be derived from taxes and royalties that can be utilised by the South African Government.
- Impacts on the bio-physical and socio-economic environments can be limited with the effective implementation of the proposed mitigation measures summarized in the EMPr.
- Water management infrastructure was designed in line with the requirements of GN704, and if managed accordingly, a limited impact on the surface water resources can be expected.

The objective of the proposed development should be to establish and manage a balance between the benefits that will be created and the mitigation measures, management and compensation for the losses. If the authorities reviewing this report make an affirmative decision, then continuous management, monitoring and evaluation of the socio-economic and environmental impacts must be implemented to ensure the effectiveness of the mitigation measures and management strategies. Wonderfontein must also establish continuous communication channels with the affected parties through the proposed management plans.

14.2 Conditions that must be included in the authorisation

14.2.1 Specific conditions that need to be included in the compilation and approval of the EMPr

The EMPr for the Road Diversion Project was compiled from a holistic perspective. Management objectives, proposed mitigation measures, monitoring, reporting and auditing requirements have been included in the EMPr. Therefore, if this project is approved, it is important that the EMPr be implemented and approved.

An Environmental Control Officer (ECO) or Environmental Manager should also be actively involved throughout the lifespan of the project, especially during construction, to ensure that the EMPr is effectively implemented to keep the impacts of this project as low as possible.

14.2.2 Rehabilitation requirements

The EMPr contains management objectives, proposed mitigation measures, monitoring, reporting and auditing requirements that is relevant to the rehabilitation process that will take place once the construction phase has been completed. A Closure Plan will not be part of this project, as the diverted road is going to permanently replace the P15-1 road.

15 ASPECTS WHICH WERE CONDITIONAL TO THE FINDINGS OF THE ASSESSMENT

No conditional findings were made, it was however recommended that the mitigation measures are strictly implemented and that the surrounding wetland areas are avoided.

16 ANY DEVIATION FROM THE APPROVED STUDY REPORT

None identified.

17 PERIOD FOR WHICH THE ENVIRONMENTAL AUTHORISATION IS REQUIRED

The diversion of the P15-1 road will be on a permanent basis. The section of the road that is going to be diverted is going to be mined out and therefore the new proposed alternative route (Alternative 1) will replace the road currently crossing over the coal reserve.

18 FINANCIAL PROVISION

Refer to *Section 6* in the **EMPr** for details related to the financial provision for the Wonderfontein Road Diversion. The provision amounts to R998 091.26 including VAT.

19 OTHER INFORMATION REQUIRED BY THE COMPETENT AUTHORITY

19.1 Compliance with the Provisions of Sections 24(4)(a) and (b) Read with Section 24 (3) (a) and (7) of NEMA

19.1.1 Impact on the Socio-economic Conditions of any Directly Affected Person

Refer to **Section8.13** in this report.

19.1.2 Impact on any National Estate Referred to in Section 3(2) of the National Heritage Resources Act

Refer to **Section 8.10** in this report.

19.2 Other Matters Required in Terms of Sections 24(4)(a) and (b) of the Act

This report adheres to the requirements stipulated in the NEMA and the recently published EIA Regulations 2014. The NEMA Appendix 2 guidelines were used as framework.

20 UNDERTAKING

The EAP herewith confirms

a) the correctness of the information provided in the reports;☒

b) the inclusion of comments and inputs from stakeholders and I&APs;☒

c) the inclusion of inputs and recommendations from the specialist reports where relevant; ☒and

d) the acceptability of the project in relation to the finding of the assessment and level of mitigation proposed.☒

Jaco-K Consulting (Pty) Ltd
Company

13 March 2020
Date

Signature of EAP

21 REFERENCES

Department of Environmental Affairs, "Guideline on Need and Desirability," Integrated Environmental Management Guideline, Pretoria, 2017.

Emakhazeni Local Municipality, "*Emakhazeni Local Municipality 2018/2019 IDP,*" Nkangala District Municipality, Middelburg, 2018.

APelser Archaeological Consulting, 2013. *A Revision of Phase 1 HIA for the proposed Wonderfontein Colliery near Belfast in Mpumalanga.* Report No APAC013/33, February 2013.

Jaco-K Consulting, 2011. *Scoping Report for Wonderfontein Mine EMP Amendment, 30/5/1/2/2/359 MR.* Unpublished report done for Umsimbithi Mining (Pty) Ltd. Report No. JKC_0373, August 2014

Nkangala District Municipality, "*Nkangala District Municipality 2013/2014 Final Reviewed Integrated Development Plan,*" Nkangala District Municipality, Middelburg, 2013.

Rehab Green, 2019. *Soil, land capability, land use and hydropedology assessment of the proposed Wonderfontein Road Diversion servitude*. Report No. RG/2018/08/07/1, July 2019.

Scientific Aquatic Services, 2019. *Freshwater ecological assessment as part of the environmental assessment and authorisation as well as Water Use Licence Application process for the proposed Wonderfontein Road Diversion, Mpumalanga Province*. Report No. SAS 219006, April 2019.

Statistics South Africa. (2011). *Census 2011: Municipal factsheet.* Pretoria . Statistician-General: Pali Lehohla.

WSP. (2018). *Traffic Impact Assessment – Proposed realignment of road P15-1, Wonderfontein, Mpumalanga*. Report No. 22115, January 2018.

CV of EPJ Kleynhans

Personal Details

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Date of birth:	23 September 1963
Identify number:	630923 5073 086
Gender:	Male
Residential address:	15 A Frame Street Middelburg, 1050
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Contact number:	082 417 6901
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Academic qualification

B Eng (Hons): University of Pretoria, South Africa

Pr Eng 17 March 1994, registration number 940108

Jaco Kleynhans is a professional engineer, ECSA number 940108, and conducted environmental assessments over the past 15 years and were the environmental assessment practitioner (EAP) for more than 50 Environmental Impact Assessment (EIA) (including assessments done under the Mineral Petroleum Resources Development Act) projects and more than 40 Basic Assessment (BA) (or equivalent) projects during that period. A list of the projects is attached as Annexure 1 (EIAs) and Annexure 2 (BA)

His expertise include the following –

Project Management

Manage legal environmental authorisation processes for both green and brown coal mining projects. It includes initiating and managing all the environmental related specialist studies that need to be undertaken as well as the conceptual engineering requirements associated with such a project. Some 100 such projects were completed successfully over the last 15 years.

Mine Water Management

Assess water quality management strategy alternatives and recommend/motivate the preferred option to the decision makers and other I&APs. It includes activities related to water, water containing waste and waste.

Water Quality Management

Compile water use license applications for coal mines in the Mpumalanga Highveld. It includes the quantification and qualification of surface water impacts. This is then followed by integrating surface and groundwater impacts resulting in a qualitative and quantitative integrated water assessment. Outputs from such an assessment include integrated water and salt balances as well as an integrated water management plans. As part of these assessments water quality objectives are developed, set and motivated.

Environmental

Operational environmental management services are provided at a number of coal mines. It includes the implementation of the EMP commitments as well as conditions set in Water Use Licenses and Environmental authorisations. Monitoring and measurement of surface - , groundwater and dust are done, results interpreted and corrective actions proposed, implemented and monitored. EMP performance assessments and annual closure cost assessments are also conducted. Conducted 6 environmental due diligence assessments that include Optimum Colliery, Kleinkoppje Colliery, Ermelo, Springlake, Vuna Mining, Keaton Energy and Project Iniqua.

Environmental Impact Assessments

Since 2005 I was the appointed EAP for various environmental impact assessments and it includes mostly green field mining related projects. A number of basic assessments were also conducted during that period. Refer to Annexure 1 and 2.

Environmental Engineering

Develop conceptual design of pollution control measures, Mine Residue Deposit, and Water Supply Services.

Water related project the past 4 years

The following water related projects were conducted during the past four years: -

- Goedehoop water management system including detailed water balance determinations and management of the water use license requirements, client Muhanga Mines
- Vlaklaagte TNC water management and water balance determination, client Muhanga Mines
- KLX project water management and water balance calculations, client South32
- Pegasus Colliery water management and water balance calculations, client South32
- Welstand Colliery dewatering and mine optimization, client Mbuyelo Mining
- Vaalwater water management and water balance calculations, client Muhanga Mines
- VDDC Dewatering, client South32
- Elandspruit, client Wescoal

Current water related projects

- Langkloof water management measures to prevent impact on wetlands, client Muhanga Mines
- Welgemeend water management and water balance calculations, client Welgemeend Colliery
- Welstand water management, client Mbuyelo Mining
- Vlaklaagte water management and water balance calculations, client 2Seam
- Diversion of the Olifants River, client 2Seam
- OC6 water management and water balance calculations, client 2Seam
- Kebrafield water management and water balance calculations, client Mbuyelo Mining
- Ermelo Dump expansion water management and water balance, client Scinta Energy

- Project Z, water management and water balance, client Mwelase Mining.

Environmental liability assessments:

Environmental liability assessments to determine the financial provision of mines have been conducted since 1995. First for Douglas Colliery over a period of 7 years and then for Optimum Colliery for a period of 3 years.

Thereafter such assessments were made for BHP Billiton, South32, Glencore, Shanduka Coal, Umcebo Mining, Umsimbithi Mining, Muhanga Mines, Rietkuil, Mzimkhulu Mining, Rietvlei Mining and Wescoal Mining.

A development of a framework in terms of the new NEMA Financial Liability Assessment, Regulation No. R 1147 of 20 November 2015, was done for Glencore.

Annual rehabilitation plans, final rehabilitation and decommissioning and closure plans as well as risk reports were compiled for Glencore, Mwelase and Scinta Mining

Summary of Work Experience:

February 2008 – present	Jaco – K Consulting Middelburg South Africa
2005 – 2008	African EPA Consulting Engineers Pretoria, South Africa - Regional Engineer
1995 – 2005	Ingwe Collieries Environmental Manager at Douglas Colliery and Optimum Colliery
1987 – 1995	Department of Agriculture – Final position: Senior Engineer

Annexure 1: EIA's including EMPs compiled for mining rights applications

Proj No	Title	Role	Detail	Client
	African EPA			
A0467	Doornrug EMP	Writer	EMP for mining right application	Umcebo
A0678	Hendrina Power Station fines project	Writer	EIA for listed activities	M Blenkinsop
A0744	Khutala Colliery EMP amendment	Writer	Amendment of EMP for Section 102 application	South32
A1301	Klippan EMPR amendment	Writer	Amendment of EMP for Section 102 application	Umcebo
A1379	Koornfontein EMPR Amendment	Writer	Amendment of EMP for Section 102 application	Koornfontein Mines
A1169	Spitskop EMPR	Reviewer	EMP for mining right application	Msobo
	Jaco - K Consulting			
A0002	Wonderfontein EMPR	Writer	EMP for mining right application	Umsimbithi
A0003	Polmaise EMPR	Reviewer	EMP for mining right application	Carbon Development Corporation
A0005	Jikama EMPR	Writer	EMP for mining right application	Kleinfontein
A0009	Klippan EMPR	Writer	EMP for mining right application	Umcebo
A0012	Langkloof EMPR	Writer	EMP for mining right application	Muhanga
A0013	Naauwpoort EMPR	Writer	EMP for mining right application	Muhanga
A0035	Zonnebloem EIA	Reviewer	EMP for mining right application	Carbon Development Corporation
A0051	Goedehoop EIA	Writer	EMP for mining right application	Muhanga
A0057	Kleinfontein amendment	Writer	Amendment of EMP for Section 102 application	Kleinfontein
A0065	Klippan EMP Amendment	Writer	Amendment of EMP for Section 102 application	Umcebo
A0099	Emmerenthia	Writer	EMP for mining right application	Muhanga
A0134	Vlaklaagte EMP River	Writer	EMP for mining right application	Muhanga
A0155	OP Goedenhoop	Writer	EMP for mining right application	Muhanga
A0172	Khutala Block A EMP	Writer	Amendment of EMP for Section 102 application	South32
A0175	Springboklaagte EMP	Writer	EMP for mining right application	Shanduka
A0207	Wachtenbietjieskop EMP	Writer	EMP for mining right application	Muhanga
A0255	Moabsvelden EIA, EMP, WUL	Reviewer	EMP for mining right application	Neoshoe Trading
A0257	TNC Mine	Writer	EMP for mining right application	Koornfontein Mines
A0268	Vlaklaagte EMP Amendment	Writer	EMP for mining right application	Muhanga

Proj No	Title	Role	Detail	Client
A0271	KSA Extension	Writer	Amendment of EMP for Section 102 application	South32
A0318	Jikama NEMA	Writer	Environmental authorisation for mining right	Kleinfontein
A0322	Argent EIA EMP WUL	Reviewer	Environmental authorisation for mining right	Dialstat
A0352	OP Goedenhoop amendment	Reviewer	Amendment of EMP for Section 102 application	Muhanga
A0364	SBL EMP EIA	Writer	EMP for mining right application	Shanduka
A0377	Pegasus EIA and EMP	Writer	EMP for mining right application	South32
A0400	Spitzkop EIA NEMA	Reviewer	Environmental authorisation for mining right	Msobo
A0447	Wonderfontein EMP Amendment	Reviewer	Amendment of EMP for Section 102 application	Umsimbithi
A0451	Vaalwater EMP WUL	Writer	EMP for mining right application	Muhanga
A0471	Elandspruit EIA	Reviewer	Environmental authorisation for mining right	Wescoal
A0519	Pegasus EIA and EMP review	Writer	Environmental authorisation for mining right	South32
A0520	KLX EMP WULA	Reviewer	Environmental authorisation for mining right	South32
A0542	VDDC Dewatering	Writer	Environmental authorisation for mining right	South32
A0653	Khutala Water treatment EIA	Reviewer	Environmental authorisation for mining right	South32
A0655	Wildfontein EIA	Writer	EMP for mining right application	Shanduka
A0663	Townlands Amendment	Writer	Amendment of EMP for Section 102 application	Shanduka
A0727	Elandspruit Amendment	Reviewer	Amendment of EMP for Section 102 application	Wescoal
A0728	Welstand EMP Amendment WUL Designs	Reviewer	Amendment of EMP for Section 102 application	Mbuyelo
A0734	Wonderfontein EMP Amendment 2016	Writer	Amendment of EMP for Section 102 application	Umsimbithi
A0735	Langkloof EMP 2017 Amendment	Writer	Amendment of EMP for Section 102 application	Muhanga
A0752	Davel EA	Reviewer	Environmental authorisation for mining right	Scinta
A0832	WP Discard Dump	Reviewer	Environmental application EIAR and EMPr	Wescoal
A0835	Zondagsvlei EMP WUL	Reviewer	Environmental authorisation for mining right	Mwelase
A0843	Ermelo Dump EIA & WUL	Reviewer	Environmental application EIAR and EMPr	Scinta
A0917	2 Seam Block 6 WUL	Reviewer	Amendment of EA and EMP	Africoalsa
A0944	Kebrafield Area 1 WUL	Reviewer	Amendment of EA and EMP	Mbuyelo
A0946	Wonderfontein road EA	Reviewer	Environmental authorisation for road diversion	Umsimbithi
A0954	Lehlabile EMP & WUL	Reviewer	Environmental authorisation for mining right	Mwelase
A0961	Welgemeend EMP Amendment 2018	Reviewer	Amendment of EA and EMP	Mavungwani
A1015	Rietkuil	Reviewer	Amendment of EA and EMP	Mwelase

Annexure 2: BA including EMPs compiled for prospecting right applications

Proj No	Title	Role	Detail	Client
A0061	Baberton Paving	Reviewer	BA for listed activity	Leadal Property investments
A0071	Ermelo Basic assessment	Writer	BA for listed activity	South32
A0082	Koubad PP EMP	Writer	EMP for prospecting	Muhanga
A0086	Gemsbokfontein	Writer	EMP for prospecting	WERM Mining
A0087	Wildebeestfontein	Writer	EMP for prospecting	Amakhozi Mining and Engineering
A0088	Strehla	Writer	EMP for prospecting	Lehlabile Africa
A0089	Kaallaagte	Writer	EMP for prospecting	Amakhozi Mining and Engineering
A0090	Moderfotein	Writer	EMP for prospecting	Amakhozi Mining and Engineering
A0091	Goedehoop PP and EMP	Writer	EMP for prospecting	Amakhozi Mining and Engineering
A0092	Resurgam PP and EMP	Writer	EMP for prospecting	WERM Mining
A0097	Groenvlei PP	Writer	EMP for prospecting	Enolonkulu Investment
A0098	Enkeldoorn PP	Writer	EMP for prospecting	Muhanga
A0100	Moabsvelden	Writer	EMP for prospecting	Lehlabile Africa
A0102	Wildfontein PP	Writer	EMP for prospecting	Lehlabile Africa
A0105	Vlaklaagte PP	Writer	EMP for prospecting	WERM Mining
A0107	Brandkraal PP	Writer	EMP for prospecting	Belton Park
A0111	Klipfontein PP	Writer	EMP for prospecting	Belton Park
A0116	Tafelkoppies PP EMP	Writer	EMP for prospecting	New Order Investments
A0117	Uitkoms PP	Writer	EMP for prospecting	Exclusive Access Trading
A0118	Ploegschaar PP EMP	Writer	EMP for prospecting	Twin Cities Trading
A0121	Jakkalsdans PP EMP	Writer	EMP for prospecting	Muhanga
A0122	De Roodepoort EMP	Writer	EMP for prospecting	Muhanga
A0131	Bezuidenhoutshoek PP	Reviewer	EMP for prospecting	New Order Investments
A0146	Delmas Prospecting	Writer	EMP for prospecting	South32
A0165	G Strydom EMP	Writer	EMP for prospecting	Muhanga
A0166	Bankfontein EMP	Writer	EMP for prospecting	Muhanga
A0212	Leandra Prospecting EMP	Writer	EMP for prospecting	South32
A0225	Sheepmore PP EMP	Writer	EMP for prospecting	Optimum Mining and Exploration
A0290	Bankfontein & Roodepoort Exceed	Writer	EMP for prospecting	Exceed Resources

Proj No	Title	Role	Detail	Client
A0346	Leinster Prospecting EMP	Reviewer	EMP for prospecting	Shaking Earth
A0350	Kleinfontein crossing BA	Reviewer	BA for listed activity	Kleinfontein
A0365	Argent Power Line	Writer	BA for listed activity	Dialstat
A0382	TNC prospecting EMP	Writer	EMP for prospecting	Koornfotnein Mines
A0394	VDD road R575 NEMA	Reviewer	BA for listed activity	Shanduka
A0395	Argent water pipeline	Reviewer	BA for listed activity	Dialstat
A0440	Springlake EIA	Writer	BA for listed activity	Springlake
A0446	Wonderfontein BA	Writer	BA for listed activity	Umsimbithi
A0509	Emmerenthia Prospecting Ptn 1	Writer	EMP for prospecting	Muhanga
A0590	Mierhoop BA	Reviewer	EMP for prospecting	Genet Manganese
A0591	Lemoenkloof	Reviewer	EMP for prospecting	Genet Manganese
A0594	BA 559 Hay	Reviewer	EMP for prospecting	Genet Manganese
A0598	K Kop BA	Reviewer	EMP for prospecting	Genet Manganese
A0603	Zeekoebaart BA	Reviewer	EMP for prospecting	Genet Manganese
A0604	Sandham BA	Reviewer	EMP for prospecting	Genet Manganese
A0937	Heildelberg Prospecting BA	Reviewer	BA for listed activity	Mwelase
A0941	Wolvenbank PP BA	Reviewer	BA for listed activity	Mwelase

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WONDERFONTEIN, 428, 3 (REMAINING EXTENT) (MPUMALANGA)

GENERAL INFORMATION

Date Requested	2020/03/03 09:01
Deeds Office	MPUMALANGA
Information Source	WINDEED DATABASE
Reference	-

Activated SearchInsure Activated

PROPERTY INFORMATION

Property Type	FARM
Farm Name	WONDERFONTEIN
Farm Number	428
Portion Number	3 (REMAINING EXTENT)
Local Authority	HIGHLANDS LOCAL MUNICIPALITY
Registration Division	JS
Province	MPUMALANGA
Diagram Deed	T1176/892
Extent	327.6659H
Previous Description	-
LPI Code	T0JS00000000042800003

OWNER INFORMATION

Owner 1 of 1

Type	PRIVATE PERSON
Name	VAN VREDEN ANNA CATHARINA
ID / Reg. Number	3502050006008
Title Deed	T42810/1988
Registration Date	1988/07/07
Purchase Price (R)	0
Purchase Date	-
Share	0.00
Microfilm	2003 1191 0159
Multiple Properties	NO
Multiple Owners	NO

ENDORSEMENTS (4)

#	Document	Institution	Amount (R)	Microfilm
1	INFO FROM PRETORIA DEEDS REGIS	-	UNKNOWN	-
2	K6150/1991L	TOTAL SUID-AFRIKA PTY LTD	UNKNOWN	1992 0018 2591
3	K6148/1991L	TOTAL SUID-AFRIKA PTY LTD	UNKNOWN	1992 0018 2558
4	JS,428,3	-	UNKNOWN	1988 1079 0626

HISTORIC DOCUMENTS (1)

#	Document	Owner	Amount (R)	Microfilm
1	T40892/1948	VILJOEN MARTHINUS JOHANNES	UNKNOWN	1988 1415 0143

WinDeed Database Deeds Office Property

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WONDERFONTEIN, 428, 7 (REMAINING EXTENT) (MPUMALANGA)

GENERAL INFORMATION

Date Requested	2020/03/03 09:07
Deeds Office	MPUMALANGA
Information Source	WINDEED DATABASE
Reference	-

Activated SearchInsure Activated

PROPERTY INFORMATION

Property Type	FARM
Farm Name	WONDERFONTEIN
Farm Number	428
Portion Number	7 (REMAINING EXTENT)
Local Authority	HIGHLANDS LOCAL MUNICIPALITY
Registration Division	JS
Province	MPUMALANGA
Diagram Deed	T8604/1918
Extent	238.2347H
Previous Description	-
LPI Code	T0JS00000000042800007

OWNER INFORMATION

Owner 1 of 1

Type	COMPANY
Name	CORLOUIS BOERDERYE PTY LTD
ID / Reg. Number	199500739207
Title Deed	T486/2012
Registration Date	2012/01/20
Purchase Price (R)	10,603,000
Purchase Date	2011/11/14
Share	0.00
Microfilm	-
Multiple Properties	NO
Multiple Owners	NO

ENDORSEMENTS (4)

#	Document	Institution	Amount (R)	Microfilm
1	B4189/2015	LAND & AGRICULTURAL DEVELOPMENT BANK OF SOUTH AFRICA	10,000,000	-
2	JS,428,7	-	UNKNOWN	1988 1079 0631
3	B349/2012	FIRSTRAND BANK LTD	7,600,000	-
4	INFO FROM PRETORIA DEEDS REGIS	-	UNKNOWN	-

HISTORIC DOCUMENTS (5)

#	Document	Owner	Amount (R)	Microfilm
1	T6031/1982	WYK PETRUS CHRISTIAAN VAN	UNKNOWN	2003 0330 3556
2	T23346/2003	WYK DANIEL SALOMON VAN	1,506,146	2003 0330 3641
3	T23346/2003	WYK JOHANNA CATHARINA VAN	1,506,146	2003 0330 3641
4	T85972/1989	WYK PETRUS CHRISTIAAN VAN	-	2003 0330 3605
5	B15475/2003	-	1,506,146	2003 0330 3658

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WONDERFONTEIN, 428, 19 (MPUMALANGA)

GENERAL INFORMATION

Date Requested	2020/03/03 09:11
Deeds Office	MPUMALANGA
Information Source	WINDEED DATABASE
Reference	-

Activated SearchInsure Activated

PROPERTY INFORMATION

Property Type	FARM
Farm Name	WONDERFONTEIN
Farm Number	428
Portion Number	19
Local Authority	HIGHLANDS LOCAL MUNICIPALITY
Registration Division	JS
Province	MPUMALANGA
Diagram Deed	T40890/1948
Extent	319.6067H
Previous Description	-
LPI Code	T0JS00000000042800019

OWNER INFORMATION

Owner 1 of 1

Type	COMPANY
Name	CORLOUIS BOERDERYE PTY LTD
ID / Reg. Number	199500739207
Title Deed	T18505/2015
Registration Date	2015/12/18
Purchase Price (R)	22,000,000
Purchase Date	2015/09/17
Share	0.00
Microfilm	-
Multiple Properties	NO
Multiple Owners	NO

ENDORSEMENTS (4)

#	Document	Institution	Amount (R)	Microfilm
1	JS,428,19	-	UNKNOWN	1988 1079 0649
2	VA263/2014	HOOGGENOEG BOERDERY CC	UNKNOWN	-
3	INFO FROM PRETORIA DEEDS REGIS	-	UNKNOWN	-
4	B7760/2015	LAND & AGRICULTURAL DEVELOPMENT BANK OF SOUTH AFRICA	12,300,000	-

HISTORIC DOCUMENTS (9)

#	Document	Owner	Amount (R)	Microfilm
1	B17943/2003	-	UNKNOWN	2003 0370 4094
2	B19895/1999	-	UNKNOWN	2001 0517 3215
3	B230/2009	-	5,100,000	2009 0019 1209
4	B58/2015	-	5,000,000	-
5	B24031/1996	STANDARD BANK	380,000	2001 0517 3303
6	B33726/2001	-	UNKNOWN	2003 0370 4133
7	T11209/1979	HOOGGENOEG BOERDERY CC	0	2009 0019 1303
8	T11209/1979	HOOGGENOEG BOERDERY PTY LTD	0	2009 0019 1303
9	B12594/1979	-	UNKNOWN	2001 0517 3293

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WONDERFONTEIN, 428, 22 (MPUMALANGA)

GENERAL INFORMATION

Date Requested	2020/03/03 09:15
Deeds Office	MPUMALANGA
Information Source	WINDEED DATABASE
Reference	-

Activated SearchInsure Activated

PROPERTY INFORMATION

Property Type	FARM
Farm Name	WONDERFONTEIN
Farm Number	428
Portion Number	22
Local Authority	HIGHLANDS LOCAL MUNICIPALITY
Registration Division	JS
Province	MPUMALANGA
Diagram Deed	T11890/1951
Extent	238.2369H
Previous Description	-
LPI Code	T0JS00000000042800022

OWNER INFORMATION

Owner 1 of 1

Type	COMPANY
Name	CORLOUIS BOERDERYE PTY LTD
ID / Reg. Number	199500739207
Title Deed	T486/2012
Registration Date	2012/01/20
Purchase Price (R)	10,603,000
Purchase Date	2011/11/14
Share	0.00
Microfilm	-
Multiple Properties	NO
Multiple Owners	NO

ENDORSEMENTS (6)

#	Document	Institution	Amount (R)	Microfilm
1	K655/1982S	BREITENBACH ANNA CATHARINA	UNKNOWN	2001 0402 1763
2	VA2273/2001	-	UNKNOWN	2003 0701 0760
3	B349/2012	FIRSTRAND BANK LTD	7,600,000	-
4	INFO FROM PRETORIA DEEDS REGIS	-	UNKNOWN	-
5	JS,428,22	-	UNKNOWN	1988 1079 0654
6	B4189/2015	LAND & AGRICULTURAL DEVELOPMENT BANK OF SOUTH AFRICA	10,000,000	-

HISTORIC DOCUMENTS (6)

#	Document	Owner	Amount (R)	Microfilm
1	T8853/1982	STANDER JOHANNA MAGDALENA	UNKNOWN	1993 0063 2046
2	T23346/2003	WYK DANIEL SALOMON VAN	1,506,146	2003 0330 3641
3	T23346/2003	WYK JOHANNA CATHARINA VAN	1,506,146	2003 0330 3641
4	T1279/1993	WYK PETRUS CHRISTIAAN VAN	200,000	2003 0330 3544
5	T85972/1989	WYK PETRUS CHRISTIAAN VAN	-	2003 0330 3605
6	B15475/2003	-	1,506,146	2003 0330 3658

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WONDERFONTEIN, 428, 26 (MPUMALANGA)

GENERAL INFORMATION

Date Requested	2020/03/03 09:19
Deeds Office	MPUMALANGA
Information Source	WINDEED DATABASE
Reference	-

PROPERTY INFORMATION

Property Type	FARM
Farm Name	WONDERFONTEIN
Farm Number	428
Portion Number	26
Local Authority	HIGHLANDS LOCAL MUNICIPALITY
Registration Division	JS
Province	MPUMALANGA
Diagram Deed	T24556/1957
Extent	147.2373H
Previous Description	-
LPI Code	T0JS00000000042800026

OWNER INFORMATION

Owner 1 of 1

Type	COMPANY
Name	CORLOUIS BOERDERYE PTY LTD
ID / Reg. Number	199500739207
Title Deed	T486/2012
Registration Date	2012/01/20
Purchase Price (R)	10,603,000
Purchase Date	2011/11/14
Share	0.00
Microfilm	-
Multiple Properties	NO
Multiple Owners	NO

ENDORSEMENTS (4)

#	Document	Institution	Amount (R)	Microfilm
1	B4189/2015	LAND & AGRICULTURAL DEVELOPMENT BANK OF SOUTH AFRICA	10,000,000	-
2	JS,428,26	-	UNKNOWN	1988 1079 0659
3	B349/2012	FIRSTRAND BANK LTD	7,600,000	-
4	INFO FROM PRETORIA DEEDS REGIS	-	UNKNOWN	-

HISTORIC DOCUMENTS (6)

#	Document	Owner	Amount (R)	Microfilm
1	T29526/1985	WYK PETRUS CHRISTIAAN VAN	83,200	2003 0330 3550
2	T23346/2003	WYK DANIEL SALOMON VAN	1,506,146	2003 0330 3641
3	T23346/2003	WYK JOHANNA CATHARINA VAN	1,506,146	2003 0330 3641
4	T85972/1989	WYK PETRUS CHRISTIAAN VAN	-	2003 0330 3605
5	B15475/2003	-	1,506,146	2003 0330 3658
6	T4832/1971	TOMMY STEELE PTY LTD	UNKNOWN	1985 1047 0106

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WONDERFONTEIN, 428, 44 (MPUMALANGA)

GENERAL INFORMATION

Date Requested	2020/03/04 12:40
Deeds Office	MPUMALANGA
Information Source	WINDEED DATABASE
Reference	-

Activated SearchInsure Activated

PROPERTY INFORMATION

Property Type	FARM
Farm Name	WONDERFONTEIN
Farm Number	428
Portion Number	44
Local Authority	HIGHLANDS LOCAL MUNICIPALITY
Registration Division	JS
Province	MPUMALANGA
Diagram Deed	T146919/2004
Extent	2.4427H
Previous Description	-
LPI Code	T0JS00000000042800044

OWNER INFORMATION

Owner 1 of 1

Type	COMPANY
Name	SUID-AFRIKAANSE NASIONALE PADAGENTSKAP LTD
ID / Reg. Number	199800958406
Title Deed	T146919/2004
Registration Date	2004/10/20
Purchase Price (R)	60,000
Purchase Date	2001/10/15
Share	0.00
Microfilm	2004 1351 3207
Multiple Properties	NO
Multiple Owners	NO

ENDORSEMENTS (1)

#	Document	Institution	Amount (R)	Microfilm
1	INFO FROM PRETORIA DEEDS REGIS	-	UNKNOWN	-

HISTORIC DOCUMENTS

No documents to display

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WONDERFONTEIN, 428, 0 (REMAINING EXTENT) (MPUMALANGA)

GENERAL INFORMATION

Date Requested	2020/03/03 09:24
Deeds Office	MPUMALANGA
Information Source	WINDEED DATABASE
Reference	-

Activated SearchInsure Activated

PROPERTY INFORMATION

Property Type	FARM
Farm Name	WONDERFONTEIN
Farm Number	428
Portion Number	0 (REMAINING EXTENT)
Local Authority	HIGHLANDS LOCAL MUNICIPALITY
Registration Division	JS
Province	MPUMALANGA
Diagram Deed	T1371/1868
Extent	143.4671H
Previous Description	-
LPI Code	T0JS00000000042800000

OWNER INFORMATION

Owner 1 of 1

Type	TRUST
Name	JOHAN STEELE FAMILIE TRUST
ID / Reg. Number	10289/1996
Title Deed	T11252/2013
Registration Date	2013/10/25
Purchase Price (R)	0
Purchase Date	-
Share	0.00
Microfilm	-
Multiple Properties	NO
Multiple Owners	NO

ENDORSEMENTS (4)

#	Document	Institution	Amount (R)	Microfilm
1	K5769/2001RM	ANGLO OPERATIONS PTY LTD	UNKNOWN	2004 0774 1524
2	K2529/2004RM	STEELECOAL PTY LTD	UNKNOWN	2004 0774 1532
3	JS,428	-	UNKNOWN	1988 1079 0621
4	INFO FROM PRETORIA DEEDS REGIS	-	UNKNOWN	-

HISTORIC DOCUMENTS (8)

#	Document	Owner	Amount (R)	Microfilm
1	T39310/1995	BREYTENBACH FAMILIETRUST	159,300	2004 1351 3202
2	T22253/1950	BREYTENBACH JOHAN HENDRIK	UNKNOWN	1994 0976 4540
3	T73587/1994	BREYTENBACH THEONITA	ESTATE	1995 0588 3992
4	T6684/2012	UMSIMIBITHI MINING PTY LTD	13,995,707	-
5	T82831/2007	WYK DANIEL SALOMON VAN	406,000	-
6	T82831/2007	WYK DANIEL SOLOMON VAN	406,000	-
7	EX272/1998-T39310/95	-	UNKNOWN	-
8	B103045/2007	-	400,000	-

DISCLAIMER

No.	Question	Relevant regulations (Reference to footnotes in the Need and Desirability Document, 2017)	Considered (yes/no)	Comments
"SECURING ECOLOGICAL SUSTAINABLE DEVELOPMENT AND USE OF NATURAL RESOURCES"				
1.	How will this development (and its separate elements/aspects) impact on the ecological integrity of the area?[13]	[13]: *Section 24 of the Constitution states:* "24. Everyone has the right – (a) to an environment that is not harmful to their health or well-being; and (b) to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that – (i) prevent pollution and ecological degradation; (ii) promote conservation; and Page 23 of 177 Prepared by: In partnership with: (iii) secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development." *Section 2(4)(a)(vi) of NEMA:* "2(4)(a) Sustainable development requires the consideration of all relevant factors including the following: (vi) that the development, use and exploitation of renewable resources and the ecosystems of which they are part do not exceed the level beyond which their integrity is jeopardised;…"	**Yes**	The impacts of the development on the area was considered, but it should be noted that the area was already disturbed by current mining activities. The possible impacts on the ecology was evaluated in depth during the EIA phase based on the specialists' reports outcome.
1.1.	How were the following ecological integrity considerations taken into account?:		**Yes**	The ecological integrity is taken into account with the specialist studies.
1.1.1.	Threatened Ecosystems,[14]	[14]:"Must consider the latest information including the notice published on 9 December 2011 (Government Notice No. 1002 in Government Gazette No. 34809 of 9 December 2011 refers) listing threatened ecosystems in terms of Section 52 of National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004)."	**Yes**	The proposed road diversion is situated within the Mesic Highveld Grassland Group 4 Wetland Vegetation Type, considered Least Threatened.
1.1.2.	Sensitive, vulnerable, highly dynamic or stressed ecosystems, such as coastal shores, estuaries, wetlands, and similar systems	[15]: *Section 2(4)(r) of NEMA:*	**Yes**	Channeled Valley Bottoms, Depressions or Pans as well as Hillslope Seepage wetlands have been identified within the area. Measures were proposed by wetland

No.	Question	Relevant regulations (Reference to footnotes in the Need and Desirability Document, 2017)	Considered (yes/no)	Comments
	require specific attention in management and planning procedures, especially where they are subject to significant human resource usage and development pressure,[15]	"2(4)(r) Sensitive, vulnerable, highly dynamic or stressed ecosystems, such as coastal shores, estuaries, wetlands, and similar systems require specific attention in management and planning procedures, especially where they are subject to significant human resource usage and development pressure."		specialists to remediate/mitigate any impacts on the wetlands that may possibly result from the activities. Measures were already recommended in **Section 5** of the EMPr, which included proper surface water management measures.
1.1.3.	Critical Biodiversity Areas ("CBAs") and Ecological Support Areas ("ESAs"),		**Yes**	According to the wetland specialist report, both CBAs and ESAs exist in the area and it is suggested that their ecological condition needs to maintained and any loss or deterioration of these areas should be avoided.
1.1.4.	Conservation targets,		**Yes**	The area has already been modified to a large extent by historical activities. Mitigation measures were recommended in **Section 5** of the EMPr regarding endangered species. Specialist will also assess the area for environmental significant species.
1.1.5.	Ecological drivers of the ecosystem,		**Yes**	Specialists were appointed to assess the ecological drivers of the ecosystem. Their findings were included in the Draft EIA and EMPr reports that will be circulated to the public for comments.
1.1.6.	Environmental Management Framework,		**Yes**	The EMF and EMP of the Nkangala District Municipality aims at addressing, protecting and managing the following factors: • Avoiding loss of biodiversity, waste, pollution and degradation of the environment. • Protection of the environment as people's heritage. • Paying specific attention in management and planning procedures to the use of our natural resources and development pressure. The alternatives assessed in **Section 6** of the EIAR takes into account the locality alternatives, the most optimal route was selected based on the fact that the route did not run through any wetlands or Critical Biodiversity Areas; thus, preventing the loss of biodiversity and the protection of the environment. Management measures proposed in **Section 5** of the EMPr included pollution prevention measures and recycling initiatives will be implemented to reduce waste.

No.	Question	Relevant regulations (Reference to footnotes in the Need and Desirability Document, 2017)	Considered (yes/no)	Comments
1.1.7.	Spatial Development Framework, and		**Yes**	Spatial Development Framework document for the NDM was consulted.
1.1.8.	Global and international responsibilities relating to the environment (e.g. RAMSAR sites, Climate Change, etc.).[16]	16: *<u>Section 2(4)(n) of NEMA:</u>* "2(4)(n) Global and international responsibilities relating to the environment must be discharged in the national interest."	**Yes**	No RAMSAR sites were identified. Special precautions will be taken to ensure that air quality and surface water in the region is not severely impacted upon. Mitigation measures were proposed in **Section 5** of the EMPr.
1.2.	How will this development disturb or enhance ecosystems and/or result in the loss or protection of biological diversity? What measures were explored to firstly avoid these negative impacts, and where these negative impacts could not be avoided altogether, what measures were explored to minimise and remedy (including offsetting) the impacts? What measures were explored to enhance positive impacts?[17]	17: *<u>Section 24 of the Constitution and Sections 2(4)(a)(i) and 2(4)(b) of NEMA:</u>* Refer to Number 1 for Section 24 of the constitution. *<u>Section 2(4)(a)(i) of NEMA:</u>* "(4)(a) Sustainable development requires the consideration of all relevant factors including the following: (i) That the disturbance of ecosystems and loss of biological diversity are avoided, or, where they cannot be altogether avoided, are minimised and remedied;.." *<u>Section 2(4)(b) of NEMA:</u>* "2(4)(b) Environmental management must be integrated, acknowledging that all elements of the environment are linked and interrelated, and it must take into account the effects of decisions on all aspects of the environment and all people in the environment by pursuing the selection of the best practicable environmental option."	**Yes**	Impacts were identified in **Section 9** of the EIAR as well as potential mitigation measures (**Section 5** of the EMPr). Specialists' studies were consulted to provide a more detailed impact assessment and mitigation measures.
The Impact Mitigation Hierarchy				

No.	Question	Relevant regulations (Reference to footnotes in the Need and Desirability Document, 2017)	Considered (yes/no)	Comments
NEMA and the EIA Regulations call for a hierarchical approach to impact management. • ***Firstly,*** **alternatives must be investigated to avoid negative impacts altogether.** • ***Secondly*****, after it has been found that the negative impacts cannot be avoided, alternatives must be investigated to reduce (mitigate and manage) unavoidable negative impact.** • ***Thirdly*****, alternatives must be investigated to remediate (rehabilitate and restore).** • ***Fourthly,*** **unavoidable impact that remain after mitigation and remediation must be compensated for through investigating options to offset the negative impacts.** • **While** ***throughout*****, alternatives must be investigated to optimise positive impact.** **In this regard, the EIA regulations states that the purpose of the EIA regulation is "… to regulate the procedure and criteria as contemplated in Chapter 5 of the Act relating to the submission, processing and consideration of, and decision on, applications for environmental authorisations for the commencement of activities** ***in order to avoid detrimental impacts on the environment, or where it cannot be avoided, ensure mitigation and management of impacts to acceptable levels, and to optimise positive environmental impacts,*** **and for matters pertaining thereto."** **In terms of having to follow the impact mitigation hierarchical, it is not acceptable to not follow the hierarchy in terms of for instance not investigation alternatives to avoid negative impacts and simply investigation options to mitigate impacts.**				
1.3.	How will this development pollute and/or degrade the biophysical environment? What measures were explored to firstly avoid these impacts, and where impacts could not be avoided altogether, what measures were explored to minimise and remedy (including offsetting) the impacts? What measures were explored to enhance positive impacts?[18]	18: *Section 24 of the Constitution and Sections 2(4)(a)(ii) and 2(4)(b) of NEMA:* Refer to Number 1 for Section 24 of the constitution. Refer to Number 1.2 for Section 2(4)(b) of NEMA. *Section 2(4)(a)(ii) of NEMA:* "2(4)(a) Sustainable development requires the consideration of all relevant factors including the following: (ii) that pollution and degradation of the environment are avoided, or, where they cannot be altogether avoided, are minimised and remedied;.."	**Yes**	Refer to response in **Number 1.2** above.
1.4.	What waste will be generated by this development? What measures were explored to firstly avoid waste, and where waste could not be avoided altogether, what measures were explored to minimise, reuse and/or recycle the waste? What measures have been explored to safely treat and/or dispose of unavoidable waste?[19]	19: *Section 24 of the Constitution and Sections 2(4)(a)(iv) and 2(4)(b) of NEMA:* Refer to Number 1 for Section 24 of the constitution. Refer to Number 1.2 for Section 2(4)(b) of NEMA. *Section 2(4)(a)(iv) of NEMA:*	**Yes**	Discussed in **Section 7.10** of the EIAR.

No.	Question	Relevant regulations (Reference to footnotes in the Need and Desirability Document, 2017)	Considered (yes/no)	Comments
		"2(4)(a) Sustainable development requires the consideration of all relevant factors including the following: (iv) that waste is avoided, or where it cannot be altogether avoided, minimised and re-used or recycled where possible and otherwise disposed of in a responsible manner;…"		
1.5.	How will this development disturb or enhance landscapes and/or sites that constitute the nation's cultural heritage? What measures were explored to firstly avoid these impacts, and where impacts could not be avoided altogether, what measures were explored to minimise and remedy (including offsetting) the impacts? What measures were explored to enhance positive impacts?[20]	[20:] *<u>Section 24 of the Constitution and Sections 2(4)(a)(iii) and 2(4)(b) of NEMA:</u>* Refer to Number 1 for Section 24 of the constitution. Refer to Number 1.2 for Section 2(4)(b) of NEMA. *<u>Section 2(4)(a)(iii) of NEMA:</u>* "2(4)(a) Sustainable development requires the consideration of all relevant factors including the following: (iii) that the disturbance of landscapes and sites that constitute the nation's cultural heritage is avoided, or where it cannot be altogether avoided, is minimised and remedied;…"	**Yes**	The area has already been disturbed by agricultural activities and will have a minimal environmental impact when compared to other site alternatives.
1.6.	How will this development use and/or impact on non-renewable natural resources? What measures were explored to ensure responsible and equitable use of the resources? How have the consequences of the depletion of the non-renewable natural resources been considered? What measures were explored to firstly avoid these impacts, and where impacts could not be avoided altogether, what measures were explored to minimise and remedy (including offsetting) the impacts? What measures were explored to enhance positive impacts?[21]	[21:] *<u>Section 24 of the Constitution and Sections 2(4)(a)(v) and 2(4)(b) of NEMA:</u>* Refer to Number 1 for Section 24 of the constitution. Refer to Number 1.2 for Section 2(4)(b) of NEMA. *<u>Section 2(4)(a)(v) of NEMA:</u>* "2(4)(a) Sustainable development requires the consideration of all relevant factors including the following: (v) that the use and exploitation of non-renewable natural resources is responsible	**Yes**	There will be no use of non-renewable resources. The potential impacts on water was evaluated in **Section 9** and that included mitigation measures. A detailed surface water management plan will be developed.

No.	Question	Relevant regulations (Reference to footnotes in the Need and Desirability Document, 2017)	Considered (yes/no)	Comments
		and equitable, and takes into account the consequences of the depletion of the resource;…”		
1.7.	How will this development use and/or impact on renewable natural resources and the ecosystem of which they are part? Will the use of the resources and/or impact on the ecosystem jeopardise the integrity of the resource and/or system taking into account carrying capacity restrictions, limits of acceptable change, and thresholds? What measures were explored to firstly avoid the use of resources, or if avoidance is not possible, to minimise the use of resources? What measures were taken to ensure responsible and equitable use of the resources? What measures were explored to enhance positive impacts?[22]	[22:] *<u>Section 24 of the Constitution and Sections 2(4)(a)(vi) and 2(4)(b) of NEMA:</u>* Refer to Number 1 for Section 24 of the constitution. Refer to Number 1.2 for Section 2(4)(b) of NEMA. *<u>Section 2(4)(a)(vi) of NEMA:</u>* “2(4)(a) Sustainable development requires the consideration of all relevant factors including the following: (vi) that the development, use and exploitation of renewable resources and the ecosystems of which they are part do not exceed the level beyond which their integrity is jeopardised;..”	**Yes**	Not applicable.
1.7.1.	Does the proposed development exacerbate the increased dependency on increased use of resources to maintain economic growth or does it reduce resource dependency (i.e. de-materialised growth)? (note: sustainability requires that settlements reduce their ecological footprint by using less material and energy demands and reduce the amount of waste they generate, without compromising their quest to improve their quality of life)		**Yes**	Not applicable.
1.7.2.	Does the proposed use of natural resources constitute the best use thereof? Is the use justifiable when considering intra- and intergenerational equity, and are there more important priorities for which the resources should be used (i.e. what are the opportunity costs of using these resources this the proposed development alternative?)		**Yes**	Not applicable.
Intra- and inter-generational equity in the context of sustainability				

No.	Question	Relevant regulations (Reference to footnotes in the Need and Desirability Document, 2017)	Considered (yes/no)	Comments
The report by the World Commission on Environment and Development, Our Common Future, issued in 1987 (also referred to as the "Brundtland Report"), is widely regarded as the key point in the evolution of the concept of "sustainability" and "sustainable development". The Brundtland Report defined sustainable development as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (WCED, 1987). Two key concepts conveyed in this definition are the notion of "needs" with a particular focus on the disadvantaged portion of current societies, and the sense of limits on the ability of the environment to meet the needs of current and future generations. The Strategic Framework for Sustainable Development (SFSD) emphasises that South Africa's current development path in many respects are not sustainable in the long-term. It highlights that economic growth in South Africa is achieved by "consuming natural resources and degrading our habitat at accelerating rates with the inevitable consequence that future economic growth and development objectives will be prejudiced. " (DEAT 2007). Intra-generational equity also refers to equitable access to, or distribution of opportunities, resources, (positive and negative) impacts between individuals and between current societies. Inter-generational equity refers to the equitable distribution of opportunities, resources, (positive and negative) impacts between current and future societies. As such, the manner in which resources are used to address the needs of current societies, must not demise the options of future societies to experience the same opportunities.				
1.7.3.	Do the proposed location, type and scale of development promote a reduced dependency on resources?		**Yes.**	Resources on site will be utilised and recycling initiatives are proposed.
1.8.	How were a risk-averse and cautious approach applied in terms of ecological impacts?[23:]	[23:] *<u>Section 24 of the Constitution and Section 2(4)(a)(vii) of NEMA:</u>* Refer to Number 1 for Section 24 of the constitution. *<u>Section 2(4)(a)(vii) of NEMA:</u>* "2(4)(a) Sustainable development requires the consideration of all relevant factors including the following: (vii) that a risk-averse and cautious approach is applied, which takes into account the limits of current knowledge about the consequences of decisions and actions; and..."	**Yes**	Draft documents will be distributed to all organs of state for their inputs and recommendations. The most optimal mitigation measures will be considered. Mitigation measures were recommended in **Section 5** of the EMPr.
1.8.1.	What are the limits of current knowledge (note: the gaps, uncertainties and assumptions must be clearly stated)?		**Yes**	Refer to **Section 13** of the EIAR.
1.8.2.	What is the level of risk associated with the limits of current knowledge?		**Yes**	Not applicable.
1.8.3.	Based on the limits of knowledge and the level of risk, how and to what extent was a risk-averse and cautious approach applied to the development?		**Yes**	Not applicable.
A risk averse and cautious approach				
A risk averse and cautious approach (the precautionary principle) in the context of the protection of environmental rights is essentially about the assessment and management of risk. South Africa has given effect to the precautionary principle in the NEMA. The NEMA in section 2 contains a principle that development must be				

No.	Question	Relevant regulations (Reference to footnotes in the Need and Desirability Document, 2017)	Considered (yes/no)	Comments
socially, environmentally and economically sustainable, and requires the consideration of all relevant factors including that: "a risk-averse and cautious approach is applied, which takes into account the limits of current knowledge about the consequences of decisions and actions" Section 2(4)(a)(vii) of NEMA applies to any organ of state that takes a decision in terms of a statutory provision connected to the protection of the environment. It must apply a risk-averse and cautious approach that takes into account the limits of current knowledge about the consequences of decisions and actions. It appears that international jurisprudence is increasingly being persuaded to accept the precautionary principle as a means of dealing with scientific uncertainty in environmental disputes. The application of the precautionary principle and the associated need to take precautionary measures are triggered by the satisfaction of two conditions precedent or thresholds: • a threat of serious or irreversible environmental damage; and • scientific uncertainty as to the nature and scope of the threat of environmental damage. If either of the conditions is not met, then there will be no basis upon which the precautionary principle can operate.				
1.9.	How will the ecological impacts resulting from this development impact on people's environmental right in terms following[24:]	[24:] *Section 24 of the Constitution and Sections 2(4)(a)(viii) and 2(4)(b) of NEMA:* Refer to Number 1 for Section 24 of the constitution. Refer to Number 1.2 for Section 2(4)(b) of NEMA. *Section 2(4)(a)(viii) of NEMA:* "2(4)(a) Sustainable development requires the consideration of all relevant factors including the following: (viii) that negative impacts on the environment and on people's environmental rights be anticipated and prevented, and where they cannot be altogether prevented, are minimised and remedied."	**Yes**	Identified in **Section 9** of the EIAR.
1.9.1.	Negative impacts: e.g. access to resources, opportunity costs, loss of amenity (e.g. open space), air and water quality impacts, nuisance (noise, odour, etc.), health impacts, visual impacts, etc. What measures were taken to firstly avoid negative impacts, but if avoidance is not possible, to minimise, manage and remedy negative impacts?		**Yes**	Negative impacts were evaluated in **Section 9** of the EIAR and mitigation measures proposed (**Section 5** of the EMPr).
1.9.2.	Positive impacts: e.g. improved access to resources, improved amenity, improved air or water quality, etc. What measures were taken to enhance positive impacts?		**Yes**	Positive impacts were evaluated in **Section 9** of the EIAR and mitigation measures proposed (**Section 5** of the EMPr).
1.10.	Describe the linkages and dependencies between human wellbeing, livelihoods and ecosystem services applicable to the area in		**Yes**	Economic impacts include potential improvement of livelihoods and employment opportunities, as discussed in **Section 9** of the EIAR.

No.	Question	Relevant regulations (Reference to footnotes in the Need and Desirability Document, 2017)	Considered (yes/no)	Comments
	question and how the development's ecological impacts will result in socio-economic impacts (e.g. on livelihoods, loss of heritage site, opportunity costs, etc.)?			
1.11.	Based on all of the above, how will this development positively or negatively impact on ecological integrity objectives/targets/considerations of the area?		**Yes**	The development will positively contribute to the socio-economic conditions of the area and negative impacts will be limited.
1.12.	Considering the need to secure ecological integrity and a healthy biophysical environment, describe how the alternatives identified (in terms of all the different elements of the development and all the different impacts being proposed), resulted in the selection of the "best practicable environmental option" in terms of ecological considerations?[25]	[25]: *<u>Section 2(4)(b) of NEMA:</u>* Refer to Number 1.2 for Section 2(4)(b) of NEMA	**Yes**	Alternatives were discussed. The site is the most optimal choice in terms of ecological integrity. Refer to **Section 6** of the EIAR.
1.13.	Describe the positive and negative cumulative ecological/biophysical impacts bearing in mind the size, scale, scope and nature of the project in relation to its location and existing and other planned developments in the area?[26]	[26]: *<u>Regulations appendix1 3(1)(h)(vii) & 3(1)(j)(i) , appendix2 2(1)(h)(vii) and appendix3 3(1)(h)(vii) & 3(1)(j)(i) in Government Notice No. R. 982:</u>* *<u>Appendix 1 3(1)(h)(vii) & 3(1)(j)(i) in Government Notice No. R. 982:</u>* **APPENDIX 1** **BASIC ASSESSMENT REPORT** "3. Scope of assessment and content of basic assessment reports (1) A basic assessment report must contain the information that is necessary for the competent authority to consider and come to a decision on the application, and must include— (h) a full description of the process followed to reach the proposed preferred alternative within the site, including— (vii) positive and negative impacts that the proposed activity and alternatives will have on the environment and on the community that	**Yes**	Included in **Section 9.5** of the EIAR.

No.	Question	Relevant regulations (Reference to footnotes in the Need and Desirability Document, 2017)	Considered (yes/no)	Comments
		may be affected focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects; (j) an assessment of each identified potentially significant impact and risk, including— (i) cumulative impacts;..” *Appendix 2 2(1)(h)(vii) in Government Notice No. R. 982:* **APPENDIX 2** **SCOPING REPORT** “2. Content of the scoping report (1) A scoping report must contain the information that is necessary for a proper understanding of the process, informing all preferred alternatives, including location alternatives, the scope of the assessment, and the consultation process to be undertaken through the environmental impact assessment process, and must include— (h) a plan of study for undertaking the environmental impact assessment process to be undertaken, including— (vii) particulars of the public participation process that will be conducted during the environmental impact assessment process; and…” *Appendix 3 3(1)(h)(vii) & 3(1)(j)(i) in Government Notice No. R. 982:* **APPENDIX 3** **ENVIRONMENTAL IMPACT ASSESSMENT REPORT** “3. Scope of assessment and content of environmental impact assessment reports		

No.	Question	Relevant regulations (Reference to footnotes in the Need and Desirability Document, 2017)	Considered (yes/no)	Comments
		(1) An environmental impact assessment report must contain the information that is necessary for the competent authority to consider and come to a decision on the application, and must include— (h) a full description of the process followed to reach the proposed development footprint within the approved site as contemplated in the accepted scoping report, including: (vii) positive and negative impacts that the proposed activity and alternatives will have on the environment and on the community that may be affected focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects; (j) an assessment of each identified potentially significant impact and risk, including— (i) cumulative impacts;…”		
Cumulative effects				
In terms of the EIA Regulations “cumulative impact”, in relation to an activity, means the past, current and reasonably foreseeable future impact of an activity, considered together with the impact of activities associated with that activity, that in itself may not be significant, but may become significant when added to the existing and reasonable foreseeable impacts eventuating from similar or diverse activities. Cumulative effects can be: Additive: the simple sum of all the effects (e.g. fertilizer inputs to a river from farms in the catchment); Synergistic: effects interact to produce a total effect greater than the sum of individual effects. These effects often happen as habitats or resources approach capacity (e.g. fragmentation of habitat for a species can have limited effect until additional fragmentation makes areas too small to support that species at all); Time crowding: frequent, repetitive impacts on a particular resource at the same time (e.g. small-scale mining within a particular ecosystem). Neutralizing: where effects may counteract each other to reduce the overall effect (e.g. infilling of a wetland for road construction, and creation of new wetlands for water treatment). Space crowding: high spatial density of impacts on an ecosystem (e.g. rapid expansion of urban sprawl). Crucial to the identification of cumulative implications of an activity or project, is to have an understanding of the context within which the impact will occur. For example, if the context (goal/vision) for an area is to protect its agricultural land use potential and its associated landscape character, the anticipated cumulative implications associated with the establishment of an industrial plant will be significant.				
“PROMOTING JUSTIFIABLE ECONOMIC AND SOCIAL DEVELOPMENT”				
2.1.	What is the socio-economic context of the area, based on, amongst other considerations, the following considerations?:		**Yes**	The socio-economic conditions of the area was discussed in detail in **Section 8.13** of the EIAR.
2.1.1.	The IDP (and its sector plans’ vision, objectives, strategies, indicators and targets)		**Yes**	Strategic Objective of IDP:

No.	Question	Relevant regulations (Reference to footnotes in the Need and Desirability Document, 2017)	Considered (yes/no)	Comments
	and any other strategic plans, frameworks of policies applicable to the area,			"To coordinate efforts to address unemployment and poverty." The LED strategy seeks to address economic growth and job creation within the municipality through engaging in number of initiatives that will sustain and enhance the economic growth of the municipality. The LED strategy however needs to be revised owing to some changes that took place in the economic environment. The project will aid in addressing poverty and unemployment. The Social and Labour Plan will have LED initiatives.
2.1.2.	Spatial priorities and desired spatial patterns (e.g. need for integrated of segregated communities, need to upgrade informal settlements, need for densification, etc.),		**Yes**	
2.1.3.	Spatial characteristics (e.g. existing land uses, planned land uses, cultural landscapes, etc.), and		**Yes**	A small area of agricultural land uses will be impacted by the road diversion. The most optimal site was selected based on wetlands and existing activities.
2.1.4.	Municipal Economic Development Strategy ("LED Strategy").		**Yes**	Refer to **Number 2.1.1.**
2.2.	Considering the socio-economic context, what will the socio-economic impacts be of the development (and its separate elements/aspects), and specifically also on the socio-economic objectives of the area?		**Yes**	Refer to **Sections 8** and **9** of the EIAR as well as **Section 5** of the EMPr.
2.2.1.	Will the development complement the local socio-economic initiatives (such as local economic development (LED) initiatives), or skills development programs?		**Yes**	The development will complement socio-economic initiatives and LED initiatives. A SLP was developed. Employment opportunities, supporting SMME's of the community and community development all forms part of SLP.
2.3.	How will this development address the specific physical, psychological, developmental, cultural and social needs and interests of the relevant communities?[28]	[28]: *Section 2(2) of NEMA:* "(2) Environmental management must place people and their needs at the forefront of its concern, and serve their physical, psychological, developmental, cultural and social interests equitably."	**Yes**	Local employment will be sourced where possible during the construction of the road. Refer to **Section 8** for the economic conditions.
2.4.	Will the development result in equitable (intra- and inter-generational) impact distribution, in the short- and long-term?[29] Will the impact be socially and economically sustainable in the short- and long-term?	[29]: *Sections 2(2) and 2(4)(c) of NEMA:* Refer to Number 2.3 for Section 2(2) of NEMA. *Sections 2(4)(c) of NEMA:*	**Yes**	The road is a short term project and will not impact the economy of the area.

No.	Question	Relevant regulations (Reference to footnotes in the Need and Desirability Document, 2017)	Considered (yes/no)	Comments
		2(4)(c) Environmental justice must be pursued so that adverse environmental impacts shall not be distributed in such a manner as to unfairly discriminate against any person, particularly vulnerable and disadvantaged persons."		
2.5.	In terms of location, describe how the placement of the proposed development will[30:]	[30:] <u>*Section 3 of the Development Facilitation Act, 1995 (Act No. 67 of 1995) ("DFA") and the National Development Plan:*</u> The Development Facilitation Act, 1995 (Act No. 67 of 1995) has been repealed by the Spatial Planning and Land Use Management Act 16 of 2013. "The National Development Plan 2030 Executive Summary (NDP) notes 10 critical actions on the road to success for South Africa. They are: i. A social compact to reduce poverty and inequality, and raise employment and investment. ii. A strategy to address poverty and its impacts by broadening access to employment, strengthening the social wage, improving public transport and raising rural incomes. iii. Steps by the state to professionalise the public service, strengthen accountability, improve coordination and prosecute corruption. iv. Boost private investment in labour-intensive areas, competitiveness and exports, with adjustments to lower the risk of hiring younger workers. v. An education accountability chain, with lines of responsibility from state to classroom. vi. Phase in national health insurance, with a focus on upgrading public health facilities, producing more health professionals and reducing the relative cost of private health care. vii. Public infrastructure investment at 10 percent of gross domestic product (GDP),	**Yes**	Alternatives were considered in **Section 6** of the EIAR**.**

No.	Question	Relevant regulations (Reference to footnotes in the Need and Desirability Document, 2017)	Considered (yes/no)	Comments
		financed through tariffs, public-private partnerships, taxes and loans and focused on transport, energy and water. viii. Interventions to ensure environmental sustainability and resilience to future shocks ix. New spatial norms and standards – densifying cities, improving transport, locating jobs where people live, upgrading informal settlements and fixing housing market gaps. x. Reduce crime by strengthening criminal justice and improving community environments."		
2.5.1.	result in the creation of residential and employment opportunities in close proximity to or integrated with each other,		**Yes**	The temporary construction employment will be sourced from the local communities where possible.
2.5.2.	reduce the need for transport of people and goods,		**Yes**	Project will not reduce these needs.
2.5.3.	result in access to public transport or enable non-motorised and pedestrian transport (e.g. will the development result in densification and the achievement of thresholds in terms public transport),		**Yes**	Project will not result in this.
2.5.4.	compliment other uses in the area,		**Yes**	An extensive road network exists in the area.
2.5.5.	be in line with the planning for the area,		**Yes**	The road will merely be constructed as a partial diversion of the existing road. Minimal footprint disturbance is expected.
2.5.6.	for urban related development, make use of underutilised land available with the urban edge,		**Yes**	Not applicable.
2.5.7.	optimise the use of existing resources and infrastructure,		**Yes**	The existing resources and infrastructure on site will be utlised as far as possible. Refer to **Section 7** of the EIAR.
2.5.8.	opportunity costs in terms of bulk infrastructure expansions in non-priority areas (e.g. not aligned with the bulk infrastructure planning for the settlement that reflects the spatial reconstruction priorities of the settlement),		**Yes**	Not applicable.
2.5.9.	discourage "urban sprawl" and contribute to compaction/densification,		**Yes**	The aim of the project is to encourage opportunities for the local communities.
2.5.10.	contribute to the correction of the historically distorted spatial patterns of settlements and to		**Yes**	Only the road and associated structures will be developed.

No.	Question	Relevant regulations (Reference to footnotes in the Need and Desirability Document, 2017)	Considered (yes/no)	Comments
	the optimum use of existing infrastructure in excess of current needs,			
2.5.11.	encourage environmentally sustainable land development practices and processes,		**Yes**	All the relevant documents including the Scoping Report, EIAR, EMPr and IWWMP focus of sustainable usage and development.
2.5.12.	take into account special locational factors that might favour the specific location (e.g. the location of a strategic mineral resource, access to the port, access to rail, etc.),		**Yes**	All the factors were considered in **Sections 6** and **7** of the EIAR.
2.5.13.	the investment in the settlement or area in question will generate the highest socio-economic returns (i.e. an area with high economic potential),		**Yes**	Even though the road construction will create temporary employment, it will prevent the sterilization of coal, thus having economic benefits for the mine and the employees.
2.5.14.	impact on the sense of history, sense of place and heritage of the area and the socio-cultural and cultural-historic characteristics and sensitivities of the area, and		**Yes**	Refer to **Section 9** of the Scoping Report.
2.5.15.	in terms of the nature, scale and location of the development promote or act as a catalyst to create a more integrated settlement?		**Yes**	The road is located in the vicinity of Carolina.
2.6.	How were a risk-averse and cautious approach applied in terms of socio-economic impacts?[31:]	[31:] *<u>Section 2(4)(a)(vii) of NEMA:</u>* "2(4)(a) Sustainable development requires the consideration of all relevant factors including the following: (vii) that a risk-averse and cautious approach is applied, which takes into account the limits of current knowledge about the consequences of decisions and actions; and…"	**Yes**	Refer to **Section 9.4.4** of the EIAR.
2.6.1.	What are the limits of current knowledge (note: the gaps, uncertainties and assumptions must be clearly stated)?[32]	[32:] *<u>Section 24(4) of NEMA:</u>* "24(4) Procedures for the investigation, assessment and communication of the potential consequences or impacts of activities on the environment – (a) must ensure, with respect to every application for an environmental authorisation— (i) coordination and cooperation between organs of state in the consideration of	**Yes**	To date, none was identified. Specialist reports were thoroughly incorporated into the Draft EIAR and EMPr.

No.	Question	Relevant regulations (Reference to footnotes in the Need and Desirability Document, 2017)	Considered (yes/no)	Comments
		assessments where an activity falls under the jurisdiction of more than one organ of state; (ii) that the findings and recommendations flowing from an investigation, the general objectives of integrated environmental management laid down in this Act and the principles of environmental management set out in section 2 are taken into account in any decision made by an organ of state in relation to any proposed policy, programme, process, plan or project; (iii) that a description of the environment likely to be significantly affected by the proposed activity is contained in such application; (iv) investigation of the potential consequences for or impacts on the environment of the activity and assessment of the significance of those potential consequences or impacts; and (v) public information and participation procedures which provide all interested and affected parties, including all organs of state in all spheres of government that may have jurisdiction over any aspect of the activity, with a reasonable opportunity to participate in those information and participation procedures; and (b) must include, with respect to every application for an environmental authorisation and where applicable— (i) investigation of the potential consequences or impacts of the alternatives to the activity on the environment and assessment of the significance of those potential consequences or impacts, including the option of not implementing the activity; (ii) investigation of mitigation measures to keep adverse consequences or impacts to a minimum; (iii) investigation, assessment and evaluation of the impact of any proposed listed or specified activity on any national estate referred to in section 3(2) of the National Heritage		

No.	Question	Relevant regulations (Reference to footnotes in the Need and Desirability Document, 2017)	Considered (yes/no)	Comments
		Resources Act, 1999 (Act No. 25 of 1999), excluding the national estate contemplated in section 3(2)(i)(vi) and (vii) of that Act; (iv) reporting on gaps in knowledge, the adequacy of predictive methods and underlying assumptions, and uncertainties encountered in compiling the required information; (v) investigation and formulation of arrangements for the monitoring and management of consequences for or impacts on the environment, and the assessment of the effectiveness of such arrangements after their implementation; (vi) consideration of environmental attributes identified in the compilation of information and maps contemplated in subsection (3); and (vii) provision for the adherence to requirements that are prescribed in a specific environmental management Act relevant to the listed or specified activity in question. (4A) Where environmental impact assessment has been identified as the environmental instrument to be utilised in informing an application for environmental authorisation, subsection (4)(b) is applicable."		
2.6.2.	What is the level of risk (note: related to inequality, social fabric, livelihoods, vulnerable communities, critical resources, economic vulnerability and sustainability) associated with the limits of current knowledge?		**Yes**	Not applicable.
2.6.3.	Based on the limits of knowledge and the level of risk, how and to what extent was a risk-averse and cautious approach applied to the development?		**Yes**	Not applicable.
2.7.	How will the socio-economic impacts resulting from this development impact on people's environmental right in terms following:			
2.7.1.	Negative impacts: e.g. health (e.g. HIV-Aids), safety, social ills, etc. What measures were taken to firstly avoid negative impacts, but if		**Yes**	Refer to **Section 9.4.4** of the EIAR.

No.	Question	Relevant regulations (Reference to footnotes in the Need and Desirability Document, 2017)	Considered (yes/no)	Comments
	avoidance is not possible, to minimise, manage and remedy negative impacts?			
2.7.2.	Positive impacts. What measures were taken to enhance positive impacts?		**Yes**	Refer to **Section 9.4.4** of the EIAR.
2.8.	Considering the linkages and dependencies between human wellbeing, livelihoods and ecosystem services, describe the linkages and dependencies applicable to the area in question and how the development's socio-economic impacts will result in ecological impacts (e.g. over utilisation of natural resources, etc.)?		**Yes**	This was considered.
2.9.	What measures were taken to pursue the selection of the "best practicable environmental option" in terms of socio-economic considerations?[33]	[33]: *<u>Section 2(4)(b) of NEMA:</u>* Refer to Number 1.2 for Section 2(4)(b) of NEMA.	**Yes**	Refer to **Section 5** of the EMPr.
2.10.	What measures were taken to pursue environmental justice so that adverse environmental impacts shall not be distributed in such a manner as to unfairly discriminate against any person, particularly vulnerable and disadvantaged persons (who are the beneficiaries and is the development located appropriately)?[34] Considering the need for social equity and justice, do the alternatives identified, allow the "best practicable environmental option" to be selected, or is there a need for other alternatives to be considered?	[34]: *<u>Section 2(4)(c) of NEMA:</u>* "2(4)(c) Environmental justice must be pursued so that adverse environmental impacts shall not be distributed in such a manner as to unfairly discriminate against any person, particularly vulnerable and disadvantaged persons."	**Yes**	Refer to **Section 5** of the EMPr.
2.11.	What measures were taken to pursue equitable access to environmental resources, benefits and services to meet basic human needs and ensure human wellbeing, and what special measures were taken to ensure access thereto by categories of persons disadvantaged by unfair discrimination?[35]	[35]: *<u>Section 2(4)(d) of NEMA:</u>* "2(4)(d) Equitable access to environmental resources, benefits and services to meet basic human needs and ensure human well-being must be pursued and special measures may be taken to ensure access thereto by categories of persons disadvantaged by unfair discrimination."	**Yes**	SLP will address social issues such as discrimination.
2.12.	What measures were taken to ensure that the responsibility for the environmental health and safety consequences of the development has	[36]: *<u>Section 2(4)(e) of NEMA:</u>* "2(4)(e) Responsibility for the environmental health and safety consequences of a policy,	**Yes**	EIAR and EMPr addressed all the measures required as well as the financial provision required for the project.

No.	Question	Relevant regulations (Reference to footnotes in the Need and Desirability Document, 2017)	Considered (yes/no)	Comments
	been addressed throughout the development's life cycle?[36]	programme, project, product, process, service or activity exists throughout its life cycle."		
2.13.	What measures were taken to:			
2.13.1.	ensure the participation of all interested and affected parties,		**Yes**	Public participation process was initiated. Community and adjacent landowners were consulted. All the draft reports will be made available for comment**.**
2.13.2.	provide all people with an opportunity to develop the understanding, skills and capacity necessary for achieving equitable and effective participation,[37]	[37:] *<u>Section 2(4)(f) of NEMA:</u>* "2(4)(f) The participation of all interested and affected parties in environmental governance must be promoted, and all people must have the opportunity to develop the understanding, skills and capacity necessary for achieving equitable and effective participation, and participation by vulnerable and disadvantaged persons must be ensured."	**Yes**	Community representatives will be engaged with. Documents will be delivered in English (universal language) to the communities' libraries.
2.13.3.	ensure participation by vulnerable and disadvantaged persons,[38]	[38:] *<u>Section 2(4)(f) of NEMA:</u>* Refer to Number 2.13.2 for Section 2(4)(f) of NEMA.	**Yes**	Community representatives will be engaged with. Documents will be delivered in English (universal language) to the communities' libraries. Public meeting will be held with communities.
2.13.4.	promote community wellbeing and empowerment through environmental education, the raising of environmental awareness, the sharing of knowledge and experience and other appropriate means,[39]	[39:] *<u>Section 2(4)(h) of NEMA:</u>* "2(4)(h) Community wellbeing and empowerment must be promoted through environmental education, the raising of environmental awareness, the sharing of knowledge and experience and other appropriate means."	**Yes**	Wonderfontein Mine will consider projects that include environmental education.
2.13.5.	ensure openness and transparency, and access to information in terms of the process,[40]	[40:] *<u>Section 2(4)(k) of NEMA:</u>* "2(4)(k) Decisions must be taken in an open and transparent manner, and access to information must be provided in accordance with the law"	**Yes**	Public Participation Process will be followed accordingly.
2.13.6.	ensure that the interests, needs and values of all interested and affected parties were taken into account, and that adequate recognition were given to all forms of knowledge, including traditional and ordinary knowledge,[41] and	[41:] *<u>Section 2(4)(g) of NEMA:</u>* "2(4)(g) Decisions must take into account the interests, needs and values of all interested and affected parties, and this includes recognising all forms of knowledge, including traditional and ordinary knowledge."	**Yes**	Public Participation Process will be followed accordingly.
2.13.7.	ensure that the vital role of women and youth in environmental management and development	[42:] *<u>Section 2(4)(q) of NEMA:</u>*	**Yes**	Involve all I&AP's.

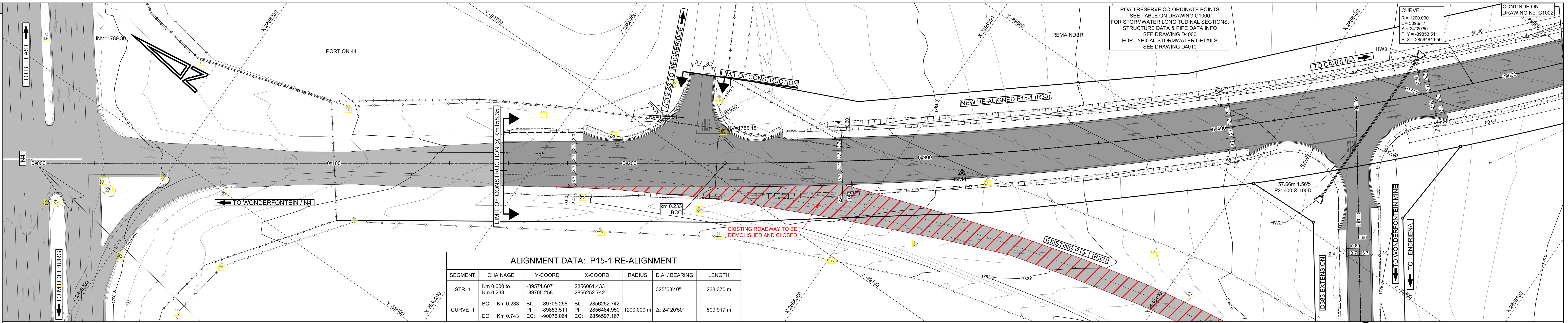
No.	Question	Relevant regulations (Reference to footnotes in the Need and Desirability Document, 2017)	Considered (yes/no)	Comments
	were recognised and their full participation therein were be promoted?[42]	"2(4)(q) The vital role of women and youth in environmental management and development must be recognised and their full participation therein must be promoted."		
2.14.	Considering the interests, needs and values of all the interested and affected parties, describe how the development will allow for opportunities for all the segments of the community (e.g.. a mixture of low-, middle-, and high-income housing opportunities) that is consistent with the priority needs of the local area (or that is proportional to the needs of an area)?[43]	[43]: *Section 2(4)(g) of NEMA:* Refer to Number 2.13.5 for Section 2(4)(g) of NEMA.	**Yes**	Part of SLP. Comments and concerns will be addressed in documents.
2.15.	What measures have been taken to ensure that current and/or future workers will be informed of work that potentially might be harmful to human health or the environment or of dangers associated with the work, and what measures have been taken to ensure that the right of workers to refuse such work will be respected and protected?[44]	[44]: *Section 2(4)(j) of NEMA:* "2(4)(j) The right of workers to refuse work that is harmful to human health or the environment and to be informed of dangers must be respected and protected."	**Yes**	Part of SLP.
2.16.	Describe how the development will impact on job creation in terms of, amongst other aspects:			
2.16.1.	the number of temporary versus permanent jobs that will be created,		**Yes**	Part of SLP.
2.16.2.	whether the labour available in the area will be able to take up the job opportunities (i.e. do the required skills match the skills available in the area),		**Yes**	Part of SLP. It is important to note that the mine is fully operational.
2.16.3.	the distance from where labourers will have to travel,		**Yes**	Belfast is located 20 km away from Wonderfontein Mine. The majority of the workers reside in the surrounding towns including Belfast and Carolina.
2.16.4.	the location of jobs opportunities versus the location of impacts (i.e. equitable distribution of costs and benefits), and		**Yes**	Part of SLP.
2.16.5.	the opportunity costs in terms of job creation (e.g. a mine might create 100 jobs, but impact on 1000 agricultural jobs, etc.).		**Yes**	No agricultural jobs will be impacted by the Road Diversion Project.
2.17.	What measures were taken to ensure:			

No.	Question	Relevant regulations (Reference to footnotes in the Need and Desirability Document, 2017)	Considered (yes/no)	Comments
2.17.1.	that there were intergovernmental coordination and harmonisation of policies, legislation and actions relating to the environment, and		**Yes**	Legislation was considered thoroughly and engagement with Departments will be continuous throughout the process.
2.17.2.	that actual or potential conflicts of interest between organs of state were resolved through conflict resolution procedures?		**Yes**	Continuous engagement with organs of state will prevent possible conflicts**.**
2.18.	What measures were taken to ensure that the environment will be held in public trust for the people, that the beneficial use of environmental resources will serve the public interest, and that the environment will be protected as the people's common heritage?[45]	[45]: *Section 2(4)(o) of NEMA:* "2(4)(o) The environment is held in public trust for the people, the beneficial use of environmental resources must serve the public interest and the environment must be protected as the people's common heritage."	**Yes**	Engagement will all I&AP's. Measures recommended in **Section 5** of the EMPr will be implemented.
2.19.	Are the mitigation measures proposed realistic and what long-term environmental legacy and managed burden will be left? [46]	[46]: *Section 24O(1)(b)(iii) of NEMA and the National Development Plan:* Refer to Number 2.5 for the National Development Plan. *Section 24O(1)(b)(iii) of NEMA:* "24O. Criteria to be taken into account by competent authorities when considering applications (1) If the Minister, the Minister responsible for mineral resources or an MEC considers an application for an environmental authorisation, the Minister, Minister responsible for mineral resources or MEC must— (b) take into account all relevant factors, which may include— (iii) the ability of the applicant to implement mitigation measures and to comply with any conditions subject to which the application may be granted;.."	**Yes**	Mitigation measures proposed are selected based on the effectiveness and how implementable the measures are. Specialist reports take into consideration the specific conditions of the area.
2.20.	What measures were taken to ensure that he costs of remedying pollution, environmental degradation and consequent adverse health effects and of preventing, controlling or minimising further pollution, environmental damage or adverse health effects will be paid	[47]: Section 2(4)(p) of NEMA: "2(4) (p) The costs of remedying pollution, environmental degradation and consequent adverse health effects and of preventing, controlling or minimising further pollution,	**Yes**	The cost assessment is conducted as part of the EMPr, refer to **Section 6** of the EMPR.

No.	Question	Relevant regulations (Reference to footnotes in the Need and Desirability Document, 2017)	Considered (yes/no)	Comments
	for by those responsible for harming the environment?[47]	environmental damage or adverse health effects must be paid for by those responsible for harming the environment."		
2.21.	Considering the need to secure ecological integrity and a healthy bio-physical environment, describe how the alternatives identified (in terms of all the different elements of the development and all the different impacts being proposed), resulted in the selection of the best practicable environmental option in terms of socio-economic considerations?[48]	[48:] Section 2(4)(b) of NEMA: Refer to Number 1.2 for Section 2(4)(b) of NEMA	**Yes**	Refer to **Section 6** of the EIAR for the discussion for the detailed alternatives.
2.22.	Describe the positive and negative cumulative socio-economic impacts bearing in mind the size, scale, scope and nature of the project in relation to its location and other planned developments in the area?		**Yes**	None identified to date.

LEGEND

- NEW ROAD SURFACE - ASPHALT
- EXISTING ROAD AREA
- PAVED AREAS
- ERF BOUNDARIES / ROAD RESERVE
- NEW ROAD RESERVE & COORDINATE POINTS
- BENCHMARKS / REFERENCE POINTS
- EXISTING FENCE-LINE
- EXISTING WALL
- EXISTING GUARDRAIL
- EXISTING ROAD SIGN
- EXISTING SIGN BOARD
- EXISTING DISTANCE MARKER
- EXISTING REFUSE BIN
- EXISTING TRAFFIC SIGNAL
- EXISTING STREET LIGHT POLE
- EXISTING ELECTRICAL MAST/POLE
- EXISTING ELEC. LINE
- EXISTING ELEC. OVERHEAD LINE
- EXISTING ELEC. MANHOLE
- EXISTING ELEC. BOX/TRANSFORMER
- EXISTING SEWER PIPE
- EXISTING SEWER MANHOLE
- EXISTING SEWER CLEANING EYE
- EXISTING STORMWATER PIPE
- EXISTING STORMWATER MANHOLE
- EXISTING WATER PIPE
- EXISTING WATER END CAP
- EXISTING WATER VALVE
- EXISTING WATER METER
- EXISTING TELKOM CABLE
- EXISTING TELKOM MANHOLE
- EXISTING TELEPHONE POLE



ALIGNMENT DATA: P15-1 RE-ALIGNMENT						
SEGMENT	CHAINAGE	Y-COORD	X-COORD	RADIUS	D.A. / BEARING	LENGTH
STR. 1	Km 0.000 to Km 0.233	-89571.607 -89705.258	2856061.433 2856252.742		325°03'40"	233.370 m
CURVE 1	BC: Km 0.233 EC: Km 0.743	BC: -89705.258 PI: -89853.511 EC: -90076.064	BC: 2856252.742 PI: 2856464.950 EC: 2856597.167	1200.000 m	Δ: 24°20'50"	509.917 m

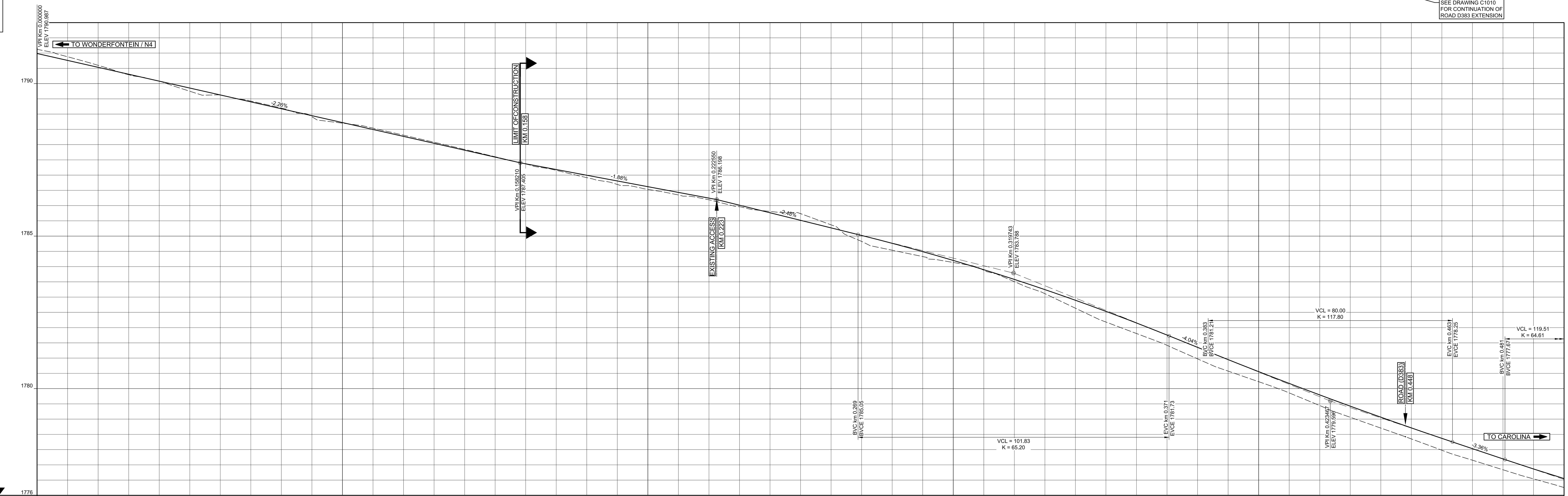
P15-1 RE-ALIGNMENT

DESIGN SPEED - 100KM/H

PROFILE OF GRADE LINE

SCALE:
HORIZONTAL 1:500
VERTICAL 1:50

DATUM 1776.500



VERTICAL CURVES GRADE: -2.26% | -1.88% | -2.48% | VCL=101.8 m K=65.20 | -4.04% | VCL=80.0 m K=117.80 | -3.36% | VCL=119.5 m K=64.61

FINAL ROAD LEVELS: H_L 3.7m LEFT; H_C ON CL; H_R 3.7m RIGHT

SUPER ELEVATION

GROUND LEVELS AT GRADE LINE

KILOMETER DISTANCE

GUARDRAIL LEFT
KERB LEFT
SHOULDER LEFT
GUARDRAIL RIGHT
KERB RIGHT
SHOULDER RIGHT

HORIZONTAL ALIGNMENT: km 0.000 STRAIGHT L=233.370m 325° 03' 40" km 0.233 | R=1200.00m L=509.92m Δ=24°20'50"

DRAINAGE — KILOMETER DISTANCE SIZE AND ANGLE: Θ = 135.7° HW 3 Km 0.460 0.600 Ø IJ 100D Θ = 315.7° HW 2

REV	DATE	BY	DESCRIPTION	CHK	APD
B	10-11-2017	-	FOR APPROVAL	-	-
A	13-01-2017	-	FOR INFORMATION	-	-

ROADS AUTHORITY: the dpwrt Department: Public Works, Roads and Transport MPUMALANGA PROVINCE

CLIENT: umsimbithi Mining (Pty) Ltd

DRAWING STATUS: FOR APPROVAL

If drawing status = construction, a signed copy of this drawing (either in hardcopy or electronic format) is available at the office of origin and at the office of issue.

WSP Group Africa (Pty) Ltd
Commercial Civils
314 Glenwood Road, Lynnwood Park, Pretoria, 0081
PostNet Suite 287, Private Bag X025, Lynnwood Ridge, 0040
Tel: +27(0)12-762-1200 Fax: +27(0)12-762-1301 www.wsp.com

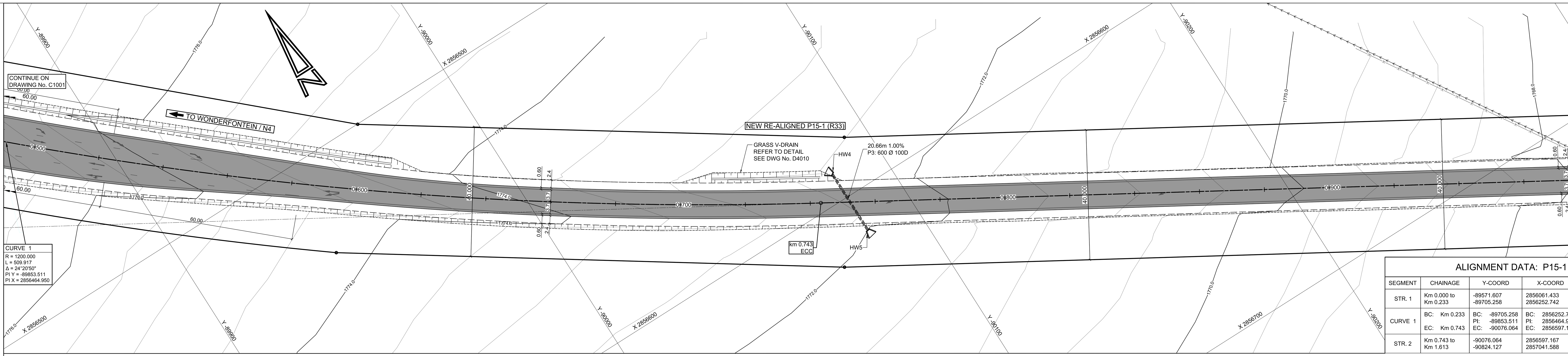
PROJECT: RE-ALIGNMENT OF PROVINCIAL ROAD P15-1 AT WONDERFONTEIN

TITLE: ROAD AND STORMWATER LAYOUT PLAN WITH LONGITUDINAL SECTION (SHEET 1 OF 10)

SCALE @ A0: 1:500	CHECKED: E. KOTZE	APPROVED: E. KOTZE
DESIGN: M.KWATSHA	DRAWN: I.WESSELS	DATE: 2017/11/20
PROJECT No: 22115	DRAWING No: C1001	REV: B

LEGEND

NEW ROAD SURFACE - ASPHALT	
EXISTING ROAD AREA	
PAVED AREAS	
ERF BOUNDARIES / ROAD RESERVE	
NEW ROAD RESERVE & COORDINATE POINTS	
BENCHMARKS / REFERENCE POINTS	BM
EXISTING FENCE-LINE	
EXISTING WALL	
EXISTING GUARDRAIL	
EXISTING ROAD SIGN	
EXISTING SIGN BOARD	
EXISTING DISTANCE MARKER	
EXISTING REFUSE BIN	
EXISTING TRAFFIC SIGNAL	
EXISTING STREET LIGHT POLE	
EXISTING ELECTRICAL MAST/POLE	
EXISTING ELEC. LINE	
EXISTING ELEC. OVERHEAD LINE	
EXISTING ELEC. MANHOLE	
EXISTING ELEC. BOX/TRANSFORMER	
EXISTING SEWER PIPE	
EXISTING SEWER MANHOLE	
EXISTING SEWER CLEANING EYE	
EXISTING STORMWATER PIPE	
EXISTING STORMWATER MANHOLE	
EXISTING WATER PIPE	
EXISTING WATER END CAP	
EXISTING WATER VALVE	
EXISTING WATER METER	
EXISTING TELKOM CABLE	
EXISTING TELKOM MANHOLE	
EXISTING TELEPHONE POLE	



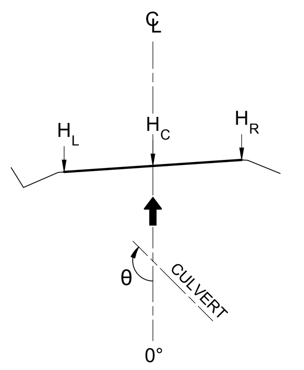
ROAD RESERVE CO-ORDINATE POINTS SEE TABLE ON DRAWING C1000
FOR STORMWATER LONGITUDINAL SECTIONS, STRUCTURE DATA & PIPE DATA INFO SEE DRAWING D4000
FOR TYPICAL STORMWATER DETAILS SEE DRAWING D4010

ALIGNMENT DATA: P15-1 RE-ALIGNMENT

SEGMENT	CHAINAGE	Y-COORD	X-COORD	RADIUS	D.A. / BEARING	LENGTH
STR. 1	Km 0.000 to Km 0.233	-89571.607 -89705.258	2856061.433 2856252.742		325°03'40"	233.370 m
CURVE 1	BC: Km 0.233 EC: Km 0.743	BC: -89705.258 PI: -89853.511 EC: -90076.064	BC: 2856252.742 PI: 2856464.950 EC: 2856597.167	1200.000 m	Δ: 24°20'50"	509.917 m
STR. 2	Km 0.743 to Km 1.613	-90076.064 -90824.127	2856597.167 2857041.588		300°42'50"	870.119 m

P15-1 RE-ALIGNMENT

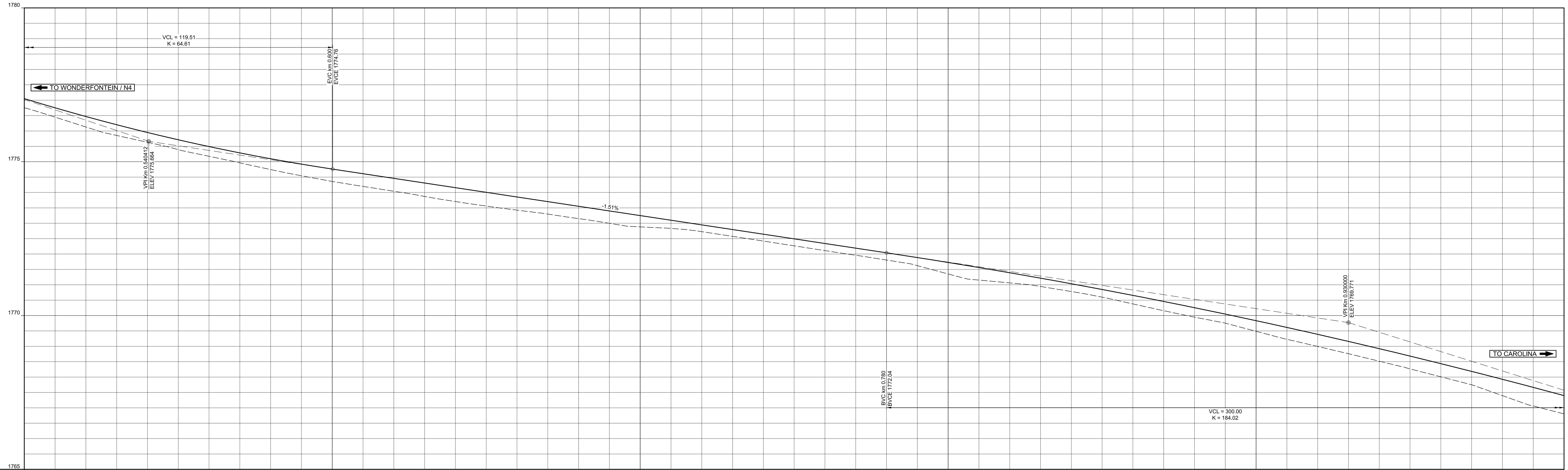
DESIGN SPEED - 100KM/H



PROFILE OF GRADE LINE

SCALE:
HORIZONTAL 1:500
VERTICAL 1:50

DATUM 1765.000



VERTICAL CURVES / GRADE: VCL=119.5 m, K=64.61; -3.36%; -1.51%; VCL=300.0 m, K=184.02; -3.14%

FINAL ROAD LEVELS: H_L 3.7m LEFT; H_C ON CL; H_R 3.7m RIGHT

KILOMETER DISTANCE	H_L 3.7m LEFT	H_C ON CL	H_R 3.7m RIGHT	GROUND LEVELS AT GRADE LINE
0.500	1776.534	1777.051	1777.549	1776.757
0.510	1776.235	1776.753	1777.246	1776.449
0.520	1775.966	1776.470	1776.943	1776.130
0.530	1775.715	1776.202	1776.639	1775.854
0.540	1775.483	1775.950	1776.350	1775.632
0.550	1775.264	1775.713	1776.088	1775.393
0.560	1775.049	1775.492	1775.838	1775.176
0.570	1774.879	1775.286	1775.597	1774.964
0.580	1774.710	1775.096	1775.376	1774.745
0.590	1774.562	1774.922	1775.174	1774.544
0.600	1774.433	1774.762	1774.990	1774.360
0.610	1774.304	1774.611	1774.825	1774.198
0.620	1774.175	1774.460	1774.672	1774.041
0.630	1774.036	1774.309	1774.529	1773.872
0.640	1773.888	1774.157	1774.393	1773.706
0.650	1773.739	1774.006	1774.256	1773.559
0.660	1773.591	1773.855	1774.106	1773.427
0.670	1773.442	1773.704	1773.941	1773.299
0.680	1773.293	1773.552	1773.775	1773.151
0.690	1773.145	1773.401	1773.610	1772.998
0.700	1772.996	1773.250	1773.444	1772.882
0.710	1772.853	1773.099	1773.278	1772.833
0.720	1772.721	1772.947	1773.109	1772.727
0.730	1772.611	1772.796	1772.937	1772.574
0.740	1772.506	1772.645	1772.765	1772.421
0.750	1772.388	1772.493	1772.591	1772.266
0.760	1772.242	1772.342	1772.411	1772.111
0.770	1772.095	1772.191	1772.228	1771.959
0.780	1771.947	1772.040	1772.045	1771.804
0.790	1771.795	1771.886	1771.863	1771.622
0.800	1771.638	1771.726	1771.680	1771.352
0.810	1771.474	1771.562	1771.494	1771.153
0.820	1771.304	1771.391	1771.305	1771.061
0.830	1771.130	1771.216	1771.116	1770.945
0.840	1770.947	1771.034	1770.928	1770.781
0.850	1770.762	1770.848	1770.739	1770.598
0.860	1770.567	1770.656	1770.542	1770.377
0.870	1770.369	1770.458	1770.334	1770.156
0.880	1770.162	1770.256	1770.126	1769.948
0.890	1769.953	1770.047	1769.919	1769.752
0.900	1769.733	1769.833	1769.707	1769.488
0.910	1769.511	1769.614	1769.494	1769.228
0.920	1769.280	1769.390	1769.270	1768.995
0.930	1769.048	1769.160	1769.045	1768.759
0.940	1768.811	1768.924	1768.810	1768.516
0.950	1768.575	1768.683	1768.572	1768.266
0.960	1768.317	1768.437	1768.326	1768.008
0.970	1768.058	1768.185	1768.076	1767.750
0.980	1767.796	1767.928	1767.819	1767.396
0.990	1767.528	1767.665	1767.556	1767.062
1.000	1767.260	1767.397	1767.287	1766.803

SUPER ELEVATION: FS km 0.510; EFS km 0.716; BNC km 0.74 L -2.5% R 2.5%; BNC km 0.82 L -2.5% R -2.5%; NC km 0.99 L -2.5% R -2.5%

GUARDRAIL LEFT
KERB LEFT
SHOULDER LEFT
GUARDRAIL RIGHT
KERB RIGHT
SHOULDER RIGHT

HORIZONTAL ALIGNMENT: km 0.233 — R=1200.00m, L=509.92m, Δ=24°20'50" — km 0.743 — STRAIGHT, L=870.119m, 300° 42' 52"

DRAINAGE — KILOMETER DISTANCE SIZE AND ANGLE: HW4, Θ = 59°, KM 0.753, 600 Ø IJ 100D, Θ = 270°, HW5

REV	DATE	BY	DESCRIPTION	CHK	APD
B	10-11-2017	-	FOR APPROVAL	-	-
A	13-01-2017	-	FOR INFORMATION	-	-

ROADS AUTHORITY: the dpwrt — Department: Public Works, Roads and Transport — MPUMALANGA PROVINCE

CLIENT: umsimbithi Mining (Pty) Ltd

DRAWING STATUS: FOR APPROVAL

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PROJECT: RE-ALIGNMENT OF PROVINCIAL ROAD P15-1 AT WONDERFONTEIN

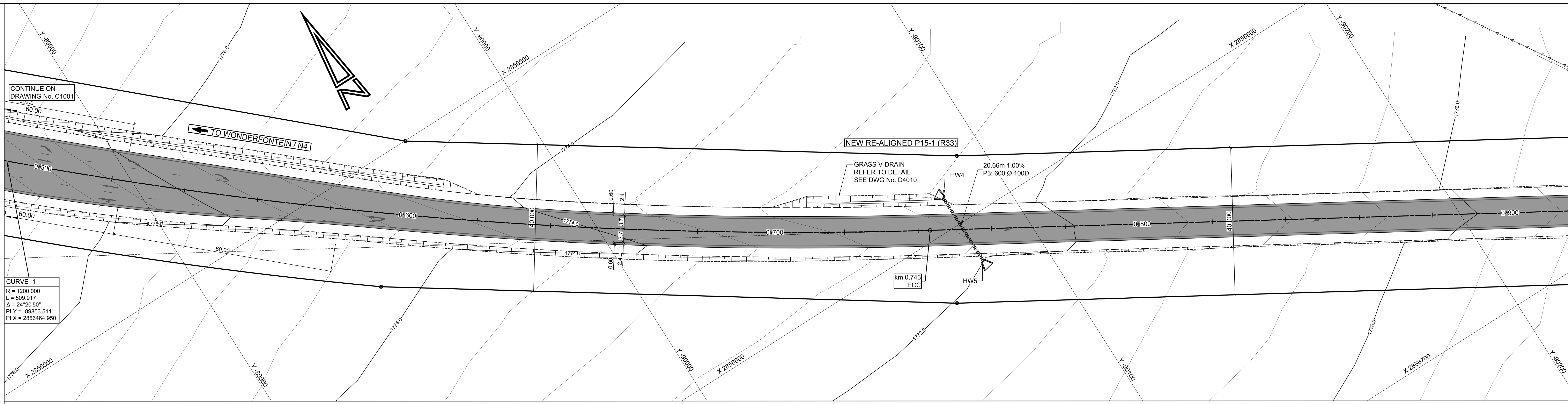
TITLE: ROAD AND STORMWATER LAYOUT PLAN WITH LONGITUDINAL SECTION (SHEET 2 OF 10)

SCALE @ A0: 1:500	CHECKED: E. KOTZE	APPROVED: E. KOTZE
DESIGN: M.KWATSHA	DRAWN: I.WESSELS	DATE: 2017/11/20
PROJECT No: 22115	DRAWING No: C1002	REV: B

LEGEND

- NEW ROAD SURFACE - ASPHALT
- EXISTING ROAD AREA
- PAVED AREAS
- ERF BOUNDARIES / ROAD RESERVE
- NEW ROAD RESERVE & COORDINATE POINTS
- BENCHMARKS / REFERENCE POINTS (BM)
- EXISTING FENCE-LINE
- EXISTING WALL
- EXISTING GUARDRAIL
- EXISTING ROAD SIGN
- EXISTING SIGN BOARD
- EXISTING DISTANCE MARKER
- EXISTING REFUSE BIN
- EXISTING TRAFFIC SIGNAL
- EXISTING STREET LIGHT POLE
- EXISTING ELECTRICAL MAST/POLE
- EXISTING ELEC. LINE
- EXISTING ELEC. OVERHEAD LINE
- EXISTING ELEC. MANHOLE
- EXISTING ELEC. BOX/TRANSFORMER
- EXISTING SEWER PIPE
- EXISTING SEWER MANHOLE
- EXISTING SEWER CLEANING EYE
- EXISTING STORMWATER PIPE
- EXISTING STORMWATER MANHOLE
- EXISTING WATER PIPE
- EXISTING WATER END CAP
- EXISTING WATER VALVE
- EXISTING WATER METER
- EXISTING TELKOM CABLE
- EXISTING TELKOM MANHOLE
- EXISTING TELEPHONE POLE

ROAD RESERVE CO-ORDINATE POINTS SEE TABLE ON DRAWING C1000
FOR STORMWATER LONGITUDINAL SECTIONS, STRUCTURE DATA & PIPE DATA INFO SEE DRAWING D4000
FOR TYPICAL STORMWATER DETAILS SEE DRAWING D4010



ALIGNMENT DATA: P15-1 RE-ALIGNMENT

SEGMENT	CHAINAGE	Y-COORD	X-COORD	RADIUS	D.A. / BEARING	LENGTH
STR. 1	Km 0.000 to Km 0.233	-89571.607 -89705.258	2856061.433 2856252.742		325°03'40"	233.370 m
CURVE 1	BC: Km 0.233 EC: Km 0.743	BC: -89705.258 PI: -89853.511 EC: -90076.064	BC: 2856252.742 PI: 2856464.950 EC: 2856597.167	1200.000 m	Δ: 24°20'50"	509.917 m
STR. 2	Km 0.743 to Km 1.613	-90076.064 -90824.127	2856597.167 2857041.588		300°42'50"	870.119 m

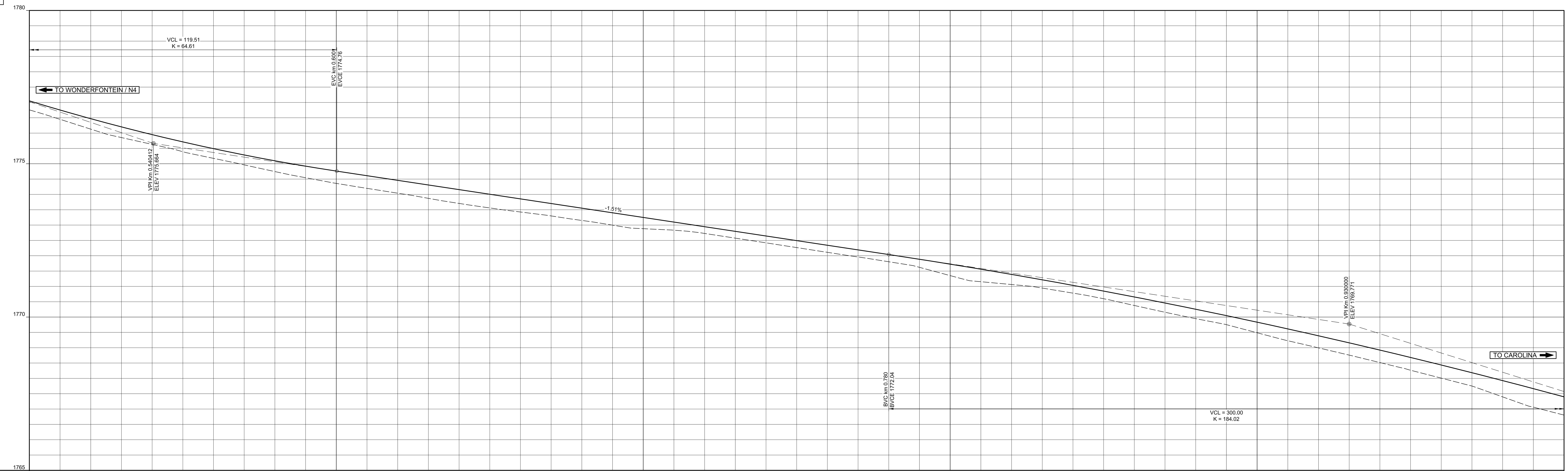
P15-1 RE-ALIGNMENT

DESIGN SPEED - 100KM/H

PROFILE OF GRADE LINE

SCALE:
HORIZONTAL 1:500
VERTICAL 1:50

DATUM 1765.000



VERTICAL CURVES / GRADE: VCL=119.5 m, K=64.61 (km 0.500–0.600); -3.36% (to km 0.540); -1.51%; VCL=300.0 m, K=184.02 (from km 0.780); -3.14% (from km 0.930)

FINAL ROAD LEVELS: H_L 3.7m LEFT; H_C ON CL; H_R 3.7m RIGHT

KILOMETER DISTANCE	H_L 3.7m LEFT	H_C ON CL	H_R 3.7m RIGHT	GROUND LEVELS AT GRADE LINE
0.500	1776.534	1777.051	1777.549	1776.757
0.510	1776.235	1776.753	1777.246	1776.449
0.520	1775.966	1776.470	1776.943	1776.130
0.530	1775.715	1776.202	1776.639	1775.854
0.540	1775.483	1775.950	1776.350	1775.632
0.550	1775.264	1775.713	1776.088	1775.393
0.560	1775.049	1775.492	1775.838	1775.176
0.570	1774.879	1775.286	1775.597	1774.964
0.580	1774.710	1775.096	1775.376	1774.745
0.590	1774.562	1774.922	1775.174	1774.544
0.600	1774.433	1774.762	1774.990	1774.360
0.610	1774.304	1774.611	1774.825	1774.198
0.620	1774.175	1774.460	1774.672	1774.041
0.630	1774.036	1774.309	1774.529	1773.872
0.640	1773.888	1774.157	1774.393	1773.706
0.650	1773.739	1774.006	1774.256	1773.559
0.660	1773.591	1773.855	1774.106	1773.427
0.670	1773.442	1773.704	1773.941	1773.299
0.680	1773.293	1773.552	1773.775	1773.151
0.690	1773.145	1773.401	1773.610	1772.998
0.700	1772.996	1773.250	1773.444	1772.882
0.710	1772.853	1773.099	1773.278	1772.833
0.720	1772.721	1772.947	1773.109	1772.727
0.730	1772.611	1772.796	1772.937	1772.574
0.740	1772.506	1772.645	1772.765	1772.421
0.750	1772.388	1772.493	1772.591	1772.266
0.760	1772.242	1772.342	1772.411	1772.111
0.770	1772.095	1772.191	1772.228	1771.959
0.780	1771.947	1772.040	1772.045	1771.804
0.790	1771.795	1771.886	1771.863	1771.622
0.800	1771.638	1771.726	1771.680	1771.352
0.810	1771.474	1771.562	1771.494	1771.153
0.820	1771.304	1771.391	1771.305	1771.061
0.830	1771.130	1771.216	1771.116	1770.945
0.840	1770.947	1771.034	1770.928	1770.781
0.850	1770.762	1770.848	1770.739	1770.598
0.860	1770.567	1770.656	1770.542	1770.377
0.870	1770.369	1770.458	1770.334	1770.156
0.880	1770.162	1770.256	1770.126	1769.948
0.890	1769.953	1770.047	1769.919	1769.752
0.900	1769.733	1769.833	1769.707	1769.488
0.910	1769.511	1769.614	1769.494	1769.228
0.920	1769.280	1769.390	1769.270	1768.995
0.930	1769.048	1769.160	1769.045	1768.759
0.940	1768.811	1768.924	1768.810	1768.516
0.950	1768.575	1768.683	1768.572	1768.266
0.960	1768.317	1768.437	1768.326	1768.008
0.970	1768.058	1768.185	1768.076	1767.750
0.980	1767.796	1767.928	1767.819	1767.396
0.990	1767.528	1767.665	1767.556	1767.062
1.000	1767.260	1767.397	1767.287	1766.803

SUPER ELEVATION: FS km 0.510 L -6.0% R 6.0%; EFS km 0.718 L -6.0% R 6.0%; BNC km 0.74 L -2.5% R 2.5%; BNC km 0.82 L -2.5% R -2.5%; NC km 0.99 L -2.5% R -2.5%

GUARDRAIL LEFT
KERB LEFT
SHOULDER LEFT
GUARDRAIL RIGHT
KERB RIGHT
SHOULDER RIGHT

HORIZONTAL ALIGNMENT: km 0.233 — R=1200.00m, L=509.92m, Δ=24°20'50"; km 0.743 — STRAIGHT, L=870.119m, 300° 42' 52"

DRAINAGE — KILOMETER DISTANCE SIZE AND ANGLE: HW4; Θ = 59°; KM 0.753, 600 Ø LJ 100D; Θ = 270°; HW5

REV	DATE	BY	DESCRIPTION	CHK	APD
B	10-11-2017	-	FOR APPROVAL	-	-
A	13-01-2017	-	FOR INFORMATION	-	-

ROADS AUTHORITY: the dpwrt Department: Public Works, Roads and Transport MPUMALANGA PROVINCE

CLIENT: umsimbithi Mining (Pty) Ltd

DRAWING STATUS: FOR APPROVAL

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PROJECT: RE-ALIGNMENT OF PROVINCIAL ROAD P15-1 AT WONDERFONTEIN

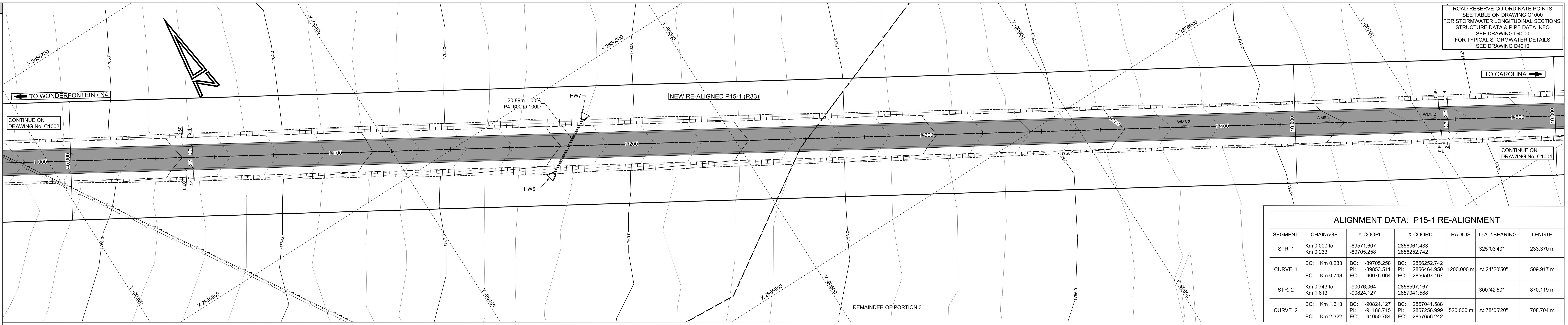
TITLE: ROAD AND STORMWATER LAYOUT PLAN WITH LONGITUDINAL SECTION (SHEET 2 OF 10)

SCALE @ A0: 1:500	CHECKED: E. KOTZE	APPROVED: E. KOTZE
DESIGN: M.KWATSHA	DRAWN: I.WESSELS	DATE: 2017/11/20
PROJECT No: 22115	DRAWING No: C1002	REV: B

PLOT DATE: 2018/01/09 09:54:22 AM
TEMPLATE VERSION 1.1

LEGEND

NEW ROAD SURFACE - ASPHALT	
EXISTING ROAD AREA	
PAVED AREAS	
ERF BOUNDARIES / ROAD RESERVE	
NEW ROAD RESERVE & COORDINATE POINTS	
BENCHMARKS / REFERENCE POINTS	BM
EXISTING FENCE-LINE	
EXISTING WALL	
EXISTING GUARDRAIL	
EXISTING ROAD SIGN	
EXISTING SIGN BOARD	
EXISTING DISTANCE MARKER	
EXISTING REFUSE BIN	
EXISTING TRAFFIC SIGNAL	
EXISTING STREET LIGHT POLE	
EXISTING ELECTRICAL MAST/POLE	
EXISTING ELEC. LINE	
EXISTING ELEC. OVERHEAD LINE	
EXISTING ELEC. MANHOLE	
EXISTING ELEC. BOX/TRANSFORMER	
EXISTING SEWER PIPE	
EXISTING SEWER MANHOLE	
EXISTING SEWER CLEANING EYE	
EXISTING STORMWATER PIPE	
EXISTING STORMWATER MANHOLE	
EXISTING WATER PIPE	
EXISTING WATER END CAP	
EXISTING WATER VALVE	
EXISTING WATER METER	
EXISTING TELKOM CABLE	
EXISTING TELKOM MANHOLE	
EXISTING TELEPHONE POLE	



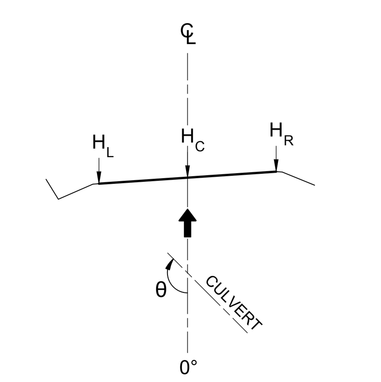
ROAD RESERVE CO-ORDINATE POINTS SEE TABLE ON DRAWING C1000
FOR STORMWATER LONGITUDINAL SECTIONS, STRUCTURE DATA & PIPE DATA INFO SEE DRAWING D4000
FOR TYPICAL STORMWATER DETAILS SEE DRAWING D4010

ALIGNMENT DATA: P15-1 RE-ALIGNMENT

SEGMENT	CHAINAGE	Y-COORD	X-COORD	RADIUS	D.A. / BEARING	LENGTH
STR. 1	Km 0.000 to Km 0.233	-89571.607 -89705.258	2856061.433 2856252.742		325°03'40"	233.370 m
CURVE 1	BC: Km 0.233 EC: Km 0.743	BC: -89705.258 PI: -89853.511 EC: -90076.064	BC: 2856252.742 PI: 2856464.950 EC: 2856597.167	1200.000 m	Δ: 24°20'50"	509.917 m
STR. 2	Km 0.743 to Km 1.613	-90076.064 -90824.127	2856597.167 2857041.588		300°42'50"	870.119 m
CURVE 2	BC: Km 1.613 EC: Km 2.322	BC: -90824.127 PI: -91186.715 EC: -91050.784	BC: 2857041.588 PI: 2857256.999 EC: 2857656.242	520.000 m	Δ: 78°05'20"	708.704 m

P15-1 RE-ALIGNMENT

DESIGN SPEED - 100KM/H

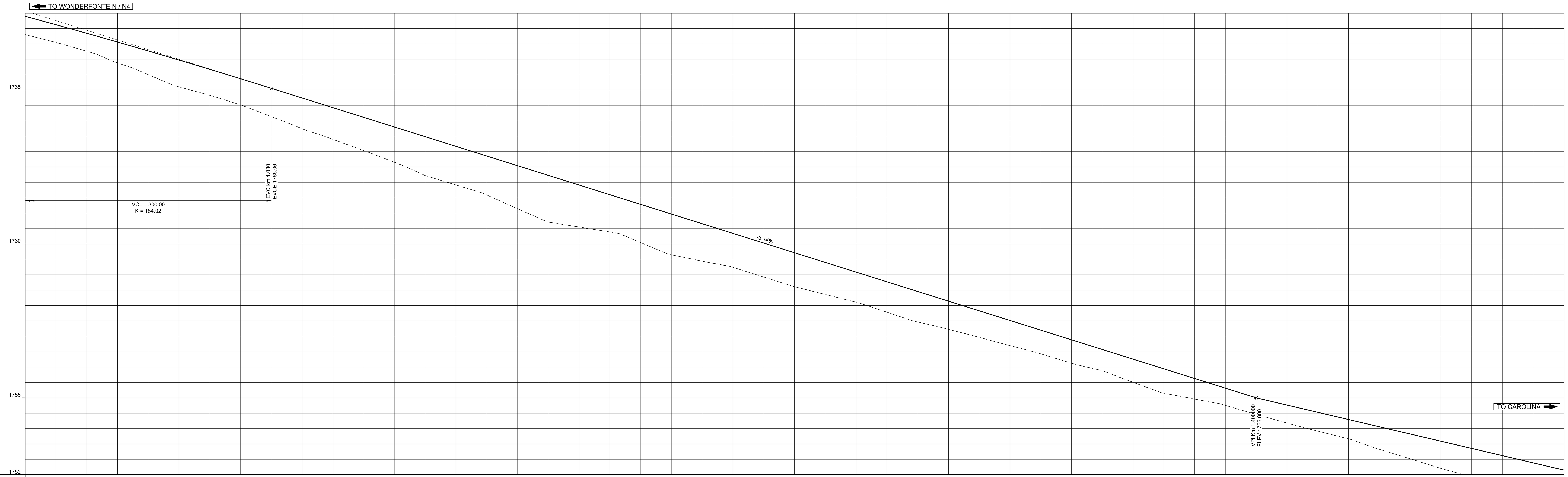


PROFILE OF GRADE LINE

SCALE:
HORIZONTAL 1:500
VERTICAL 1:50

50 m

DATUM 1752.500



VERTICAL CURVES / GRADE: VCL=300.0 m, K=184.02; -3.14%; -2.35%

FINAL ROAD LEVELS / GROUND LEVELS AT GRADE LINE / KILOMETER DISTANCE

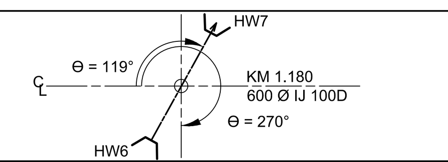
KILOMETER DISTANCE	H_L 3.7m LEFT	H_C ON CL	H_R 3.7m RIGHT	GROUND LEVELS AT GRADE LINE
1.000	1767.260	1767.397	1767.287	1766.803
1.010	1766.992	1767.124	1767.013	1766.546
1.020	1766.718	1766.845	1766.733	1766.261
1.030	1766.433	1766.560	1766.445	1765.882
1.040	1766.148	1766.270	1766.154	1765.501
1.050	1765.864	1765.975	1765.859	1765.103
1.060	1765.571	1765.675	1765.563	1764.830
1.070	1765.270	1765.368	1765.258	1764.516
1.080	1764.968	1765.057	1764.944	1764.137
1.090	1764.667	1764.743	1764.630	1763.744
1.100	1764.356	1764.428	1764.316	1763.399
1.110	1764.038	1764.114	1764.002	1763.034
1.120	1763.720	1763.800	1763.688	1762.654
1.130	1763.402	1763.485	1763.373	1762.223
1.140	1763.078	1763.171	1763.059	1761.915
1.150	1762.751	1762.857	1762.745	1761.590
1.160	1762.436	1762.543	1762.431	1761.143
1.170	1762.122	1762.228	1762.117	1760.708
1.180	1761.807	1761.914	1761.803	1760.549
1.190	1761.493	1761.600	1761.489	1760.389
1.200	1761.179	1761.286	1761.175	1760.044
1.210	1760.865	1760.971	1760.861	1759.648
1.220	1760.550	1760.657	1760.547	1759.440
1.230	1760.236	1760.343	1760.233	1759.240
1.240	1759.922	1760.028	1759.919	1758.925
1.250	1759.607	1759.714	1759.605	1758.611
1.260	1759.293	1759.400	1759.290	1758.359
1.270	1758.979	1759.086	1758.976	1758.107
1.280	1758.665	1758.771	1758.662	1757.783
1.290	1758.350	1758.457	1758.348	1757.465
1.300	1758.036	1758.143	1758.034	1757.225
1.310	1757.722	1757.828	1757.720	1756.967
1.320	1757.408	1757.514	1757.406	1756.698
1.330	1757.075	1757.200	1757.092	1756.429
1.340	1756.741	1756.886	1756.778	1756.126
1.350	1756.413	1756.571	1756.464	1755.883
1.360	1756.091	1756.257	1756.150	1755.505
1.370	1755.778	1755.943	1755.836	1755.151
1.380	1755.478	1755.629	1755.522	1754.960
1.390	1755.185	1755.314	1755.207	1754.756
1.400	1754.900	1755.000	1754.900	1754.464
1.410	1754.629	1754.765	1754.665	1754.182
1.420	1754.365	1754.531	1754.430	1753.920
1.430	1754.108	1754.296	1754.195	1753.667
1.440	1753.864	1754.061	1753.960	1753.327
1.450	1753.629	1753.826	1753.724	1753.021
1.460	1753.400	1753.592	1753.489	1752.708
1.470	1753.178	1753.357	1753.254	1752.441
1.480	1752.955	1753.122	1753.019	1752.184
1.490	1752.732	1752.888	1752.784	1751.933
1.500	1752.510	1752.653	1752.549	1751.704

SUPER ELEVATION

GUARDRAIL LEFT
KERB LEFT
SHOULDER LEFT
GUARDRAIL RIGHT
KERB RIGHT
SHOULDER RIGHT

HORIZONTAL ALIGNMENT: km 0.743 — STRAIGHT L=870.119m 300° 42' 52"

DRAINAGE — KILOMETER DISTANCE SIZE AND ANGLE



REV	DATE	BY	DESCRIPTION	CHK	APD
B	10-11-2017	-	FOR APPROVAL	-	-
A	13-01-2017	-	FOR INFORMATION	-	-

ROADS AUTHORITY: the dpwrt Department: Public Works, Roads and Transport MPUMALANGA PROVINCE

CLIENT: umsimbithi Mining (Pty) Ltd

DRAWING STATUS: FOR INFORMATION

If drawing status = construction, a signed copy of this drawing (either in hardcopy or electronic format) is available at the office of origin and at the office of issue.

WSP Group Africa (Pty) Ltd
Commercial Civils
314 Glenwood Road, Lynnwood Park, Pretoria, 0081
PostNet Suite 287, Private Bag X025, Lynnwood Ridge, 0040
Tel: +27(0)12-762-1200 Fax: +27(0)12-762-1301 www.wsp.com

PROJECT: RE-ALIGNMENT OF PROVINCIAL ROAD P15-1 AT WONDERFONTEIN

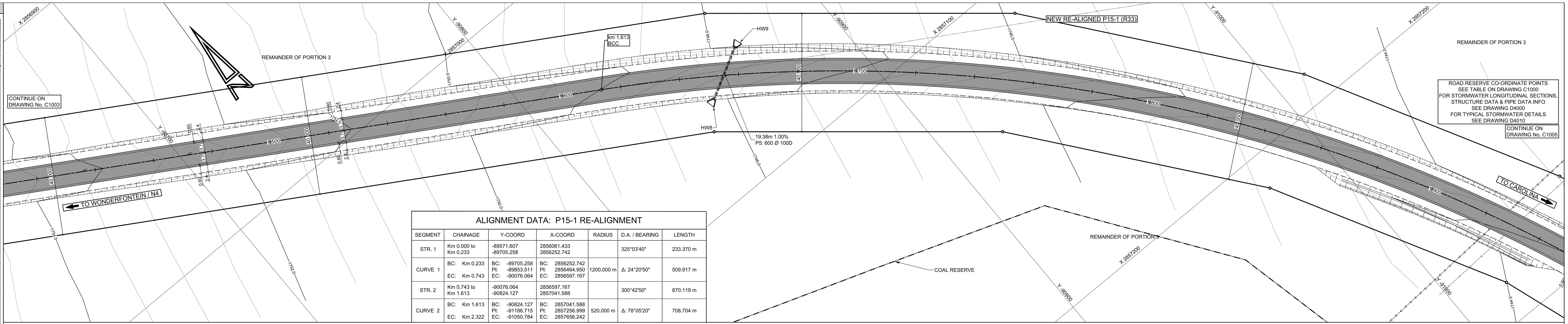
TITLE: ROAD AND STORMWATER LAYOUT PLAN WITH LONGITUDINAL SECTION (SHEET 3 OF 10)

SCALE @ A0: 1:500	CHECKED: E. KOTZE	APPROVED: E. KOTZE
DESIGN: M.KWATSHA	DRAWN: I.WESSELS	DATE: 2017/11/20
PROJECT No: 22115	DRAWING No: C1003	REV: B

CESA

LEGEND

NEW ROAD SURFACE - ASPHALT	
EXISTING ROAD AREA	
PAVED AREAS	
ERF BOUNDARIES / ROAD RESERVE	
NEW ROAD RESERVE & COORDINATE POINTS	
BENCHMARKS / REFERENCE POINTS	BM
EXISTING FENCE-LINE	
EXISTING WALL	
EXISTING GUARDRAIL	
EXISTING ROAD SIGN	
EXISTING SIGN BOARD	
EXISTING DISTANCE MARKER	
EXISTING REFUSE BIN	
EXISTING TRAFFIC SIGNAL	
EXISTING STREET LIGHT POLE	
EXISTING ELECTRICAL MAST/POLE	
EXISTING ELEC. LINE	
EXISTING ELEC. OVERHEAD LINE	
EXISTING ELEC. MANHOLE	
EXISTING ELEC. BOX/TRANSFORMER	
EXISTING SEWER PIPE	
EXISTING SEWER MANHOLE	
EXISTING SEWER CLEANING EYE	
EXISTING STORMWATER PIPE	
EXISTING STORMWATER MANHOLE	
EXISTING WATER PIPE	
EXISTING WATER END CAP	
EXISTING WATER VALVE	
EXISTING WATER METER	
EXISTING TELKOM CABLE	
EXISTING TELKOM MANHOLE	
EXISTING TELEPHONE POLE	

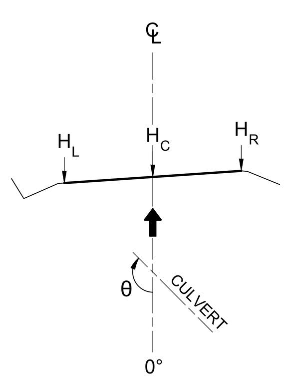


ALIGNMENT DATA: P15-1 RE-ALIGNMENT

SEGMENT	CHAINAGE	Y-COORD	X-COORD	RADIUS	D.A. / BEARING	LENGTH
STR. 1	Km 0.000 to Km 0.233	-89571.607 -89705.258	2856061.433 2856252.742		325°03'40"	233.370 m
CURVE 1	BC: Km 0.233 EC: Km 0.743	BC: -89705.258 PI: -89853.511 EC: -90076.064	BC: 2856252.742 PI: 2856464.950 EC: 2856597.167	1200.000 m	Δ: 24°20'50"	509.917 m
STR. 2	Km 0.743 to Km 1.613	-90076.064 -90824.127	2856597.167 2857041.588		300°42'50"	870.119 m
CURVE 2	BC: Km 1.613 EC: Km 2.322	BC: -90824.127 PI: -91186.715 EC: -91050.784	BC: 2857041.588 PI: 2857256.999 EC: 2857656.242	520.000 m	Δ: 78°05'20"	708.704 m

P15-1 RE-ALIGNMENT

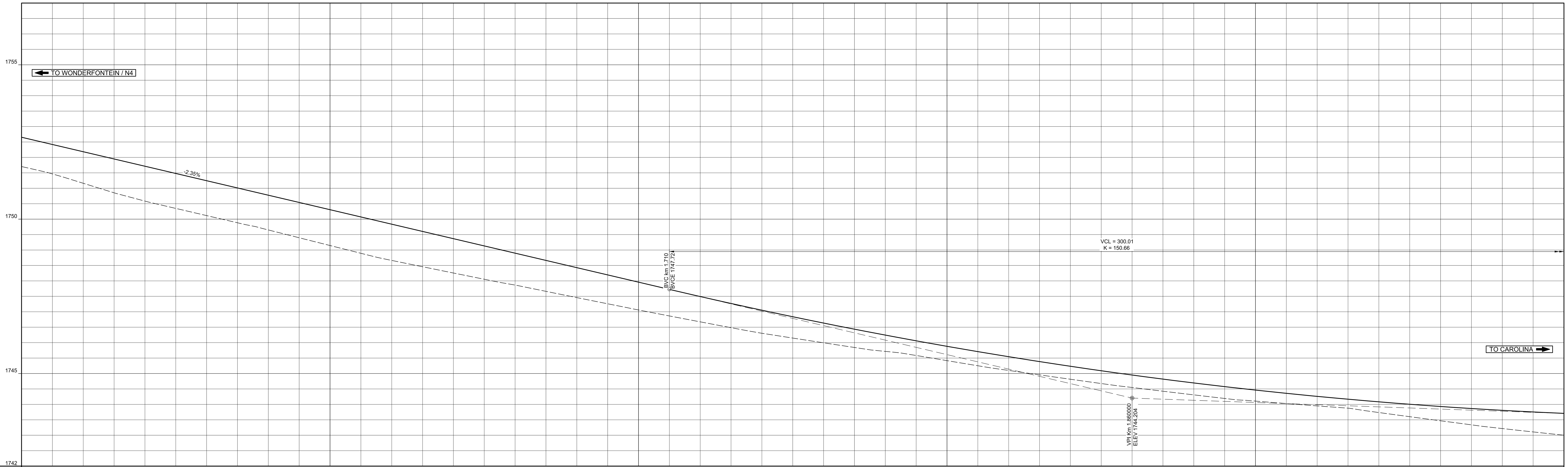
DESIGN SPEED - 100KM/H



PROFILE OF GRADE LINE

SCALE:
HORIZONTAL 1:500
VERTICAL 1:50

DATUM 1742.000



VERTICAL CURVES: VCL=300.0 m, K=150.66

GRADE: -2.35% ; -0.36%

KILOMETER DISTANCE	1.500	1.510	1.520	1.530	1.540	1.550	1.560	1.570	1.580	1.590	1.600
FINAL ROAD LEVELS H_L 3.7m LEFT	1752.510	1752.287	1752.065	1751.842	1751.645	1751.449	1751.253	1751.056	1750.860	1750.663	1750.467
H_C ON CL	1752.653	1752.418	1752.184	1751.949	1751.714	1751.479	1751.245	1751.010	1750.775	1750.541	1750.306
H_R 3.7m RIGHT	1752.549	1752.313	1752.078	1751.843	1751.608	1751.373	1751.126	1750.866	1750.607	1750.347	1750.087
GROUND LEVELS AT GRADE LINE	1751.704	1751.466	1751.162	1750.853	1750.585	1750.348	1750.115	1749.882	1749.650	1749.397	1749.146

KILOMETER DISTANCE	1.610	1.620	1.630	1.640	1.650	1.660	1.670	1.680	1.690	1.700
H_L 3.7m LEFT	1750.270	1750.073	1749.875	1749.677	1749.441	1749.203	1748.965	1748.727	1748.490	1748.252
H_C ON CL	1750.071	1749.837	1749.602	1749.367	1749.132	1748.898	1748.663	1748.428	1748.194	1747.959
H_R 3.7m RIGHT	1749.827	1749.569	1749.311	1749.053	1748.796	1748.539	1748.287	1748.039	1747.800	1747.564
GROUND LEVELS AT GRADE LINE	1748.894	1748.663	1748.459	1748.255	1748.053	1747.865	1747.661	1747.459	1747.258	1747.058

KILOMETER DISTANCE	1.710	1.720	1.730	1.740	1.750	1.760	1.770	1.780	1.790	1.800
H_L 3.7m LEFT	1748.018	1747.788	1747.568	1747.351	1747.143	1746.939	1746.744	1746.552	1746.371	1746.192
H_C ON CL	1747.724	1747.493	1747.268	1747.050	1746.839	1746.634	1746.436	1746.244	1746.059	1745.881
H_R 3.7m RIGHT	1747.337	1747.113	1746.899	1746.687	1746.485	1746.286	1746.096	1745.909	1745.732	1745.556
GROUND LEVELS AT GRADE LINE	1746.865	1746.673	1746.484	1746.303	1746.148	1745.995	1745.843	1745.716	1745.584	1745.417

KILOMETER DISTANCE	1.810	1.820	1.830	1.840	1.850	1.860	1.870	1.880	1.890	1.900
H_L 3.7m LEFT	1746.023	1745.856	1745.701	1745.547	1745.404	1745.263	1745.133	1745.005	1744.888	1744.773
H_C ON CL	1745.709	1745.544	1745.386	1745.234	1745.089	1744.950	1744.819	1744.693	1744.575	1744.463
H_R 3.7m RIGHT	1745.392	1745.229	1745.077	1744.926	1744.786	1744.647	1744.520	1744.393	1744.278	1744.164
GROUND LEVELS AT GRADE LINE	1745.251	1745.100	1744.956	1744.814	1744.675	1744.548	1744.427	1744.308	1744.192	1744.106

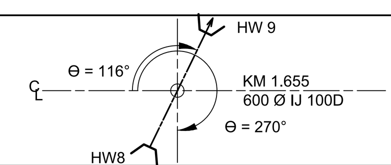
KILOMETER DISTANCE	1.910	1.920	1.930	1.940	1.950	1.960	1.970	1.980	1.990	2.000
H_L 3.7m LEFT	1744.669	1744.566	1744.475	1744.385	1744.307	1744.230	1744.162	1744.100	1744.048	1743.996
H_C ON CL	1744.358	1744.259	1744.167	1744.082	1744.003	1743.931	1743.865	1743.807	1743.755	1743.709
H_R 3.7m RIGHT	1744.061	1743.960	1743.869	1743.780	1743.701	1743.625	1743.557	1743.494	1743.449	1743.412
GROUND LEVELS AT GRADE LINE	1744.027	1743.951	1743.877	1743.736	1743.601	1743.469	1743.337	1743.217	1743.108	1743.001

SUPER ELEVATION: ENC km 1.54 L -2.5% R -2.5% ; ENC km 1.61 L 2.5% R -2.5% ; BFS km 1.638 L 7.3% R -7.3% ; FS km 1.995 L 7.3% R -7.3%

GUARDRAIL LEFT
KERB LEFT
SHOULDER LEFT
GUARDRAIL RIGHT
KERB RIGHT
SHOULDER RIGHT

HORIZONTAL ALIGNMENT: STRAIGHT L=870.119m 300° 42' 52" (km 0.743 – km 1.613) ; R=520.00m L=708.70m Δ=78°05'20"

DRAINAGE — KILOMETER DISTANCE SIZE AND ANGLE



REV	DATE	BY	DESCRIPTION	CHK	APD
B	10-11-2017	-	FOR APPROVAL	-	-
A	13-01-2017	-	FOR INFORMATION	-	-

ROADS AUTHORITY: the dpwrt Department: Public Works, Roads and Transport MPUMALANGA PROVINCE

CLIENT: umsimbithi Mining (Pty) Ltd

DRAWING STATUS: FOR APPROVAL

If drawing status = construction, a signed copy of this drawing (either in hardcopy or electronic format) is available at the office of origin and at the office of issue.

WSP Group Africa (Pty) Ltd
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314 Glenwood Road, Lynnwood Park, Pretoria, 0081
PostNet Suite 287, Private Bag X025, Lynnwood Ridge, 0040
Tel: +27(0)12-762-1200 Fax: +27(0)12-762-1301 www.wsp.com

PROJECT: RE-ALIGNMENT OF PROVINCIAL ROAD P15-1 AT WONDERFONTEIN

TITLE: ROAD AND STORMWATER LAYOUT PLAN WITH LONGITUDINAL SECTION (SHEET 4 OF 10)

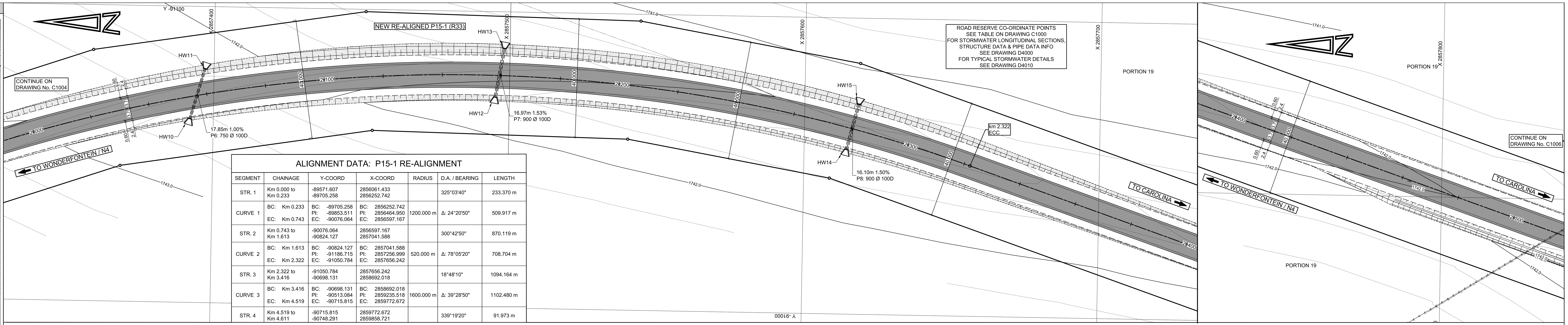
SCALE @ A0: 1:500	CHECKED: E. KOTZE	APPROVED: E. KOTZE
DESIGN: M.KWATSHA	DRAWN: I.WESSELS	DATE: 2017/11/20
PROJECT No: 22115	DRAWING No: C1004	REV: B

PLOT DATE: 2018/01/09 09:59:43 AM

TEMPLATE VERSION 1.1

LEGEND

- NEW ROAD SURFACE - ASPHALT
- EXISTING ROAD AREA
- PAVED AREAS
- ERF BOUNDARIES / ROAD RESERVE
- NEW ROAD RESERVE & COORDINATE POINTS
- BENCHMARKS / REFERENCE POINTS (BM)
- EXISTING FENCE-LINE
- EXISTING WALL
- EXISTING GUARDRAIL
- EXISTING ROAD SIGN (RS)
- EXISTING SIGN BOARD (SB)
- EXISTING DISTANCE MARKER (DM)
- EXISTING REFUSE BIN (BIN)
- EXISTING TRAFFIC SIGNAL (TS)
- EXISTING STREET LIGHT POLE (LP)
- EXISTING ELECTRICAL MAST/POLE (EP)
- EXISTING ELEC. LINE
- EXISTING ELEC. OVERHEAD LINE (OH)
- EXISTING ELEC. MANHOLE
- EXISTING ELEC. BOX/TRANSFORMER
- EXISTING SEWER PIPE (SE)
- EXISTING SEWER MANHOLE (SE)
- EXISTING SEWER CLEANING EYE (CE)
- EXISTING STORMWATER PIPE (SW)
- EXISTING STORMWATER MANHOLE (SW)
- EXISTING WATER PIPE (W)
- EXISTING WATER END CAP
- EXISTING WATER VALVE
- EXISTING WATER METER (M)
- EXISTING TELKOM CABLE (T)
- EXISTING TELKOM MANHOLE (T)
- EXISTING TELEPHONE POLE (TP)



ALIGNMENT DATA: P15-1 RE-ALIGNMENT

SEGMENT	CHAINAGE	Y-COORD	X-COORD	RADIUS	D.A. / BEARING	LENGTH
STR. 1	Km 0.000 to Km 0.233	-89571.607 -89705.258	2856061.433 2856252.742		325°03'40"	233.370 m
CURVE 1	BC: Km 0.233 EC: Km 0.743	BC: -89705.258 PI: -89853.511 EC: -90076.064	BC: 2856252.742 PI: 2856464.950 EC: 2856597.167	1200.000 m	Δ: 24°20'50"	509.917 m
STR. 2	Km 0.743 to Km 1.613	-90076.064 -90824.127	2856597.167 2857041.588		300°42'50"	870.119 m
CURVE 2	BC: Km 1.613 EC: Km 2.322	BC: -90824.127 PI: -91186.715 EC: -91050.784	BC: 2857041.588 PI: 2857256.999 EC: 2857656.242	520.000 m	Δ: 78°05'20"	708.704 m
STR. 3	Km 2.322 to Km 3.416	-91050.784 -90698.131	2857656.242 2858692.018		18°48'10"	1094.164 m
CURVE 3	BC: Km 3.416 EC: Km 4.519	BC: -90698.131 PI: -90513.084 EC: -90715.815	BC: 2858692.018 PI: 2859235.518 EC: 2859772.672	1600.000 m	Δ: 39°28'50"	1102.480 m
STR. 4	Km 4.519 to Km 4.611	-90715.815 -90748.291	2859772.672 2859858.721		339°19'20"	91.973 m

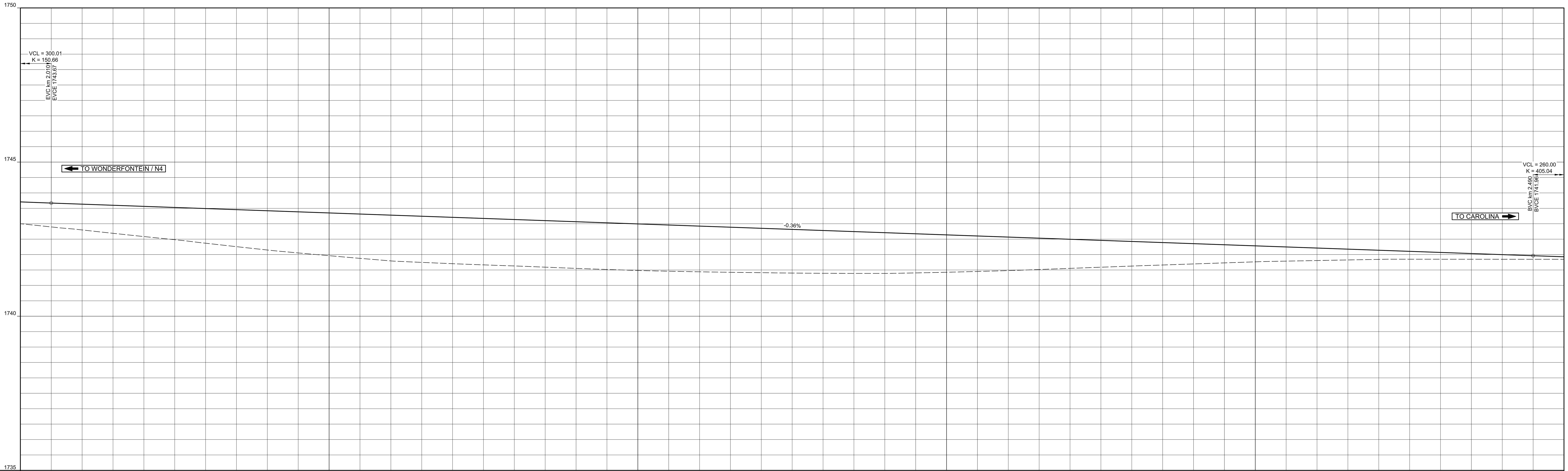
P15-1 RE-ALIGNMENT

DESIGN SPEED - 100KM/H

PROFILE OF GRADE LINE

SCALE:
HORIZONTAL 1:500
VERTICAL 1:50

DATUM 1735.000



VERTICAL CURVES GRADE: VCL=300.0 m, K=150.66; -0.36%; VCL=260.0 m, K=405.04

FINAL ROAD LEVELS: H_L 3.7m LEFT; H_C ON CL; H_R 3.7m RIGHT

KILOMETER DISTANCE	H_L 3.7m LEFT	H_C ON CL	H_R 3.7m RIGHT	GROUND LEVELS AT GRADE LINE
2.000	1743.996	1743.709	1743.412	1743.001
2.010	1743.956	1743.670	1743.376	1742.896
2.020	1743.917	1743.635	1743.339	1742.798
2.030	1743.884	1743.599	1743.302	1742.690
2.040	1743.851	1743.563	1743.265	1742.584
2.050	1743.819	1743.528	1743.229	1742.482
2.060	1743.786	1743.492	1743.192	1742.368
2.070	1743.753	1743.457	1743.155	1742.256
2.080	1743.720	1743.421	1743.119	1742.148
2.090	1743.687	1743.385	1743.082	1742.053
2.100	1743.654	1743.350	1743.045	1741.963
2.110	1743.621	1743.314	1743.008	1741.877
2.120	1743.588	1743.279	1742.972	1741.794
2.130	1743.555	1743.243	1742.935	1741.746
2.140	1743.518	1743.208	1742.898	1741.704
2.150	1743.472	1743.172	1742.862	1741.666
2.160	1743.426	1743.136	1742.825	1741.630
2.170	1743.380	1743.101	1742.788	1741.591
2.180	1743.334	1743.065	1742.751	1741.552
2.190	1743.288	1743.030	1742.719	1741.516
2.200	1743.242	1742.994	1742.690	1741.484
2.210	1743.197	1742.959	1742.661	1741.460
2.220	1743.151	1742.923	1742.632	1741.441
2.230	1743.105	1742.887	1742.603	1741.425
2.240	1743.059	1742.852	1742.574	1741.413
2.250	1743.013	1742.816	1742.545	1741.400
2.260	1742.967	1742.781	1742.516	1741.393
2.270	1742.921	1742.745	1742.487	1741.389
2.280	1742.875	1742.710	1742.458	1741.389
2.290	1742.829	1742.674	1742.429	1741.405
2.300	1742.783	1742.638	1742.400	1741.426
2.310	1742.737	1742.603	1742.371	1741.452
2.320	1742.675	1742.567	1742.343	1741.480
2.330	1742.611	1742.532	1742.313	1741.515
2.340	1742.546	1742.496	1742.284	1741.552
2.350	1742.482	1742.461	1742.255	1741.590
2.360	1742.418	1742.425	1742.226	1741.627
2.370	1742.354	1742.389	1742.197	1741.662
2.380	1742.289	1742.354	1742.168	1741.696
2.390	1742.225	1742.318	1742.138	1741.730
2.400	1742.178	1742.283	1742.109	1741.764
2.410	1742.147	1742.247	1742.080	1741.787
2.420	1742.116	1742.212	1742.051	1741.806
2.430	1742.085	1742.176	1742.022	1741.825
2.440	1742.054	1742.140	1741.993	1741.844
2.450	1742.023	1742.105	1741.963	1741.849
2.460	1741.993	1742.069	1741.934	1741.848
2.470	1741.962	1742.034	1741.905	1741.848
2.480	1741.931	1741.998	1741.876	1741.847
2.490	1741.900	1741.962	1741.847	1741.847
2.500	1741.869	1741.928	1741.818	1741.847

SUPER ELEVATION: FS km 1.995 L 7.3% R -7.3%; EFS km 2.297 L 7.3% R -7.3%; BNC km 2.32 L 2.5% R -2.5%; BNC km 2.40 L -2.5% R -2.5%

GUARDRAIL LEFT
KERB LEFT
SHOULDER LEFT
GUARDRAIL RIGHT
KERB RIGHT
SHOULDER RIGHT

HORIZONTAL ALIGNMENT: km 1.613 — R=520.00m, L=708.70m, Δ=78°05'20" — km 2.322 — STRAIGHT, L=1094.164m, 18° 48' 08"

DRAINAGE — KILOMETER DISTANCE SIZE AND ANGLE:
- HW 10 / HW 11: Km 2.056, 0.750 Ø IJ 100D, Θ = 116°, Θ = 270°
- HW 12 / HW 13: Km 2.159, 0.900 Ø IJ 100D, Θ = 99°, Θ = 270°
- HW 14 / HW 15: Km 2.282, 0.900 Ø IJ 100D, Θ = 90°, Θ = 270°

REV	DATE	BY	DESCRIPTION	CHK	APD
B	10-11-2017	-	FOR APPROVAL	-	-
A	13-01-2017	-	FOR INFORMATION	-	-

ROADS AUTHORITY: the dpwrt — Department: Public Works, Roads and Transport — MPUMALANGA PROVINCE

CLIENT: umsimbithi Mining (Pty) Ltd

DRAWING STATUS: FOR APPROVAL

If drawing status = construction, a signed copy of this drawing (either in hardcopy or electronic format) is available at the office of origin and at the office of issue.

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Tel: +27(0)12-762-1200 Fax: +27(0)12-762-1301 www.wsp.com

PROJECT: RE-ALIGNMENT OF PROVINCIAL ROAD P15-1 AT WONDERFONTEIN

TITLE: ROAD AND STORMWATER LAYOUT PLAN WITH LONGITUDINAL SECTION (SHEET 5 OF 10)

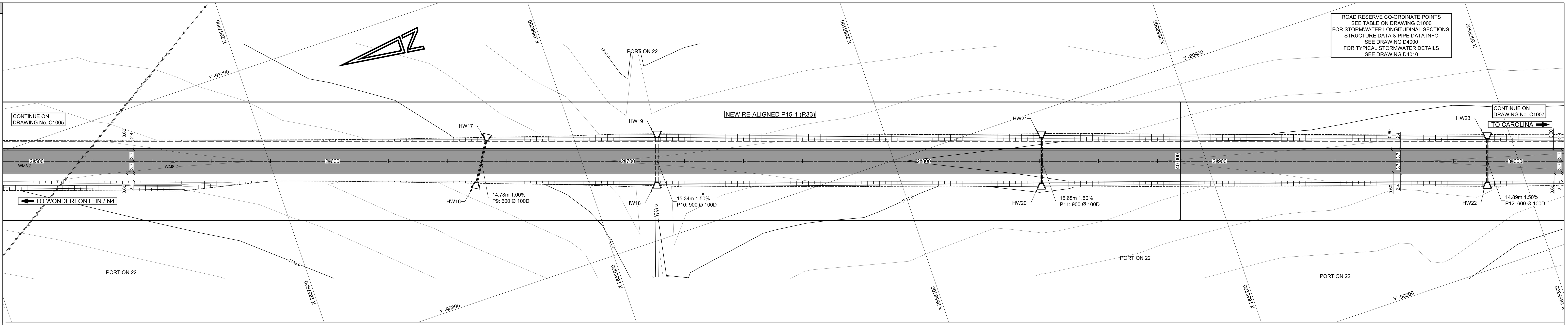
SCALE @ A0: 1:500	CHECKED: E. KOTZE	APPROVED: E. KOTZE (PR No.: ---)
DESIGN: M.KWATSHA	DRAWN: I.WESSELS	DATE: 2017/11/20
PROJECT No: 22115	DRAWING No: C1005	REV: B

PLOT DATE: 2018/01/09 10:02:30 AM

TEMPLATE VERSION 1.1

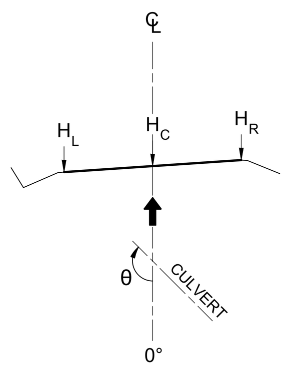
LEGEND

NEW ROAD SURFACE - ASPHALT	
EXISTING ROAD AREA	
PAVED AREAS	
ERF BOUNDARIES / ROAD RESERVE	
NEW ROAD RESERVE & COORDINATE POINTS	
BENCHMARKS / REFERENCE POINTS	BM
EXISTING FENCE-LINE	
EXISTING WALL	
EXISTING GUARDRAIL	
EXISTING ROAD SIGN	
EXISTING SIGN BOARD	
EXISTING DISTANCE MARKER	
EXISTING REFUSE BIN	
EXISTING TRAFFIC SIGNAL	
EXISTING STREET LIGHT POLE	
EXISTING ELECTRICAL MAST/POLE	
EXISTING ELEC. LINE	
EXISTING ELEC. OVERHEAD LINE	
EXISTING ELEC. MANHOLE	
EXISTING ELEC. BOX/TRANSFORMER	
EXISTING SEWER PIPE	
EXISTING SEWER MANHOLE	
EXISTING SEWER CLEANING EYE	
EXISTING STORMWATER PIPE	
EXISTING STORMWATER MANHOLE	
EXISTING WATER PIPE	
EXISTING WATER END CAP	
EXISTING WATER VALVE	
EXISTING WATER METER	
EXISTING TELKOM CABLE	
EXISTING TELKOM MANHOLE	
EXISTING TELEPHONE POLE	



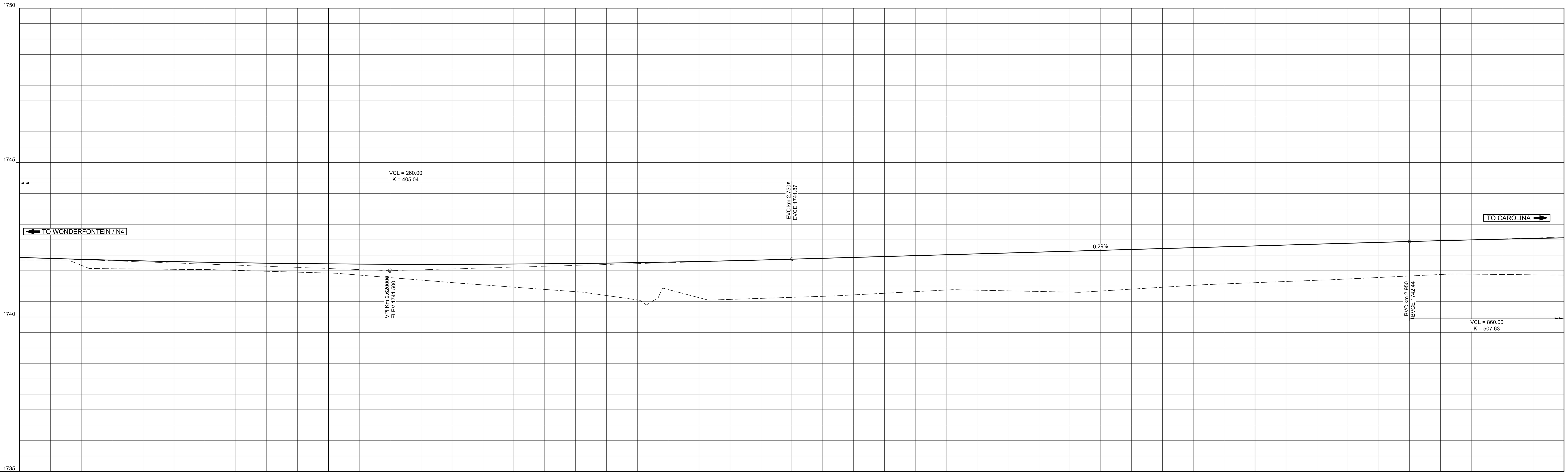
P15-1 RE-ALIGNMENT

DESIGN SPEED - 100KM/H



PROFILE OF GRADE LINE

SCALE:
HORIZONTAL 1:500
VERTICAL 1:50



DATUM 1735.000

VERTICAL CURVES: VCL=260.0 m, K=405.04 (km 2.500 – 2.750); VCL=860.0 m, K=507.63 (from km 2.950)

GRADE: -0.36% (to km 2.620); 0.29% (from km 2.620)

FINAL ROAD LEVELS: H_L 3.7m LEFT; H_C ON CL; H_R 3.7m RIGHT

SUPER ELEVATION: NC km 2.51 L -2.5% R -2.5%; NC km 2.991 L -2.5% R -2.5%

KILOMETER DISTANCE	H_L 3.7m LEFT	H_C ON CL	H_R 3.7m RIGHT	GROUND LEVELS AT GRADE LINE
2.500	1741.869	1741.928	1741.869	1741.847
2.510	1741.839	1741.896	1741.839	1741.847
2.520	1741.808	1741.867	1741.808	1741.674
2.530	1741.783	1741.840	1741.783	1741.563
2.540	1741.760	1741.815	1741.760	1741.554
2.550	1741.736	1741.793	1741.736	1741.544
2.560	1741.712	1741.774	1741.712	1741.535
2.570	1741.689	1741.757	1741.689	1741.510
2.580	1741.673	1741.742	1741.673	1741.481
2.590	1741.663	1741.730	1741.663	1741.452
2.600	1741.654	1741.721	1741.654	1741.423
2.610	1741.644	1741.713	1741.644	1741.357
2.620	1741.635	1741.709	1741.635	1741.276
2.630	1741.628	1741.706	1741.628	1741.195
2.640	1741.633	1741.707	1741.633	1741.115
2.650	1741.637	1741.709	1741.637	1741.040
2.660	1741.642	1741.714	1741.642	1740.966
2.670	1741.647	1741.722	1741.647	1740.893
2.680	1741.652	1741.732	1741.652	1740.820
2.690	1741.668	1741.745	1741.668	1740.696
2.700	1741.687	1741.760	1741.687	1740.554
2.710	1741.706	1741.777	1741.706	1740.889
2.720	1741.725	1741.797	1741.725	1740.626
2.730	1741.744	1741.820	1741.744	1740.570
2.740	1741.766	1741.845	1741.766	1740.604
2.750	1741.792	1741.872	1741.792	1740.637
2.760	1741.818	1741.901	1741.818	1740.670
2.770	1741.844	1741.929	1741.844	1740.717
2.780	1741.870	1741.958	1741.870	1740.769
2.790	1741.896	1741.986	1741.896	1740.821
2.800	1741.922	1742.015	1741.922	1740.874
2.810	1741.948	1742.044	1741.948	1740.869
2.820	1741.974	1742.072	1741.974	1740.848
2.830	1742.000	1742.101	1742.000	1740.827
2.840	1742.026	1742.130	1742.026	1740.806
2.850	1742.052	1742.158	1742.052	1740.841
2.860	1742.076	1742.187	1742.076	1740.903
2.870	1742.100	1742.215	1742.100	1740.964
2.880	1742.123	1742.244	1742.123	1741.025
2.890	1742.146	1742.273	1742.146	1741.072
2.900	1742.169	1742.301	1742.169	1741.111
2.910	1742.192	1742.330	1742.192	1741.150
2.920	1742.216	1742.358	1742.216	1741.189
2.930	1742.239	1742.387	1742.239	1741.232
2.940	1742.262	1742.416	1742.262	1741.280
2.950	1742.285	1742.444	1742.285	1741.328
2.960	1742.308	1742.472	1742.308	1741.376
2.970	1742.332	1742.498	1742.332	1741.388
2.980	1742.355	1742.521	1742.355	1741.377
2.990	1742.378	1742.543	1742.378	1741.367
3.000	1742.401	1742.563	1742.401	1741.356

GUARDRAIL LEFT
KERB LEFT
SHOULDER LEFT
GUARDRAIL RIGHT
KERB RIGHT
SHOULDER RIGHT

HORIZONTAL ALIGNMENT: km 2.322 — STRAIGHT L=1094.164m 18° 48' 08"

DRAINAGE — KILOMETER DISTANCE SIZE AND ANGLE

REV	DATE	BY	DESCRIPTION	CHK	APD
B	10-11-2017	-	FOR APPROVAL	-	-
A	13-01-2017	-	FOR INFORMATION	-	-

ROADS AUTHORITY: the dpwrt Department: Public Works, Roads and Transport MPUMALANGA PROVINCE

CLIENT: umsimbithi Mining (Pty) Ltd

DRAWING STATUS: FOR APPROVAL

If drawing status = construction, a signed copy of this drawing (either in hardcopy or electronic format) is available at the office of origin and at the office of issue.

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Tel: +27(0)12-762-1200 Fax: +27(0)12-762-1301 www.wsp.com

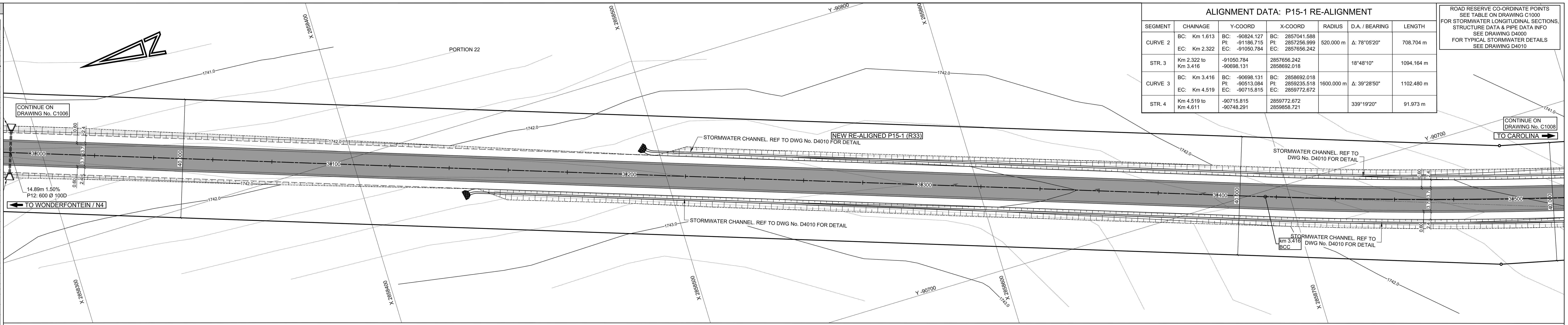
PROJECT: RE-ALIGNMENT OF PROVINCIAL ROAD P15-1 AT WONDERFONTEIN

TITLE: ROAD AND STORMWATER LAYOUT PLAN WITH LONGITUDINAL SECTION (SHEET 6 OF 10)

SCALE @ A0: 1:500	CHECKED: E. KOTZE	APPROVED: E. KOTZE
DESIGN: M.KWATSHA	DRAWN: I.WESSELS	DATE: 2017/11/20
PROJECT No: 22115	DRAWING No: C1006	REV: B

LEGEND

- NEW ROAD SURFACE - ASPHALT
- EXISTING ROAD AREA
- PAVED AREAS
- ERF BOUNDARIES / ROAD RESERVE
- NEW ROAD RESERVE & COORDINATE POINTS
- BENCHMARKS / REFERENCE POINTS (BM)
- EXISTING FENCE-LINE
- EXISTING WALL
- EXISTING GUARDRAIL
- EXISTING ROAD SIGN
- EXISTING SIGN BOARD
- EXISTING DISTANCE MARKER
- EXISTING REFUSE BIN
- EXISTING TRAFFIC SIGNAL
- EXISTING STREET LIGHT POLE
- EXISTING ELECTRICAL MAST/POLE
- EXISTING ELEC. LINE
- EXISTING ELEC. OVERHEAD LINE
- EXISTING ELEC. MANHOLE
- EXISTING ELEC. BOX/TRANSFORMER
- EXISTING SEWER PIPE
- EXISTING SEWER MANHOLE
- EXISTING SEWER CLEANING EYE
- EXISTING STORMWATER PIPE
- EXISTING STORMWATER MANHOLE
- EXISTING WATER PIPE
- EXISTING WATER END CAP
- EXISTING WATER VALVE
- EXISTING WATER METER
- EXISTING TELKOM CABLE
- EXISTING TELKOM MANHOLE
- EXISTING TELEPHONE POLE



ALIGNMENT DATA: P15-1 RE-ALIGNMENT

SEGMENT	CHAINAGE	Y-COORD	X-COORD	RADIUS	D.A. / BEARING	LENGTH
CURVE 2	BC: Km 1.613 EC: Km 2.322	BC: -90824.127 PI: -91186.715 EC: -91050.784	BC: 2857041.588 PI: 2857256.999 EC: 2857656.242	520.000 m	Δ: 78°05'20"	708.704 m
STR. 3	Km 2.322 to Km 3.416	-91050.784 -90698.131	2857656.242 2858692.018		18°48'10"	1094.164 m
CURVE 3	BC: Km 3.416 EC: Km 4.519	BC: -90698.131 PI: -90513.084 EC: -90715.815	BC: 2858692.018 PI: 2859235.518 EC: 2859772.672	1600.000 m	Δ: 39°28'50"	1102.480 m
STR. 4	Km 4.519 to Km 4.611	-90715.815 -90748.291	2859772.672 2859858.721		339°19'20"	91.973 m

ROAD RESERVE CO-ORDINATE POINTS SEE TABLE ON DRAWING C1000
FOR STORMWATER LONGITUDINAL SECTIONS, STRUCTURE DATA & PIPE DATA INFO SEE DRAWING D4000
FOR TYPICAL STORMWATER DETAILS SEE DRAWING D4010

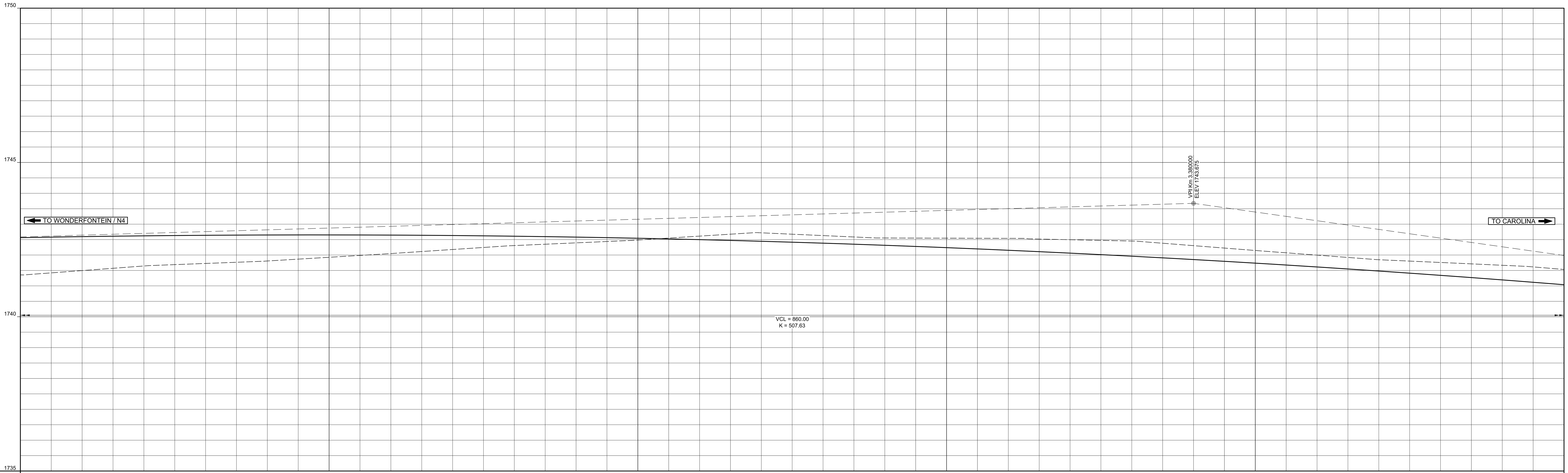
P15-1 RE-ALIGNMENT

DESIGN SPEED - 100KM/H

PROFILE OF GRADE LINE

SCALE:
HORIZONTAL 1:500
VERTICAL 1:50

DATUM 1735.000



VERTICAL CURVES: VCL=860.0 m, K=507.63

GRADE: 0.29% ; -1.41%

SUPER ELEVATION: NC km 3.01 L -2.5% R -2.5%; ENC km 3.34 L -2.5% R -2.5%; ENC km 3.42 L -2.5% R 2.5%; BFS km 3.441 L -4.0% R 4.0%

KILOMETER DISTANCE	FINAL ROAD LEVELS H_L 3.7m LEFT	FINAL ROAD LEVELS H_C ON CL	FINAL ROAD LEVELS H_R 3.7m RIGHT	GROUND LEVELS AT GRADE LINE
3.000	1742.401	1742.563	1742.428	1741.356
3.010	1742.424	1742.581	1742.444	1741.422
3.020	1742.448	1742.596	1742.459	1741.496
3.030	1742.471	1742.610	1742.475	1741.570
3.040	1742.494	1742.622	1742.490	1741.645
3.050	1742.517	1742.632	1742.506	1741.689
3.060	1742.526	1742.640	1742.521	1741.727
3.070	1742.520	1742.646	1742.537	1741.766
3.080	1742.514	1742.650	1742.527	1741.807
3.090	1742.508	1742.652	1742.514	1741.867
3.100	1742.503	1742.652	1742.501	1741.927
3.110	1742.497	1742.650	1742.488	1741.987
3.120	1742.491	1742.646	1742.475	1742.047
3.130	1742.485	1742.640	1742.462	1742.113
3.140	1742.480	1742.632	1742.449	1742.179
3.150	1742.474	1742.623	1742.436	1742.245
3.160	1742.468	1742.611	1742.424	1742.307
3.170	1742.462	1742.597	1742.411	1742.350
3.180	1742.457	1742.581	1742.398	1742.394
3.190	1742.443	1742.564	1742.385	1742.438
3.200	1742.429	1742.544	1742.372	1742.487
3.210	1742.414	1742.522	1742.359	1742.550
3.220	1742.400	1742.499	1742.346	1742.613
3.230	1742.370	1742.473	1742.333	1742.676
3.240	1742.338	1742.446	1742.320	1742.720
3.250	1742.307	1742.416	1742.307	1742.675
3.260	1742.275	1742.385	1742.275	1742.630
3.270	1742.235	1742.351	1742.241	1742.585
3.280	1742.195	1742.316	1742.206	1742.552
3.290	1742.154	1742.279	1742.172	1742.549
3.300	1742.113	1742.239	1742.138	1742.546
3.310	1742.073	1742.198	1742.104	1742.543
3.320	1742.032	1742.155	1742.069	1742.540
3.330	1741.991	1742.109	1742.035	1742.518
3.340	1741.951	1742.062	1742.001	1742.496
3.350	1741.901	1742.013	1741.966	1742.475
3.360	1741.841	1741.962	1741.930	1742.453
3.370	1741.782	1741.909	1741.890	1742.382
3.380	1741.722	1741.854	1741.850	1742.304
3.390	1741.663	1741.796	1741.810	1742.226
3.400	1741.601	1741.737	1741.770	1742.147
3.410	1741.539	1741.676	1741.723	1742.072
3.420	1741.475	1741.613	1741.673	1741.997
3.430	1741.409	1741.548	1741.619	1741.922
3.440	1741.340	1741.482	1741.566	1741.848
3.450	1741.270	1741.413	1741.509	1741.803
3.460	1741.198	1741.342	1741.447	1741.759
3.470	1741.124	1741.269	1741.383	1741.714
3.480	1741.048	1741.194	1741.319	1741.668
3.490	1740.970	1741.117	1741.253	1741.615
3.500	1740.888	1741.039	1741.180	1741.532

GUARDRAIL LEFT
KERB LEFT
SHOULDER LEFT
GUARDRAIL RIGHT
KERB RIGHT
SHOULDER RIGHT

HORIZONTAL ALIGNMENT: km 2.322 STRAIGHT L=1094.164m 18° 48' 08" km 3.416 ; R=1600.00m L=1102.48m Δ=39°28'50"

DRAINAGE: KILOMETER DISTANCE SIZE AND ANGLE

REV	DATE	BY	DESCRIPTION	CHK	APD
B	10-11-2017	-	FOR APPROVAL	-	-
A	13-01-2017	-	FOR INFORMATION	-	-

ROADS AUTHORITY: the dpwrt Department: Public Works, Roads and Transport MPUMALANGA PROVINCE

CLIENT: umsimbithi Mining (Pty) Ltd

DRAWING STATUS: FOR APPROVAL

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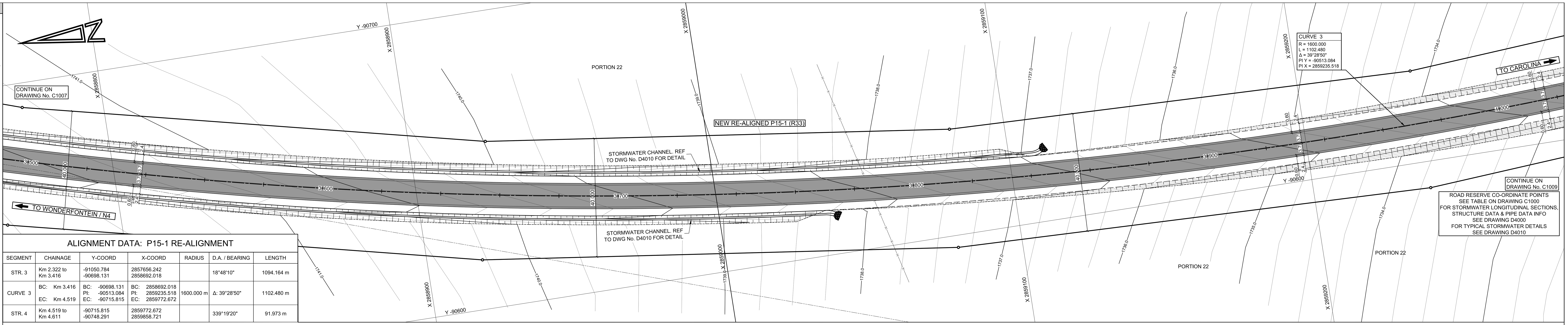
PROJECT: RE-ALIGNMENT OF PROVINCIAL ROAD P15-1 AT WONDERFONTEIN

TITLE: ROAD AND STORMWATER LAYOUT PLAN WITH LONGITUDINAL SECTION (SHEET 7 OF 10)

SCALE @ A0	CHECKED	APPROVED
1:500	E. KOTZE	E. KOTZE
DESIGN: M.KWATSHA	DRAWN: I.WESSELS	DATE: 2017/11/20
PROJECT No: 22115	DRAWING No: C1007	REV: B

LEGEND

- NEW ROAD SURFACE - ASPHALT
- EXISTING ROAD AREA
- PAVED AREAS
- ERF BOUNDARIES / ROAD RESERVE
- NEW ROAD RESERVE & COORDINATE POINTS
- BENCHMARKS / REFERENCE POINTS (BM)
- EXISTING FENCE-LINE
- EXISTING WALL
- EXISTING GUARDRAIL
- EXISTING ROAD SIGN
- EXISTING SIGN BOARD
- EXISTING DISTANCE MARKER
- EXISTING REFUSE BIN
- EXISTING TRAFFIC SIGNAL
- EXISTING STREET LIGHT POLE (LP)
- EXISTING ELECTRICAL MAST/POLE (EP)
- EXISTING ELEC. LINE
- EXISTING ELEC. OVERHEAD LINE (OH)
- EXISTING ELEC. MANHOLE
- EXISTING ELEC. BOX/TRANSFORMER
- EXISTING SEWER PIPE (SE)
- EXISTING SEWER MANHOLE
- EXISTING SEWER CLEANING EYE (CE)
- EXISTING STORMWATER PIPE (SW)
- EXISTING STORMWATER MANHOLE
- EXISTING WATER PIPE (W)
- EXISTING WATER END CAP
- EXISTING WATER VALVE
- EXISTING WATER METER
- EXISTING TELKOM CABLE (T)
- EXISTING TELKOM MANHOLE
- EXISTING TELEPHONE POLE (TP)



ALIGNMENT DATA: P15-1 RE-ALIGNMENT

SEGMENT	CHAINAGE	Y-COORD	X-COORD	RADIUS	D.A. / BEARING	LENGTH
STR. 3	Km 2.322 to Km 3.416	-91050.784 -90698.131	2857656.242 2858692.018		18°48'10"	1094.164 m
CURVE 3	BC: Km 3.416 EC: Km 4.519	BC: -90698.131 PI: -90513.084 EC: -90715.815	BC: 2858692.018 PI: 2859235.518 EC: 2859772.672	1600.000 m	Δ: 39°28'50"	1102.480 m
STR. 4	Km 4.519 to Km 4.611	-90715.815 -90748.291	2859772.672 2859858.721		339°19'20"	91.973 m

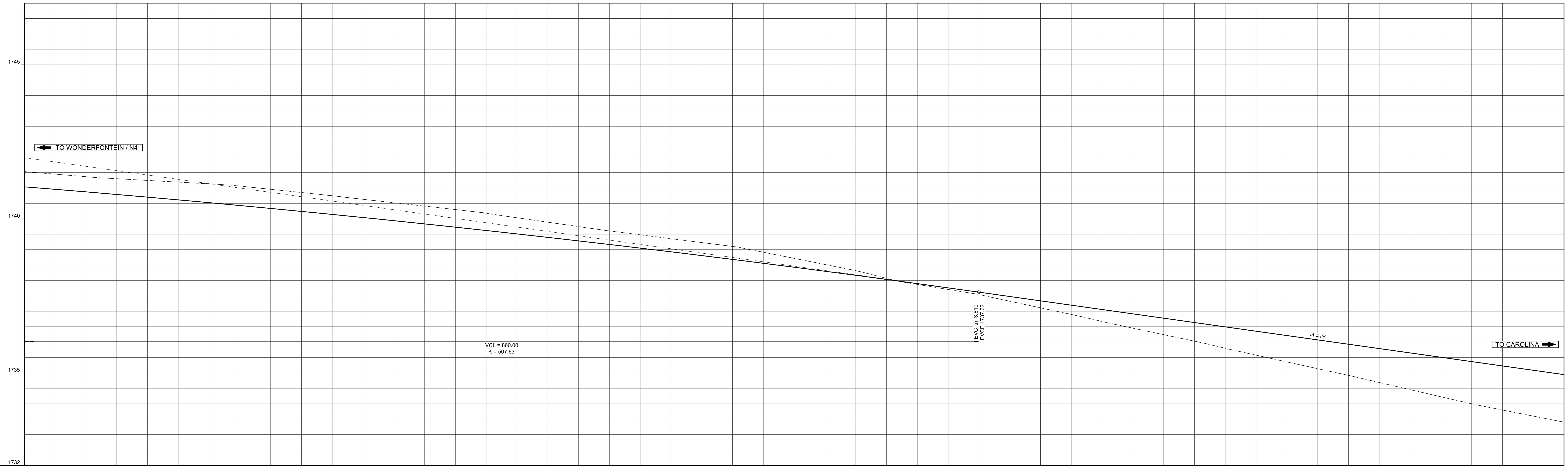
P15-1 RE-ALIGNMENT

DESIGN SPEED - 100KM/H

PROFILE OF GRADE LINE

SCALE:
HORIZONTAL 1:500
VERTICAL 1:50

DATUM 1732.000



VERTICAL CURVES / GRADE: VCL=860.0 m, K=507.63; -1.41%

SUPER ELEVATION: FS km 3.510 L -6.0% R 6.0%; FS km 3.990 L -6.0% R 6.0%

KILOMETER DISTANCE	FINAL ROAD LEVELS H_L 3.7m LEFT	FINAL ROAD LEVELS H_C ON CL	FINAL ROAD LEVELS H_R 3.7m RIGHT	GROUND LEVELS AT GRADE LINE
3.500	1740.888	1741.039	1741.180	1741.532
3.510	1740.807	1740.958	1741.107	1741.450
3.520	1740.724	1740.875	1741.033	1741.367
3.530	1740.636	1740.791	1740.957	1741.301
3.540	1740.548	1740.704	1740.874	1741.247
3.550	1740.459	1740.615	1740.790	1741.191
3.560	1740.368	1740.525	1740.706	1741.135
3.570	1740.272	1740.432	1740.617	1741.062
3.580	1740.175	1740.338	1740.526	1740.959
3.590	1740.079	1740.241	1740.432	1740.854
3.600	1739.980	1740.143	1740.336	1740.749
3.610	1739.876	1740.042	1740.236	1740.634
3.620	1739.773	1739.940	1740.136	1740.523
3.630	1739.669	1739.836	1740.032	1740.412
3.640	1739.561	1739.729	1739.923	1740.300
3.650	1739.450	1739.621	1739.813	1740.181
3.660	1739.339	1739.511	1739.703	1740.034
3.670	1739.226	1739.399	1739.588	1739.891
3.680	1739.111	1739.284	1739.468	1739.748
3.690	1738.992	1739.168	1739.349	1739.607
3.700	1738.873	1739.050	1739.229	1739.481
3.710	1738.752	1738.930	1739.106	1739.356
3.720	1738.629	1738.808	1738.981	1739.230
3.730	1738.504	1738.684	1738.856	1739.104
3.740	1738.379	1738.558	1738.726	1738.916
3.750	1738.255	1738.430	1738.594	1738.717
3.760	1738.124	1738.300	1738.462	1738.518
3.770	1737.984	1738.168	1738.330	1738.318
3.780	1737.844	1738.034	1738.195	1738.068
3.790	1737.705	1737.898	1738.058	1737.872
3.800	1737.565	1737.760	1737.921	1737.709
3.810	1737.425	1737.620	1737.783	1737.545
3.820	1737.286	1737.480	1737.644	1737.326
3.830	1737.146	1737.339	1737.505	1737.111
3.840	1737.006	1737.198	1737.366	1736.897
3.850	1736.866	1737.057	1737.227	1736.668
3.860	1736.727	1736.916	1737.088	1736.452
3.870	1736.587	1736.776	1736.948	1736.241
3.880	1736.447	1736.635	1736.808	1736.030
3.890	1736.308	1736.494	1736.668	1735.799
3.900	1736.168	1736.353	1736.528	1735.576
3.910	1736.028	1736.212	1736.387	1735.356
3.920	1735.889	1736.072	1736.247	1735.137
3.930	1735.749	1735.931	1736.107	1734.920
3.940	1735.609	1735.790	1735.967	1734.689
3.950	1735.469	1735.649	1735.827	1734.457
3.960	1735.330	1735.508	1735.687	1734.226
3.970	1735.190	1735.368	1735.547	1733.998
3.980	1735.050	1735.227	1735.407	1733.796
3.990	1734.911	1735.086	1735.267	1733.598
4.000	1734.771	1734.945	1735.127	1733.402

GUARDRAIL LEFT
KERB LEFT
SHOULDER LEFT
GUARDRAIL RIGHT
KERB RIGHT
SHOULDER RIGHT

HORIZONTAL ALIGNMENT: km 3.416 — STRAIGHT L=1102.480m 359° 03' 45"

DRAINAGE: KILOMETER DISTANCE SIZE AND ANGLE

REV	DATE	BY	DESCRIPTION	CHK	APD
B	10-11-2017	-	FOR APPROVAL	-	-
A	13-01-2017	-	FOR INFORMATION	-	-

ROADS AUTHORITY: the dpwrt Department: Public Works, Roads and Transport MPUMALANGA PROVINCE

CLIENT: umsimbithi Mining (Pty) Ltd

DRAWING STATUS: FOR APPROVAL

If drawing status = construction, a signed copy of this drawing (either in hardcopy or electronic format) is available at the office of origin and at the office of issue.

WSP Group Africa (Pty) Ltd
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314 Glenwood Road, Lynnwood Park, Pretoria, 0081
PostNet Suite 287, Private Bag X025, Lynnwood Ridge, 0040
Tel: +27(0)12-762-1200 Fax: +27(0)12-762-1301 www.wsp.com

PROJECT: RE-ALIGNMENT OF PROVINCIAL ROAD P15-1 AT WONDERFONTEIN

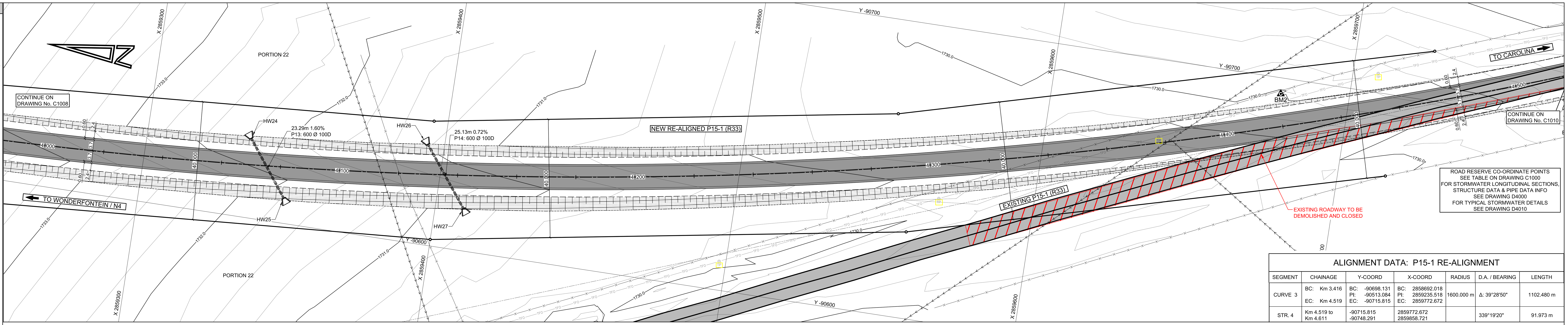
TITLE: ROAD AND STORMWATER LAYOUT PLAN WITH LONGITUDINAL SECTION (SHEET 8 OF 10)

SCALE @ A0: 1:500	CHECKED: E. KOTZE	APPROVED: E. KOTZE
DESIGN: M.KWATSHA	DRAWN: I.WESSELS	DATE: 2017/11/20
PROJECT No: 22115	DRAWING No: C1008	REV: B

TEMPLATE VERSION 1.1

LEGEND

- NEW ROAD SURFACE - ASPHALT
- EXISTING ROAD AREA
- PAVED AREAS
- ERF BOUNDARIES / ROAD RESERVE
- NEW ROAD RESERVE & COORDINATE POINTS
- BENCHMARKS / REFERENCE POINTS (BM)
- EXISTING FENCE-LINE
- EXISTING WALL
- EXISTING GUARDRAIL
- EXISTING ROAD SIGN
- EXISTING SIGN BOARD
- EXISTING DISTANCE MARKER
- EXISTING REFUSE BIN
- EXISTING TRAFFIC SIGNAL
- EXISTING STREET LIGHT POLE
- EXISTING ELECTRICAL MAST/POLE
- EXISTING ELEC. LINE
- EXISTING ELEC. OVERHEAD LINE
- EXISTING ELEC. MANHOLE
- EXISTING ELEC. BOX/TRANSFORMER
- EXISTING SEWER PIPE
- EXISTING SEWER MANHOLE
- EXISTING SEWER CLEANING EYE
- EXISTING STORMWATER PIPE
- EXISTING STORMWATER MANHOLE
- EXISTING WATER PIPE
- EXISTING WATER END CAP
- EXISTING WATER VALVE
- EXISTING WATER METER
- EXISTING TELKOM CABLE
- EXISTING TELKOM MANHOLE
- EXISTING TELEPHONE POLE



ROAD RESERVE CO-ORDINATE POINTS SEE TABLE ON DRAWING C1000
FOR STORMWATER LONGITUDINAL SECTIONS, STRUCTURE DATA & PIPE DATA INFO SEE DRAWING D4000
FOR TYPICAL STORMWATER DETAILS SEE DRAWING D4010

ALIGNMENT DATA: P15-1 RE-ALIGNMENT

SEGMENT	CHAINAGE	Y-COORD	X-COORD	RADIUS	D.A. / BEARING	LENGTH
CURVE 3	BC: Km 3.416 EC: Km 4.519	BC: -90698.131 PI: -90513.084 EC: -90715.815	BC: 2858692.018 PI: 2859235.518 EC: 2859772.672	1600.000 m	Δ: 39°28'50"	1102.480 m
STR. 4	Km 4.519 to Km 4.611	-90715.815 -90748.291	2859772.672 2859858.721		339°19'20"	91.973 m

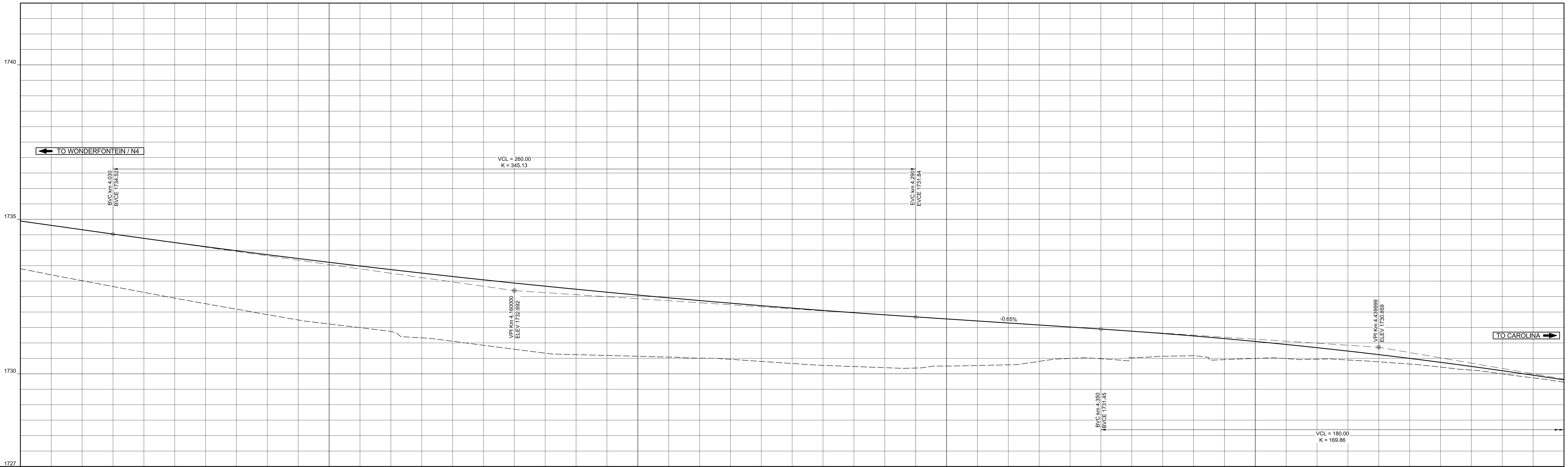
P15-1 RE-ALIGNMENT

DESIGN SPEED - 100KM/H

PROFILE OF GRADE LINE

SCALE:
HORIZONTAL 1:500
VERTICAL 1:50

DATUM 1727.000



VERTICAL CURVES / GRADE: -1.41% (to km 4.160); VCL=260.0 m, K=345.13 (km 4.030 – 4.290); -0.65%; VCL=180.0 m, K=169.86 (from km 4.350); -1.71% (from km 4.440)

SUPER ELEVATION: FS km 4.010 L -6.0% R 6.0%; EFS km 4.494 L -4.0% R 4.0%

KILOMETER DISTANCE	FINAL ROAD LEVELS H_L 3.7m LEFT	H_C ON CL	H_R 3.7m RIGHT	GROUND LEVELS AT GRADE LINE
4.000	1734.771	1734.945	1735.127	1733.402
4.010	1734.631	1734.804	1734.987	1733.204
4.020	1734.490	1734.664	1734.846	1733.014
4.030	1734.347	1734.523	1734.706	1732.825
4.040	1734.208	1734.383	1734.566	1732.636
4.050	1734.069	1734.247	1734.426	1732.449
4.060	1733.931	1734.113	1734.287	1732.269
4.070	1733.802	1733.983	1734.160	1732.092
4.080	1733.676	1733.855	1734.034	1731.916
4.090	1733.550	1733.730	1733.907	1731.741
4.100	1733.426	1733.608	1733.782	1731.613
4.110	1733.312	1733.489	1733.661	1731.494
4.120	1733.199	1733.373	1733.543	1731.370
4.130	1733.086	1733.260	1733.431	1731.163
4.140	1732.978	1733.149	1733.325	1731.053
4.150	1732.878	1733.042	1733.221	1730.924
4.160	1732.777	1732.937	1733.117	1730.796
4.170	1732.678	1732.835	1733.012	1730.668
4.180	1732.585	1732.737	1732.909	1730.620
4.190	1732.492	1732.641	1732.813	1730.594
4.200	1732.399	1732.548	1732.717	1730.568
4.210	1732.307	1732.458	1732.625	1730.542
4.220	1732.215	1732.371	1732.535	1730.507
4.230	1732.127	1732.286	1732.449	1730.468
4.240	1732.038	1732.205	1732.364	1730.401
4.250	1731.958	1732.126	1732.283	1730.334
4.260	1731.878	1732.051	1732.203	1730.273
4.270	1731.800	1731.978	1732.127	1730.235
4.280	1731.729	1731.908	1732.055	1730.198
4.290	1731.660	1731.841	1731.984	1730.187
4.300	1731.596	1731.776	1731.914	1730.252
4.310	1731.534	1731.710	1731.849	1730.269
4.320	1731.475	1731.645	1731.788	1730.290
4.330	1731.416	1731.579	1731.728	1730.402
4.340	1731.354	1731.514	1731.668	1730.497
4.350	1731.289	1731.448	1731.611	1730.487
4.360	1731.216	1731.380	1731.550	1730.521
4.370	1731.140	1731.306	1731.460	1730.567
4.380	1731.057	1731.226	1731.370	1730.584
4.390	1730.969	1731.140	1731.281	1730.459
4.400	1730.875	1731.048	1731.191	1730.497
4.410	1730.778	1730.950	1731.101	1730.492
4.420	1730.674	1730.846	1731.006	1730.472
4.430	1730.564	1730.736	1730.903	1730.448
4.440	1730.448	1730.621	1730.796	1730.387
4.450	1730.330	1730.499	1730.674	1730.316
4.460	1730.203	1730.372	1730.542	1730.217
4.470	1730.072	1730.239	1730.394	1730.119
4.480	1729.934	1730.100	1730.242	1729.997
4.490	1729.795	1729.955	1730.082	1729.869
4.500	1729.652	1729.804	1729.903	1729.728

GUARDRAIL LEFT
KERB LEFT
SHOULDER LEFT
GUARDRAIL RIGHT
KERB RIGHT
SHOULDER RIGHT

HORIZONTAL ALIGNMENT: km 3.416 — STRAIGHT L=1102.480m 359° 03' 45"

DRAINAGE — KILOMETER DISTANCE SIZE AND ANGLE:
HW 24 / HW 25: θ = 58°, Km 4.075.18, 0.600 Ø IJ 100D, θ = 237.5°
HW 26 / HW 27: θ = 60°, Km 4.135.78, 0.600 Ø IJ 100D, θ = 240°

REV	DATE	BY	DESCRIPTION	CHK	APD
B	10-11-2017	-	FOR APPROVAL	-	-
A	13-01-2017	-	FOR INFORMATION	-	-

ROADS AUTHORITY: the dpwrt Department: Public Works, Roads and Transport MPUMALANGA PROVINCE

CLIENT: umsimbithi Mining (Pty) Ltd

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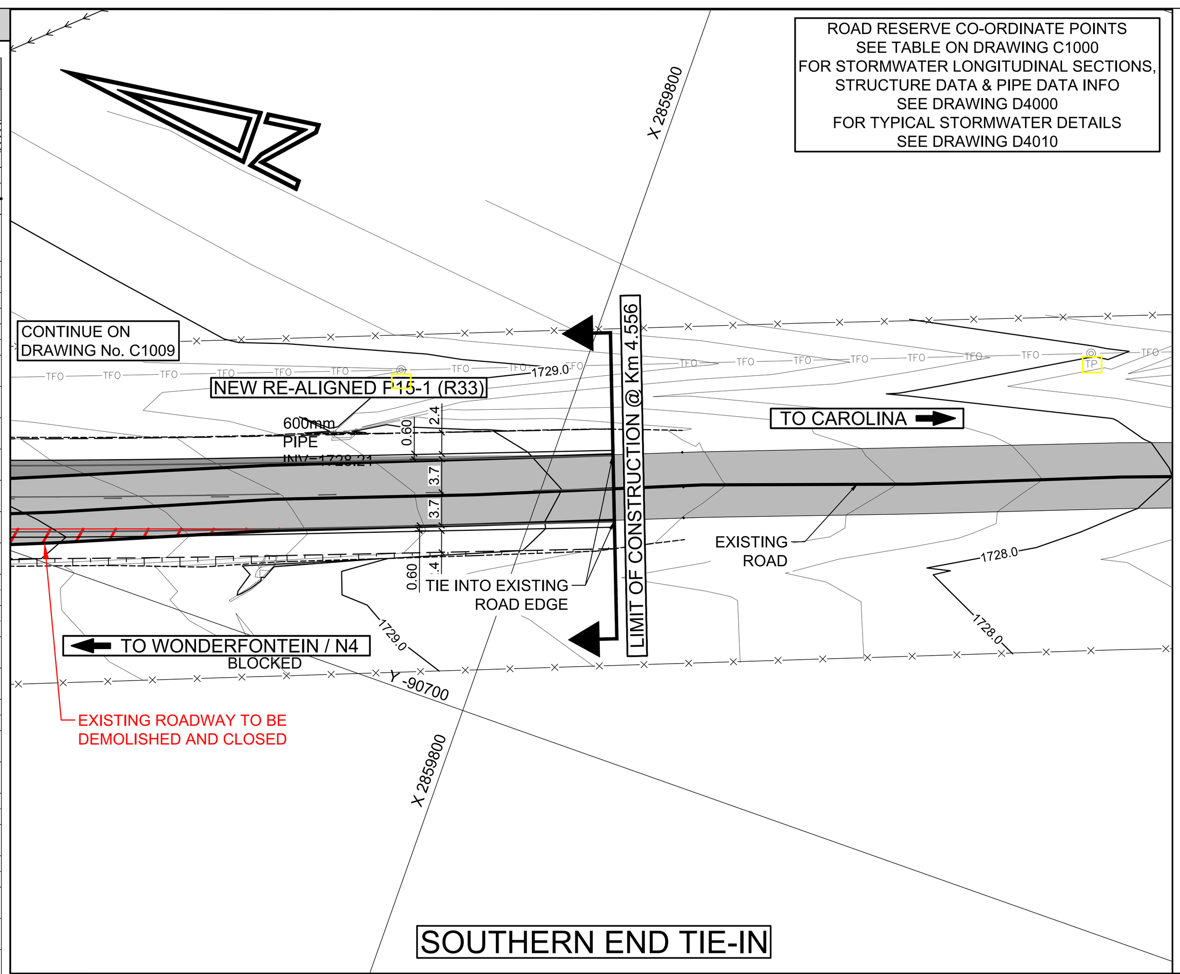
PROJECT: RE-ALIGNMENT OF PROVINCIAL ROAD P15-1 AT WONDERFONTEIN

TITLE: ROAD AND STORMWATER LAYOUT PLAN WITH LONGITUDINAL SECTION (SHEET 9 OF 10)

SCALE @ A0	CHECKED	APPROVED
1:500	E. KOTZE	E. KOTZE
DESIGN: M.KWATSHA	DRAWN: I.WESSELS	DATE: 2017/11/20
PROJECT No: 22115	DRAWING No: C1009	REV: B

LEGEND

- NEW ROAD SURFACE - ASPHALT
- EXISTING ROAD AREA
- PAVED AREAS
- ERF BOUNDARIES / ROAD RESERVE
- NEW ROAD RESERVE & COORDINATE POINTS
- BENCHMARKS / REFERENCE POINTS (BM)
- EXISTING FENCE-LINE
- EXISTING WALL
- EXISTING GUARDRAIL
- EXISTING ROAD SIGN
- EXISTING SIGN BOARD
- EXISTING DISTANCE MARKER
- EXISTING REFUSE BIN
- EXISTING TRAFFIC SIGNAL
- EXISTING STREET LIGHT POLE
- EXISTING ELECTRICAL MAST/POLE
- EXISTING ELEC. LINE
- EXISTING ELEC. OVERHEAD LINE
- EXISTING ELEC. MANHOLE
- EXISTING ELEC. BOX/TRANSFORMER
- EXISTING SEWER PIPE
- EXISTING SEWER MANHOLE
- EXISTING SEWER CLEANING EYE
- EXISTING STORMWATER PIPE
- EXISTING STORMWATER MANHOLE
- EXISTING WATER PIPE
- EXISTING WATER END CAP
- EXISTING WATER VALVE
- EXISTING WATER METER
- EXISTING TELKOM CABLE
- EXISTING TELKOM MANHOLE
- EXISTING TELEPHONE POLE



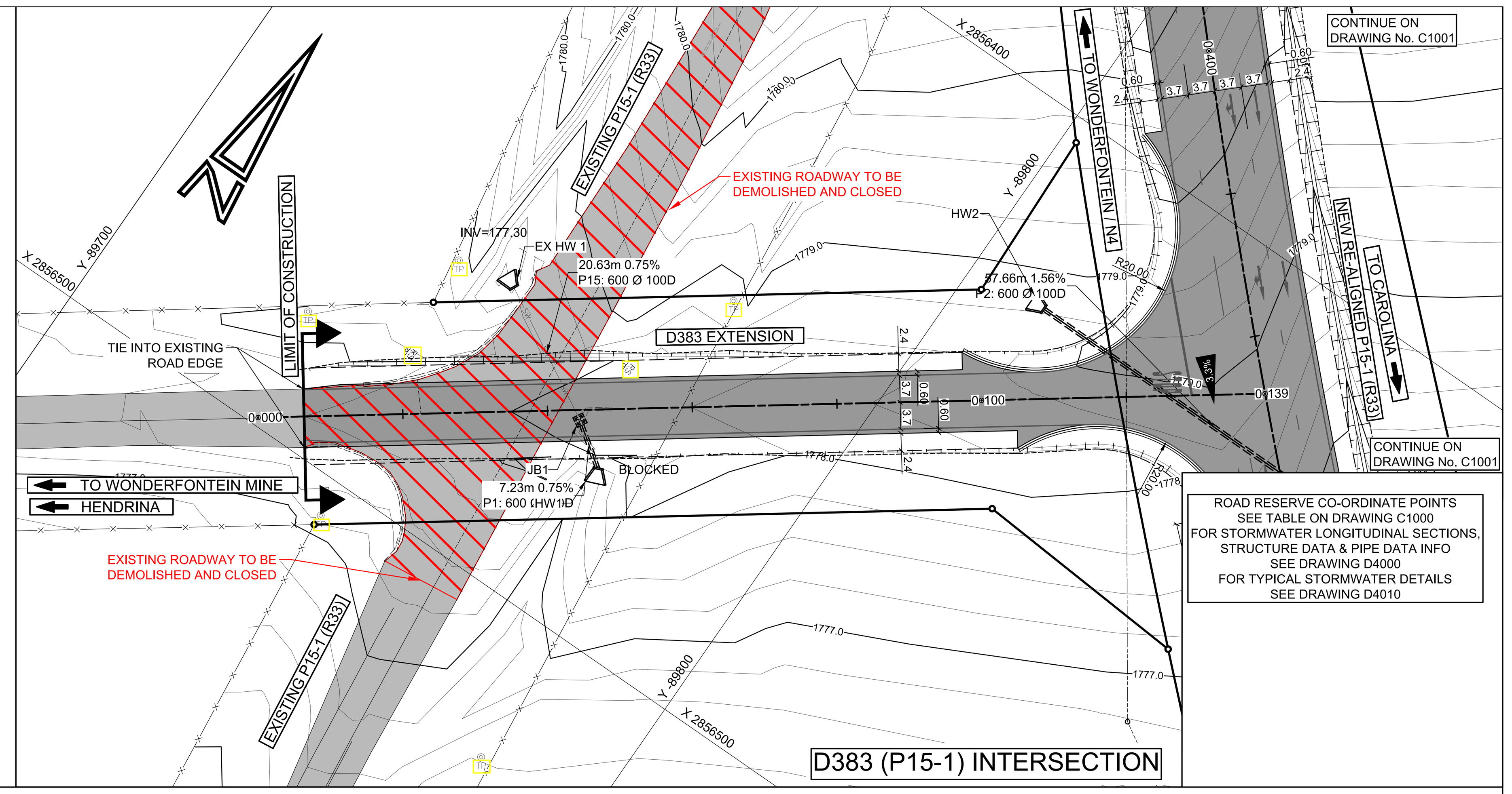
SOUTHERN END TIE-IN

ALIGNMENT DATA: P15-1 RE-ALIGNMENT

SEGMENT	CHAINAGE	Y-COORD	X-COORD	RADIUS	D.A. / BEARING	LENGTH
STR. 1	Km 0.000 to Km 0.233	-89571.607 -89705.258	2856061.433 2856252.742		325°03'40"	233.370 m
CURVE 1	BC: Km 0.233 PI: EC: Km 0.743	BC: -89705.258 PI: -89853.511 EC: -90076.064	BC: 2856252.742 PI: 2856464.950 EC: 2856597.167	1200.000 m	Δ: 24°20'50"	509.917 m
STR. 2	Km 0.743 to Km 1.613	-90076.064 -90824.127	2856597.167 2857041.588		300°42'50"	870.119 m
CURVE 2	BC: Km 1.613 PI: EC: Km 2.322	BC: -90824.127 PI: -91186.715 EC: -91050.784	BC: 2857041.588 PI: 2857256.999 EC: 2857656.242	520.000 m	Δ: 78°05'20"	708.704 m
STR. 3	Km 2.322 to Km 3.416	-91050.784 -90698.131	2857656.242 2858692.018		18°48'10"	1094.164 m
CURVE 3	BC: Km 3.416 PI: EC: Km 4.519	BC: -90698.131 PI: -90513.084 EC: -90715.815	BC: 2858692.018 PI: 2859235.518 EC: 2859772.672	1600.000 m	Δ: 39°28'50"	1102.480 m
STR. 4	Km 4.519 to Km 4.611	-90715.815 -90748.291	2859772.672 2859858.721		339°19'20"	91.973 m

ALIGNMENT DATA: D383 EXTENSION

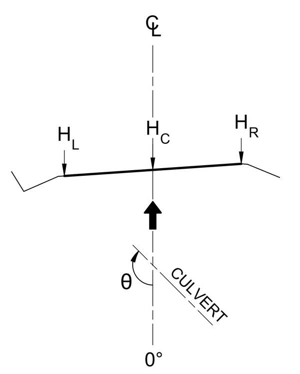
SEGMENT	CHAINAGE	Y-COORD	X-COORD	RADIUS	D.A. / BEARING	LENGTH
STR. 9	Km 0.000 to Km 0.139	-89730.821 -89843.256	2856498.875 2856416.826		233°52'50"	139.189 m



D383 (P15-1) INTERSECTION

P15-1 RE-ALIGNMENT

DESIGN SPEED - 100KM/H

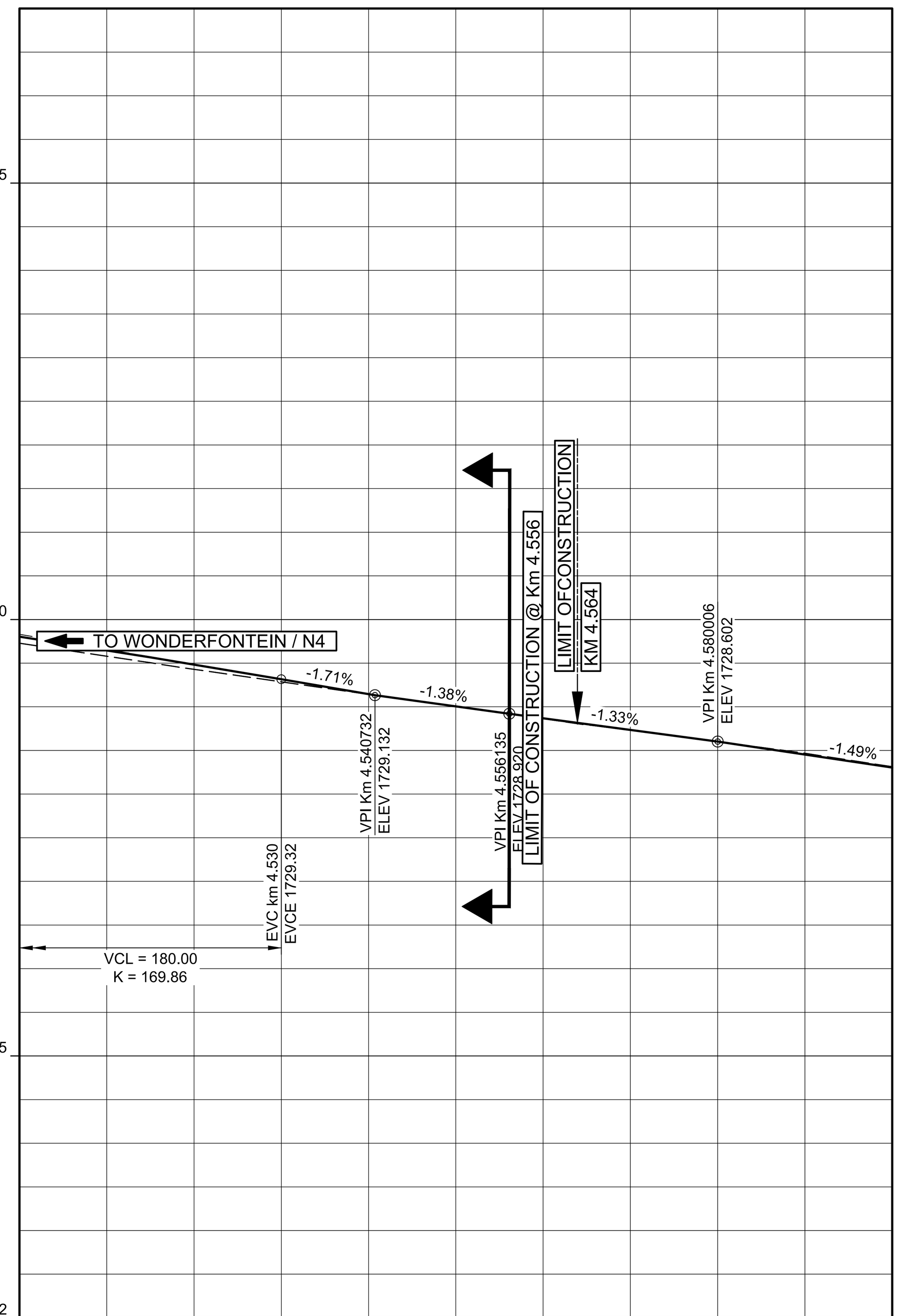


PROFILE OF GRADE LINE

SCALE:
HORIZONTAL 1:500
VERTICAL 1:50

50 m

DATUM 1722.000



	4.500	4.510	4.520	4.530	4.540	4.550	4.560	4.570	4.580	4.590	4.600
VERTICAL CURVES / GRADE	VCL=180.0 m, K=169.86; -1.71%					-1.38%		-1.33%		-1.49%	
FINAL ROAD LEVELS — H_L 3.7m LEFT	1729.652	1729.509	1729.366	1729.226	1729.085	1728.957	1728.828				
FINAL ROAD LEVELS — H_C ON CL	1729.804	1729.647	1729.485	1729.316	1729.145	1729.005	1728.869	1728.735	1728.602	1728.453	1728.304
FINAL ROAD LEVELS — H_R 3.7m RIGHT	1729.903	1729.725	1729.535	1729.345	1729.156	1728.971	1728.809				
SUPER ELEVATION		BNC km 4.519 L -2.5% R 2.5%								BNC km 4.59 L -2.5% R -2.5%	
GROUND LEVELS AT GRADE LINE	1729.728	1729.579	1729.430	1729.286	1729.143	1729.005	1728.864	1728.731	1728.602	1728.467	1728.313
KILOMETER DISTANCE	4.500	4.510	4.520	4.530	4.540	4.550	4.560	4.570	4.580	4.590	4.600

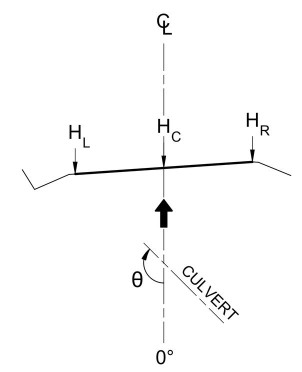
GUARDRAIL LEFT
KERB LEFT
SHOULDER LEFT
GUARDRAIL RIGHT
KERB RIGHT
SHOULDER RIGHT

HORIZONTAL ALIGNMENT: km 3.416 — R=1600.00m, L=1102.48m, Δ=39°28'50" — km 4.519 — STRAIGHT, L=91.973m, 339° 19' 21"

DRAINAGE — KILOMETER DISTANCE SIZE AND ANGLE

D383 EXTENSION

DESIGN SPEED - 100KM/H

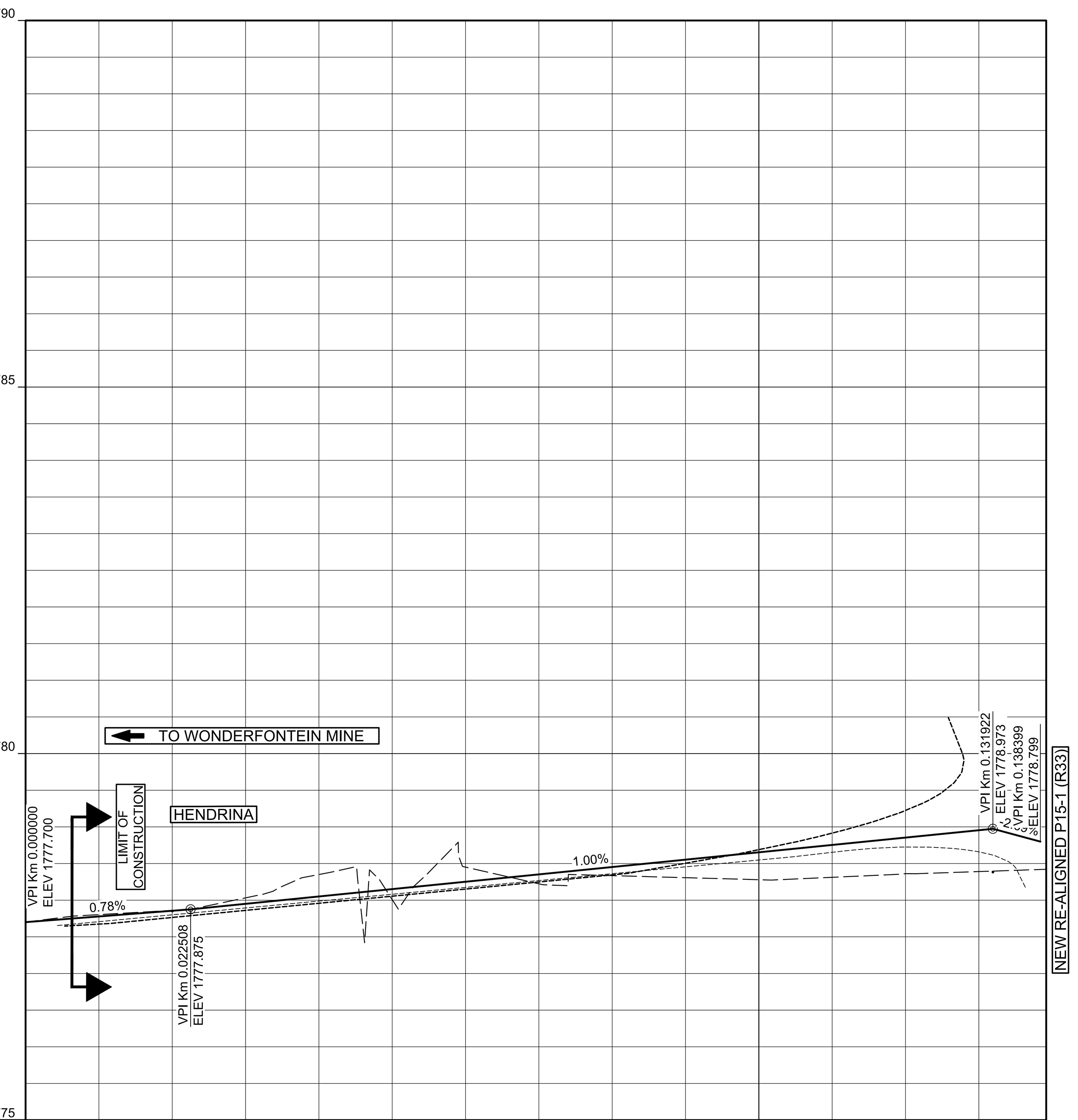


PROFILE OF GRADE LINE

SCALE:
HORIZONTAL 1:500
VERTICAL 1:50

50 m

DATUM 1775.000

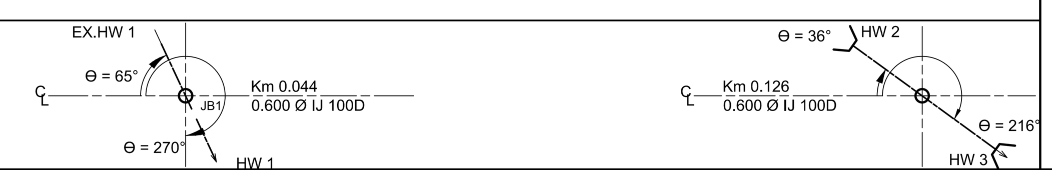


	0.000	0.010	0.020	0.030	0.040	0.050	0.060	0.070	0.080	0.090	0.100	0.110	0.120	0.130	0.139
VERTICAL CURVES / GRADE		0.78%		1.00%											-2.69%
FINAL ROAD LEVELS — H_L 3.7m LEFT		1777.674	1777.764	1777.861	1777.958	1778.055	1778.152	1778.248	1778.345	1778.504	1778.690	1778.915	1779.224		
FINAL ROAD LEVELS — H_C ON CL		1777.778	1777.858	1777.950	1778.051	1778.151	1778.251	1778.352	1778.452	1778.552	1778.653	1778.753	1778.853	1778.954	1778.780
FINAL ROAD LEVELS — H_R 3.7m RIGHT		1777.707	1777.801	1777.894	1777.987	1778.081	1778.174	1778.268	1778.361	1778.455	1778.548	1778.653	1778.725	1778.659	
SUPER ELEVATION															
GROUND LEVELS AT GRADE LINE		1777.778	1777.858	1777.950	1778.051	1778.151	1778.251	1778.352	1778.452	1778.552	1778.653	1778.753	1778.853	1778.954	1778.780
KILOMETER DISTANCE	0.000	0.010	0.020	0.030	0.040	0.050	0.060	0.070	0.080	0.090	0.100	0.110	0.120	0.130	0.139

GUARDRAIL LEFT
KERB LEFT
SHOULDER LEFT
GUARDRAIL RIGHT
KERB RIGHT
SHOULDER RIGHT

HORIZONTAL ALIGNMENT

DRAINAGE — KILOMETER DISTANCE SIZE AND ANGLE



REV	DATE	BY	DESCRIPTION	CHK	APD
B	10-11-2017	-	FOR APPROVAL	-	-
A	13-01-2017	-	FOR INFORMATION	-	-

ROADS AUTHORITY: the dpwrt Department: Public Works, Roads and Transport MPUMALANGA PROVINCE

CLIENT: umsimbithi Mining (Pty) Ltd

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Tel: +27(0)12-762-1200 Fax: +27(0)12-762-1301 www.wsp.com

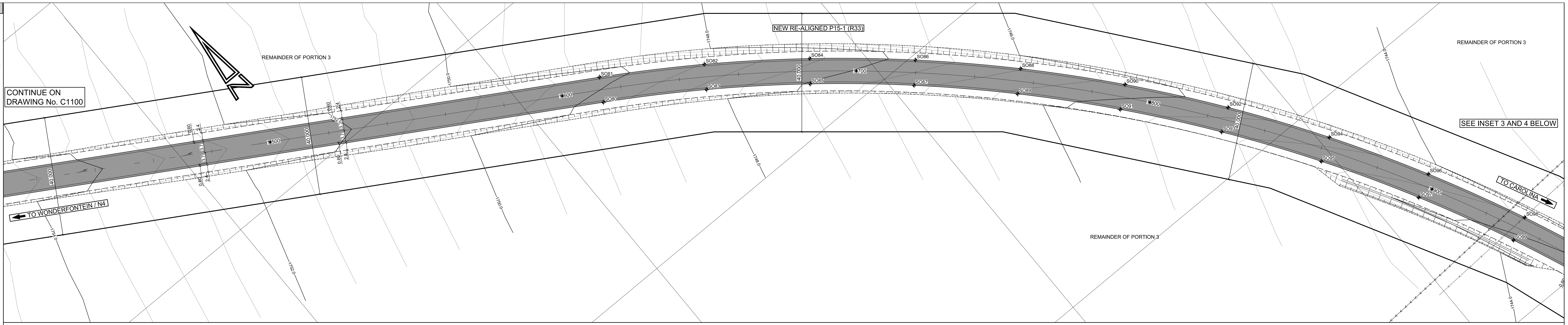
PROJECT: RE-ALIGNMENT OF PROVINCIAL ROAD P15-1 AT WONDERFONTEIN

TITLE: ROAD AND STORMWATER LAYOUT PLAN WITH LONGITUDINAL SECTION (SHEET 10 OF 10)

SCALE @ A0: 1:500	CHECKED: E. KOTZE	APPROVED: E. KOTZE
DESIGN: M. KWATSHA	DRAWN: I.WESSELS	DATE: 2017/11/20
PROJECT No: 22115	DRAWING No: C1010	REV: B

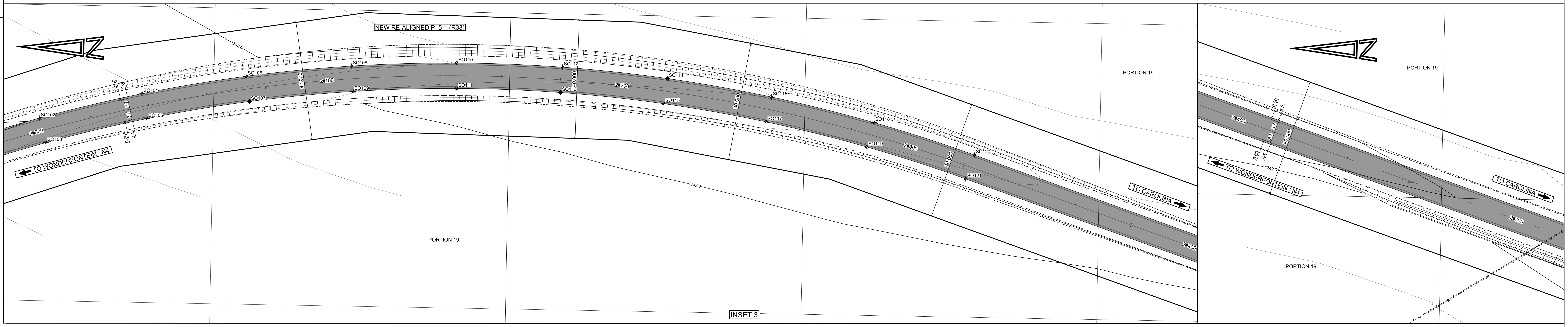
LEGEND

- NEW ROAD SURFACE - ASPHALT
- EXISTING ROAD AREA
- PAVED AREAS
- ERF BOUNDARIES / ROAD RESERVE
- NEW ROAD RESERVE & COORDINATE POINTS
- BENCHMARKS / REFERENCE POINTS (BM)
- EXISTING FENCE-LINE
- EXISTING WALL
- EXISTING GUARDRAIL
- EXISTING ROAD SIGN
- EXISTING SIGN BOARD
- EXISTING DISTANCE MARKER
- EXISTING REFUSE BIN
- EXISTING TRAFFIC SIGNAL
- EXISTING STREET LIGHT POLE
- EXISTING ELECTRICAL MAST/POLE
- EXISTING ELEC. LINE
- EXISTING ELEC. OVERHEAD LINE
- EXISTING ELEC. MANHOLE
- EXISTING ELEC. BOX/TRANSFORMER
- EXISTING SEWER PIPE
- EXISTING SEWER MANHOLE
- EXISTING SEWER CLEANING EYE
- EXISTING STORMWATER PIPE
- EXISTING STORMWATER MANHOLE
- EXISTING WATER PIPE
- EXISTING WATER END CAP
- EXISTING WATER VALVE
- EXISTING WATER METER
- EXISTING TELKOM CABLE
- EXISTING TELKOM MANHOLE
- EXISTING TELEPHONE POLE (TP)

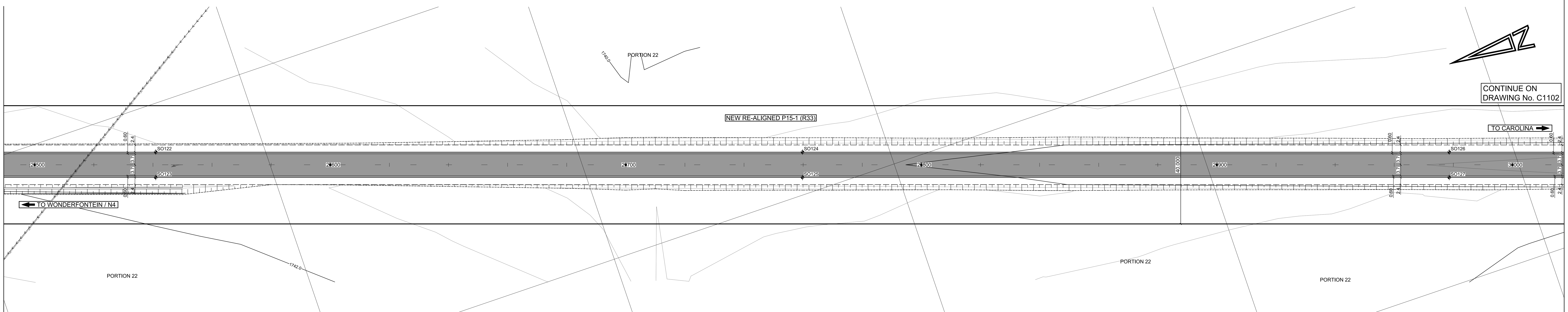


SETTING OUT COORDINATES
WGS84
ELEVATIONS: TOP-OF-FINAL

POINT	Y COORD	X COORD	ELEVATION
SO80	-90821.931	2857045.285	1749.739
SO81	-90826.323	2857037.891	1750.203
SO82	-90856.394	2857057.171	1749.468
SO83	-90851.508	2857064.249	1748.826
SO84	-90885.083	2857078.455	1748.625
SO85	-90879.726	2857085.183	1747.938
SO86	-90912.255	2857101.642	1747.795
SO87	-90906.453	2857107.990	1747.119
SO88	-90937.786	2857126.626	1747.037
SO89	-90931.565	2857132.564	1746.383
SO90	-90961.556	2857153.290	1746.358
SO91	-90954.946	2857158.791	1745.720
SO92	-90983.456	2857181.511	1745.761
SO93	-90976.486	2857186.549	1745.137
SO94	-91003.383	2857211.158	1745.244
SO95	-90996.086	2857215.710	1744.629
SO96	-91021.245	2857242.093	1744.808
SO97	-91013.655	2857246.137	1744.200
SO98	-91036.959	2857274.172	1744.452
SO99	-91029.112	2857277.690	1743.848
SO100	-91050.453	2857307.247	1744.176
SO101	-91042.384	2857310.222	1743.571
SO102	-91061.663	2857341.163	1743.982
SO103	-91053.410	2857343.582	1743.402
SO104	-91070.537	2857375.765	1743.856
SO105	-91062.139	2857377.616	1743.271
SO106	-91077.035	2857410.890	1743.739
SO107	-91068.530	2857412.165	1743.142
SO108	-91081.126	2857446.376	1743.623
SO109	-91072.554	2857447.070	1743.011
SO110	-91082.791	2857482.059	1743.495
SO111	-91074.192	2857482.167	1742.882
SO112	-91082.023	2857517.772	1743.333
SO113	-91073.436	2857517.294	1742.750
SO114	-91078.825	2857553.350	1743.169
SO115	-91070.290	2857552.288	1742.646
SO116	-91073.211	2857588.627	1743.007
SO117	-91064.769	2857586.987	1742.542
SO118	-91065.209	2857623.440	1742.844
SO119	-91056.898	2857621.229	1742.440
SO120	-91054.854	2857657.628	1742.661
SO121	-91046.713	2857654.856	1742.336
SO122	-90984.323	2857864.783	1741.751
SO123	-90976.182	2857862.011	1741.709
SO124	-90913.793	2858071.938	1741.818
SO125	-90905.652	2858069.167	1741.792
SO126	-90843.262	2858279.094	1742.352
SO127	-90835.121	2858276.322	1742.395
SO128	-90772.732	2858486.249	1742.440
SO129	-90764.591	2858483.477	1742.375
SO130	-90702.201	2858693.404	1741.500
SO131	-90694.060	2858690.632	1741.693
SO132	-90686.836	2858740.959	1741.151
SO133	-90678.613	2858738.444	1741.409



INSET 3



INSET 4

REV	DATE	BY	DESCRIPTION	CHK	APD
A	10-11-2017	-	FOR APPROVAL	-	-

ROADS AUTHORITY: the dpwrt Department: Public Works, Roads and Transport MPUMALANGA PROVINCE

CLIENT: umsimbithi Mining (Pty) Ltd

DRAWING STATUS: FOR APPROVAL

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PROJECT: RE-ALIGNMENT OF PROVINCIAL ROAD P15-1 AT WONDERFONTEIN

TITLE: SETTING OUT LAYOUT PLAN (SHEET 2 OF 3)

SCALE @ A0: 1:500	CHECKED: E. KOTZE	APPROVED: E. KOTZE
DESIGN: M.KWATSHA	DRAWN: I.WESSELS	DATE: 2017/11/20
PROJECT No: 22115	DRAWING No: C1101	REV: A

CESA

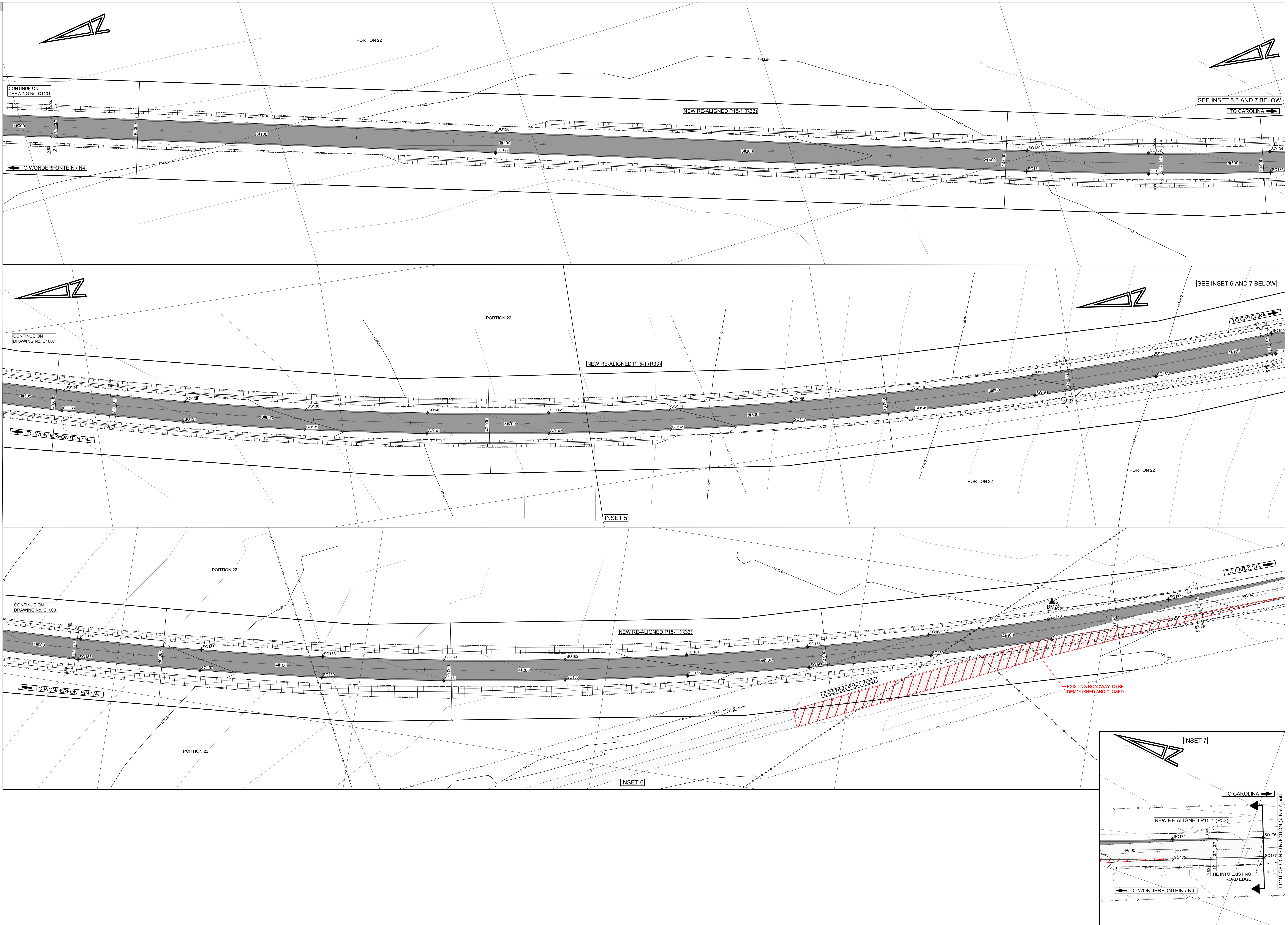
TEMPLATE VERSION 1.1

LEGEND

- NEW ROAD SURFACE - ASPHALT
- EXISTING ROAD AREA
- PAVED AREAS
- ERF BOUNDARIES / ROAD RESERVE
- NEW ROAD RESERVE & COORDINATE POINTS (RR1)
- BENCHMARKS / REFERENCE POINTS (BM)
- EXISTING FENCE-LINE
- EXISTING WALL
- EXISTING GUARDRAIL
- EXISTING ROAD SIGN (RS)
- EXISTING SIGN BOARD (SB)
- EXISTING DISTANCE MARKER (DM)
- EXISTING REFUSE BIN (BIN)
- EXISTING TRAFFIC SIGNAL (TS)
- EXISTING STREET LIGHT POLE (LP)
- EXISTING ELECTRICAL MAST/POLE (EP)
- EXISTING ELEC. LINE
- EXISTING ELEC. OVERHEAD LINE (OH)
- EXISTING ELEC. MANHOLE
- EXISTING ELEC. BOX/TRANSFORMER
- EXISTING SEWER PIPE (SE)
- EXISTING SEWER MANHOLE (SE)
- EXISTING SEWER CLEANING EYE (CE)
- EXISTING STORMWATER PIPE (SW)
- EXISTING STORMWATER MANHOLE (SW)
- EXISTING WATER PIPE (W)
- EXISTING WATER END CAP
- EXISTING WATER VALVE
- EXISTING WATER METER (M)
- EXISTING TELKOM CABLE (T)
- EXISTING TELKOM MANHOLE (T)
- EXISTING TELEPHONE POLE (TP)

SETTING OUT COORDINATES
WGS84
ELEVATIONS: TOP-OF-FINAL

POINT	Y COORD	X COORD	ELEVATION
SO128	-90772.732	2858486.249	1742.440
SO129	-90764.591	2858483.477	1742.375
SO130	-90702.201	2858693.404	1741.500
SO131	-90694.060	2858690.632	1741.693
SO132	-90686.836	2858740.959	1741.151
SO133	-90678.613	2858738.444	1741.409
SO134	-90672.969	2858788.973	1740.754
SO135	-90664.670	2858786.716	1741.061
SO136	-90660.611	2858837.397	1740.306
SO137	-90652.246	2858835.401	1740.648
SO138	-90649.776	2858886.184	1739.809
SO139	-90641.352	2858884.451	1740.169
SO140	-90640.474	2858935.287	1739.263
SO141	-90632.000	2858933.819	1739.626
SO142	-90632.714	2858984.657	1738.667
SO143	-90624.199	2858983.455	1739.019
SO144	-90626.505	2859034.246	1738.025
SO145	-90617.956	2859033.311	1738.370
SO146	-90621.851	2859084.004	1737.325
SO147	-90613.277	2859083.338	1737.683
SO148	-90618.757	2859133.885	1736.625
SO149	-90610.166	2859133.487	1736.986
SO150	-90617.227	2859183.837	1735.925
SO151	-90608.628	2859183.709	1736.284
SO152	-90617.262	2859233.813	1735.225
SO153	-90608.664	2859233.954	1735.582
SO154	-90618.863	2859283.764	1734.524
SO155	-90610.272	2859284.174	1734.880
SO156	-90622.026	2859333.639	1733.829
SO157	-90613.453	2859334.318	1734.189
SO158	-90626.750	2859383.392	1733.219
SO159	-90618.202	2859384.339	1733.567
SO160	-90633.030	2859432.972	1732.698
SO161	-90624.516	2859434.186	1733.033
SO162	-90640.859	2859482.331	1732.232
SO163	-90632.387	2859483.811	1732.552
SO164	-90650.230	2859531.420	1731.814
SO165	-90641.809	2859533.165	1732.141
SO166	-90661.133	2859580.192	1731.485
SO167	-90652.771	2859582.200	1731.796
SO168	-90673.559	2859628.599	1731.153
SO169	-90665.263	2859630.867	1731.474
SO170	-90687.494	2859676.593	1730.690
SO171	-90679.274	2859679.120	1731.023
SO172	-90702.926	2859724.127	1730.091
SO173	-90694.789	2859726.910	1730.420
SO174	-90719.838	2859771.154	1729.384
SO175	-90711.792	2859774.191	1729.558
SO176	-90733.037	2859806.126	1728.876
SO177	-90724.991	2859809.163	1728.868



REV	DATE	BY	DESCRIPTION	CHK	APD
A	10-11-2017	-	FOR APPROVAL	-	-

ROADS AUTHORITY: the dpwrt Department: Public Works, Roads and Transport MPUMALANGA PROVINCE

CLIENT: umsimbithi Mining (Pty) Ltd

DRAWING STATUS: FOR APPROVAL

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PROJECT: RE-ALIGNMENT OF PROVINCIAL ROAD P15-1 AT WONDERFONTEIN

TITLE: SETTING OUT LAYOUT PLAN (SHEET 3 OF 3)

SCALE @ A0: 1:500	CHECKED: E. KOTZE	APPROVED: E. KOTZE
DESIGN: M.KWATSHA	DRAWN: I.WESSELS	DATE: 2017/11/20
PROJECT No: 22115	DRAWING No: C1102	REV: A

PLOT DATE: 2018/01/09 10:23:05 AM

TEMPLATE VERSION 1.1

REV	DATE	BY	DESCRIPTION	CHK	APD
A	10-11-2017	-	FOR APPROVAL	-	-

REV	DATE	BY	DESCRIPTION	CHK	APD

ROADS AUTHORITY

CLIENT:

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PROJECT: RE-ALIGNMENT OF PROVINCIAL ROAD P15-1 AT WONDERFONTEIN

TITLE: ROAD CROSS SECTIONS (SHEET 1 OF 10)

SCALE @ A0: 1:500	CHECKED: E. KOTZE	APPROVED: E. KOTZE
DESIGN: M. KWATSHA	DRAWN: M. KWATSHA	DATE: 2017/11/10
PROJECT No: 22115	DRAWING No: C1200	REV: A

NEW RE-ALIGNED P15-1 (R33)

REV	DATE	BY	DESCRIPTION	CHK	APD
A	10-11-2017	-	FOR APPROVAL	-	-

ROADS AUTHORITY:

CLIENT:

DRAWING STATUS: FOR APPROVAL

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PROJECT: RE-ALIGNMENT OF PROVINCIAL ROAD P15-1 AT WONDERFONTEIN

TITLE: ROAD CROSS SECTIONS (SHEET 2 OF 10)

SCALE @ A0: 1:500	CHECKED: E. KOTZE	APPROVED: E. KOTZE
DESIGN: M.KWATSHA	DRAWN: M.KWATSHA	DATE: 2017/11/10
PROJECT No: 22115	DRAWING No: C1201	REV: A

TEMPLATE VERSION 1.1

NEW RE-ALIGNED P15-1 (R33)

REV	DATE	BY	DESCRIPTION	CHK	APD
A	10-11-2017	-	FOR APPROVAL	-	-

ROADS AUTHORITY

CLIENT:

DRAWING STATUS: FOR APPROVAL

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PROJECT: RE-ALIGNMENT OF PROVINCIAL ROAD P15-1 AT WONDERFONTEIN

TITLE: ROAD CROSS SECTIONS (SHEET 3 OF 10)

SCALE @ A0: 1:500	CHECKED: E. KOTZE	APPROVED: E. KOTZE
DESIGN: M.KWATSHA	DRAWN: M.KWATSHA	DATE: 2017/11/10
PROJECT No: 22115	DRAWING No: C1202	REV: A

TEMPLATE VERSION 1.1

REV	DATE	BY	DESCRIPTION	CHK	APD
A	10-11-2017	-	FOR APPROVAL	-	-

REV	DATE	BY	DESCRIPTION	CHK	APD

ROADS AUTHORITY:

CLIENT:

DRAWING STATUS: FOR APPROVAL

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PROJECT: RE-ALIGNMENT OF PROVINCIAL ROAD P15-1 AT WONDERFONTEIN

TITLE: ROAD CROSS SECTIONS (SHEET 4 OF 10)

SCALE @ A0: 1:500	CHECKED: E. KOTZE	APPROVED: E. KOTZE
DESIGN: M.KWATSHA	DRAWN: M.KWATSHA	DATE: 2017/11/10
PROJECT No: 22115	DRAWING No: C1203	REV: A

TEMPLATE VERSION 1.1

NEW RE-ALIGNED P15-1 (R33)

REV	DATE	BY	DESCRIPTION	CHK	APD
A	10-11-2017	-	FOR APPROVAL	-	-

REV	DATE	BY	DESCRIPTION	CHK	APD

ROADS AUTHORITY

CLIENT:

DRAWING STATUS: FOR APPROVAL

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PROJECT: RE-ALIGNMENT OF PROVINCIAL ROAD P15-1 AT WONDERFONTEIN

TITLE: ROAD CROSS SECTIONS (SHEET 5 OF 10)

SCALE @ A0: 1:500	CHECKED: E. KOTZE	APPROVED: E. KOTZE
DESIGN: M.KWATSHA	DRAWN: M.KWATSHA	DATE: 2017/11/10
PROJECT No: 22115	DRAWING No: C1204	REV: A

TEMPLATE VERSION 1.1

NEW RE-ALIGNED P15-1 (R33)

REV	DATE	BY	DESCRIPTION	CHK	APD
A	10-11-2017	-	FOR APPROVAL	-	-

REV	DATE	BY	DESCRIPTION	CHK	APD

ROADS AUTHORITY:

CLIENT:

DRAWING STATUS: FOR APPROVAL

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PROJECT: RE-ALIGNMENT OF PROVINCIAL ROAD P15-1 AT WONDERFONTEIN

TITLE: ROAD CROSS SECTIONS (SHEET 5 OF 10)

SCALE @ A0: 1:500	CHECKED: E. KOTZE	APPROVED: E. KOTZE
DESIGN: M.KWATSHA	DRAWN: M.KWATSHA	DATE: 2017/11/10
PROJECT No: 22115	DRAWING No: C1204	REV: A

PLOT DATE: 2018/01/09 10:17:53 AM

TEMPLATE VERSION 1.1

REV	DATE	BY	DESCRIPTION	CHK	APD
A	10-11-2017	-	FOR APPROVAL	-	-

ROADS AUTHORITY:

CLIENT:

DRAWING STATUS: FOR APPROVAL

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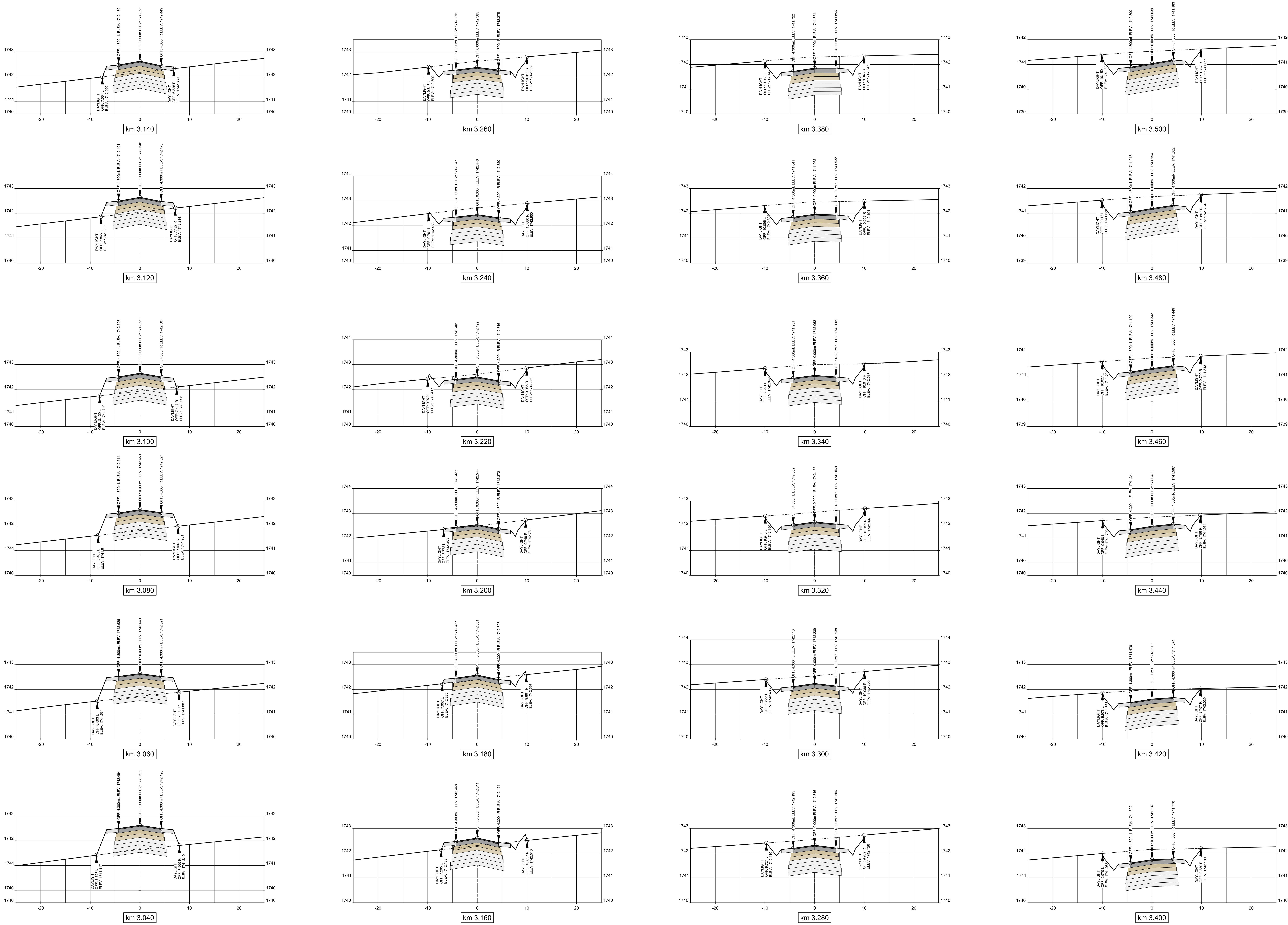
PROJECT: RE-ALIGNMENT OF PROVINCIAL ROAD P15-1 AT WONDERFONTEIN

TITLE: ROAD CROSS SECTIONS (SHEET 6 OF 10)

SCALE @ A0: 1:500	CHECKED: E. KOTZE	APPROVED: E. KOTZE
DESIGN: M.KWATSHA	DRAWN: M.KWATSHA	DATE: 2017/11/10
PROJECT No: 22115	DRAWING No: C1205	REV: A



NEW RE-ALIGNED P15-1 (R33)

REV	DATE	BY	DESCRIPTION	CHK	APD
A	10-11-2017	-	FOR APPROVAL	-	-

REV	DATE	BY	DESCRIPTION	CHK	APD

ROADS AUTHORITY

CLIENT:

DRAWING STATUS: FOR CONSTRUCTION

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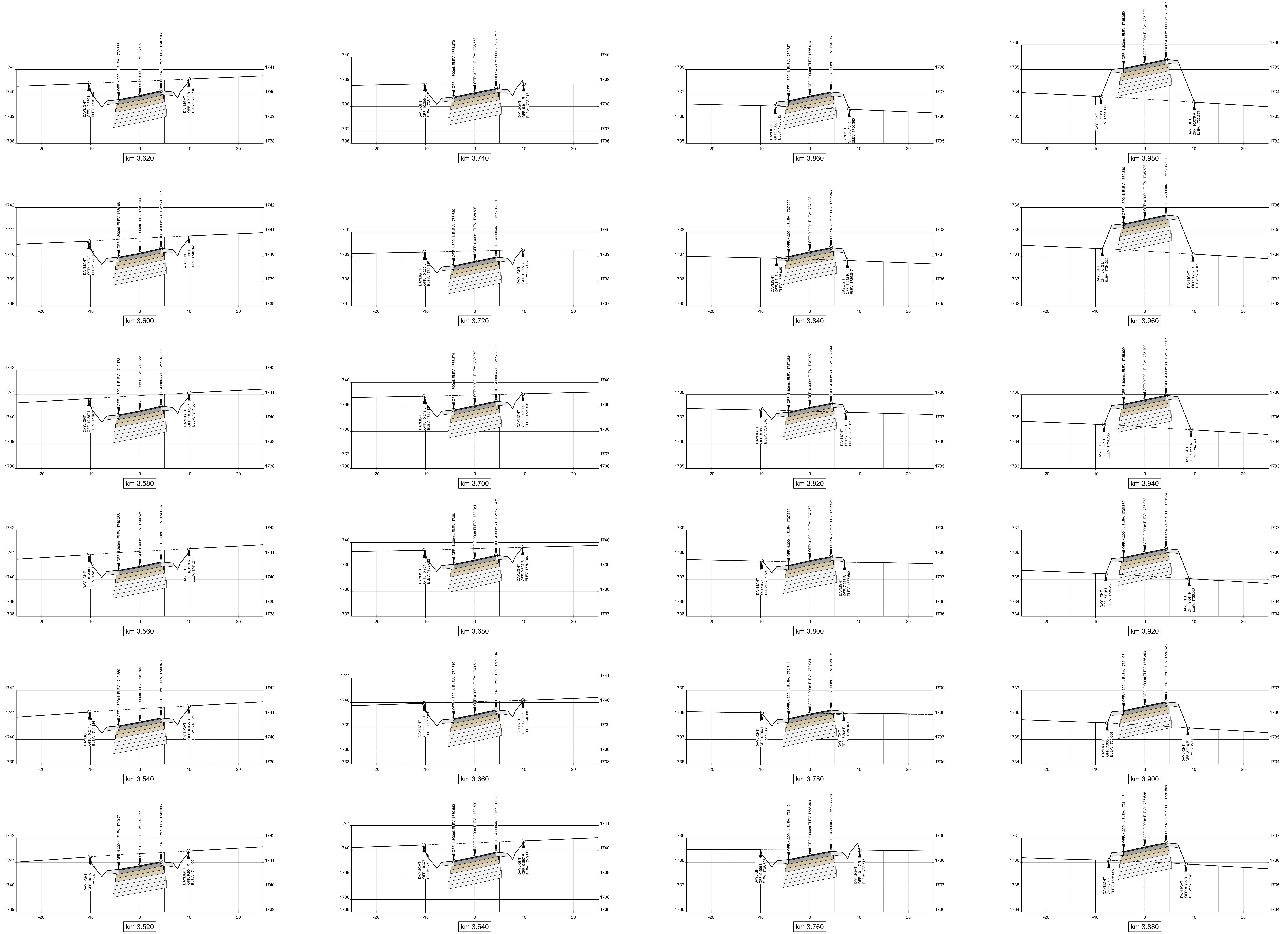
PROJECT: RE-ALIGNMENT OF PROVINCIAL ROAD P15-1 AT WONDERFONTEIN

TITLE: ROAD CROSS SECTIONS (SHEET 7 OF 10)

SCALE @ A0: 1:500	CHECKED: E. KOTZE	APPROVED: E. KOTZE
DESIGN: M.KWATSHA	DRAWN: M.KWATSHA	DATE: 2017/11/10
PROJECT No: 22115	DRAWING No: C1206	REV: A

TEMPLATE VERSION 1.1



NEW RE-ALIGNED P15-1 (R33)

REV	DATE	BY	DESCRIPTION	CHK	APD
A	10-11-2017	-	FOR APPROVAL	-	-

REV	DATE	BY	DESCRIPTION	CHK	APD

ROADS AUTHORITY

CLIENT:

DRAWING STATUS: FOR APPROVAL

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PROJECT: RE-ALIGNMENT OF PROVINCIAL ROAD P15-1 AT WONDERFONTEIN

TITLE: ROAD CROSS SECTIONS (SHEET 8 OF 10)

SCALE @ A0: 1:500	CHECKED: E. KOTZE	APPROVED: E. KOTZE
DESIGN: M.KWATSHA	DRAWN: M.KWATSHA	DATE: 2017/11/10
PROJECT No: 22115	DRAWING No: C1207	REV: A

TEMPLATE VERSION 1.1

REV	DATE	BY	DESCRIPTION	CHK	APD
A	10-11-2017	-	FOR APPROVAL	-	-

REV	DATE	BY	DESCRIPTION	CHK	APD

ROADS AUTHORITY

CLIENT:

DRAWING STATUS: FOR APPROVAL

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PROJECT: RE-ALIGNMENT OF PROVINCIAL ROAD P15-1 AT WONDERFONTEIN

TITLE: ROAD CROSS SECTIONS (SHEET 9 OF 10)

SCALE @ A0:	CHECKED:	APPROVED:
1:500	E. KOTZE	E. KOTZE
DESIGN: M.KWATSHA	DRAWN: M.KWATSHA	DATE: 2017/11/09
PROJECT No: 22115	DRAWING No: C1208	REV: A

TEMPLATE VERSION 1.1

REV	DATE	BY	DESCRIPTION	CHK	APD
A	10-11-2017	-	FOR APPROVAL	-	-

REV	DATE	BY	DESCRIPTION	CHK	APD

ROADS AUTHORITY

CLIENT:

DRAWING STATUS: FOR APPROVAL

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WSP Group Africa (Pty) Ltd
Commercial Civils
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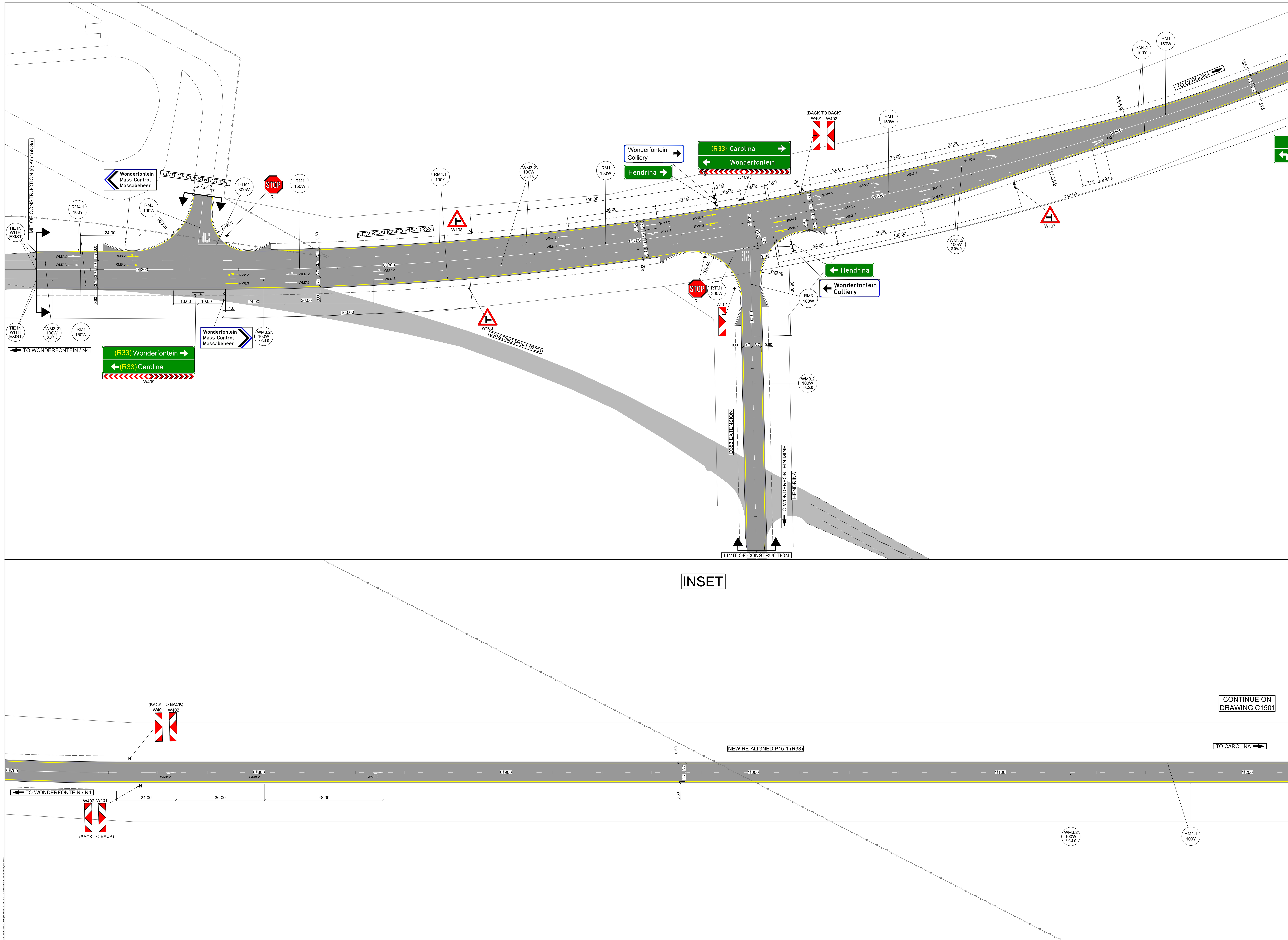
PostNet Suite 287, Private Bag X025, Lynnwood Ridge, 0040
Tel: +27(0)12-762-1200 Fax: +27(0)12-762-1301 www.wsp.com

PROJECT: RE-ALIGNMENT OF PROVINCIAL ROAD P15-1 AT WONDERFONTEIN

TITLE: ROAD CROSS SECTIONS (SHEET 10 OF 10)

SCALE @ A0: 1:500	CHECKED: E. KOTZE	APPROVED: E. KOTZE
DESIGN: M.KWATSHA	DRAWN: M.KWATSHA	DATE: 2017/11/10
PROJECT No: 22115	DRAWING No: C1209	REV: A

TEMPLATE VERSION 1.1



ROADMARKINGS & ROADSIGNS LEGEND

EXISTING ROAD MARKINGS TO BE REMOVED BY MEANS OF SANDBLASTING

TIWE — TIE IN WITH EXISTING ROADMARKINGS

NEW ROAD MARKING LEGEND

MARKING No. WIDTH/COLOUR GAP/LINE

WHERE
W = WHITE
Y = YELLOW
R = RED

ROADMARKING NOTES

1. PAINTED LINE DIMENSIONS:
2. ALL LINES 100mm WIDE UNLESS OTHERWISE INDICATED.
   - 2.1. STOP LINES (RTM1) = 300/500mm
   - 2.2. EDGE LINE RIGHT (RM4.2) = 100mm WHITE
   - 2.3. EDGE LINE LEFT (RM4.1) = 100mm YELLOW
   - 2.4. LANE LINE (GM1) = 100mm WHITE OR AS INDICATED
   - 2.5. CONTINUITY LINE (WM2) = 200mm WHITE
   - 2.6. CHANNELISING LINE (RM3) = 100/200mm WHITE
   - 2.7. CONTINUITY LINE MARKING = 12m & 24m LONG
   - 2.8. ALL SYMBOLS = 4m LONG
3. PAINTED TRAFFIC ISLANDS (RM5)
   - 3.1. BAR WIDTH = AS PER DETAIL
   - 3.2. SPACING = AS PER DETAIL PARALLEL TO BAR AT 30° TO DIRECTION OF FLOW.

GENERAL NOTES

1. ALL ROAD SIGNS AND MARKINGS TO COMPLY WITH THE REQUIREMENTS OF THE LATEST EDITION OF THE SOUTH AFRICAN ROAD TRAFFIC SIGNS MANUAL.
2. RETRO-REFLECTIVE ROAD MARKINGS APPLIED WITH HIGHLY DURABLE MATERIAL.
3. ALL MARKINGS TO BE CHECKED BY ENGINEER / AUTHORITY AT PRE-MARKING STAGE BEFORE ANY PAINTING TAKES PLACE.-NB
4. FINAL POSITIONS OF ROAD SIGNS TO BE AS PER LOCAL AUTHORITY.
5. MINIMUM CLEARANCE OF 2.1m BENEATH AND 500mm BEHIND THE BACK OF KERBS ROAD SIGNS ADJACENT TO SIDEWALKS.
6. ALL ROADSIGN POLES TO BE ROUND AND GALVANISED.
7. ALL ROAD MARKINGS TO BE PAINTED TO **1,0/m²**.
8. THE GEOMETRICAL LAYOUT WILL BE TO LOCAL AUTHORITY STANDARDS.
9. ALL EXISTING ROAD SIGNS TO BE ALLOCATED TO NEW POSITIONS AS SHOWN. NEW ROAD SIGNS TO BE CONFIRMED BY THE RESIDENT ENGINEER.

REV	DATE	BY	DESCRIPTION	CHK	APD
B	10-11-2017	-	FOR APPROVAL	-	-
A	-	-	INITIAL ISSUE	-	-

ARCHITECT: the dpwrt — Department: Public Works, Roads and Transport — MPUMALANGA PROVINCE

CLIENT: umsimbithi Mining (Pty) Ltd

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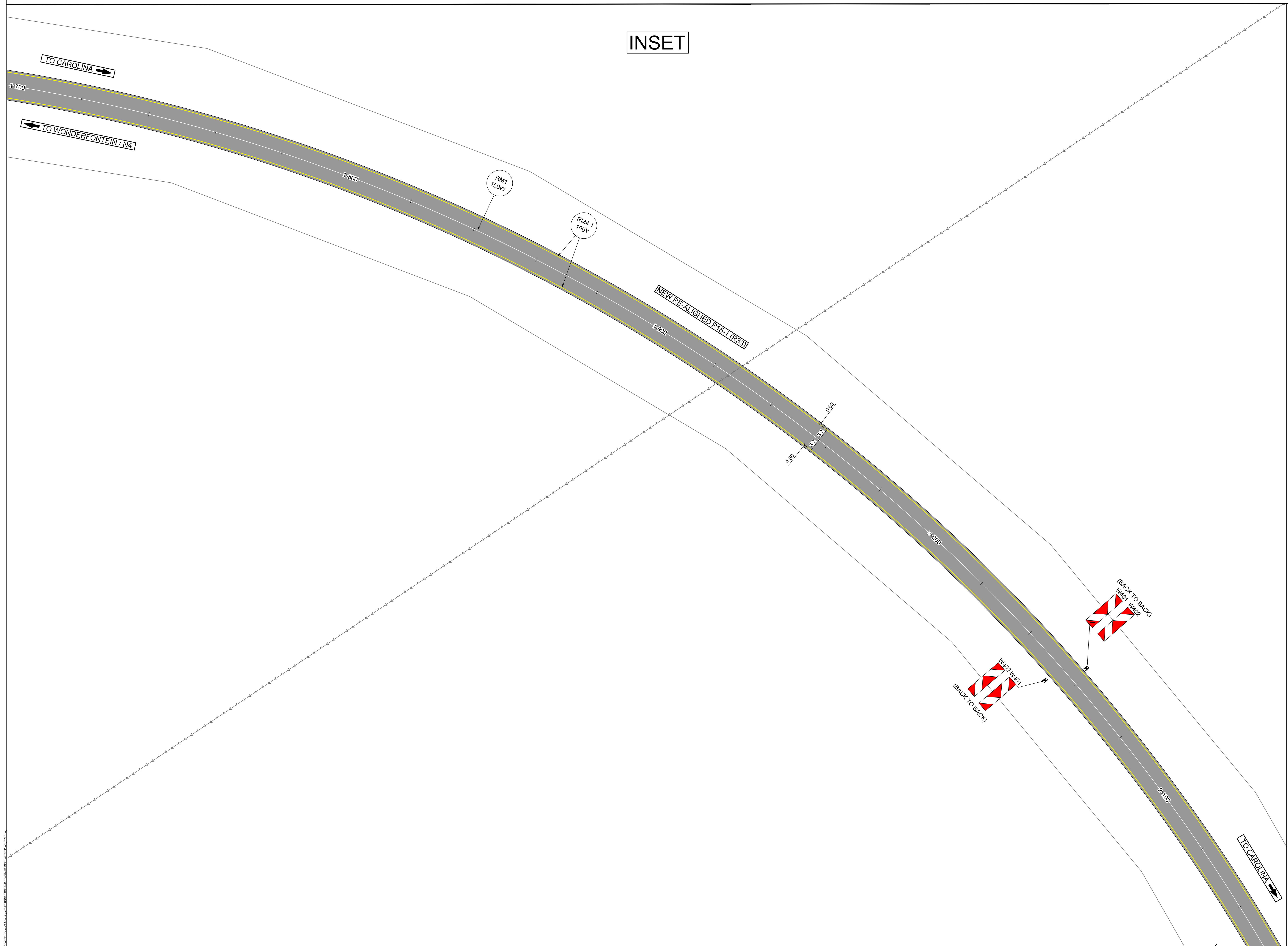
PROJECT: RE-ALIGNMENT OF PROVINCIAL ROAD P15-1 AT WONDERFONTEIN

TITLE: ROAD SIGNS AND ROAD MARKINGS LAYOUT PLAN

SCALE @ A0: 1:500	CHECKED: E. KOTZE	APPROVED: E. KOTZE
DESIGN: M.KWATSHA	DRAWN: I.WESSELS	DATE: 2017/11/21
PROJECT No: 22115	DRAWING No: C1500	REV: B



CONTINUE ON DRAWING C1502

ROADMARKINGS & ROADSIGNS LEGEND

EXISTING ROAD MARKINGS TO BE REMOVED BY MEANS OF SANDBLASTING

TIWE TIE IN WITH EXISTING ROADMARKINGS

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ARCHITECT: the dpwrt Department: Public Works, Roads and Transport MPUMALANGA PROVINCE

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PROJECT: RE-ALIGNMENT OF PROVINCIAL ROAD P15-1 AT WONDERFONTEIN

TITLE: ROAD SIGNS AND ROAD MARKINGS LAYOUT PLAN

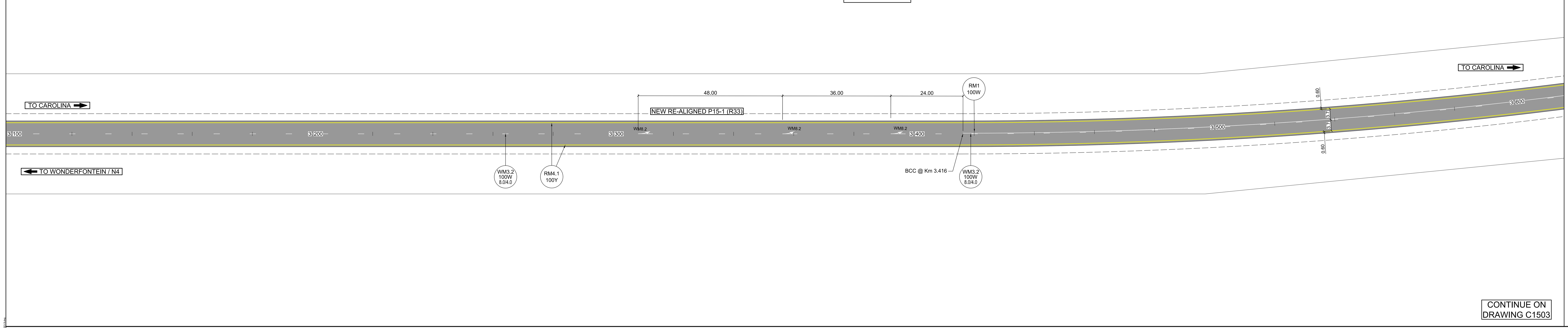
SCALE @ A0: 1:500	CHECKED: E. KOTZE	APPROVED: E. KOTZE
DESIGN: M.KWATSHA	DRAWN: I.WESSELS	DATE: 2017/11/21
PROJECT No: 22115	DRAWING No: C1501	REV: B

PLOT DATE: 2018/01/09 10:24:24 AM

TEMPLATE VERSION 1.1

INSET 1

INSET 2



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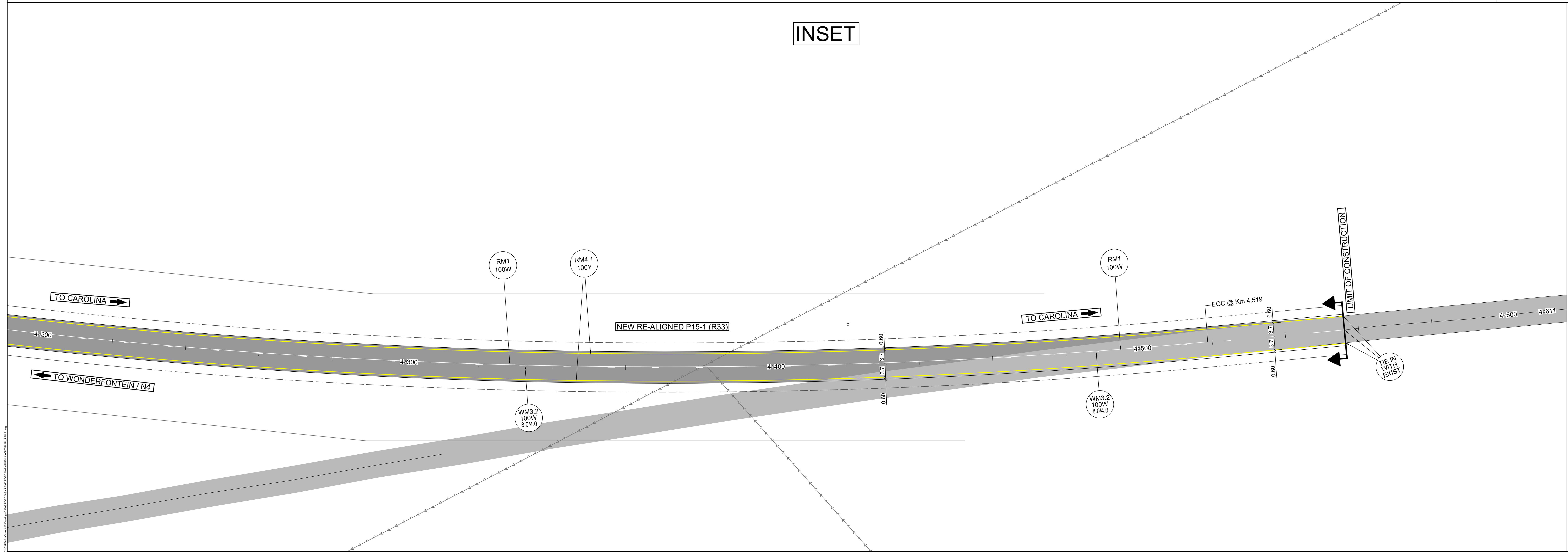
PROJECT: RE-ALIGNMENT OF PROVINCIAL ROAD P15-1 AT WONDERFONTEIN

TITLE: ROAD SIGNS AND ROAD MARKINGS LAYOUT PLAN

SCALE @ A0: 1:500	CHECKED: E. KOTZE	APPROVED: E. KOTZE (PR No.: ---)
DESIGN: M.KWATSHA	DRAWN: I.WESSELS	DATE: 2017/11/21
PROJECT No: 22115	DRAWING No: C1502	REV: B

PLOT DATE: 2018/01/09 10:25:00 AM

TEMPLATE VERSION 1.1



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PROJECT: RE-ALIGNMENT OF PROVINCIAL ROAD P15-1 AT WONDERFONTEIN

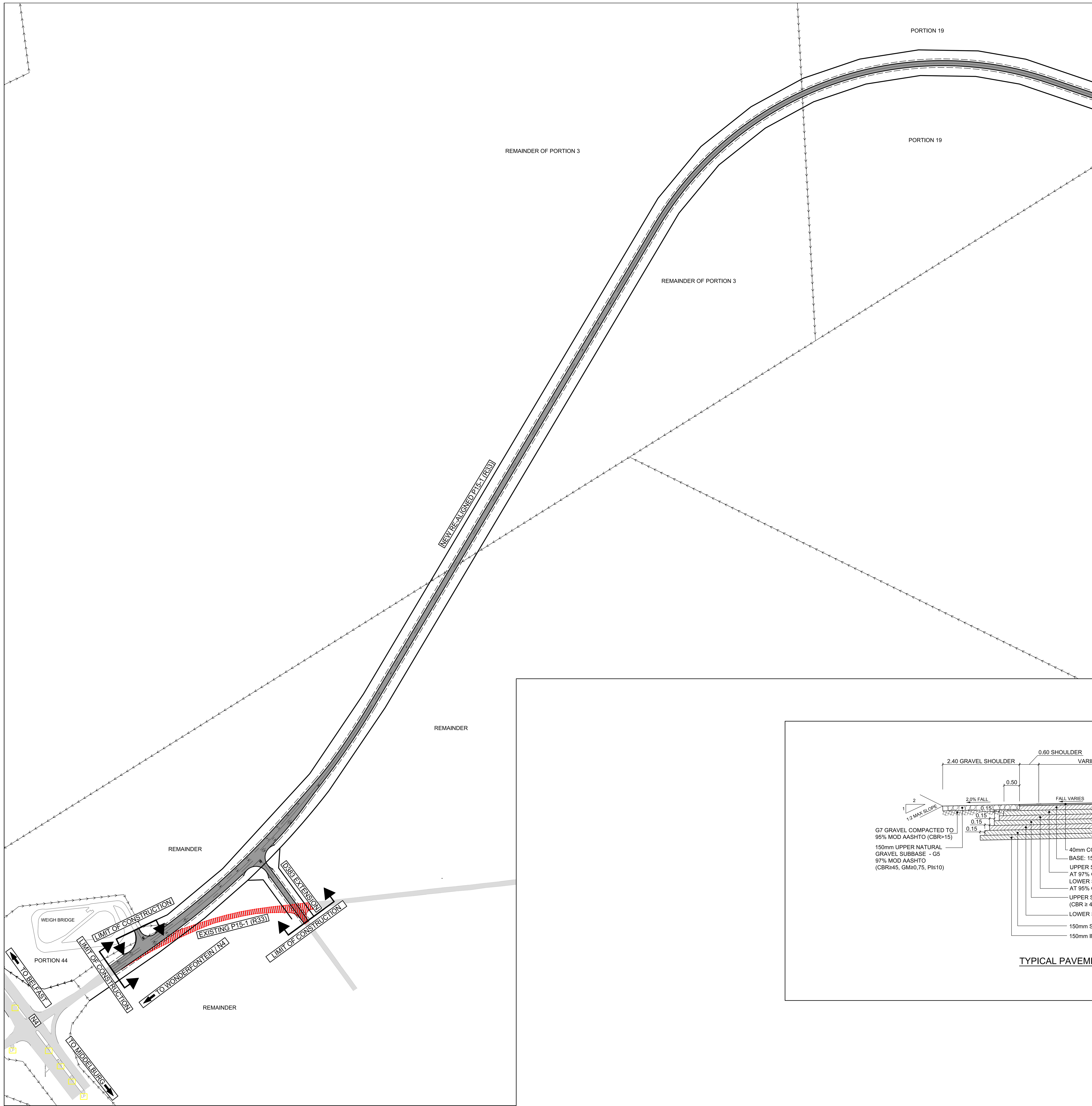
TITLE: ROAD SIGNS AND ROAD MARKINGS LAYOUT PLAN

SCALE @ A0:	CHECKED:	APPROVED:
1:500	E. KOTZE	E. KOTZE (PR No.: ---)
DESIGN: M.KWATSHA	DRAWN: I.WESSELS	DATE: 2017/11/21
PROJECT No: 22115	DRAWING No: C1503	REV: B

CESA

PLOT DATE: 2018/01/09 10:25:34 AM

TEMPLATE VERSION 1.1



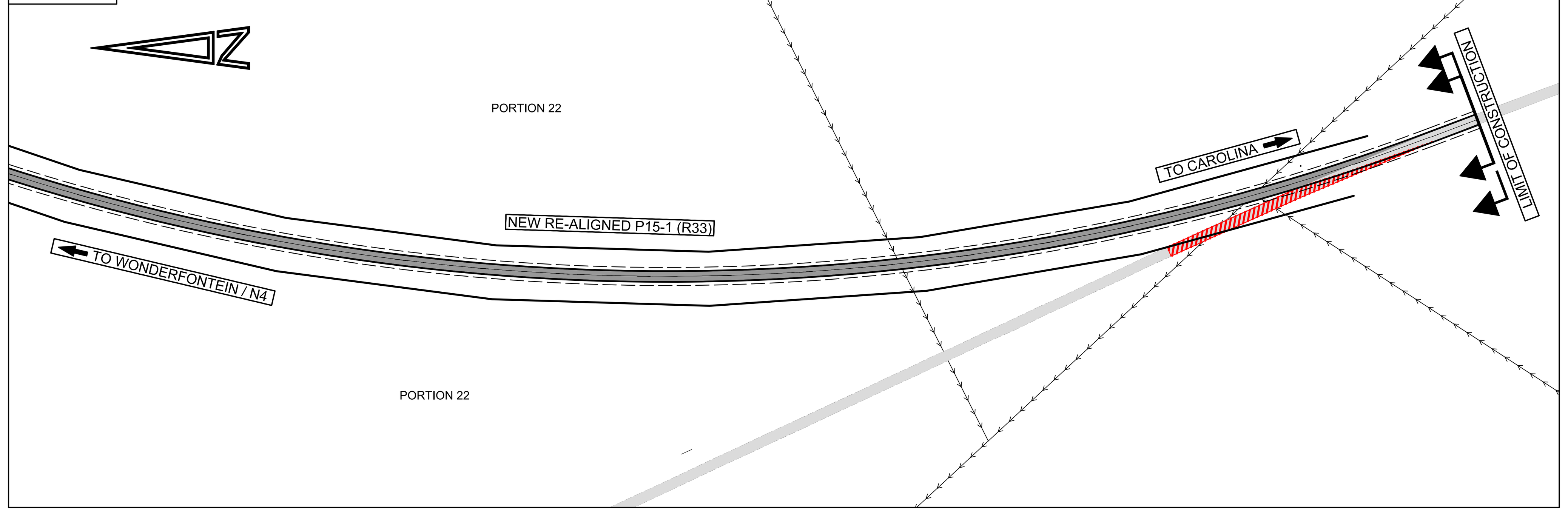
GENERAL NOTES

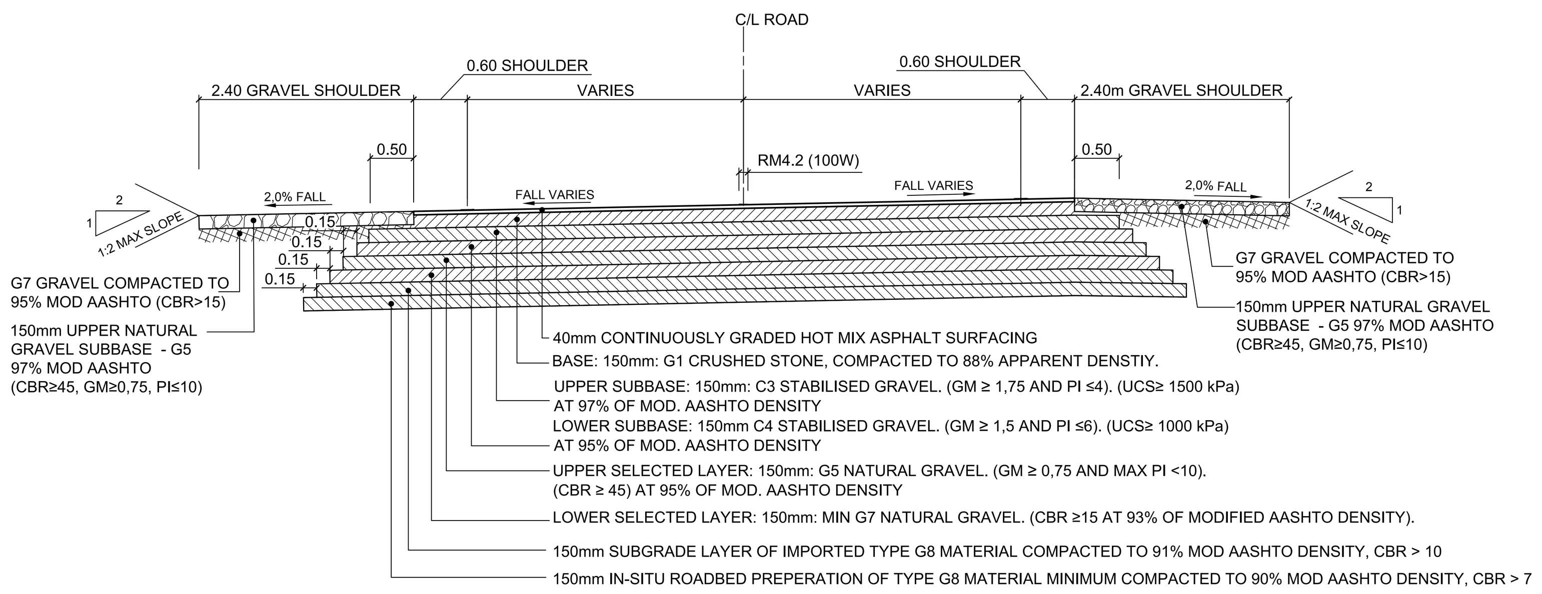
THIS DRAWING IS NOT TO BE SCALED, USE FIGURED DIMENSIONS AND/OR COORDINATE DATA ONLY. ANY DISCREPANCIES OR QUERIES RELATED TO THIS DRAWING TO BE REFERED TO THE ENGINEER FOR CLARIFICATION BEFORE WORK IS COMMENCED. NO ALTERATIONS OR AMENDMENTS SHALL BE MADE TO THIS DRAWING WITHOUT REFERENCE TO THE ENGINEERS.

ROADS NOTES:

1. ALL CONSTRUCTION, TOLERANCES AND TESTING MUST BE STRICLY IN ACCORDANCE WITH SANS 1200 SERIES OF SPECIFICATIONS - ANY DEVIATION FROM THE ABOVE WILL BE FOR THE COST OF THE CONTRACTOR.
2. ALL INTERSECTION RADII AS NOTED ON PLAN.
3. ALL ROAD KERBING SHALL BE PRECAST FIG. 8C KERBS TO SANS 927.
4. CONSTRUCTION OF KERBING MUST COMPLY WITH SANS 1200 MK CLAUSE 3 AND 5 AND SAMPLES OF UNITS SHALL BE SUBMITTED FOR APPROVAL TO THE ENGINEER AS PER SANS 1200 A AND SANS 1200 AA SUB-CLAUSE 3.1.
5. AN "AS BUILT" SURVEY MUST BE SUBMITTED TO THE ENGINEER FOR APPROVAL PRIOR TO WORK COMPLETION.
6. GENERAL BACKFILL MATERIAL AT ALL TRAFFICABLE AREAS TO BE AT LEAST A TYPE G7 QUALITY MATERIAL. COMPACTED IN 150mm LAYERS TO 93% MOD AASHTO DENSITY.

INSET





TYPICAL PAVEMENT DESIGN - ROUTE P15-1 AND D383

SCALE 1 : 50

PROPERTY	G1	G2	G3	G4	G5	G6	G7
MAX DIAMETER (mm)	37.5	37.5	37.5	53.0	63.0	63.0	100.0
GRADING MODULUS	GRADING ENVELOPE	GRADING ENVELOPE	GRADING ENVELOPE	GRADING ENVELOPE	>= 1.50	>= 1.20	>= 0.75
LIQUID LIMIT (MAX) (%)	25	25	25	25	30	-	-
PLASTICITY INDEX (MAX) (%)	4	6	6	6	10	12	12
10% FACT (MIN) (kN)	110	110	N.A.	N.A.	N.A.	N.A.	N.A.
LINEAR SHRINKAGE (%) (MAX)	2	3	3	3	5	6	6
ACV (MAX) (%)	29	29	N.A.	N.A.	N.A.	N.A.	N.A.
FLAKINESS INDEX (%)	<= 35.0	<= 35.0	N.A.	N.A.	N.A.	N.A.	N.A.
MIN. CBR %	N.A.	80 @ 98% MOD AASHTO	80 @ 98% MOD AASHTO	80 @ 98% MOD AASHTO	45 @ 95% MOD AASHTO	35 @ 95% MOD AASHTO	15 @ 93% MOD AASHTO
SWELL (MAX) % AT 100% MOD	N.A.	0.2	0.2	0.2	0.5	1.0	1.5
SOLUBLE SALTS (%)	< 0.2%	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
$MgSO_4 + Na_2SO_4$ (%)	< 0.05%	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.

MATERIAL PROPERTIES FOR :

CRUSHED STONE (G1,G2,G3)
NATURAL GRAVEL (G4,G5,G6)
GRAVEL SOIL (G7)

PROPERTY	G8	G9	G10	SELECTED FILL
GRADING MODULUS	NO REQUIREMENTS	NO REQUIREMENTS	NO REQUIREMENTS	0.75
MIN CBR% AT IN-SITU DENSITY	10	7	3	10
SWELL (MAX) % AT 100% MOD AASHTO	1.5	1.5	1.5	1.5
LIQUID LIMIT (MAX) (%)	N.A.	N.A.	N.A.	40
PLASTICITY INDEX (MAX) (%)	N.A.	N.A.	N.A.	18

MATERIAL PROPERTIES FOR GRAVEL - SOIL AND SELECTED FILL:

IN LAYERS OF 150mm MAXIMUM AND COMPACTED TO 90% MOD AASHTO DENSITY.

PROPERTY	C1	C2	C3	C4
MAX DIAMETER (mm)	37.5	37.5	63.0	63.0
GRADING MODULUS BEFORE TREATMENT	>= 1.50	>= 1.50	>= 1.50	>= 1.50
LIQUID LIMIT (MAX) BEFORE (%)	25	25	30	45
PLASTICITY INDEX (MAX) BEFORE (%)	6	6	10	10
PLASTICITY INDEX (MAX) AFTER (%)	N.A.	N.A.	6	6
10% FACT (MIN) kN	110	110	N.A.	N.A.
ACV (MAX) (%)	29.0	29.0	N.A.	N.A.
FLAKINESS INDEX (%)	<= 35.0	<= 35.0	N.A.	N.A.
SAND ADDED EQUIVALENT (%)	>= 30.0	>= 30.0	N.A.	N.A.
UCS 100% MOD AASHTO (MPa)	> 6.0 < 12.0	> 3.0 < 6.0	> 1.5 < 3.0	> 0.75 < 1.5

MATERIAL PROPERTIES FOR CEMENTED CRUSHED STONE OR NATURAL GRAVEL

SIEVE SIZE	% PASSING		
	G1,C1,C2	G2,G3,C1,C2	G4
53.0mm	100	100	100
37.5mm	100	100	85-100
26.5mm	84-94	100	-
19.0mm	71-84	85-95	60-90
13.2mm	59-75	71-84	-
4.75mm	36-53	42-60	30-65
2.00mm	23-40	27-45	20-50
0.425mm	11-24	13-27	10-30
0.075mm	4-12	5-12	5-15

GRADING ENVELOPE

NOTE:

1. TYPE AND PERCENTAGE OF STABILIZATION TO BE DETERMINED BY LABORATORY.
2. MATERIAL PROPERTIES DERIVED FROM TRH 14 AND SABS. 1200

MATERIAL PROPERTIES FOR LAYERWORKS

REV	DATE	BY	DESCRIPTION	CHK	APD
B	10-11-2017	-	FOR APPROVAL	-	-
A	-	-	INITIAL ISSUE	-	-

ARCHITECT: the dpwrt Department: Public Works, Roads and Transport MPUMALANGA PROVINCE

CLIENT: umsimbithi Mining (Pty) Ltd

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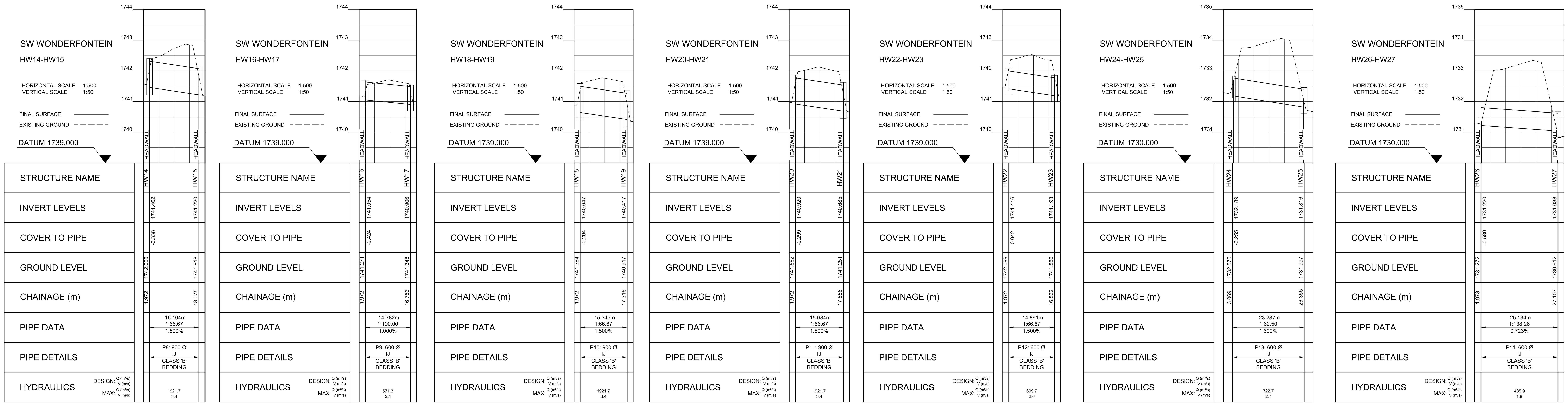
PROJECT: RE-ALIGNMENT OF PROVINCIAL ROAD P15-1 AT WONDERFONTEIN

TITLE: PAVEMENT DESIGN

SCALE @ A0: 1:2500	CHECKED: E. KOTZE	APPROVED: E. KOTZE PR No.: ---
DESIGN: T JOUBERT	DRAWN: T JOUBERT	DATE: 2017/11/22
PROJECT No: 22115	DRAWING No: C1550	REV: B



STRUCTURE DATA: SW WONDERFONTEIN

NAME	DESCRIPTION	SIZE/SPEC	Y-COORD	X-COORD	DETAILS
EX HW 1	HEADWALL	STANDARD SPEC TO DETAIL	-89749.488	2856463.885	DEPTH = 1.161m P15 INV OUT = 1777.300
HW1	HEADWALL	STANDARD SPEC TO DETAIL	-89773.484	2856477.981	DEPTH = 0.698m P1 INV IN = 1777.091
HW2	HEADWALL	STANDARD SPEC TO DETAIL	-89811.363	2856424.647	DEPTH = 0.704m P2 INV OUT = 1778.193
HW3	HEADWALL	STANDARD SPEC TO DETAIL	-89869.025	2856424.647	DEPTH = 0.747m P2 INV IN = 1777.295
HW4	HEADWALL	SANRAL SPEC	-90083.784	2856591.479	DEPTH = 0.764m P3 INV OUT = 1771.721
HW5	HEADWALL	SANRAL SPEC	-90083.784	2856612.140	DEPTH = 0.698m P3 INV IN = 1771.514
HW6	HEADWALL	SANRAL SPEC TO DETAIL	-90442.252	2856825.571	DEPTH = 0.698m P4 INV OUT = 1760.605
HW7	HEADWALL	SANRAL SPEC TO DETAIL	-90460.346	2856815.125	DEPTH = 0.698m P4 INV IN = 1760.396
HW8	HEADWALL	SANRAL SPEC TO DETAIL	-90851.178	2857068.496	DEPTH = 0.698m P5 INV OUT = 1747.915
HW9	HEADWALL	SANRAL SPEC TO DETAIL	-90868.200	2857059.231	DEPTH = 0.755m P5 INV IN = 1747.722
HW10	HEADWALL	SANRAL SPEC TO DETAIL	-91061.943	2857392.070	DEPTH = 0.870m P6 INV OUT = 1742.391
HW11	HEADWALL	SANRAL SPEC TO DETAIL	-91079.111	2857396.974	DEPTH = 0.870m P6 INV IN = 1742.212
HW12	HEADWALL	SANRAL SPEC TO DETAIL	-91071.029	2857495.244	DEPTH = 1.029m P7 INV OUT = 1741.713
HW13	HEADWALL	SANRAL SPEC TO DETAIL	-91087.758	2857498.104	DEPTH = 1.029m P7 INV IN = 1741.453
HW14	HEADWALL	SANRAL SPEC TO DETAIL	-91055.495	2857614.324	DEPTH = 1.029m P8 INV OUT = 1741.462

STRUCTURE DATA: SW WONDERFONTEIN

NAME	DESCRIPTION	SIZE/SPEC	Y-COORD	X-COORD	DETAILS
HW15	HEADWALL	SANRAL SPEC TO DETAIL	-91071.104	2857618.286	DEPTH = 1.029m P8 INV IN = 1741.220
HW16	HEADWALL	SANRAL SPEC TO DETAIL	-90938.292	2857964.099	DEPTH = 0.698m P9 INV OUT = 1741.054
HW17	HEADWALL	SANRAL SPEC TO DETAIL	-90950.923	2857971.776	DEPTH = 0.698m P9 INV IN = 1740.906
HW18	HEADWALL	SANRAL SPEC TO DETAIL	-90918.736	2858021.809	DEPTH = 1.029m P10 INV OUT = 1740.647
HW19	HEADWALL	SANRAL SPEC TO DETAIL	-90933.261	2858026.754	DEPTH = 1.029m P10 INV IN = 1740.417
HW20	HEADWALL	SANRAL SPEC TO DETAIL	-90876.507	2858144.759	DEPTH = 1.029m P11 INV OUT = 1740.920
HW21	HEADWALL	SANRAL SPEC TO DETAIL	-90891.354	2858149.814	DEPTH = 1.029m P11 INV IN = 1740.685
HW22	HEADWALL	SANRAL SPEC TO DETAIL	-90828.191	2858287.567	DEPTH = 0.740m P12 INV OUT = 1741.416
HW23	HEADWALL	SANRAL SPEC TO DETAIL	-90842.287	2858292.366	DEPTH = 0.720m P12 INV IN = 1741.193
HW24	HEADWALL	SANRAL SPEC TO DETAIL	-90626.911	2859334.921	DEPTH = 0.698m P13 INV OUT = 1732.189
HW25	HEADWALL	SANRAL SPEC TO DETAIL	-90608.327	2859348.953	DEPTH = 0.698m P13 INV IN = 1731.816
HW26	HEADWALL	SANRAL SPEC TO DETAIL	-90633.973	2859394.255	DEPTH = 0.698m P14 INV OUT = 1731.220
HW27	HEADWALL	SANRAL SPEC TO DETAIL	-90614.073	2859409.608	DEPTH = 0.698m P14 INV IN = 1731.038
JB1	JUNCTION BOX	STANDARD SPEC TO DETAIL	-89767.565	2856473.826	DEPTH = 0.983m P15 INV IN = 1777.145 P1 INV OUT = 1777.145

PIPE DATA: SW WONDERFONTEIN

NAME	SIZE	MATERIAL & CLASS	LENGTH	SPAN
P4	600 Ø	INTERLOCKING 100D SANS 677	20.9 m	HW6 - HW7
P5	600 Ø	INTERLOCKING 100D SANS 677	19.4 m	HW8 - HW9
P2	600 Ø	INTERLOCKING 100D SANS 677	57.7 m	HW2 - HW3
P1	600 Ø	INTERLOCKING 100D SANS 677	7.2 m	JB1 - HW1
P15	600 Ø	INTERLOCKING 100D SANS 677	20.6 m	EX HW 1 - JB1
P14	600 Ø	INTERLOCKING 100D SANS 677	25.1 m	HW26 - HW27
P13	600 Ø	INTERLOCKING 100D SANS 677	23.3 m	HW24 - HW25
P12	600 Ø	INTERLOCKING 100D SANS 677	14.9 m	HW22 - HW23
P9	600 Ø	INTERLOCKING 100D SANS 677	14.8 m	HW16 - HW17
P3	600 Ø	INTERLOCKING 100D SANS 677	20.7 m	HW4 - HW5
P6	750 Ø	INTERLOCKING 100D SANS 677	17.9 m	HW10 - HW11
P11	900 Ø	INTERLOCKING 100D SANS 677	15.7 m	HW20 - HW21
P10	900 Ø	INTERLOCKING 100D SANS 677 2 PIPES	15.3 m	HW18 - HW19
P8	900 Ø	INTERLOCKING 100D SANS 677	16.1 m	HW14 - HW15
P7	900 Ø	INTERLOCKING 100D SANS 677	17.0 m	HW12 - HW13

REV	DATE	BY	DESCRIPTION	CHK	APD
B	10-11-2017	-	FOR APPROVAL	-	-
A	-	-	INITIAL ISSUE	-	-

ARCHITECT: the dpwrt Department: Public Works, Roads and Transport MPUMALANGA PROVINCE

CLIENT: umsimbithi Mining (Pty) Ltd

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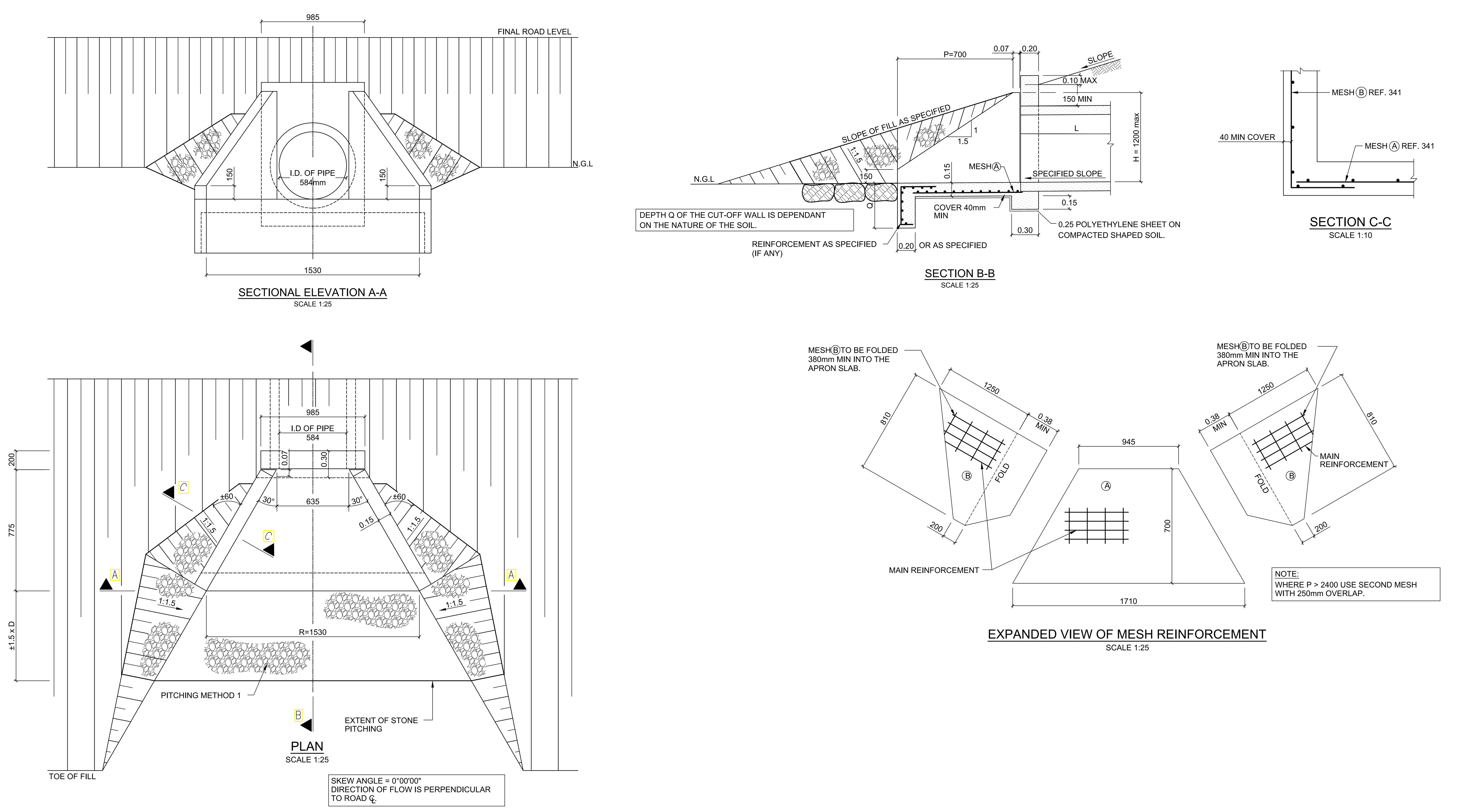
PROJECT: RE-ALIGNMENT OF PROVINCIAL ROAD P15-1 AT WONDERFONTEIN

TITLE: STORMWATER LONGITUDINAL SECTIONS

SCALE @ A0: AS SHOWN	CHECKED: E. KOTZE	APPROVED: E. KOTZE
DESIGN: M.KWATSHA	DRAWN: M.KWATSHA	DATE: 2017/11/17
PROJECT No: 22115	DRAWING No: D4000	REV: B

PLOT DATE: 2018/01/09 10:27:00 AM
TEMPLATE VERSION 1.1



SECTIONAL ELEVATION A-A — SCALE 1:25

PLAN — SCALE 1:25

SECTION B-B — SCALE 1:25

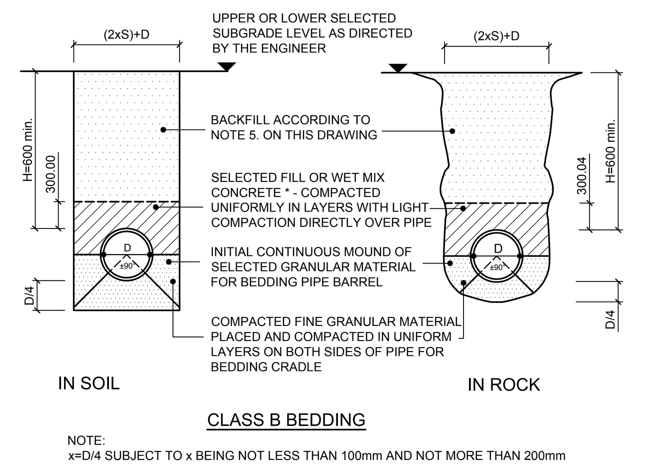
SECTION C-C — SCALE 1:10

EXPANDED VIEW OF MESH REINFORCEMENT — SCALE 1:25

NOTE: WHERE P > 2400 USE SECOND MESH WITH 250mm OVERLAP.

SKEW ANGLE = 0°00'00"
DIRECTION OF FLOW IS PERPENDICULAR TO ROAD ℄

DETAIL 4: TYPE 1 HEADWALL - 600mm O.D. (GDRT TYPICAL DRAWING: GTD2/1)

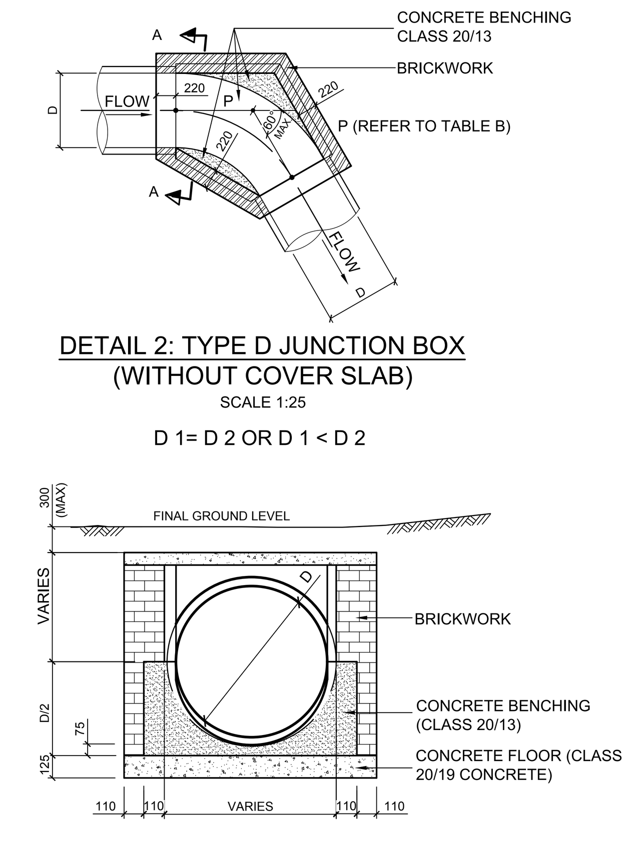


CLASS B BEDDING

EXTERNAL DIAMETER OF PIPE BARREL		SIDE ALLOWANCE ON EACH SIDE (mm)
OVER	UP TO AND INCL.	S
-	125	300
125	700	300
700	1000	400
1000	2000	500
2000	-	600

NOTES: PIPE CULVERTS
1. BEDDING BLANKET OF APPROVED SELECTED FILL MATERIAL IN 150mm THICK LAYERS AND HAND COMPACTED TO 90% MOD AASHTO DENSITY.
2. ALL PIPE CULVERTS TO BE INTERLOCKING JOINT PIPES - SABS 677 (SC TYPE)
3. ALL STORMWATER PIPES SHALL BE CLASS 100D UNLESS OTHERWISE SPECIFIED.
AREAS SUBJECT TO TRAFFIC LOADS:
4. BACKFILLING IN 150mm THICK MAX. LAYERS AND COMPACTED TO 93% MOD AASHTO (COHESIVE SOILS) AND COMPACTED TO 98% MOD AASHTO (NON COHESIVE SOILS) OR
AREAS NOT SUBJECTED TO TRAFFIC LOADS:
5. BACKFILLING IN 300mm THICK MAX. LAYERS AND COMPACTED TO 90% MOD AASHTO DENSITY.
* WET MIX CONCRETE ONLY WHEN ORDERED BY THE ENGINEER.
S=SIDE ALLOWANCE ; D=NOMINAL DIAMETER OF PIPE

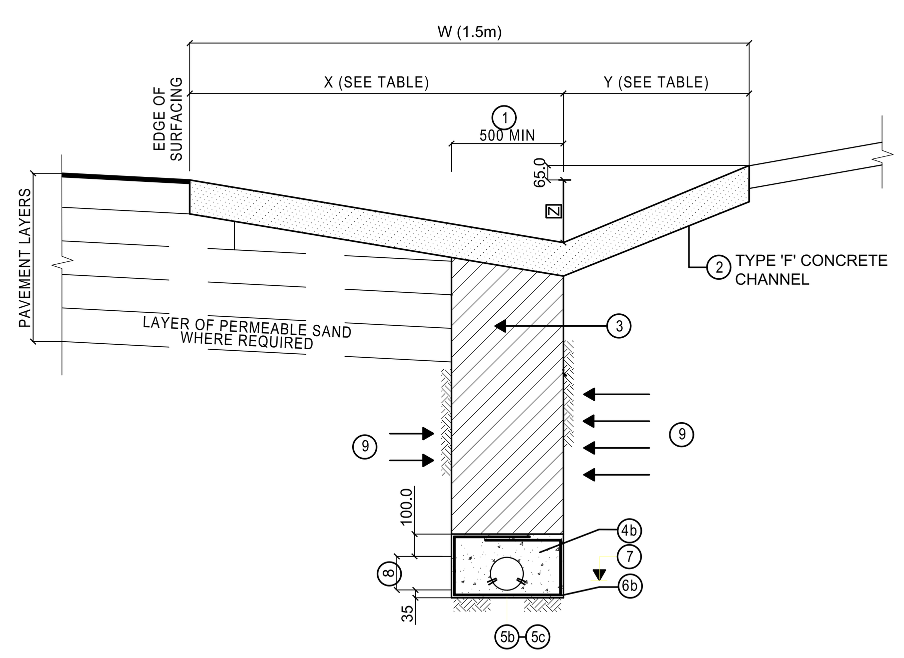
PIPE BEDDING DETAILS — SCALE 1:50



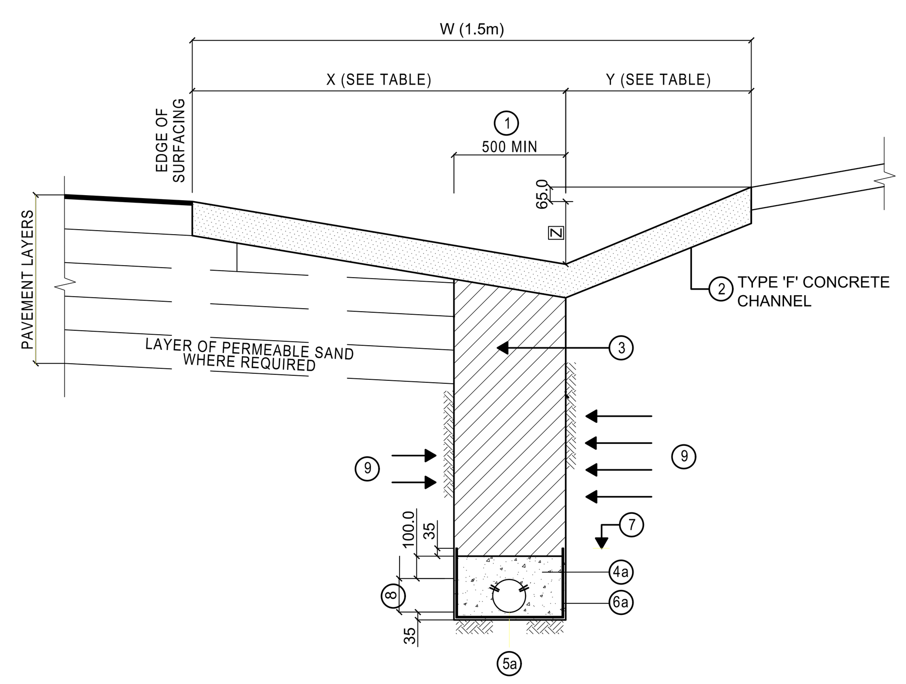
DETAIL 2: TYPE D JUNCTION BOX (WITHOUT COVER SLAB) — SCALE 1:25

D 1= D 2 OR D 1 < D 2

SECTION A-A — SCALE 1:25



SUBSOIL DRAIN WITH SYNTHETIC FIBRE FILTER FABRIC — SCALE 1:20



SUBSOIL DRAIN WITH POLYETHYLENE LINING — SCALE 1:20

W	X	Y	Z	D UNREINFORCED	D REINFORCED
1000	670	330	110	125	100
1500	1000	500	170	125	100
2000	1330	670	220	150	100
2500	1670	830	280	150	100

DIMENSIONS OF TYPE 'F' CONCRETE CHANNEL

No	DESCRIPTION
1	THIS DIMENSION MAY BE REDUCED TO A MINIMUM OF PIPE DIAMETER + 200mm PROVIDED THAT THE CROSS-SECTIONAL AREA IS ADEQUATE (SEE SUBCLAUSE 2104(b) OF THE STANDARD SPECIFICATIONS).
2	IMPERMEABLE BACKFILL MATERIAL. (MIN 150mm THICK) TAKEN TO TOP OF WATER BEARING LAYER IN CASES WHERE NO CONCRETE SIDE DRAIN IS PROVIDED.
3	FILTER SAND OF APPROVED SOURCE AND GRADE.
4a 4b	FILTER STONE: FINE OR COARSE GRADE AS REQUIRED. (SEE SUBCLAUSE 2104(a)(ii) OF THE STANDARD SPECIFICATIONS).
5a 5b 5c	PERFORATED / SLOTTED SUBSOIL DRAINAGE PIPES. (POSITION OF PERFORATIONS INDICATED).
6a	POLYETHYLENE 0.15mm THICKNESS.
6b	SYNTHETIC FIBRE FILTER FABRIC WITH 200mm OVERLAP (GRADE 2 OR APPROVED EQUIVALENT).
7	LEVEL TO WHICH SURROUNDING AREA IS TO BE DRAINED.
8	INTERNAL PIPE DIAMETER: 110mm OR 150mm.
9	WATER BEARING STRATA.

NOTES:

1. ALL CRITERIA ASSUMES THAT FILTER SAND AND FILTER STONE ARE CONTINUOUSLY GRADED FROM COARSE TO FINE.
2. USE THE ENVELOPE CURVES FOR THE WATER BEARING STRATA, FILTER SAND AND FILTER STONE GRADINGS AND APPLY TO MOST CRITICAL COMBINATIONS.
3. IF REQUIRED BY THE ENGINEER, SUBSOIL DRAINAGE MUST ALSO BE PROVIDED ON THE INSIDE OF BENCHING, WHERE USED.
4. WHERE SUBSOIL DRAINAGE IS INSTALLED IN SOLID ROCK THE POLYETHYLENE LINING MAY BE OMITTED.
5. TYPE A OUTLET PREFERABLY TO BE USED WHERE THE NATURAL GROUND LEVELS ALLOW IT. OUTLETS MAY ALSO BE COMBINED WITH CULVERT IN- OR OUTLETS.
6. ALL CONCRETE SHALL BE CLASS 20/19.
7. SPACING OF CLEANING EYES TO BE AS FOLLOWS:
   (a) 100m MAX ON STRAIGHT SECTIONS.
   (b) AT ALL BENDS.
   (c) OR AS DIRECTED BY THE ENGINEER.
8. TRANSVERSE SUBSOIL DRAINAGE TO BE PROVIDED AT ALL CUT TO FILL TRANSITIONS.
9. PLATE WITH THE INSCRIPTION "CLEANING EYE FOR SUBSOIL DRAIN". STAMPED ON TO BE AFFIXED TO CONCRETE COVER.
10. LETTER SIZE ON PLATE: 10mm SERIES C, CAPITAL LETTERS.
11. SYNTHETIC FIBRE FILTER FABRIC TO BE REPLACED WITH POLYETHYLENE LINING IN THE FOLLOWING INSTANCES:
   (a) WHERE THE SURROUNDING SOIL IS VERY PERMIOUS.
   (b) WHERE THE SURROUNDING SOIL HAS A HIGH FINES CONTENT WHICH COULD LEAD TO CLOGGING OF FILTER FABRICS.
12. STEEL PLATE TO BE FIXED TO TOP PORTION OF FENCE LINE OPPOSITE THE SUBSOIL OUTLET STRUCTURE.
13. BACKGROUND : MATT-WHITE
    TEXT : DIN A, MATT-BLACK

FILTER CRITERIA

A. "D x" IS THE SIZE OF SIEVE THROUGH WHICH x % OF THE FILTER MATERIAL WILL PASS.
0^{50} (GF) = AVERAGE SIZE OF THE OPENINGS OF THE SYNTHETIC FIBRE FILTER FABRIC.

B. FILTER SAND (FS) IN RELATION TO WATER BEARING STRATA (WS)

1. FOR D^{85} (WS) > 0.05mm:
   (a) TO PREVENT BLOCKING OF FILTER SAND:
   D^{15} (FS) < 5 x D^{85} (WS)
   D^{50} (FS) < 25 x D^{50} (WS)
   (b) FOR PERMEABILITY OF FILTER SAND:
   D^{15} (FS) > 5 x D^{15} (WS)
2. FOR D^{85} (WS) < 0.05mm:
   (a) TO PREVENT BLOCKING OF FILTER SAND:
   D^{15} (FS) < 0.25mm
   D^{05} (FS) > 0.075mm
   (b) PERMEABILITY REQUIREMENTS NOT NECESSARY

C. FILTER STONE (FSN) IN RELATION TO FILTER SAND (FS)

(a) TO PREVENT BLOCKING OF FILTER STONE:
D^{15} (FSN) < 5 x D^{85} (FS)
D^{50} (FSN) < 25 x D^{50} (FS)
(b) PERMEABILITY: FILTER STONE MUST BE COARSER THAN SAND AT ALL PERCENTAGES

D. FILTER STONE (FSN) IN RELATION TO PERFORATIONS IN PIPES

TO PREVENT BLOCKING OF PERFORATIONS IN PIPES:
D^{85} (FSN) > 1.2 x DIAMETER OF ROUND PERFORATIONS
D^{85} (FSN) > 1.2 x WIDTH OF SLOTS

E. SYNTHETIC FIBRE FILTER FABRIC (SF) IN RELATION TO FILTER SAND (FS)

(a) TO PREVENT CLOGGING OF SYNTHETIC FIBRE FILTER FABRIC:
O^{50} (SF) < D^{85} (FS)
(b) FOR PERMEABILITY OF SYNTHETIC FIBRE FILTER FABRIC:
O^{50} (SF) > D^{15} (FS)

REV	DATE	BY	DESCRIPTION	CHK	APD
B	10-11-2017	-	FOR APPROVAL	-	-
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ARCHITECT: the dpwrt — Department: Public Works, Roads and Transport — MPUMALANGA PROVINCE

CLIENT: umsimbithi Mining (Pty) Ltd

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PROJECT: RE-ALIGNMENT OF PROVINCIAL ROAD P15-1 AT WONDERFONTEIN

TITLE: STORMWATER TYPICAL DETAILS

SCALE @ A0: AS SHOWN	CHECKED: E. KOTZE	APPROVED: E. KOTZE
DESIGN: T JOUBERT	DRAWN: T JOUBERT	DATE: 2017/11/06
PROJECT No: 22115	DRAWING No: D4010	REV: B

TEMPLATE VERSION 1.1

FRESHWATER ECOLOGICAL ASSESSMENT AS PART OF THE ENVIRONMENTAL ASSESSMENT AND AUTHORISATION AS WELL AS WATER USE LICENSE APPLICATION PROCESS FOR THE PROPOSED WONDERFONTEIN ROAD DIVERSION, MPUMALANGA PROVINCE

Prepared for

Jaco K Consulting (Pty) Ltd

April 2019

Prepared by:	**Scientific Aquatic Services**
Report author:	**L. Robson (Cand. Sci. Nat)**
Report reviewer:	**S. van Staden (Pr. Sci. Nat)**
Report reference:	**SAS 219006**
Date:	**April 2019**

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EXECUTIVE SUMMARY

Based on the findings of the freshwater ecological assessment and the results of the risk assessment, it is the opinion of the ecologist that the proposed road diversion poses both direct and indirect risks to the wetlands associated with the proposed road diversion. Alternative 1 is not proposed to traverse any wetlands while Alternative 2 is proposed to traverse both CVB 2 and HHS 4. Therefore, the potential risk to the freshwater environment posed by Alternative 1 is lower than that of Alternative 2, as evidenced by the lower risk rating for Alternative 1. Thus, Alternative 1 is the preferred alternative from a freshwater resource management perspective. Adherence to cogent, well-conceived and ecologically sensitive site development plans, and the mitigation measures provided in this report as well as general good construction practice, is essential if the significance of perceived impacts is to be reduced.

It is the opinion of the freshwater specialist that the proposed road diversion, from a freshwater resource perspective, is considered acceptable, with the proviso that strict adherence to mitigation measures is enforced to ensure that the ecological integrity of the freshwater environment is not further compromised.

MANAGEMENT SUMMARY

Scientific Aquatic Services (SAS) was appointed to conduct a freshwater ecological assessment as part of the environmental assessment and authorisation process as well as water use license application (WULA) process for the proposed diversion of a portion of Wonderfontein Road, Mpumalanga Province, henceforth referred to as the "proposed road diversion". The proposed road diversion entails the realignment of a portion of Wonderfontein Road, located approximately 230m south of the N4 national highway and approximately 19km south west of Belfast. The portion of road to be diverted is approximately 3.6km long which traverses planned opencast mining areas associated with the Wonderfontein Mine, situated in the Mpumalanga Province between Wonderfontein and Carolina. Thus, the proposed road diversion will be placed outside of the planned mining footprint. Two road diversion alternatives have been proposed, comprising Alternative 1 (the preferred alternative) and Alternative 2 located to east and west of the existing Wonderfontein Road, respectively.

A desktop study was conducted, in which possible watercourses were identified for on-site investigation, and relevant national and provincial databases were consulted. The results of the desktop study are contained in Section 3 of this report.

During the site assessment undertaken in April 2019, numerous wetlands including channelled valley bottom (CVB) wetlands, hillslope seep (HSS) wetlands and depressions were identified within the investigation area. The wetlands located within the investigation area have all been impacted upon to some degree, with specific mention of the historical and ongoing surrounding agricultural activities. Agricultural fields have, in many areas, encroached on the wetland boundaries. Road infrastructure (such as Wonderfontein Road and the N4) were found to also traverse some of the wetlands. Generally, the conversion of natural areas to largely agricultural land-uses have impacted on the overall hydrological and geomorphological functioning of these wetlands. The detailed results of the field assessment are contained in Section 4 of this report; a summary of which is provided in the table below.

Table A: Summary of results of the field assessment as discussed in Section 4.

Watercourse	PES	Ecoservices	EIS	REC and RMO
CVB 1	C (Moderately modified)	Intermediate	Moderate	REC C RMO: Maintain
CVB 2 and associated HHS 4	B (Small modification)	Intermediate	Moderate	REC B RMO: Maintain
HHS 1	D (Largely modified)	Intermediate	Moderately low	REC D

Watercourse	PES	Ecoservices	EIS	REC and RMO
				RMO: Maintain
Depression 1	D (Largely modified)	Intermediate	Moderately low	REC D RMO: Maintain

Following the assessment of the wetlands, the Department of Water and Sanitation (DWS) Risk Assessment Matrix (2016) was applied to ascertain the significance of possible impacts which may occur because of the proposed road diversion. The risk assessment was undertaken based on the layout provided by the proponent, which indicates that Alternative 1 will not traverse any wetlands while Alternative 2 is proposed to traverse both CVB 2 and HHS 4. The results of this assessment are presented in Section 5 of this report, and show that, assuming mitigation measures are strictly enforced, impact significance is of low to moderate significance during the construction and operational phase. The results of the risk assessment are summarised in Table B below.

Table B: Summary of the results of the risk assessment applied to the wetlands associated with the proposed road diversion.

No.	Phases	Activity	Aspect	Impact	Severity	Consequence	Likelihood	Significance	Risk Rating
1	Construction Phase	Site preparation prior to commencement of construction activities, outside of the wetlands.	*Vehicular transport and access to the site; *Removal of vegetation and associated disturbances to soil; *Miscellaneous activities by construction personnel.	*Exposure of soil, leading to increased runoff and erosion, and thus increased sedimentation of the wetlands; *Increased sedimentation of the wetlands, resulting in loss of freshwater habitat and ecological structure leading to impacts on biota; *Decreased ecoservice provision; and *Proliferation of alien vegetation as a result of disturbances.	2.5	4.5	5	**22.5**	**L**
2	Construction Phase	Site preparation prior to commencement of construction activities, within wetland boundaries.	*Vehicular transport and access to the site; *Removal of vegetation and associated disturbances to soil; *Miscellaneous activities by construction personnel.	*Destruction of wetland habitat and functionality within the road footprint crossing the wetland; *Disturbance to the wetland vegetation; and *Trampling within the wetland beyond the construction footprint.	2.5	4.5	9	**40.5**	**L**
3a - **Alternative 1**	Construction Phase	Excavation for road layer works.	*Disturbances to soil within the wetland; and Removal of topsoil and creation of stockpiles.	*Disturbances to soil leading to increased alien vegetation proliferation, and in turn to further altered freshwater habitat; *Altered runoff patterns and alteration to flow	2.5	5.5	5	**27.5**	**L**

No.	Phases	Activity	Aspect	Impact	Severity	Consequence	Likelihood	Significance	Risk Rating
3b - **Alternative 2**				patterns, leading to increased erosion and sedimentation of the wetland; and *Possible contamination of soil and surface water, leading to further reduced ability to support biodiversity.	5	9	10	**90**	**M**
4a - **Alternative 1**			*Movement of construction equipment/vehicles within the wetlands; and *Possible spills / leaks from construction vehicles.	*Disturbances to soil leading to increased alien vegetation proliferation, and in turn to further altered wetland habitat; *Altered runoff patterns and alteration to flow patterns, leading to increased erosion and sedimentation of the wetland; and *Possible contamination of soil and surface water, leading to further reduced ability to support biodiversity.	2.75	5.8	5	**28.75**	**L**
4b - **Alternative 2**					5	8	10	**80**	**M**
5a - **Alternative 1**		Construction of road diversion within the wetland (road crossing of Alternative 2), including construction of drainage culverts.	*Movement of construction equipment/vehicles within the wetland; *Possible spills / leaks from construction vehicles; *Possible discard of construction material within the wetland; and *Disturbances to soil as culverts are installed.	*Diversion of flow around the construction area could potentially change in flow pattern and timing of water entering the downgradient reach of the wetland; *Altered runoff patterns, leading to increased erosion and sedimentation of the wetland; *Trampling by construction personnel and equipment is likely to impact on the wetland vegetation, leading to habitat degradation; *Potential for hydrocarbons and oil spills from entering into the wetland; *Construction of the road crossing would entail the use of concrete, which could potentially impact on the water quality of the downgradient reach of the wetland; *Alterations to flow patterns and hydrological processes through	3	6	7	**42**	**L**
5b - **Alternative 2**					5	10	11	**110**	**M**

No.	Phases	Activity	Aspect	Impact	Severity	Consequence	Likelihood	Significance	Risk Rating
				constriction of flow through the culverts leafing to desiccation of the wider wetland area and the risk of erosion and incision where flow is concentrated.					
6	Operational Phase	Maintenance of the road crossing.	*Potential movement of construction machinery/vehicles within the wetland; *Possible spills / leaks from construction vehicles; *Possible discard of construction material within the wetland; and *Disturbances to or removal of vegetation whilst accessing culverts to carry out maintenance activities.	*Potential loss of indigenous vegetation and the further proliferation of alien floral species due to disturbances.	3	5	8	**40**	**L**
7		Rehabilitation activities of portions of the wetlands impacted by construction.	*Re-vegetate disturbed wetland areas, remove any remaining construction waste.	*Exposure of soil, leading to increased runoff and erosion, and thus increased sedimentation of the wetlands; and *Proliferation of alien vegetation as a result of disturbances.	4	6	8	**48**	**L**

Alternative 1 is not proposed to traverse any wetlands while Alternative 2 is proposed to traverse both CVB 2 and HHS 4. Therefore, the potential risk to the freshwater environment posed by Alternative 1 is lower than that of Alternative 2, as evidenced by the lower risk rating for Alternative 1. Thus, Alternative 1 is the preferred alternative from a freshwater resource management perspective. As the outcome of the Risk Assessment indicates that Alternative 1 poses a low risk to the wetlands, the project may be authorised by means of a General Authorisation (GA), provided that Alternative 1 is the chosen option and that the recommended mitigation measures are implemented. It must be noted that the Department of Water and Sanitation (DWS) is the competent authority, and this opinion should be confirmed by the DWS.

Based on the findings of the freshwater ecological assessment, several recommended mitigation measures are made to minimise the impact on the freshwater resources. Key mitigation measures include (but are not limited to):

- If feasible, construction must be scheduled for the drier winter period in order to minimise the risk of sediment-laden runoff reaching the wetlands as a result of the construction activities;
- Should it be necessary to clear any areas of vegetation, these areas, including contractor laydown areas, must remain as small as possible, to reduce the risk of further proliferation of alien vegetation, and to retain a level of protection to the wetlands during construction (e.g. sediment trapping, slowing of stormwater runoff etc.);
- Contractor laydown areas and all non-essential activities are to remain outside of the delineated wetlands and the 32m NEMA zone of regulation, and as much as feasible no natural/indigenous wetland vegetation is to be cleared;

- All exposed soils must be protected for the duration of the construction phase with a suitable geotextile (e.g. Geojute or hessian) to prevent erosion and sedimentation of the wetlands. Soils should not be stockpiled within close proximity to the wetlands, but should rather be outside of the temporary zone boundaries to prevent sedimentation of the wetlands, and stockpiles may not exceed 2m in height to prevent the structural properties of the soil being compromised;
- The design of the portion of road traversing the wetlands should ensure adequate flow, hydraulic conditions and connectivity between the upgradient and downgradient portions of the wetlands using either culvert structures or pipe culverts or a combination of both. These structures should be sized to accommodate a 1:100 year flood event and should allow for the recharge of the entire width of the wetland; and
- It is highly recommended that the proponent make provision for small-scale rehabilitation of the reaches of the wetlands which may be directly impacted upon by construction activities. The area must preferably be rehabilitated to conditions as close as possible to the “natural” state, not the pre-construction state since the state of the wetlands is deemed to be altered from a reference condition. This will ensure that the current levels of ecological service provision of the wetlands are maintained and where feasible, improved.

Based on the findings of the freshwater ecological assessment and the results of the risk assessment, it is the opinion of the ecologist that the proposed road diversion poses both direct and indirect risks to the wetlands associated with the proposed road diversion. Adherence to cogent, well-conceived and ecologically sensitive site development plans, and the mitigation measures provided in this report as well as general good construction practice, is essential if the significance of perceived impacts is to be reduced.

It is the opinion of the freshwater specialist that the proposed road diversion, from a freshwater resource perspective, is considered acceptable, with the proviso that strict adherence to mitigation measures is enforced to ensure that the ecological integrity of the freshwater environment is not further compromised beyond that which will be lost within the footprint of the proposed road.

DOCUMENT GUIDE

No.	Requirement	Section in report
a)	Details of -	
(i)	The specialist who prepared the report	Appendix G
(ii)	The expertise of that specialist to compile a specialist report including a curriculum vitae	Appendix G
b)	A declaration that the specialist is independent	Appendix G
c)	An indication of the scope of, and the purpose for which, the report was prepared	Section 1.2
cA)	An indication of the quality and age of base data used for the specialist report	Section 2.1
cB)	A description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change	Section 4
d)	The duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment	Section 2.1
e)	A description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used	Appendix C
f)	Details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives	Section 4
g)	An identification of any areas to be avoided, including buffers	Section 4.3
h)	A map superimposing the activity including the associated structure and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers	Section 4.3
i)	A description of any assumption made and any uncertainties or gaps in knowledge	Section 1.3
j)	A description the findings and potential implication\s of such findings on the impact of the proposed activity, including identified alternatives on the environment or activities	Section 4, 5, and 6
k)	Any mitigation measures for inclusion in the EMPr	Section 5.1
l)	Any conditions for inclusion in the environmental authorisation	Section 5
m)	Any monitoring requirements for inclusion in the EMPr or environmental authorisation	Section 5
n)	A reasoned opinion -	
(i)	As to whether the proposed activity, activities or portions thereof should be authorised	Section 6
(iA)	Regarding the acceptability of the proposed activity or activities	Section 6
(ii)	If the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan	Section 6
o)	A description of any consultation process that was undertaken during the course of preparing the specialist report	N/A
p)	A summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	N/A
q)	Any other information requested by the competent authority	N/A

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GLOSSARY OF TERMS

Alien vegetation:	Plants that do not occur naturally within the area but have been introduced either intentionally or unintentionally. Vegetation species that originate from outside of the borders of the biome -usually international in origin.
Biodiversity:	The number and variety of living organisms on earth, the millions of plants, animans and micro-organisms, the genes they contain, the evolutionary history and potential they encompass and the ecosystems, ecological processes and landscape of which they are integral parts.
Buffer:	A strip of land surrounding a wetland or riparian area in which activities are controlled or restricted, in order to reduce the impact of adjacent land uses on the wetland or riparian area.
Catchment:	The area where water is collected by the natural landscape, where all rain and run-off water ultimately flows into a river, wetland, lake, and ocean or contributes to the groundwater system.
Delineation (of a wetland):	To determine the boundary of a wetland based on soil, vegetation and/or hydrological indicators.
Ecoregion:	An ecoregion is a "recurring pattern of ecosystems associated with characteristic combinations of soil and landform that characterise that region".
Facultative species:	Species usually found in wetlands (76%-99% of occurrences) but occasionally found in non-wetland areas
Fluvial:	Resulting from water movement.
Gleying:	A soil process resulting from prolonged soil saturation which is manifested by the presence of neutral grey, bluish or greenish colours in the soil matrix.
Groundwater:	Subsurface water in the saturated zone below the water table.
Hydromorphic soil:	A soil that in its undrained condition is saturated or flooded long enough to develop anaerobic conditions favouring the growth and regeneration of hydrophytic vegetation (vegetation adapted to living in anaerobic soils).
Hydrology:	The study of the occurrence, distribution and movement of water over, on and under the land surface.
Hydrophyte:	Any plant that grows in water or on a substratum that is at least periodically deficient of oxygen as a result of soil saturation or flooding; plants typically found in wet habitats.
Indigenous vegetation:	Vegetation occurring naturally within a defined area.
Mottles:	Soils with variegated colour patterns are described as being mottled, with the "background colour" referred to as the matrix and the spots or blotches of colour referred to as mottles.
Obligate species:	Species almost always found in wetlands (>99% of occurences).
Perched water table:	The upper limit of a zone of saturation that is perched on an unsaturated zone by an impermeable layer, hence separating it from the main body of groundwater
Perennial:	Flows all year round.
RAMSAR:	The Ramsar Convention (The Convention on Wetlands of International Importance, especially as Waterfowl Habitat) is an international treaty for the conservation and sustainable utilisation of wetlands, i.e., to stem the progressive encroachment on and loss of wetlands now and in the future, recognising the fundamental ecological functions of wetlands and their economic, cultural, scientific, and recreational value. It is named after the city of Ramsar in Iran, where the Convention was signed in 1971.
RDL (Red Data listed) species:	Organisms that fall into the Extinct in the Wild (EW), critically endangered (CR), Endangered (EN), Vulnerable (VU) categories of ecological status
Seasonal zone of wetness:	The zone of a wetland that lies between the Temporary and Permanent zones and is characterised by saturation from three to ten months of the year, within 50cm of the surface
Temporary zone of wetness:	the outer zone of a wetland characterised by saturation within 50cm of the surface for less than three months of the year
Watercourse:	In terms of the definition contained within the National Water Act, a watercourse means: • A river or spring; • A natural channel which water flows regularly or intermittently; • A wetland, dam or lake into which, or from which, water flows; and • Any collection of water which the Minister may, by notice in the Gazette, declare to be a watercourse; • and a reference to a watercourse includes, where relevant, its bed and banks
Wetland Vegetation (WetVeg) type:	Broad groupings of wetland vegetation, reflecting differences in regional context, such as geology, climate, and soils, which may in turn have an influence on the ecological characteristics and functioning of wetlands.

ACRONYMS

°C	Degrees Celsius.
BAR	Basic Assessment Report
BGIS	Biodiversity Geographic Information Systems
CBA	Critical Biodiversity Area
CSIR	Council of Scientific and Industrial Research
CVB	Channelled Valley Bottom
DWA	Department of Water Affairs
DWAF	Department of Water Affairs and Forestry
DWS	Department of Water and Sanitation
EAP	Environmental Assessment Practitioner
EC	Ecological Class or Electrical Conductivity (use to be defined in relevant sections)
EIA	Environmental Impact Assessment
EIS	Ecological Importance and Sensitivity
EMC	Ecological Management Class
EMP	Environmental Management Program
ESA	Ecological Support Area
EWR	Ecological Water Requirements
FEPA	Freshwater Ecosystem Priority Areas
GIS	Geographic Information System
GN	Government Notice
GPS	Global Positioning System
HGM	Hydrogeomorphic
HHS	Hillslope Seep
m	Meter
MAP	Mean Annual Precipitation
MHW	Mpumalanga Highveld Wetlands
NEMA	National Environmental Management Act
NFEPA	National Freshwater Ecosystem Priority Areas
NWA	National Water Act
PES	Present Ecological State
REC	Recommended Ecological Category
RE	Remaining Extent
RMO	Resource Management Objective
RQIS	Research Quality Information Services
SACNASP	South African Council for Natural Scientific Professions
SANBI	South African National Biodiversity Institute
SAS	Scientific Aquatic Services
SQR	Sub quaternary catchment reach
subWMA	Sub-Water Management Area
WetVeg Groups	Wetland Vegetation Groups
WMA	Water Management Areas
WMS	Water Management System
WRC	Water Research Commission
WULA	Water Use License Application

1 INTRODUCTION

1.1 Background

Scientific Aquatic Services (SAS) was appointed to conduct a freshwater ecological assessment as part of the environmental assessment and authorisation process as well as water use license application (WULA) process for the proposed diversion of a portion of Wonderfontein Road, Mpumalanga Province, henceforth referred to as the "proposed road diversion".

The proposed road diversion entails the realignment of a portion of Wonderfontein Road, located approximately 230m south of the N4 national highway and approximately 19km south west of Belfast. The portion of road to be diverted is approximately 3.6km long which traverses planned opencast mining areas associated with the Wonderfontein Mine, situated in the Mpumalanga Province between Wonderfontein and Carolina. Thus, the proposed road diversion will be placed outside of the planned mining footprint.

Two road diversion alternatives have been proposed, comprising Alternative 1 (the preferred alternative) and Alternative 2 located to east and west of the existing Wonderfontein Road, respectively (Figures 1 and 2).

In order to identify all watercourses that may potentially be impacted by the proposed road diversion, a 500m "zone of investigation" around the two proposed road diversion alternatives, in accordance with Government Notice (GN) 509 of 2016 as it relates to the National Water Act, 1998 (Act No. 36 of 1998), was used as a guide in which to assess possible sensitivities of the receiving freshwater environment. This area – i.e. the 500m zone of investigation around the two proposed road diversion alternatives - will henceforth be referred to as the "Investigation Area".

The purpose of this report is to define the ecology of the area in terms of watercourse characteristics, including mapping of the watercourses, defining areas of increased Ecological Importance and Sensitivity (EIS), and to define the Present Ecological State (PES) of the watercourses associated with the proposed road diversion. Additionally, this report aims to define the socio-cultural and ecological service provision of the watercourses and the Recommended Management Objectives (RMO) and Recommended Ecological Category

(REC) for the watercourses. It is a further objective of this study to provide detailed information to be considered when considering the proposed road diversion in the vicinity of the watercourses, to ensure the ongoing functioning of the ecosystem, such that local and regional conservation requirements and the provision of ecological services in the local area are supported while considering the need for sustainable economic development.

The Department of Water and Sanitation (DWS) Risk Assessment Matrix (2016) as it relates to activities as stipulated in Section 21(c) and (i) of the National Water Act, 1998 (Act No. 36 of 1998) was applied to determine the significance of the perceived impacts associated with the proposed road diversion, and the operational activities' impact on the receiving freshwater environment. In addition, mitigatory measures were developed which aim to minimise the perceived impacts associated with the proposed road diversion, followed by an assessment of the significance of the impacts after mitigation, assuming that they are fully implemented.

This report, after consideration and a description of the ecological integrity of the proposed road diversion, must guide the Environmental Assessment Practitioner (EAP) as well as the proponent and the relevant authorities, by means of a reasoned opinion and recommendations, as to the viability of the proposed road diversion from a freshwater ecological management point of view and provide recommendations to minimise the impacts on the receiving freshwater environment in line with the requirements of the mitigation hierarchy as advocated by the Department of Environmental Affairs (DEA) and DWS.

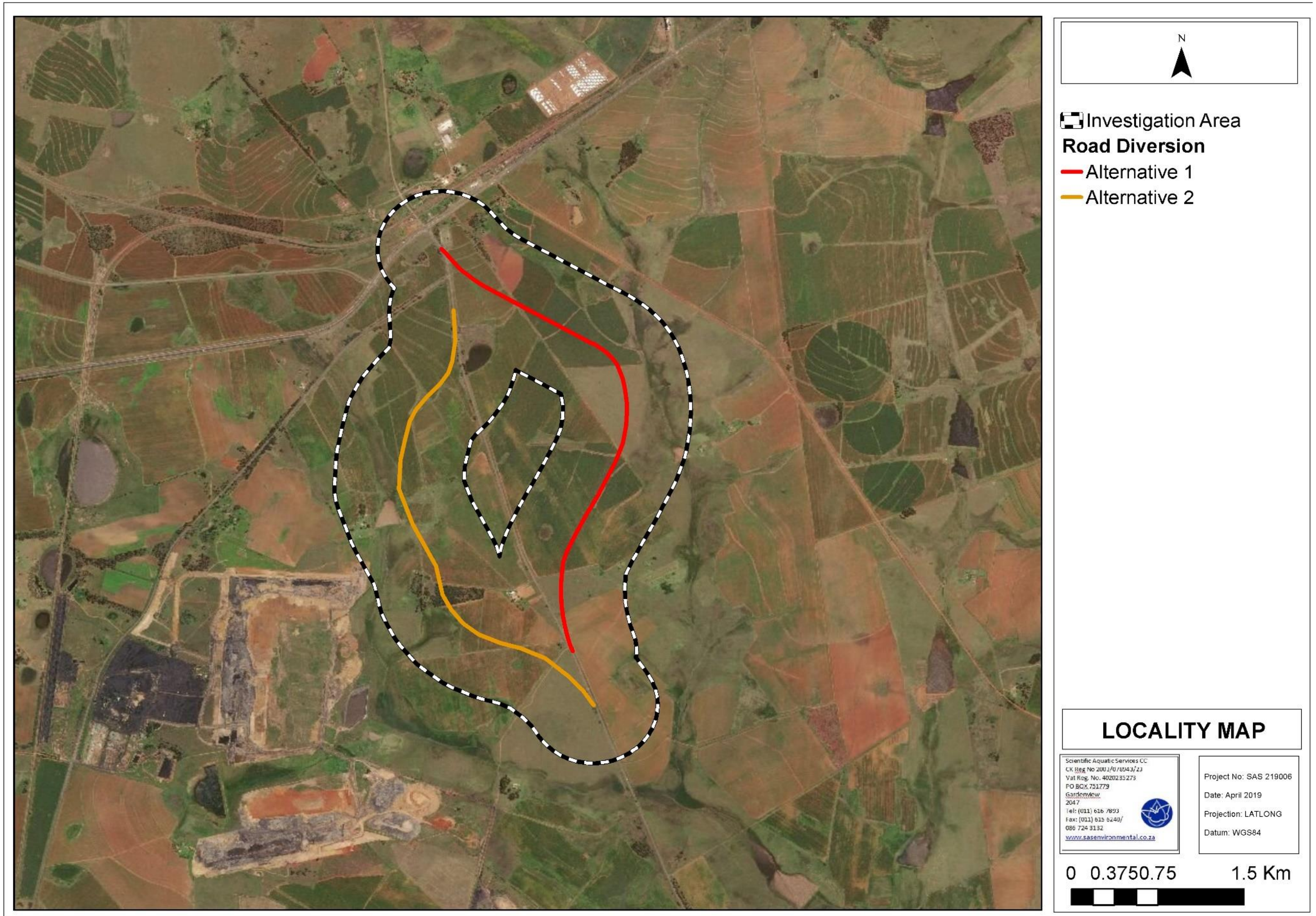


Figure 1: A digital satellite image depicting the location of the road diversion alternatives and investigation area in relation to the surrounding area.

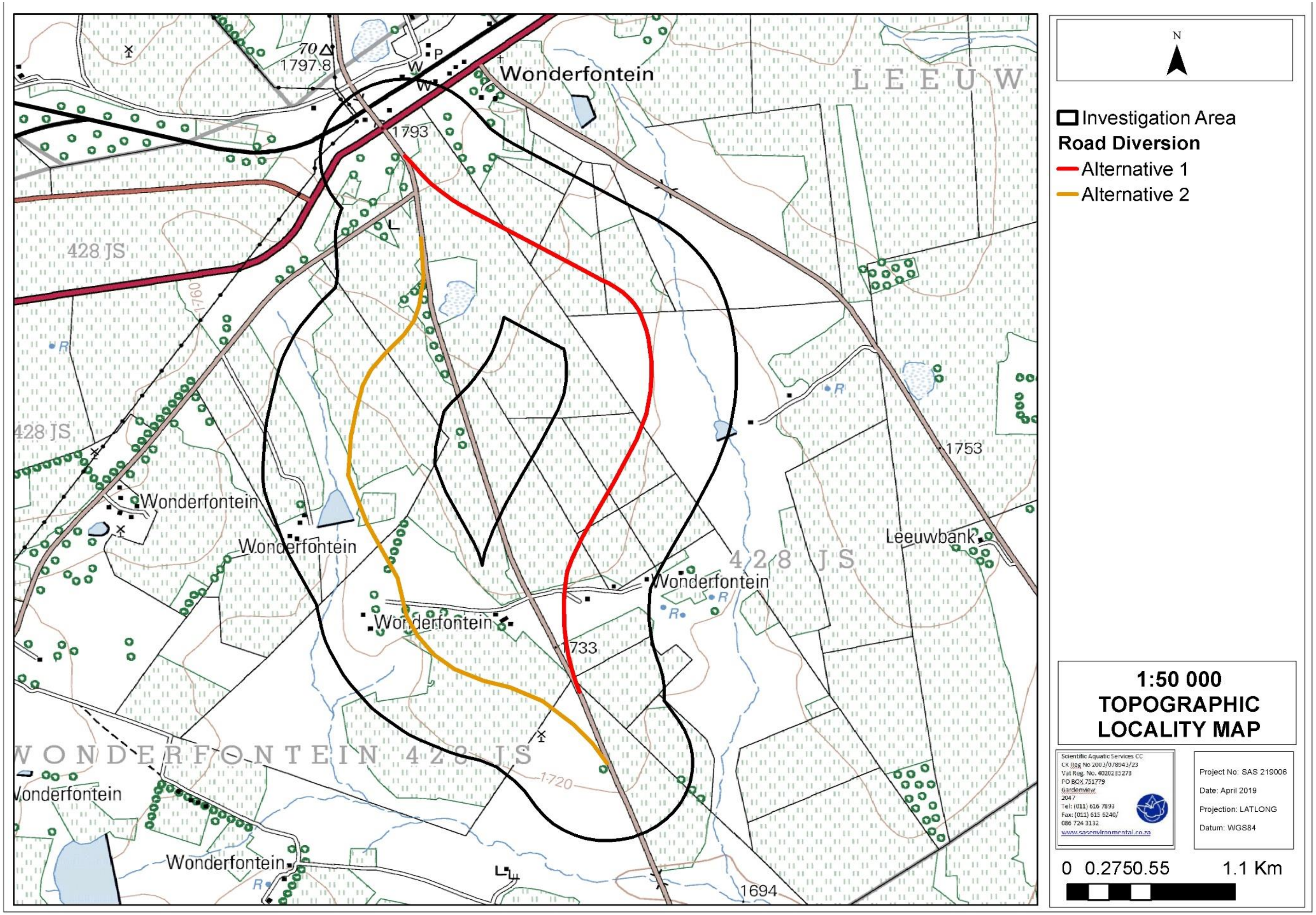


Figure 2: The road diversion alternatives and investigation area depicted on a 1:50 000 topographical map in relation to the surrounding area.

1.2 Scope of Work

Specific outcomes in terms of this report are outlined below:

- A background study of relevant national, provincial and municipal datasets (such as the National Freshwater Ecosystem Priority Areas [NFEPA] 2011 database; the Department of Water and Sanitation Research Quality Information Services [DWS RQIS PES/EIS], 2014 database, Mpumalanga Highveld Wetlands (2013) and the Mpumalanga Biodiversity Sector Plan (MBSP, 2014) was undertaken to aid in defining the PES and EIS of the watercourses;
- The watercourse classification assessment was undertaken according to the Classification System for Wetlands and other Aquatic Ecosystems in South Africa. User Manual: Inland systems (Ollis *et al*., 2013);
- The EIS of the watercourses were determined according to the method described by Rountree & Kotze, (2013);
- The PES of the watercourses was assessed according to the resource directed measures guideline as advocated by Macfarlane *et al.,* (2008);
- Watercourses were mapped according to the ecological sensitivity of each hydrogeomorphic unit in relation to the proposed road diversion. In addition to the watercourse boundaries, the appropriate provincial recommended buffers and legislated zones of regulation were depicted where applicable;
- Allocation of a suitable REC and RMO to the watercourses based on the results obtained from the PES and EIS assessments;
- The DWS Risk Assessment Matrix (2016) was applied to identify potential impacts that may affect the watercourses as a result of the proposed road diversion, and to aim to quantify the significance thereof; and
- To present management and mitigation measures which should be implemented during the various development phases to assist in minimising the impact on the receiving freshwater environment.

1.3 Assumptions and Limitations

The following assumptions and limitations are applicable to this report:

- The determination of the watercourse boundaries and the assessment thereof, is confined to the watercourses associated with the zone of influence (32m radius) of the proposed road diversion alternatives. All watercourses identified within 500m of the proposed road diversion alternatives were delineated in fulfilment of GN509 as it relates to the National Water Act, 1998 (Act No. 36 of 1998) on a desktop level, however these watercourses were not assessed in detail. The general surroundings were considered in the desktop assessment of the proposed road diversion;

- The watercourse delineations as presented in this report are regarded as a best estimate, based on the site conditions present at the time of assessment. Global Positioning System (GPS) technology is inherently inaccurate and some inaccuracies due to the use of handheld GPS instrumentation may occur. If more accurate assessments are required, the watercourses will need to be surveyed and pegged according to surveying principles;
- Freshwater and terrestrial zones create transitional areas where an ecotone is formed as vegetation species change from terrestrial to obligate/facultative species. Within this transition zone, some variation of opinion on the watercourse boundary may occur. However, if the DWAF (2008) method is followed, all assessors should get largely similar results; and
- With ecology being dynamic and complex, certain aspects (some of which may be important) may have been overlooked. It is, however, expected that the watercourses associated with the proposed development have been accurately assessed and considered, based on the field observations undertaken and the consideration of existing studies in terms of the freshwater ecology.

1.4 Legislative Requirements and Provincial Guidelines

The following legislative requirements and relevant provincial guidelines were taken into consideration during the assessment. A detailed description of these legislative requirements is presented in Appendix B:

- The National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA);
- The National Water Act, 1998 (Act No. 36 of 1998) (NWA); and
- GN509 as published in the Government Gazette 40229 of 2016 as it relates to the National Water Act, 1998 (Act No. 36 of 1998).

2 ASSESSMENT APPROACH

2.1 Watercourse Field Verification

For the purposes of this investigation, the definitions of a watercourse and a wetland were taken as per that in the National Water Act, 1998 (Act No. 36 of 1998). The definitions are as follows:

A **watercourse** means:
(a) a river or spring;
(b) a natural channel in which water flows regularly or intermittently;
(c) a wetland, lake or dam into which, or from which, water flows; and
(d) any collection of water which the Minister may, by notice in the *Gazette,* declare to be a watercourse,
and a reference to a watercourse includes, where relevant, its bed and banks.

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

The watercourse delineation took place according to the method presented in "A practical field procedure for identification and delineation of wetlands and riparian areas" (DWAF, 2008) as far as practically feasible, given the condition of the area at the time of assessment. The foundation of the method is based on the fact that watercourses have several distinguishing factors including the following:

- Landscape position;
- The presence of water at or near the ground surface;
- Distinctive hydromorphic soils; and
- Vegetation adapted to saturated soils.

In addition to the delineation process, a detailed assessment of the watercourses was undertaken (in April 2019), whereby factors affecting the integrity of the watercourses were taken into consideration and aided in the determination of the functioning as well as the provision of ecological and socio-cultural services by the watercourses. A detailed explanation of the method of assessment related to the watercourse assessment is provided in Appendix C of this report.

2.2 Sensitivity Mapping

The watercourses associated with the proposed road diversion were delineated with the use of a Global Positioning System (GPS). Geographic Information System (GIS) was used to project the features onto digital satellite imagery and topographic maps. The sensitivity map presented in Section 4.3 should guide the design and layout of the proposed road diversion.

2.3 Risk Assessment and Recommendations

Following the completion of the assessment, a risk assessment was conducted (please refer to Appendix D for the method of approach) and recommendations were developed to address and mitigate impacts associated with the proposed road diversion. These recommendations also include general 'best practice' management measures, which apply to the proposed road diversion as a whole, and which are presented in Appendix F. Mitigation measures have been developed to address issues in all phases throughout the life of the operation including planning, construction and operation. The detailed site-specific mitigation measures are outlined in Section 5 of this report.

3 RESULTS OF THE DESKTOP ANALYSIS

3.1 Analyses of Relevant Databases

The following section contains data accessed as part of the desktop assessment and are presented as a "dashboard style" report below (Table 1). The dashboard report aims to present concise summaries of the data on as few pages as possible in order to allow for integration of results by the reader to take place.

It is important to note that although all data sources used provide useful and often verifiable, high quality data, the various databases used do not always provide an entirely accurate indication of the proposed road diversion's actual site characteristics at the scale required to inform the environmental authorisation and/or water use licencing processes. However, this information is considered useful as background information to the study. Thus, this data was used as a guideline to inform the assessment and to focus on areas and aspects of increased conservation importance.

Table 1: Desktop data relating to the character of watercourses associated with the proposed road diversion and surrounding region.

Aquatic ecoregion and sub-regions in which the proposed road diversion is located	
Ecoregion	Highveld
Catchment	Komati/Crocodile
Quaternary Catchment (Figure 4)	X11C
WMA	Inkomati
subWMA	Komati West
Dominant characteristics of the Highveld Aquatic Ecoregion Level 2 (11.02) (Kleynhans *et al.*, 2007)	
Dominant primary terrain morphology	Plains; moderate relief, moderately undulating plains and pans
Dominant primary vegetation types	Moist Sandy Highveld Grassland
Altitude (m a.m.s.l)	1300 to 1900
MAP (mm)	500 to 800
Coefficient of Variation (% of MAP)	20 to 29
Rainfall concentration index	55 to 64
Rainfall seasonality	Early to mid-summer
Mean annual temp. (°C)	12 to 18
Winter temperature (July)	0 – 20 °C
Summer temperature (Feb)	10 – 26 °C
Median annual simulated runoff (mm)	20 to 80
Underlying Geology of the proposed road diversion	
The proposed road diversion is underlain by sandstone, greywacke and arkose formations	
Importance according to the Mpumalanga Highveld Wetlands (MHW) Database (2014) (Figure 6 – 9)	
• According to the MHW database various natural wetlands and one artificial feature are situated within the investigation area; • The wetlands are classified by the MHW database as a, dam, channelled valley bottom wetlands (three), seep wetlands (two), and a depression; • The channelled valley bottom wetlands and the depression are considered to be in a moderately modified condition (Class C), while the seep wetland is considered to be in a heavily modified condition (Class z); and • All wetlands within the investigation area are classified by the MHW database as Freshwater Ecosystem Priority Area (FEPA) wetlands.	

Detail of the proposed road diversion in terms of the National Freshwater Ecosystem Priority Area (NFEPA) (2011) database	
FEPACODE	The proposed road diversion is located within a subWMA currently not considered important in terms of fish or watercourse conservation.
NFEPA Wetlands (Figure 3 & 4))	According to the NFEPA database, there are two natural wetlands situated within the investigation area. The wetland situated approximately 34m west of alternative 2 is identified by NFEPA as a channelled valley bottom wetland, while a depression wetland is situated approximately west of alternative 1. The channelled valley bottom wetland is considered moderately modified (Class C) while the depression wetland is heavily to critically modified (Class Z1), according to the NFEPA database.
Wetland Vegetation Type	The proposed road diversion a is situated within the Mesic Highveld Grassland Group 4 Wetland Vegetation Type, considered Least Threatened as provided by Mbona *et al.* (2014).
NFEPA Rivers	There are no rivers associated with the proposed road diversion, nor with the investigation area. The Witkloofspruit is situated approximately 2.6 km east of the proposed road diversion and is considered by NFEPA to be moderately modified.
Detail of the proposed road diversion in terms of the Mpumalanga Biodiversity Sector Plan (MBSP, 2014)	
Critical Biodiversity Areas (CBA) Wetlands (Figure 5)	According to the MBSP Aquatics Database, the wetlands as identified by the NFEPA database are considered to be CBA wetlands. These are wetlands important to meet freshwater ecosystems biodiversity targets, their ecological condition need to be maintained or improved, and any loss or deterioration of these wetlands must be avoided.
Ecological Support Area (ESA) (Important sub-catchments) (Figure 5)	Alternatives 1 and 2 both traverse areas considered to be ESA important sub-catchments. These are sub-catchments that either contain river FEPAs and/or Fish Support Areas.
Heavily Modified (Figure 9) (Figure 5)	According to the MBSP Database, the majority of the area associated with the proposed road diversion is considered to be heavily modified. These include all areas currently modified to such an extent that any valuable biodiversity and ecological function has been lost.
Ecological Status of the most proximal sub-quaternary reach (DWS, 2014) (Figure 10)	
Sub-quaternary reach	X11C-01147 (Witkloofspruit)
Proximity to Linear Development	Approximately 2.6 km east of the road diversion
Assessed by expert?	Yes
PES Category Median	Moderately Modified (Class C)
Mean Ecological Importance (EI) Class	Moderate
Mean Ecological Sensitivity (ES) Class	High
Stream Order	1
Default Ecological Class (based on median PES and highest EI or ES mean)	High (Class B)

CBA = Critical Biodiversity Area; DWS = Department of Water and Sanitation; EI = Ecological Importance; ES = Ecological Sensitivity; ESA = Ecological Support Area; FEPA = Freshwater Ecosystem Priority Area; m.a.m.s.l = Metres above Mean Sea Level; MAP = Mean Annual Precipitation; MBSP = Municipal Biodiversity Summary Project; NFEPA = National Freshwater Ecosystem Priority Areas; PES = Present Ecological State; WMA = Water Management Area.

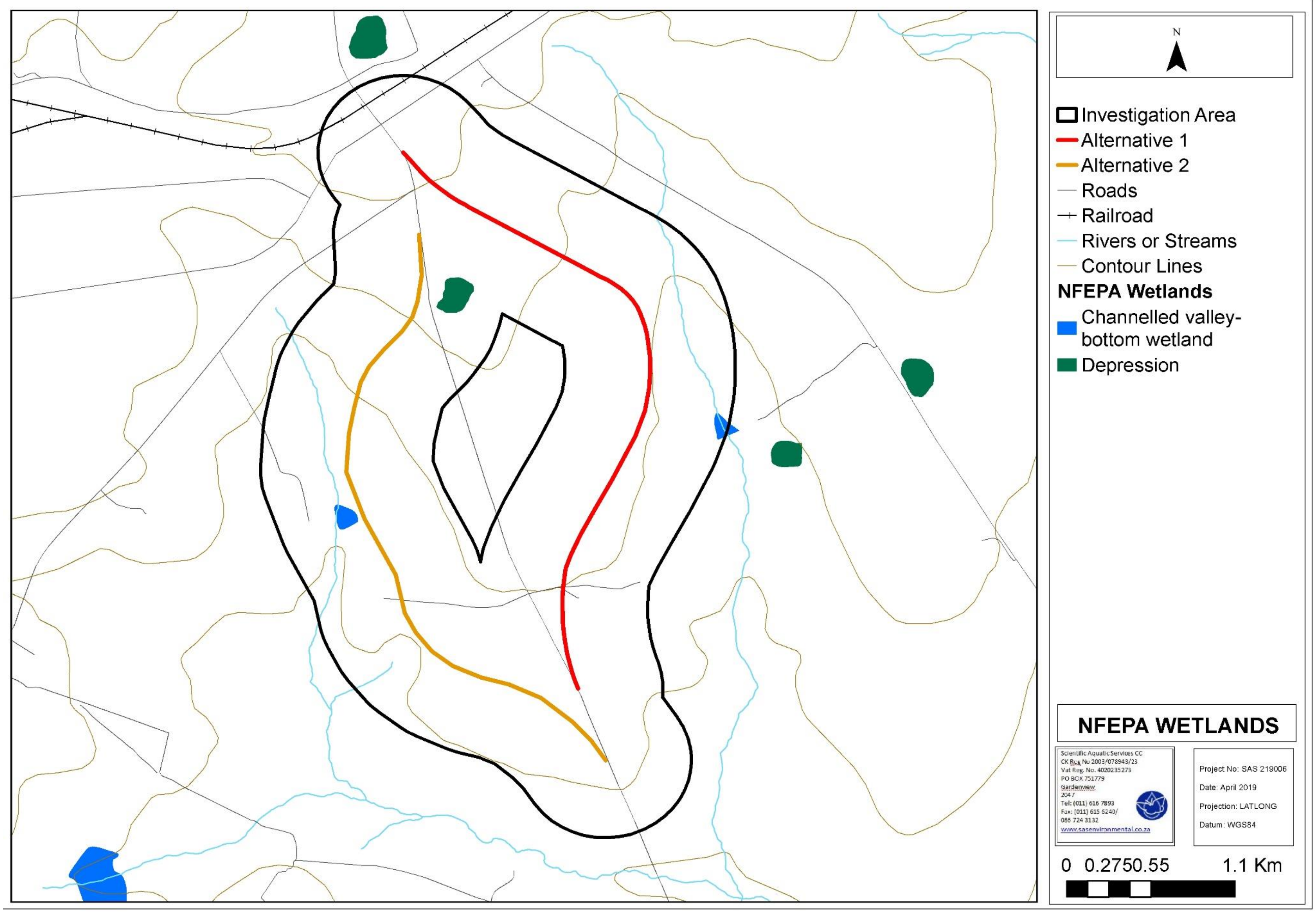


Figure 3: Wetland features associated with proposed road diversion and the investigation area (NFEPA, 2011).

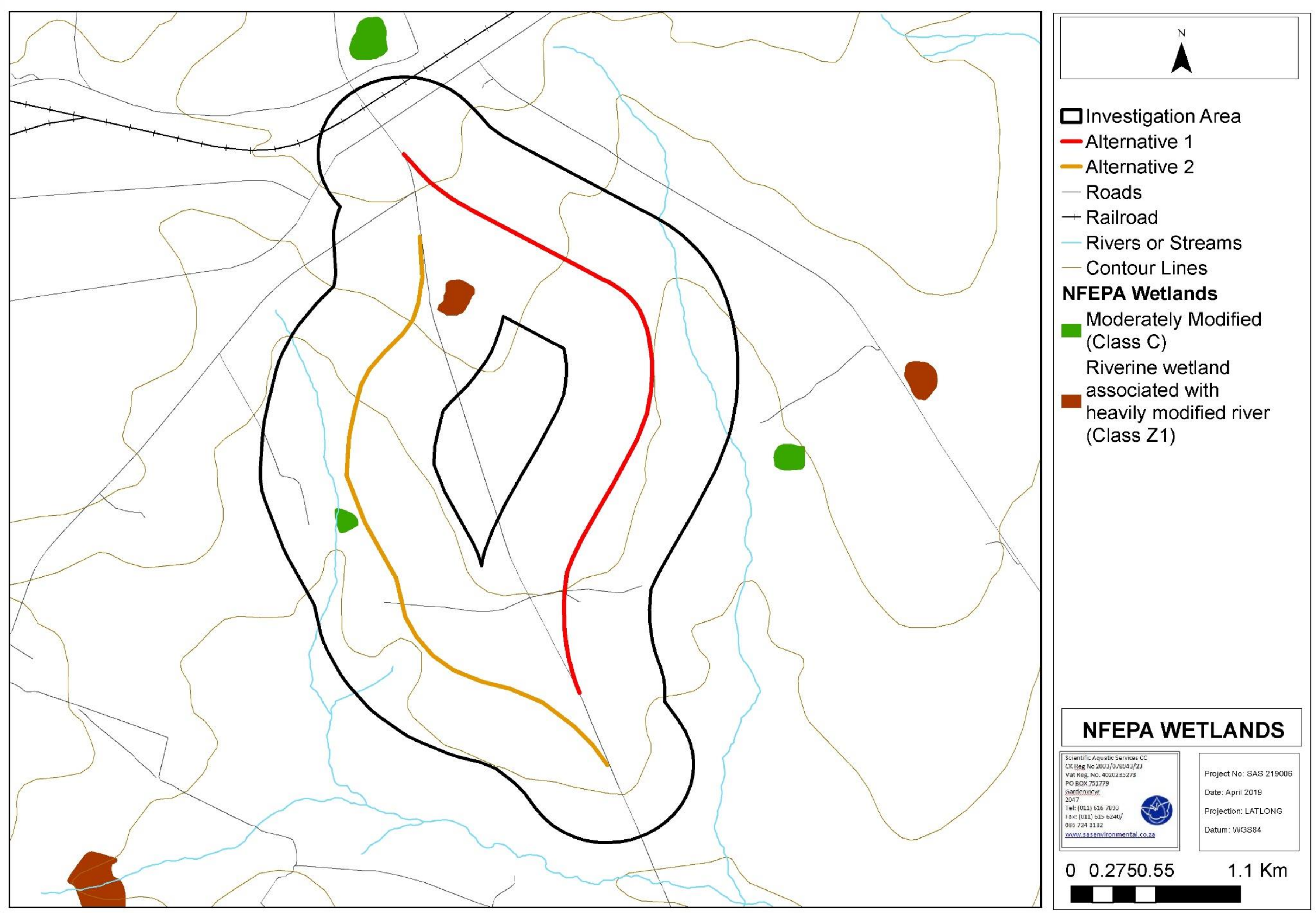


Figure 4: Condition of wetland features according to NFEPA (2011).

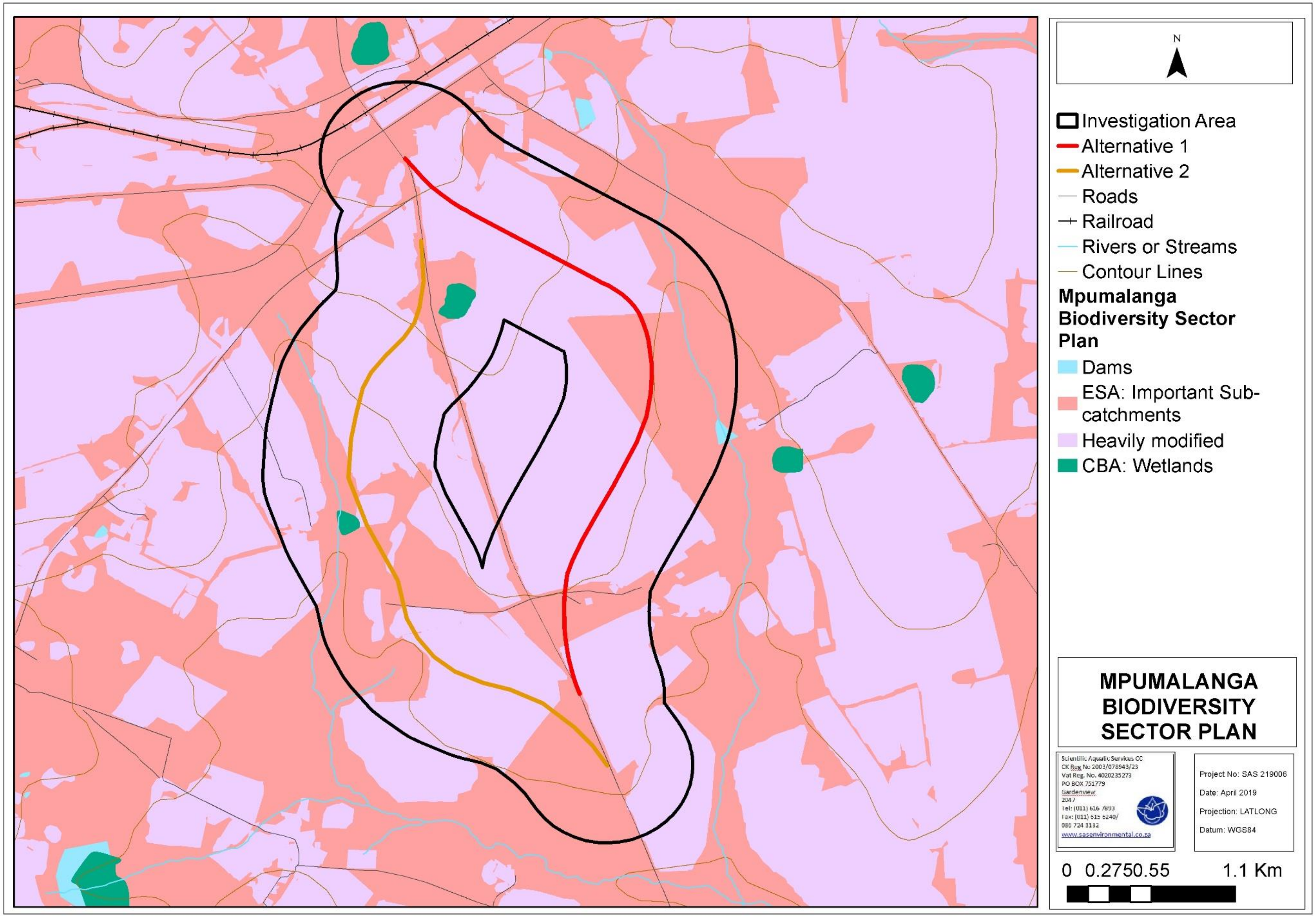


Figure 5: Importance of the proposed road diversion according to the MBSP Aquatic Database (2014).

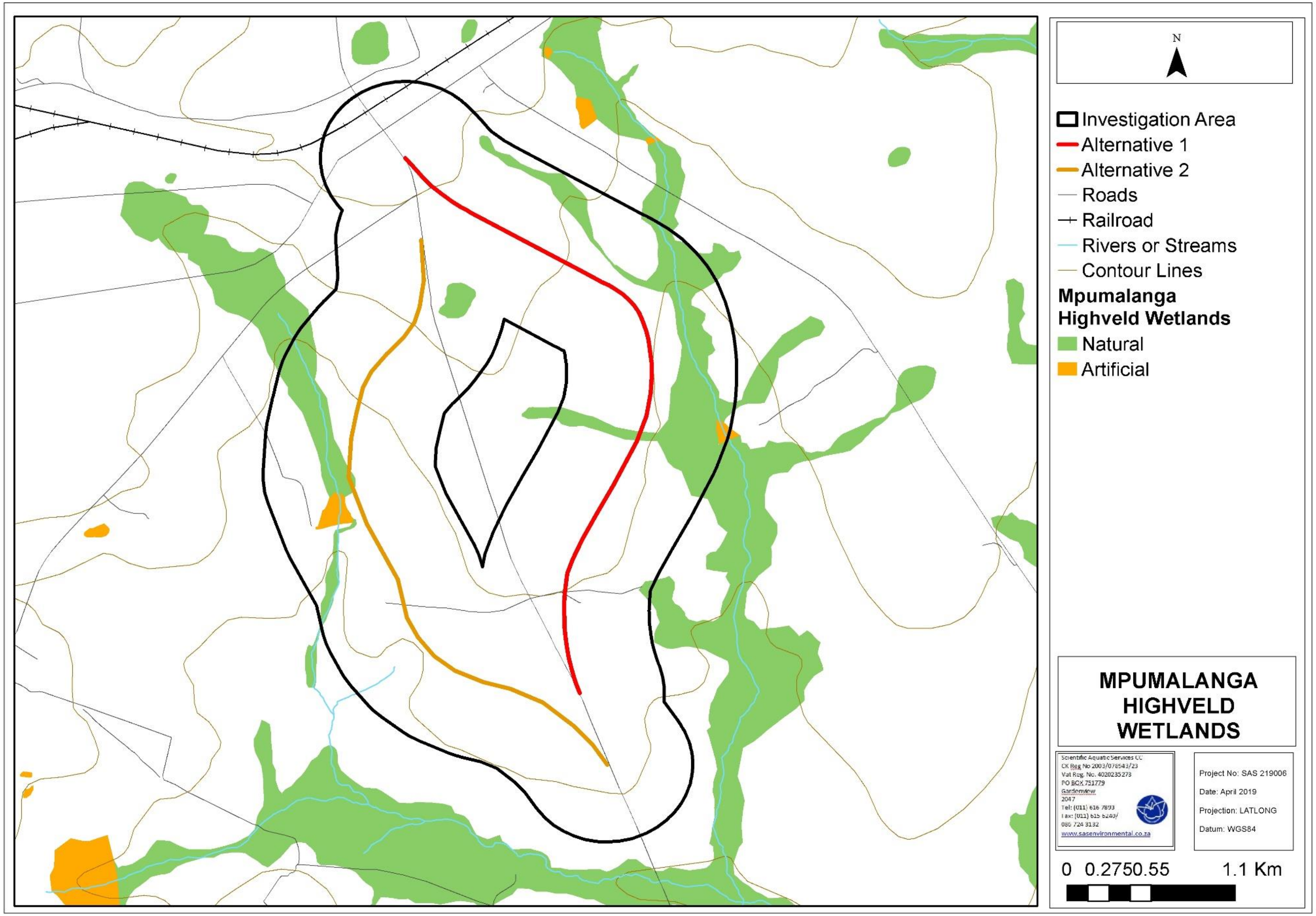


Figure 6: Natural and artificial wetlands associated with the proposed road diversion according to the Mpumalanga Highveld Wetlands Database (2014).

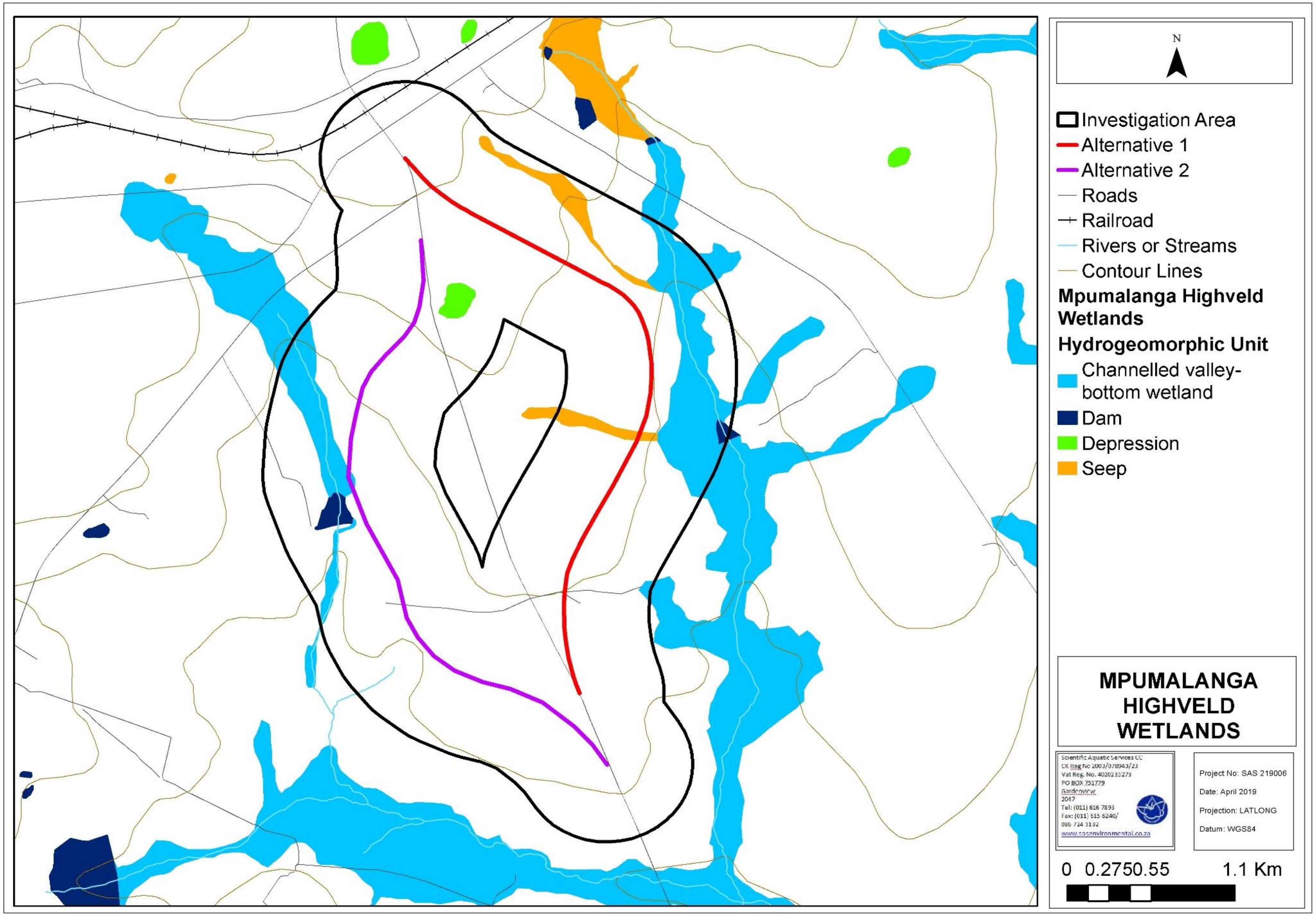


Figure 7: Hydrogeomorphic units associated with the proposed road diversion according to the Mpumalanga Highveld Wetlands Database (2014).

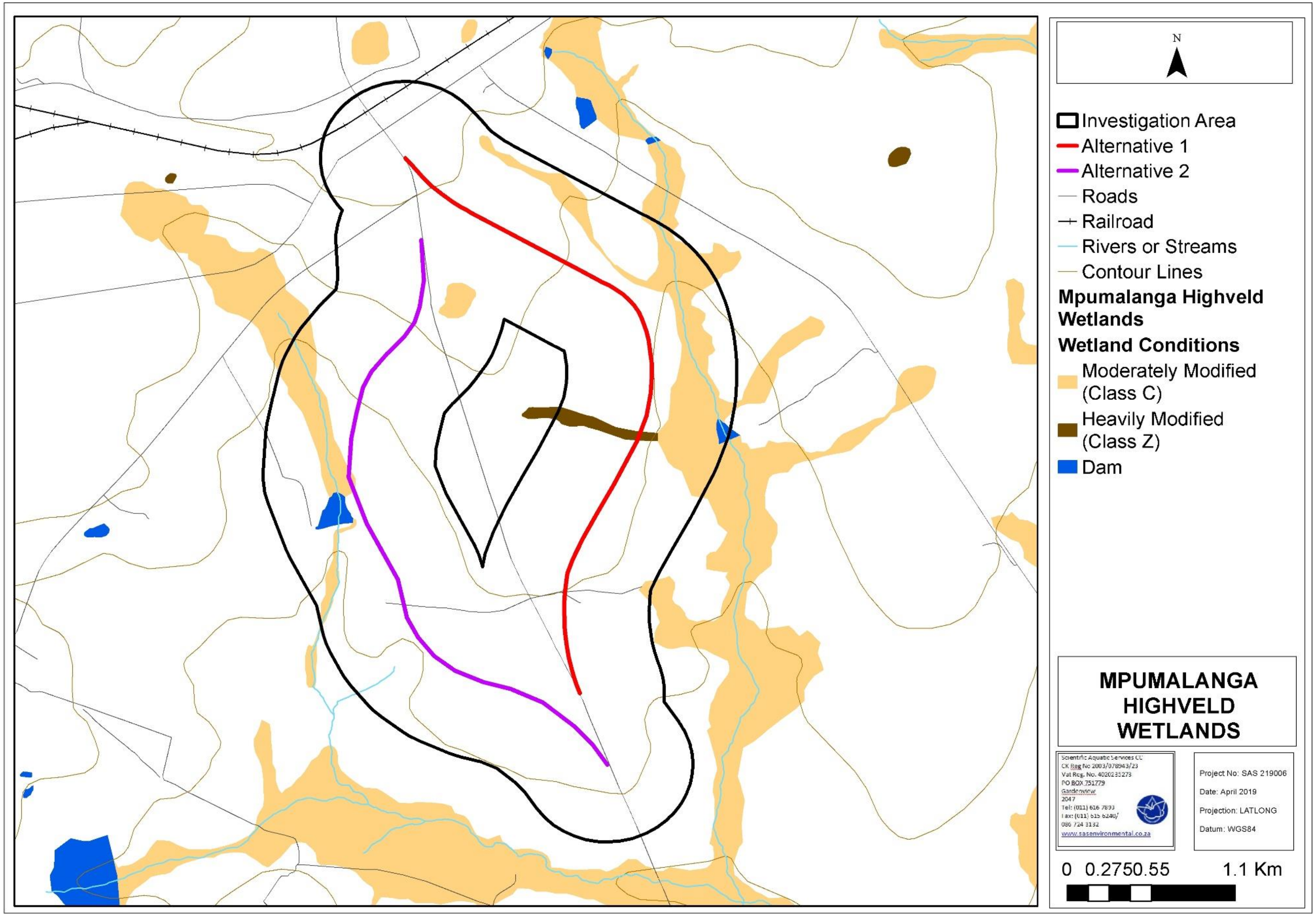


Figure 8: Ecological condition of the wetlands associated with the proposed road diversion according to the Mpumalanga Highveld Wetlands Database (2014).

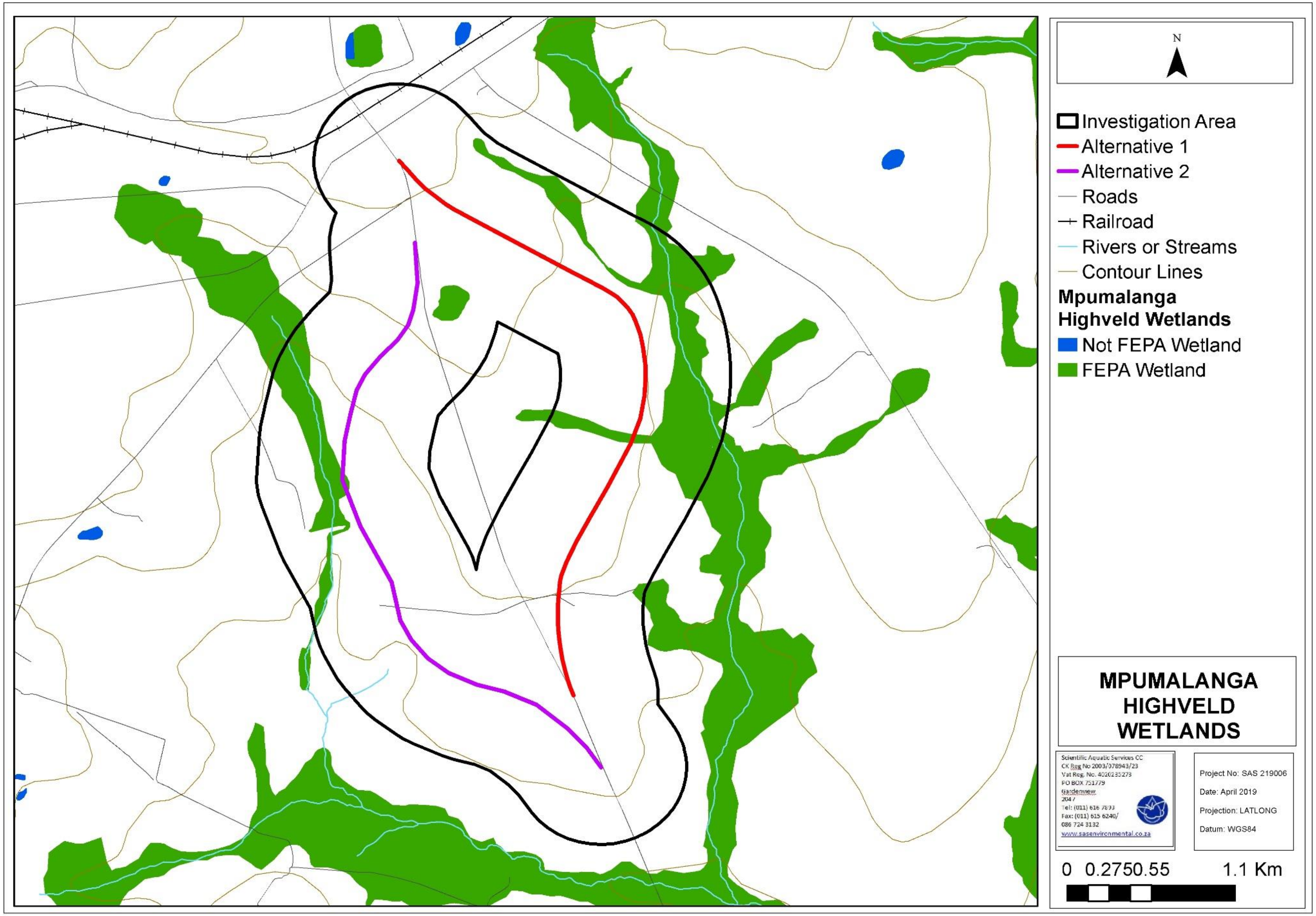


Figure 9: FEPA Wetland associated with the proposed road diversion according to the Mpumalanga Highveld Wetlands Database (2014).

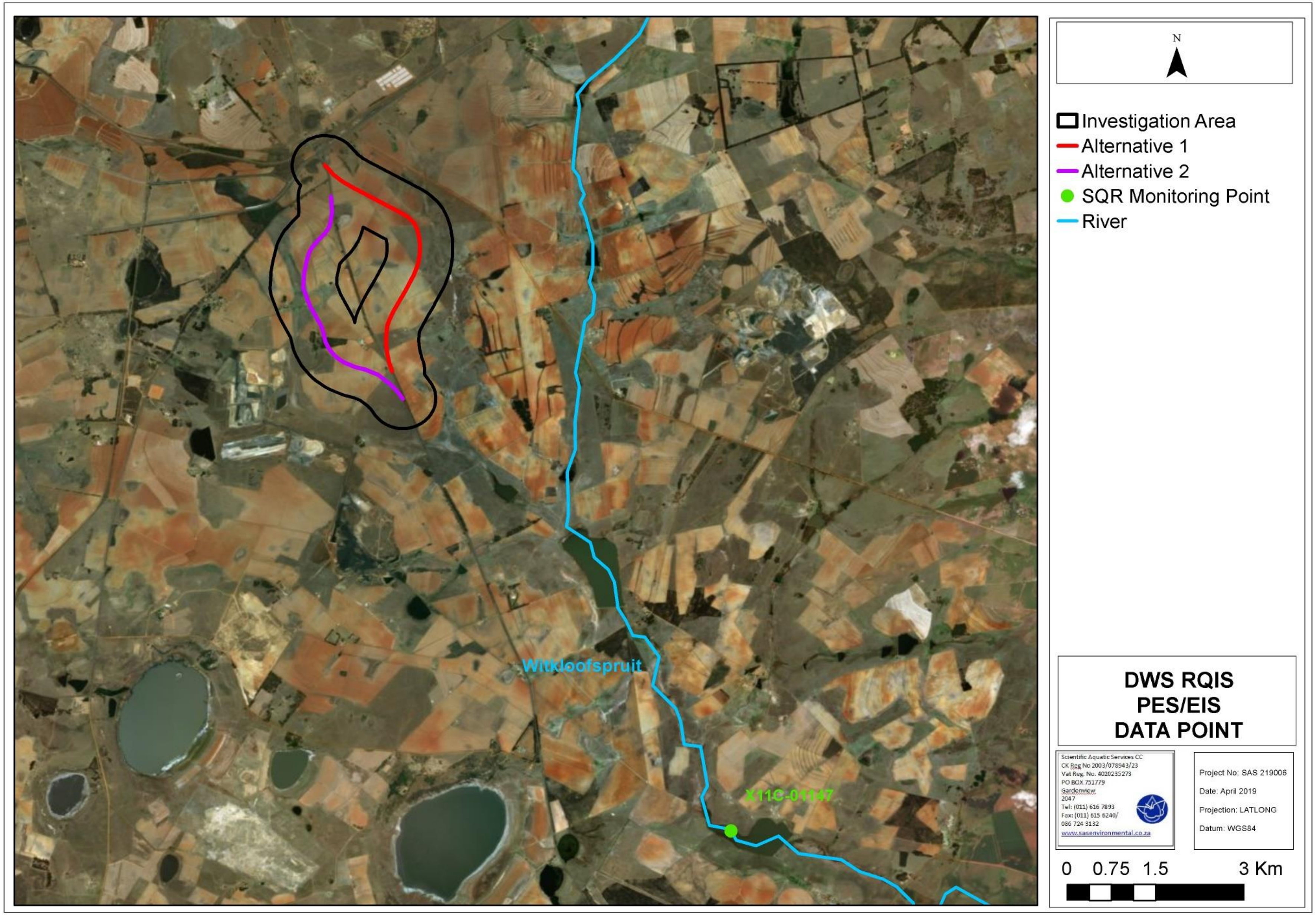


Figure 10: Relevant Sub-Quaternary Catchment Reach (SQR) in the vicinity of the proposed road diversion.

4 RESULTS: WATERCOURSE ASSESSMENT

4.1 Watercourse System Characterisation

In preparation for the field assessment, digital satellite imagery and provincial and national watercourse databases (as outlined in Section 3 of this report) were used to identify areas of interest at a desktop level. During the site assessment undertaken in April 2019, numerous wetlands including channelled valley bottom (CVB) wetlands, hillslope seep (HSS) wetlands and depressions were identified within the investigation area. Figure 11 illustrates the locality of the wetlands in relation to the proposed road diversion.

In terms of the Classification System for Wetlands and other Aquatic Ecosystems in South Africa (Ollis *et. al*, 2013), all wetland resources identified within the investigation area are classified as inland systems (i.e. a system having no existing connection to the ocean, but which is inundated or saturated with water, either permanently or periodically), located within the Highveld Aquatic Ecoregion. The applicable wetland vegetation (WetVeg) group is the Mesic Highveld Grassland Group 4. The characterisation of the wetlands is summarised in Table 2 below.

Table 2: Characterisation of the watercourses identified within the investigation area.

Watercourse	Level 3: Landscape unit	Level 4: HGM Type
Wetlands within investigation area	**Valley floor:** The base of a valley, situated between two distinct valley side-slopes.	**Channelled valley bottom:** A valley bottom wetland with a river channel running through it.
	Slope: an included stretch of ground that is not part of a valley floor, which is typically located on the side of a mountain, hill or valley.	**Hillslope Seep:** a wetland area located on (gently to steeply) sloping land, which is dominated by the colluvial (i.e. gravity-driven), unidirectional movement of material down-slope. Seeps are often located on the side-slopes of a valley, but they do not, typically, extend into a valley floor.
	Plain: an extensive area of low relief. These areas are generally characterised by relatively level, gently undulating or uniformly sloping land with a very gentle gradient that is not located within a valley. Gradient is typically less than 0.01 or 1:100.	**Depression:** a wetland or aquatic ecosystem with closed (or near-closed) elevation contours, which increases in depth from the perimeter to a central area of greatest depth and within which water typically accumulates, including pans.

The wetlands located within the investigation area have all been impacted upon to some degree, with specific mention of the historical and ongoing surrounding agricultural activities. Agricultural fields have, in many areas, encroached on the wetland boundaries. Road infrastructure (such as Wonderfontein Road and the N4) were found to also traverse some of the wetlands. Generally, the conversion of natural areas to largely agricultural land-uses have impacted on the overall hydrological and geomorphological functioning of these wetlands.

Although CVB 1 is not traversed by the proposed road diversion and does not fall within the 32m zone of regulation, as defined by NEMA, this wetland was assessed individually as significant impacts to this wetland may potentially occur as a result of the proposed alternative 1 road diversion.

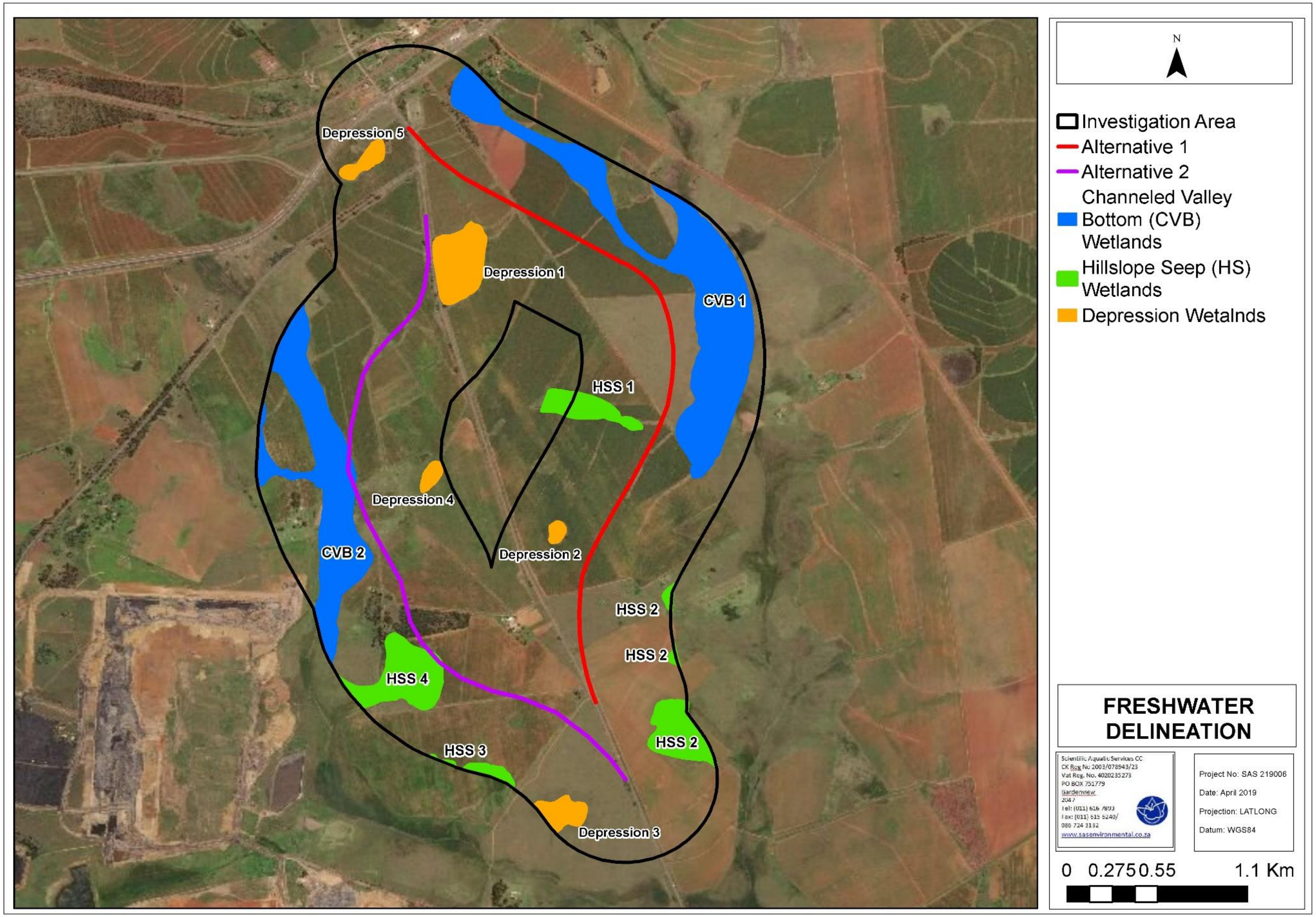


Figure 11: The location of the delineated wetlands associated with the proposed road diversion.

4.2 Field Verification Results

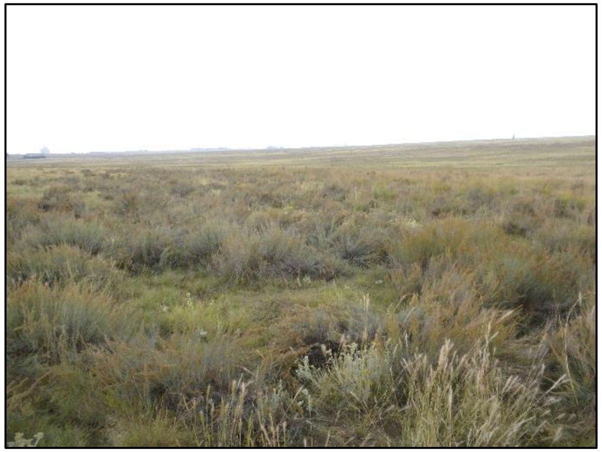
Following the site visit, various assessments were undertaken in order to determine the following:

- PES, incorporating aspects such as hydrology, vegetation and geomorphology;
- Service provision of the watercourses, which incorporates biodiversity maintenance, flood attenuation, streamflow regulation and assimilation, to name a few;
- The EIS is guided by the results obtained from the assessment of PES and service provision of the watercourses;
- An appropriate REC to guide the management of the watercourses with the intent of enhancing the ecological integrity of the watercourses where feasible; and
- Assessment of impacts of the construction and operation of the proposed road diversion on the freshwater system.

The results of the assessments are presented in the “dashboard style” reports below. The results of the assessments of CVB 1 are provided in Table 3, while the results of the assessments of CVB 2 and the associated HSS wetland (HHS 4) are presented in a single dashboard on a system level (Table 4). Table 5 and 6 present the results of the assessments of HHS 1 and depression 1, respectively. The results of the PES and EIS assessments are graphically presented in Figure 16 and 17, respectively.

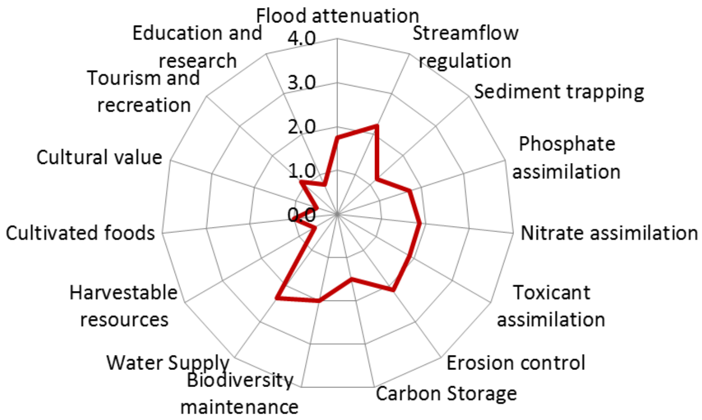
Table 3: Summary of the assessment of channeled valley bottom (CVB) 1.





Photograph notes	Representative photographs of the CVB 1 wetland system, located to the north and east of road diversion alternative 1. Modifiers to the system include agricultural activities such as grazing of livestock (left), the construction of an instream impoundment (middle) and the proliferation of invasive plant species such as *Seriphium plumosum* (right).

Ecological & socio-cultural service provision graph:



PES discussion	**PES Category: C (Moderately modified)** The hydrological processes of the wetland and natural wetland vegetation have undergone the most significant impacts, although the geomorphological processes have also been modified. Modifiers include aspects such as an artificial impoundment (in-stream dam) constructed within the wetland system, encroachment of cultivated fields into the wetland boundary, as well as grazing of cattle resulting in trampling within the wetland. Invasion of alien floral species, as well as areas of erosion within the active channel of the wetland were noted. The overall PES of the system is considered to be category C, as a moderate change in ecosystem processes and loss of natural habitats has taken place, but the natural habitat remains predominantly intact.
Ecoservice provision	**Intermediate** Despite the moderately decreased ecological integrity of the system, the wetland retains capacity to function at an intermediate level in terms of the provision of ecological services such as streamflow regulation, erosion control, and the supply of water for human use, in particular, the provision of water for agricultural use.
EIS discussion	**EIS Category: C (Moderate)** The results of the EIS assessment indicate that the wetland is deemed of moderate ecological importance and sensitivity (Category C). This is largely attributable to the hydro-functional importance of the system, primarily due to the ability of the system to attenuate floods, control erosion and regulate streamflow. Characteristics of the wetland such as moderately high surface roughness due to extensive vegetation cover aid in the provision of these services.
REC Category	**REC Category: C (Moderately modified)** **RMO: C (Maintain)** The recommended management objective (RMO) for the wetland based on the PES and EIS scores is to maintain an ecological category of C. No further degradation should be permitted and thus, mitigation measures should be implemented during all phases of the proposed road diversion to minimise the risk of further negative impacts on the wetland.

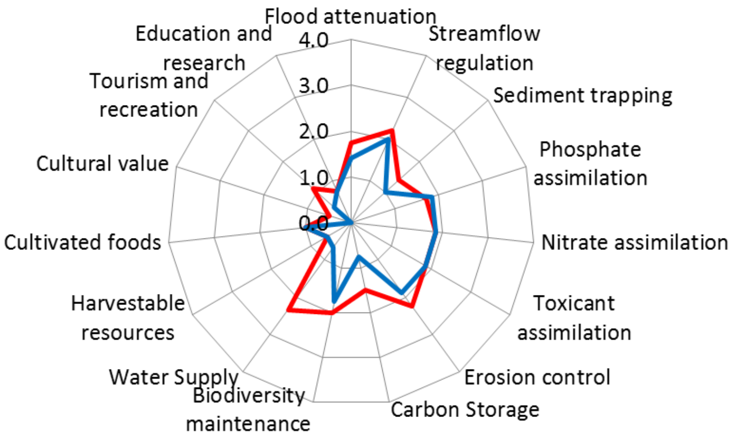
Watercourse drivers:	
a) Hydrology It is likely that the wetland system is largely driven by recharge from the greater catchment upstream of this point. The hydrological processes of the wetland have been modified by the construction of an instream impoundment located within the wetland, as well as runoff from the surrounding cultivated fields.	**c) Topography: Geomorphology and sediment balance** The surrounding cultivated fields and road infrastructure traversing the wetland, has significantly altered the geomorphology of the wetland system. Windblown dust and surface soil runoff from the surrounding informal roads and crop fields (especially after harvesting of crops, when the fields are bare) are likely to increase the sediment load of the wetland.
b) Water quality The water quality of the wetland is most likely impacted by agricultural runoff and runoff from the N4 and surrounding informal roads, likely contaminated with fertilizers and hydrocarbons.	**d) Habitat and biota** The surrounding cultivated fields, which have encroached up to the wetland boundary in some places, as well as trampling and grazing by livestock has resulted in the removal of natural wetland vegetation. Habitat provision is therefore considered to be altered (especially due to the invasion of some alien vegetation species), resulting in a lowered species diversity. Despite this, some areas of the wetland have extensive vegetation cover and therefore provides some foraging and breeding habitat for avifaunal and mammalian species. For more information on habitat and biota, please refer to the Fauna and Flora Assessment conducted by SAS (SAS, 2019).
Possible significant impacts, Business case, Conclusion and Mitigation Requirements:	
The CVB wetland will not be traversed by the proposed road diversion; although, it is anticipated that the construction of alternative 1 will possibly result in impacts to this wetland. However, the risk significance of impacts to CVB 1 as a result of the construction of road diversion alternative 1 are likely to be of low significance. Despite this, appropriate mitigation measures as outlined in Section 5 and Appendix F must be implemented to ensure that further impacts to the wetland are mitigated.	

Table 4: Summary of the assessment of channeled valley bottom (CVB) 2 and the associated hillslope seep (HHS) wetland (HHS 4).



Photograph notes	Representative photographs of CVB 2 and HHS 4, located to the west of road diversion alternative 2. Modifiers to the system include agricultural activities such encroachment of cultivated fields up to the wetland boundary, existing mining activities adjacent to the wetland (left)l, the construction of an instream impoundment (middle) and some proliferation of invasive plant species such as *Verbena bonariensis* (right).

Ecological & socio-cultural service provision graph (red = CVB 2; blue = HHS 4):



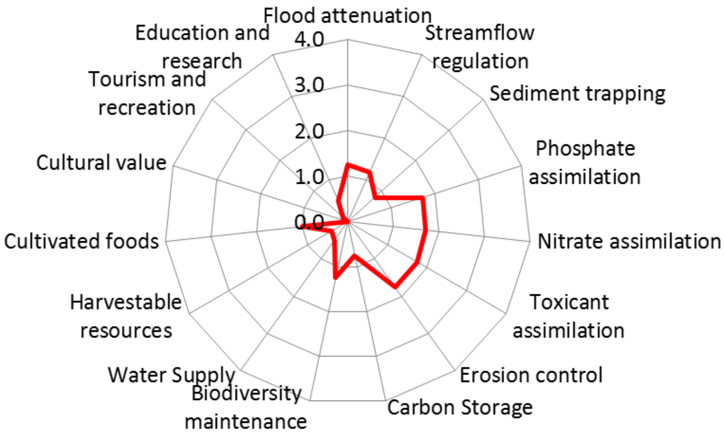
PES discussion	**PES Category: B (Small modification)** Despite the existing modifiers to the system as described in the photograph notes above, this wetland system comprising CVB 2 and HHS 4 is considered largely natural as a slight change in ecosystem processes is discernible and a small loss of natural habitats and biota may have taken place. The natural wetland vegetation has undergone the most significant impacts, although the geomorphological and hydrological processes of the wetland system have also been modified. Thus, the overall PES of the system is considered to be category C, as a moderate change in ecosystem processes and loss of natural habitats has taken place.
Ecoservice provision	**Intermediate** The wetland system functions at an overall intermediate level in terms of ecoservices. The CVB wetland is anticipated to provide a higher level of ecoservices than the HSS wetland. This is particularly evident when comparing ecoservices such as erosion control and the provision of water for human (agricultural use) use. Additional ecoservices provided by the wetland system include that of flood attenuation and biodiversity maintenance. Characteristics of the wetland system, such as the largely natural condition of the wetland, aid in the provision of an intermediate level of biodiversity maintenance within the wetland, and in particular, CVB 2.
EIS discussion	**EIS Category: C (Moderate)** The results of the EIS assessment indicate that the wetland is deemed to be of moderate ecological importance and sensitivity (Category C) on a landscape scale, as well as due to the hydro-functional importance of the system, primarily due to the ability of the system to attenuate floods, control erosion and regulate streamflow.
REC Category	**REC Category: B (Moderately modified)** **RMO: (Maintain)B** The recommended management objective (RMO) for the wetland system based on the PES and EIS scores is to maintain an ecological category of B. No further degradation should be permitted and thus, mitigation measures should be implemented during all phases of the proposed road diversion to minimise the risk of further negative impacts on the wetland system.

Watercourse drivers:	
c) Hydrology It is likely that the wetland system is largely driven by recharge from the greater catchment upstream of this point. The hydrological processes of the wetland have been modified by the construction of an instream impoundment located within the wetland, as well as runoff from the surrounding cultivated fields.	**e) Topography: Geomorphology and sediment balance** The surrounding cultivated fields and road infrastructure traversing the wetland, has significantly altered the geomorphology of the wetland system. Windblown dust and surface soil runoff from the surrounding informal roads and crop fields (especially after harvesting of crops, when the fields are bare) are likely to increase the sediment load of the wetland.
d) Water quality The water quality of the wetland is most likely impacted by agricultural and road runoff from the N4 and surrounding informal roads, likely contaminated with fertilizers and hydrocarbons.	**f) Habitat and biota** The surrounding cultivated fields, which have encroached up to the wetland boundary in some places, as well as trampling and grazing by livestock has resulted in the removal of natural wetland vegetation. Habitat provision is therefore considered to be altered (especially due to the invasion of some alien vegetation species), resulting in a lowered species diversity. Despite this, some areas of the wetland have extensive vegetation cover and therefore provides some foraging and breeding habitat for avifaunal and mammalian species. For more information on habitat and biota, please refer to the Fauna and Flora Assessment conducted by SAS (SAS, 2019).
Possible significant impacts, Business case, Conclusion and Mitigation Requirements:	
The CVB wetland will not be traversed by the proposed road diversion; although, it is anticipated that the construction of alternative 1 will likely result in impacts to this wetland. However, the risk significance of impacts to CVB 1 as a result of the construction of road diversion alternative are likely to be of low significance. Despite this, appropriate mitigation measures as outlined in Section 5 and Appendix F must be implemented to ensure that further impacts to the wetland are mitigated. The alignment of the road diversion must be optimised to remain outside of the delineated wetlands and ideally the associated 32m zone of regulation as defined by NEMA.	

Table 5: Summary of the assessment of hillslope seep (HSS) 1.

Representative photographs of HHS 1 located within the proposed route for road diversion alternative 1. Although some areas are well vegetated with indigenous species such as *Imperata cylindrica*, impacts associated with the surrounding cultivated fields and alien invasive plant species were observed.

Ecological & socio-cultural service provision graph:



PES discussion	**PES Category: D (Largely modified)** The hillslope seep wetlands are considered to be largely modified; however, the result of the PES assessment was bordering on Category C (moderately modified) (4.1). The geomorphological processes and natural wetland vegetation have undergone the most significant impacts. Modifications to these seeps can mainly be attributed to vegetation removal with the related invasion of alien species.
Ecoservice provision	**Moderately low** As a result of the wetland having an overall reduced ecological integrity, functioning is considered to be at an overall moderately low level. Some ecoservices such as the assimilation of phosphates nitrates and toxicants are provided at an intermediate level; however, this is likely as a result of the extent of these sources within the wetland's catchment. The wetland is not considered important for education and research, or for tourism and recreation.
EIS discussion	**EIS Category: C (Moderate)** The results of the EIS assessment indicate that the wetland is deemed to be of moderate ecological importance and sensitivity (Category C). This is largely attributable to the hydro-functional importance of the system, primarily due to the ability of the system to assimilate nitrates, phosphates and toxicants.
REC Category	**REC Category: D (Largely modified)** **RMO: D (Maintain)** The recommended management objective (RMO) for the wetland based on the PES and EIS scores is to maintain an ecological category of D. No further degradation should be permitted and thus, mitigation measures should be implemented during all phases of the proposed road diversion to minimise the risk of further negative impacts on the wetland.

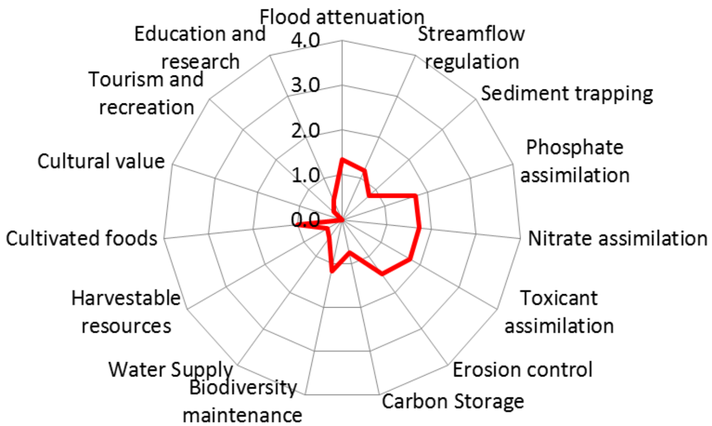
Watercourse drivers:	
a) Hydrology Runoff from the surrounding area, mainly dominated by cultivated fields, enters the wetland. Thus, modifications to the hydrological processes of the wetland are attributed to increased runoff from the surrounding cultivated fields.	**c) Topography: Geomorphology and sediment balance** The greatest impact on the wetland in terms of geomorphological processes is altered sediment regime and loss of habitat due to the surrounding cultivated fields. Windblown dust and surface soil runoff from the surrounding informal roads and cultivated fields (especially after harvesting of crops, when the fields are bare) are likely to increase the sediment load of the wetland.
b) Water quality It is considered likely that some contamination of the water quality of the wetland may occur during rainfall events, in terms of excess nutrients being transported from adjacent agricultural land into the wetland, as well as possible contaminated runoff (sediment and hydrocarbons).	**d) Habitat and biota** The surrounding cultivated fields, which have encroached up to the wetland boundary, has resulted in the removal of natural wetland vegetation. Habitat provision is therefore considered to be altered (additionally due to the invasion of some alien vegetation species). For more information on habitat and biota, please refer to the Fauna and Flora Assessment conducted by SAS (SAS, 2019).
Possible significant impacts, Business case, Conclusion and Mitigation Requirements:	
Although neither of the road diversion alternatives are proposed to traverse this wetland, it is still considered imperative that suitable mitigation measures, as provided for in Section 5 and Appendix F of this report, are strictly adhered to in order to minimise the impacts associated with the proposed road diversion and decrease the significance of cumulative impacts on the wetland.	

Table 6: Summary of the assessment of depression 1.



Representative photographs of depression 1 located adjacent to the existing Wonderfontein road as well as the proposed alternative 2 road diversion. The wetland is well vegetated; however, evidence of encroachment of cultivated fields into the wetland boundary was visible.

Ecological & socio-cultural service provision graph:



PES discussion	**PES Category: D (Largely modified)** The hydrological processes and natural wetland vegetation have undergone the most significant impacts; however, the geomorphological processes of the wetland have also been modified. Modifications to the wetland are mainly attributed to vegetation removal within the wetland as a result of encroachment of cultivated fields and the construction of the existing Wonderfontein Road, and the related invasion of alien species.
Ecoservice provision	**Moderately low** As a result of the wetland having an overall reduced ecological integrity, functioning is considered to be at an overall moderately low level. Some ecoservices such as the assimilation of phosphates nitrates and toxicants are provided at an intermediate level; however, this is likely as a result of the extent of these sources within the wetland's catchment. The wetland is not considered important for education and research, or for tourism and recreation.
EIS discussion	**EIS Category: C (Moderate)** The results of the EIS assessment indicate that the wetland is deemed to be of moderate ecological importance and sensitivity (Category C). This is largely attributable to the hydro-functional importance of the system, primarily due to the ability of the system to assimilate nitrates, phosphates and toxicants.
REC Category	**REC Category: D (Largely modified)** **RMO: D (Maintain)** The recommended management objective (RMO) for the wetland based on the PES and EIS scores is to maintain an ecological category of D. No further degradation should be permitted and thus, mitigation measures should be implemented during all phases of the proposed road diversion to minimise the risk of further negative impacts on the wetland.

Watercourse drivers:	
a) Hydrology Runoff from the greater catchment contributes to the hydrological functioning of the wetland, predominantly during high rainfall periods. Runoff from the surrounding cultivated fields enters the wetland and thus alters the hydrological processes of the wetland.	**e) Topography: Geomorphology and sediment balance** The greatest impact on the wetland in terms of geomorphological processes is altered sediment regime and loss of habitat due to the surrounding cultivated fields. Windblown dust and surface soil runoff from the surrounding informal roads and cultivated fields (especially after harvesting of crops, when the fields are bare) are likely to increase the sediment load of the wetland.
b) Water quality The water quality of the wetland is most likely impacted by runoff containing nutrients and fertilizers from the surrounding cultivated fields.	**f) Habitat and biota** The surrounding cultivated fields, which have encroached up to the wetland boundary, have resulted in the removal of natural wetland vegetation. However, the wetland is well vegetated and therefore has the potential to provide habitat for a variety of avifaunal species. For more information on habitat and biota, please refer to the Fauna and Flora Assessment conducted by SAS (SAS, 2019).
Possible significant impacts, Business case, Conclusion and Mitigation Requirements:	
The depression wetland falls within the 32m zone of influence of the construction of road diversion alternative 2. Despite this, significant impacts to the wetland are not anticipated to occur as the proposed road diversion does not traverse the wetland, while the existing Wonderfontein Road acts as a catchment divide between the wetland and the proposed road diversion. However, due to the proximity of the proposed road diversion alternative 2 to the wetland, care must still be taken to ensure the edge effects from the road diversion are managed appropriately.	

4.3 Delineation and Sensitivity Mapping

4.3.1 Delineation

The delineation of the wetlands as presented in this report is regarded as a best estimate of the wetland zone boundaries based on the site conditions present at the time of assessment. During the assessment, the following indicators were used to delineate the boundary of the temporary freshwater zones:

- Terrain units were utilised as the primary determinant to ascertain in which parts of the landscape the watercourse would be likely to occur; and
- Where feasible, the vegetation and soil form indicators were utilised. Obligate and facultative wetland species were used to determine the wetland boundary, while the soil form indicator was used to determine the presence of soils that are associated with prolonged and frequent saturation with key indicators including gleying, mottling, organic streaking and increased clay content.

4.3.2 Legislative Requirements, national and provincial guidelines pertaining to the application of buffer zones

According to Macfarlane *et al.* (2015) the definition of a buffer zone is variable, depending on the purpose of the buffer zone, however in summary, it is considered to be “a strip of land with a use, function or zoning specifically designed to protect one area of land against impacts from another”. Buffer zones are considered to be important to provide protection of basic ecosystem processes (in this case, the protection of aquatic and wetland ecological services), reduce impacts on water resources arising from upstream activities (e.g. by removing or filtering sediment and pollutants), provision of habitat for aquatic and wetland species as well as for certain terrestrial species, and a range of ancillary societal benefits (Macfarlane *et. al,* 2015). It should be noted however that buffer zones are not considered to be effective mitigation against impacts such as hydrological changes arising from stream flow reduction, impoundments or abstraction, nor are they considered to be effective in the management of point-source discharges or contamination of groundwater, both of which require site-specific mitigation measures (Macfarlane *et. al,* 2015).

Legislative requirements were first taken into consideration when determining a suitable buffer zone for the wetland resources. The definition and motivation for a regulated zone of activity as well as buffer zone for the protection of the wetlands can be summarised as follows:

Table 7: Articles of Legislation and the relevant zones of regulation applicable to each article.

Regulatory authorisation required	Zone of applicability
Listed activities in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) Environmental Impact Assessment (EIA) Regulations, 2014 (as amended).	32m from the edge of a watercourse.
Water Use License Application in terms of the National Water Act, 1998 (Act No. 36 of 1998) (NWA).	In accordance with GN509 of 2016 as it relates to the National Water Act, 1998 (Act No. 36 of 1998), a regulated area of a watercourse for Section 21 (c) and 21 (i) of the National Water Act, 1998 (Act No, 36 of 1998) is defined as: • the outer edge of the 1 in 100 year flood line and/or delineated riparian habitat, whichever is the greatest distance, measured from the middle of the watercourse of a river, spring, natural channel, lake or dam; • in the absence of a determined 1 in 100 year flood line or riparian area the area within 100 m from the edge of a watercourse where the edge of the watercourse is the first identifiable annual bank fill flood bench; or • a 500 m radius from the delineated boundary (extent) of any wetland or pan in terms of this regulation.

The delineated wetlands and their applicable zones of regulation in terms of NEMA and GN509 of 2016 as it relates to the NWA and GN704 are conceptually depicted in Figure 12 below.

It must be noted that all the wetlands associated with the proposed road diversion (within the investigation area) have been identified by the Mpumalanga Highveld Wetlands database (2014) as FEPA wetlands. As such, a 1km buffer around these FEPA wetlands is required. The FEPA wetlands as per the Mpumalanga Highveld Wetlands database (2014) as well as the 1km buffer are depicted in Figure 13 below.

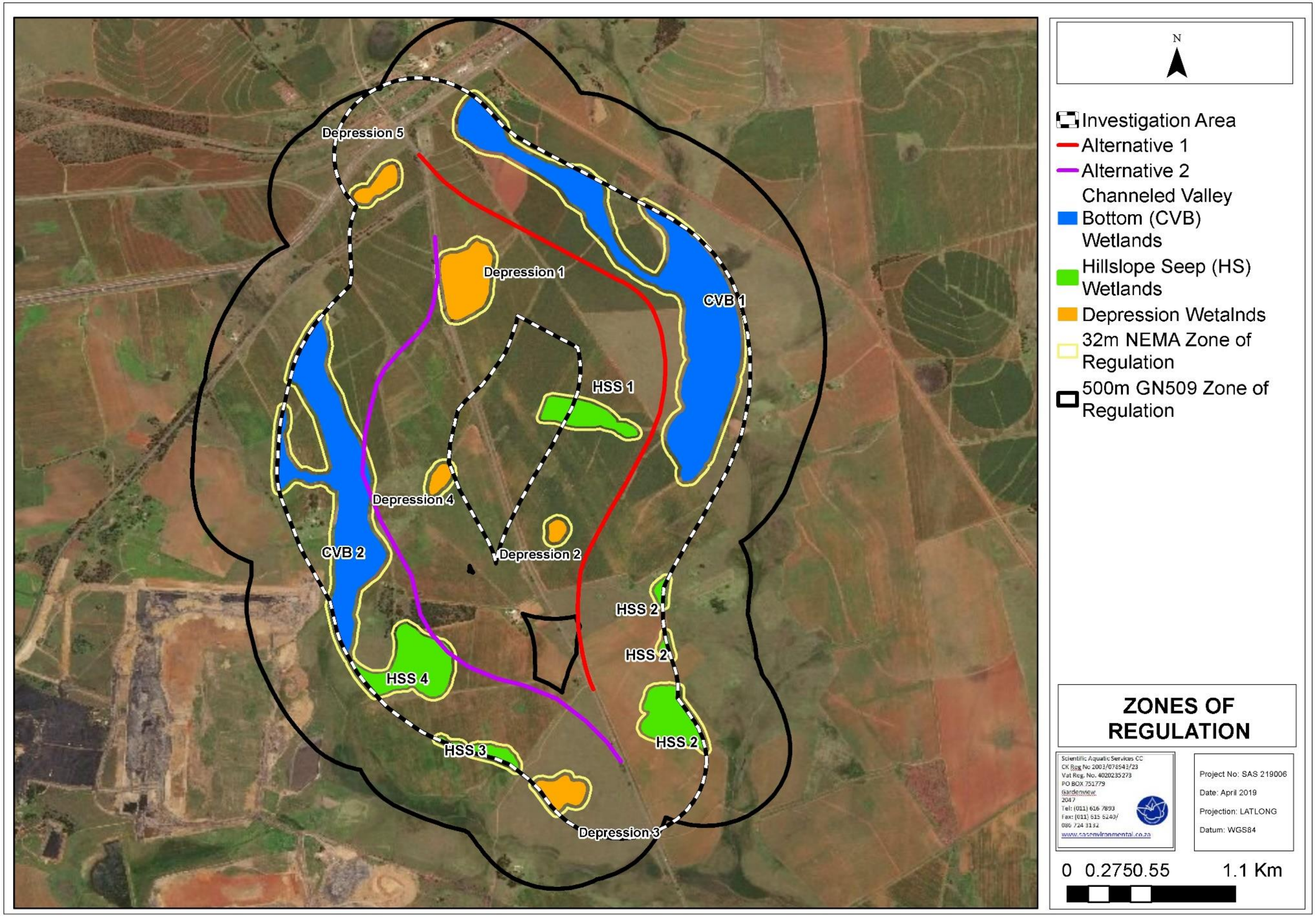


Figure 12: Conceptual presentation of the zones of regulation in terms NEMA and GN509 of 2016 as it relates to the NWA in relation to the wetlands.

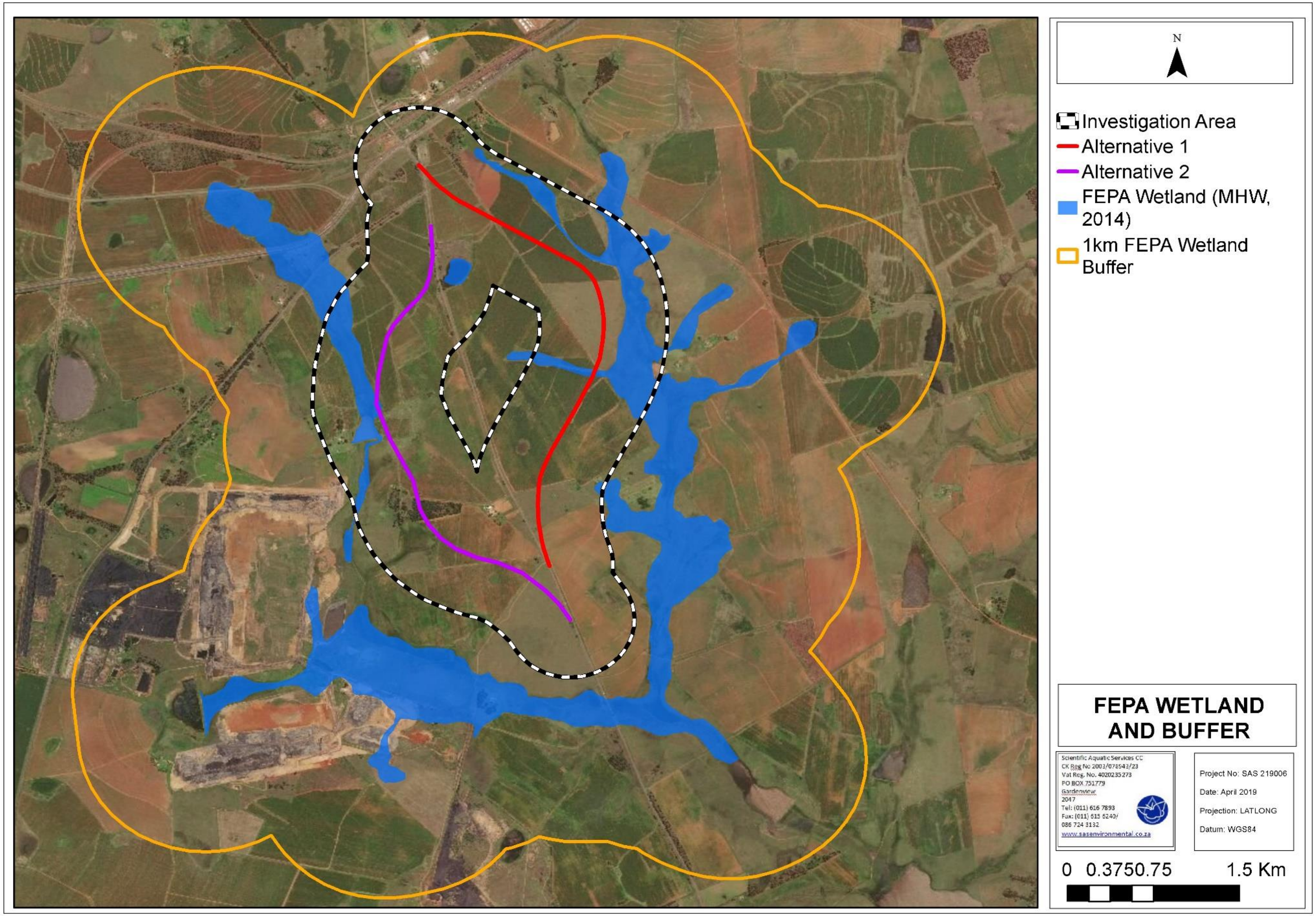


Figure 13: The FEPA wetlands associated with the proposed road diversion as per the MHW database (2014) and applicable 1km buffer.

5 RISK ASSESSMENT

This section presents the significance of potential impacts on the freshwater ecology of the wetlands associated with the proposed road diversion. In addition, it also indicates the required mitigatory measures needed to minimise the perceived impacts of the proposed road diversion and presents an assessment of the significance of the impacts taking into consideration the available mitigatory measures and assuming that they are fully implemented.

The risk assessment was based on the initial proposed layout as provided by the proponent (refer to Figure 3), which indicates the following:

- Alternative 1 does not traverse any wetlands and does not fall within 32m of any wetlands; and
- Alternative 2 traverses CVB 2 and HSS 4. Additionally, depression 1 falls within the 32m zone of influence of this alternative.

5.1 Risk Analyses

5.1.1 Consideration of impacts and application of mitigation measures

Following the assessment of the wetlands associated with the proposed road diversion, the DWS prescribed Risk Assessment Matrix (2016) was applied to ascertain the significance of perceived impacts on the key drivers and receptors (hydrology, water quality, geomorphology, habitat and biota) of these wetlands. These results are summarised in Table 8 presented at the end of Section 5.1.2 of this report.

The points below summarise the considerations undertaken when applying the DWS Risk Assessment:

- Risks associated with Alternative 1 and Alternative 2 were assessed separately for the relevant activities associated with the proposed road diversion;
- The risk assessment was applied assuming that a high level of mitigation is implemented, thus the results of the risk assessment provided in this report present the perceived impact significance *post-mitigation*;
- In applying the risk assessment, it was assumed that the mitigation hierarchy as advocated by the DEA *et al* would be followed, i.e. the impacts would first be avoided, minimised if avoidance is not feasible, rehabilitated as necessary and offset if required;
- At the time of this assessment, the overall freshwater environment was considered largely modified (HSS 1 and depression 1) to largely natural (CVB 2 and HHS 4), and

of low to moderate ecological importance and sensitivity. However, the severity of the impact on the wetlands cannot be calculated/presented precisely for some activities using the Risk Assessment Tool – since some areas of the proposed road diversion directly traverses some of the wetlands, the severity of all potential impacts on the wetlands must be rated at the highest significant level (level 5, disastrous/extremely harmful). Similarly, the default score for legal issues is also '5' since the activity is within the 500m Zone of Regulation in terms of GN509;

- Some of the activities are all highly site specific, not of a significant extent relative to the area of the wetland assessed, and therefore have a limited spatial extent. However, some activities have a larger spatial extent and thus have the potential to impact on downgradient neighbouring areas;
- Most impacts are considered to be easily detectable;
- The considered mitigation measures are easily practicable; and
- It is highly recommended that the proponent make provision for small-scale rehabilitation of the reaches of the wetlands which may be directly impacted upon by construction activities. The area must preferably be rehabilitated to conditions as close as possible to the "natural" state, not the pre-construction state since the state of the wetlands is deemed to be altered from a reference condition. This will ensure that the current levels of ecological service provision of the wetlands are maintained and where feasible, improved.

5.1.2 Impact discussion and essential mitigation measures

There are four key ecological impacts on the wetlands that are anticipated to occur namely,

- Loss of wetland habitat and ecological structure;
- Changes to the sociocultural and service provision;
- Impacts on the hydrology and sediment balance of the wetlands; and
- Impacts on water quality.

Various activities and development aspects may lead to these impacts, however, provided that the mitigation hierarchy is followed, some impacts can be avoided or adequately minimised where avoidance is not feasible. The mitigation measures provided in this report have been developed with the mitigation hierarchy in mind, and the implementation and strict adherence to these measures will assist in minimising the significance of impacts on the receiving freshwater environment. A summary of the risk assessment is provided in the table below, followed by a discussion of the outcome thereof.

Table 8: Summary of the results of the risk assessment applied to the wetlands associated with the proposed road diversion.

No.	Phases	Activity	Aspect	Impact	Severity	Consequence	Likelihood	Significance	Risk Rating	Mitigation Measures to be implemented
1	Construction Phase	Site preparation prior to commencement of construction activities, outside of the wetlands.	*Vehicular transport and access to the site; *Removal of vegetation and associated disturbances to soil; *Miscellaneous activities by construction personnel.	*Exposure of soil, leading to increased runoff and erosion, and thus increased sedimentation of the wetlands; *Increased sedimentation of the wetlands, resulting in loss of freshwater habitat and ecological structure leading to impacts on biota; *Decreased ecoservice provision; and *Proliferation of alien vegetation as a result of disturbances.	2.5	4.5	5	**22.5**	**L**	*Contractor laydown areas and stockpiles to be established outside of the delineated watercourses and the applicable 32m zone of regulation; *All development footprint areas to remain as small as possible and vegetation clearing to be limited to what is absolutely essential; *Retain as much indigenous vegetation as possible; *Vehicles to be serviced at the contractor laydown area and all re-fueling is to take place outside of the wetlands and the applicable 32m zone of regulation; *It should be feasible to utilise existing roads to gain access to the construction site, and crossing the wetlands in areas where no existing crossing is apparent should be unnecessary; and *The wetlands and the applicable 32m zone of regulation should be clearly demarcated and marked as a 'no-go' area where no construction activities are planned.
2		Site preparation prior to commencement of construction activities.	*Vehicular transport and access to the site; *Removal of vegetation and associated disturbances to soil; *Miscellaneous activities by construction personnel.	*Destruction of wetland habitat and functionality within the road footprint crossing the wetland; *Disturbance to the wetland vegetation; and *Trampling within the wetland beyond the construction footprint.	5	7	9	**63**	**M**	
3a - **Alternative 1**		Excavation for road layer works.	*Disturbances to soil within the wetland; and Removal of topsoil and creation of stockpiles.	*Disturbances to soil leading to increased alien vegetation proliferation, and in turn to further altered freshwater habitat; *Altered runoff patterns and alteration to flow patterns, leading to increased erosion and sedimentation of the	2.75	5.8	5	**28.75**	**L**	*Limit vehicle/construction equipment activity within the freshwater resources to what is absolutely essential; *Re-fueling of vehicles to take place outside of the freshwater resources & associated buffer zones, on sealed surfaces; *During excavation activities, the topsoil as well as the vegetation (if indigenous vegetation is present) should be removed up to a depth of 150mm and be stockpiled outside of the appropriate setback area. The

No.	Phases	Activity	Aspect	Impact	Severity	Consequence	Likelihood	Significance	Risk Rating	Mitigation Measures to be implemented
3b - **Alternative 2**				wetland; and *Possible contamination of soil and surface water, leading to further reduced ability to support biodiversity.	5	9	10	**90**	**M**	vegetation must be kept moist, until it can be used to rehabilitate the site; *Excavated materials should not be contaminated, and it should be ensured that the minimum surface area is taken up, however the stockpiles may not exceed 2m in height to retain fertility and the structural integrity of the soil; *All exposed soils must be protected for the duration of the construction phase with a suitable geotextile (e.g. Geojute or hessian) in order to prevent erosion and sedimentation of the watercourses in close proximity to these stockpiles; *Ensure sediment control devices are in place prior to the start of the excavation activities; *Maintain sediment/erosion control devices to minimise risk of sedimentation of the downstream areas; and *The alignment of the road diversion must be optimised to remain outside of the delineated wetlands and ideally the associated 32m zone of regulation as defined by NEMA.
4a - **Alternative 1**			*Movement of construction equipment /vehicles within the wetlands; and *Possible spills / leaks from construction vehicles.	*Disturbances to soil leading to increased alien vegetation proliferation, and in turn to further altered wetland habitat; *Altered runoff patterns and alteration to flow patterns, leading to increased erosion and sedimentation of the wetland; and *Possible contamination of soil and surface water, leading to further reduced ability to support biodiversity.	3	6	7	**42**	**L**	*Limit vehicle/construction equipment activity within the wetlands to what is absolutely essential; *Re-fueling of vehicles to take place outside of the wetlands & associated 32m NEMA zone of regulation, on sealed surfaces; *During excavation activities, the topsoil as well as the vegetation (if indigenous vegetation is present) should be removed up to a depth of 150mm and be stockpiled outside of the 32m NEMA zone of regulation. The vegetation must be kept moist, until it can be used to rehabilitate the site; *Excavated materials should not be contaminated, and it should be ensured that the minimum surface area is taken up, however the stockpiles may not exceed 2m in height; *All exposed soil must be protected for the duration of the construction phase with a suitable geotextile (e.g. Geojute or hessian) in order to prevent erosion and sedimentation of the wetlands in close proximity to these stockpiles; *Ensure sediment control devices are in place prior to the start of the excavation activities; and
4b - **Alternative 2**					5	8	10	**80**	**M**	

No.	Phases	Activity	Aspect	Impact	Severity	Consequence	Likelihood	Significance	Risk Rating	Mitigation Measures to be implemented
										*Maintain sediment/erosion control devices to minimise risk of sedimentation of the downstream areas.
5a - Alternative		Construction of road diversion (road crossing for Alternative 2), including construction of drainage culverts.	*Movement of construction equipment/vehicles within the wetland; *Possible spills / leaks from construction vehicles; *Possible discard of construction material within the wetland; and *Disturbances to soil as culverts are installed.	*Diversion of flow around the construction area could potentially change in flow pattern and timing of water entering the downgradient reach of the wetland; *Altered runoff patterns, leading to increased erosion and sedimentation of the wetland; *Trampling by construction personnel and equipment is likely to impact on the wetland vegetation, leading to habitat degradation; *Potential for hydrocarbons and oil spills from entering into the wetland; *Construction of the road crossing would entail the use of concrete, which could potentially impact on the water quality of the downgradient reach of the wetland; *Alterations to flow patterns and hydrological processes through constriction of flow through the culverts leafing to desiccation of the wider wetland area and the risk of erosion and incision where flow is concentrated.	3	6	7	**42**	**L**	*The design of the road crossing should ensure adequate flow connectivity between the upgradient and downgradient portions of the wetland using either culvert structures or pipe culverts or a combination of both; *The culvert structure must extend the width of the wetland to ensure recharge of the wetland area downgradient of the crossing; *The crossing and the through-flow structures should be sized to accommodate a 1:100 year flood; *Ensure that the creation of the diversion does not result in a significant water level difference upgradient or downgradient of the construction site or lead to excessive concentration of flow which will lead to erosion and incision of the watercourse; *The duration of impacts within the wetland should be minimised as far as possible by ensuring that the duration of time in which flow alteration and sedimentation will take place is minimised. Therefore, the construction period should be kept as short as possible; *Silt traps should be installed at the construction area. This would limit the sediment load entering the wetland; and *Restrict construction activities to the drier months as far as possible, to limit the possibility of permanent changes to the system. *No mixed concrete/grout may be deposited outside of the designated construction footprint, to limit it from entering the canal and ultimately the downgradient wetland; *A batter/dagga board mixing trays and impermeable sumps should be provided, onto which any mixed concrete/grout can be deposited while it awaits placing; *Concrete/grout spilled outside of the demarcated area must be
5b - Alternative 2					5	10	11	**110**	**M**	

No.	Phases	Activity	Aspect	Impact	Severity	Consequence	Likelihood	Significance	Risk Rating	Mitigation Measures to be implemented
										promptly removed and taken to a suitably licensed waste disposal site; and *The alignment of the road diversion must be optimised to remain outside of the delineated wetlands and ideally the associated 32m zone of regulation as defined by NEMA.
6	Operational Phase	Maintenance of the road crossing.	*Potential movement of construction machinery/vehicles within the wetland; *Possible spills / leaks from construction vehicles; *Possible discard of construction material within the wetland; and *Disturbances to or removal of vegetation whilst accessing culverts to carry out maintenance activities.	*Potential loss of indigenous vegetation and the further proliferation of alien floral species due to disturbances.	3	5	8	**40**	**L**	*Limit vehicle/construction equipment activity within the wetlands to what is absolutely essential; *Re-fueling of vehicles to take place outside of the wetlands and associated 32m NEMA zone of regulation, on sealed surfaces; and *All construction waste should be removed and disposed of at an appropriate disposal facility.
7		Rehabilitation activities of portions of the wetlands impacted by construction.	*Re-vegetate disturbed wetland areas, remove any remaining construction waste.	*Exposure of soil, leading to increased runoff and erosion, and thus increased sedimentation of the wetlands; and *Proliferation of alien vegetation as a result of disturbances.	4	6	8	**48**	**L**	*Limit vehicle/machinery activity within the freshwater resources to what is absolutely essential; *Maintain sediment/erosion control devices to minimise risk of sedimentation of downstream areas; *Duration of impacts must be minimised; and *Re-seed with indigenous species as soon as the culvert construction is completed.

The activities associated with the portions of the road diversion that traverse the wetlands pose the highest risk to the receiving freshwater environment. This is mainly due to the disruption of flow and the associated trampling/soil compaction as a result of construction activities by personnel and construction vehicles within the wetlands. The proposed wetland crossings will also require the removal of wetland vegetation, and since the wetland does provide habitat to a variety of avifaunal species, this would have an impact on the habitat provisioning of the wetlands.

The duration of impacts within the wetland should also be minimised as far as possible by ensuring that the duration of time in which flow alteration and sedimentation will take place is minimised. Therefore, the construction period should be kept as short as possible and should ideally take place in the winter, low flow period.

Alternative 1 is not proposed to traverse any wetlands while Alternative 2 is proposed to traverse both CVB 2 and HHS 4. Therefore, the potential risk to the freshwater environment posed by Alternative 1 is lower than that of Alternative 2, as evidenced by the lower risk rating for Alternative 1. Thus, Alternative 1 is the preferred alternative from a freshwater resource management perspective. As the outcome of the Risk Assessment indicates that Alternative 1 poses a low risk to the wetlands, the project may be authorised by means of a General Authorisation (GA), provided that Alternative 1 is the chosen option and that the recommended mitigation measures are implemented. It must be noted that the Department of Water and Sanitation (DWS) is the competent authority, and this opinion should be confirmed by the DWS.

Based on the findings of the freshwater ecological assessment, several recommended mitigation measures are made to minimise the impact on the freshwater resources. Key mitigation measures include (but are not limited to):

- If feasible, construction must be scheduled for the drier winter period in order to minimise the risk of sediment-laden runoff reaching the wetlands as a result of the construction activities;
- Should it be necessary to clear any areas of vegetation, these areas, including contractor laydown areas, must remain as small as possible, to reduce the risk of further proliferation of alien vegetation, and to retain a level of protection to the wetlands during construction (e.g. sediment trapping, slowing of stormwater runoff etc.);

- Contractor laydown areas and all non-essential activities are to remain outside of the delineated wetlands and the 32m NEMA zone of regulation, and as much as feasible no natural/indigenous wetland vegetation is to be cleared;
- All exposed soils must be protected for the duration of the construction phase with a suitable geotextile (e.g. Geojute or hessian) to prevent erosion and sedimentation of the wetlands. Soils should not be stockpiled within close proximity to the wetlands, but should rather be outside of the temporary zone boundaries to prevent sedimentation of the wetlands, and stockpiles may not exceed 2m in height to prevent the structural properties of the soil being compromised;
- The design of the portion of road traversing the wetlands should ensure adequate flow, hydraulic conditions and connectivity between the upgradient and downgradient portions of the wetlands using either culvert structures or pipe culverts or a combination of both. These structures should be sized to accommodate a 1:100 year flood event and should allow for the recharge of the entire width of the wetland; and
- It is highly recommended that the proponent make provision for small-scale rehabilitation of the reaches of the wetlands which may be directly impacted upon by construction activities. The area must preferably be rehabilitated to conditions as close as possible to the “natural” state, not the pre-construction state since the state of the wetlands is deemed to be altered from a reference condition. This will ensure that the current levels of ecological service provision of the wetlands are maintained and where feasible, improved.

Additional “good practice” mitigation measures applicable to a project of this nature are provided in Appendix F of this report.

6 CONCLUSION

During the site assessment undertaken in April 2019, numerous wetlands including channelled valley bottom (CVB) wetlands, hillslope seep (HSS) wetlands and depressions were identified within the investigation area. Following the assessment of these wetlands, the ecological condition thereof could be summarised as below:

Table 9: Summary of results of the field assessment as discussed in Section 4.

Watercourse	PES	Ecoservices	EIS	REC and RMO
CVB 1	C (Moderately modified)	Intermediate	Moderate	REC C RMO: Maintain
CVB 2 and associated HHS 4	B (Small modification)	Intermediate	Moderate	REC B RMO: Maintain

HHS 1	D (Largely modified)	Intermediate	Moderately low	REC D RMO: Maintain
Depression 1	D (Largely modified)	Intermediate	Moderately low	REC D RMO: Maintain

The wetlands located within the investigation area have all been impacted upon to some degree, with specific mention of the historical and ongoing surrounding agricultural activities. Agricultural fields have, in many areas, encroached on the wetland boundaries. Road infrastructure (such as Wonderfontein Road and the N4) were found to also traverse some of the wetlands. Generally, the conversion of natural areas to largely agricultural land-uses have impacted on the overall hydrological and geomorphological functioning of these wetlands.

Following the assessment of the wetlands, the DWS risk assessment matrix was applied to ascertain the significance of possible impacts which may occur because of the proposed road diversion. The results of this assessment are presented in Section 5 of this report, and show that, assuming mitigation measures are strictly enforced, impact significance is of low to moderate significance during the construction and operational phase. As Alternative 1 does not traverse any wetlands and therefore poses a lower risk to the wetlands within the investigation than Alternative 2, Alternative 1 is considered the preferred alternative from a freshwater resource management perspective. However, it is considered imperative that suitable mitigation measures, as provided for in Section 5 and Appendix F of this report, are strictly adhered to in order to minimise the impacts associated with the proposed road diversion and decrease the significance of cumulative impacts on the freshwater environment.

Based on the findings of the freshwater ecological assessment and the results of the risk assessment, it is the opinion of the ecologist that the proposed road diversion poses both direct and indirect risks to the wetlands associated with the proposed road diversion. Adherence to cogent, well-conceived and ecologically sensitive site development plans, and the mitigation measures provided in this report as well as general good construction practice, is essential if the significance of perceived impacts is to be reduced.

It is the opinion of the freshwater specialist that the proposed road diversion, from a freshwater resource perspective, is considered acceptable, with the proviso that strict adherence to mitigation measures is enforced to ensure that the ecological integrity of the freshwater environment is not further compromised beyond that which will be lost within the footprint of the proposed road.

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APPENDIX A – Terms of Use and Indemnity

INDEMNITY AND TERMS OF USE OF THIS REPORT

The findings, results, observations, conclusions and recommendations given in this report are based on the author's best scientific and professional knowledge as well as available information. The report is based on survey and assessment techniques which are limited by time and budgetary constraints relevant to the type and level of investigation undertaken and SAS CC and its staff reserve the right to modify aspects of the report including the recommendations if and when new information may become available from ongoing research or further work in this field, or pertaining to this investigation.

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APPENDIX B – Legislation

LEGISLATIVE REQUIREMENTS

National Environmental Management Act (NEMA) (Act No. 107 of 1998)	The National Environmental Management Act (NEMA) (Act 107 of 1998) and the associated Regulations as amended in 2017, states that prior to any development taking place within a wetland or riparian area, an environmental authorisation process needs to be followed. This could follow either the Basic Assessment Report (BAR) process or the Environmental Impact Assessment (EIA) process depending on the scale of the impact. Provincial regulations must also be considered.
National Water Act (NWA) (Act No. 36 of 1998)	The National Water Act (NWA) (Act 36 of 1998) recognises that the entire ecosystem and not just the water itself in any given water resource constitutes the resource and as such needs to be conserved. No activity may therefore take place within a watercourse unless it is authorised by the Department of Water and Sanitation (DWS). Any area within a wetland or riparian zone is therefore excluded from development unless authorisation is obtained from the DWS in terms of Section 21 (c) & (i).
Government Notice 509 as published in the Government Gazette 40229 of 2016 as it relates to the NWA (Act 36 of 1998)	In accordance with Regulation GN509 of 2016, a regulated area of a watercourse for section 21c and 21i of the NWA, 1998 is defined as: a) The outer edge of the 1 in 100 year flood line and/or delineated riparian habitat, whichever is the greatest distance, measured from the middle of the watercourse of a river, spring, natural channel, lake or dam; b) In the absence of a determined 1 in 100 year flood line or riparian area the area within 100 m from the edge of a watercourse where the edge of the watercourse is the first identifiable annual bank fill flood bench; or c) A 500 m radius from the delineated boundary (extent) of any wetland or pan. This notice **replaces GN1199** and may be exercised as follows: i) Exercise the water use activities in terms of Section 21(c) and (i) of the Act as set out in the table below, subject to the conditions of this authorisation; ii) Use water in terms of section 21(c) or (i) of the Act if it has a low risk class as determines through the Risk Matrix; iii) Do maintenance with their existing lawful water use in terms of section 21(c) or (i) of the Act that has a LOW risk class as determined through the Risk Matrix; iv) Conduct river and stormwater management activities as contained in a river management plan; v) Conduct rehabilitation of wetlands or rivers where such rehabilitation activities has a LOW risk class as determined through the Risk Matrix; and vi) Conduct emergency work arising from an emergency situation or incident associated with the persons' existing lawful water use, provided that all work is executed and reported in the manner prescribed in the Emergency protocol. A General Authorisation (GA) issued as per this notice will require the proponent to adhere with specific conditions, rehabilitation criteria and monitoring and reporting programme. Furthermore, the water user must ensure that there is a sufficient budget to complete, rehabilitate and maintain the water use as set out in this GA. Upon completion of the registration, the responsible authority will provide a certificate of registration to the water user within 30 working days of the submission. On written receipt of a registration certificate from the Department, the person will be regarded as a registered water user and can commence within the water use as contemplated in the GA.

APPENDIX C – Method of Assessment

FRESHWATER RESOURCE METHOD OF ASSESSMENT

1. Desktop Study

Prior to the commencement of the field assessment, a background study, including a literature review, was conducted in order to determine the ecoregion and ecostatus of the larger aquatic system within which the freshwater features present or in close proximity of the proposed study area are located. Aspects considered as part of the literature review are discussed in the sections that follow.

1.1 National Freshwater Ecosystem Priority Areas (NFEPA, 2011)

The NFEPA project is a multi-partner project between the Council of Scientific and Industrial Research (CSIR), Water Research Commission (WRC), South African National Biodiversity Institute (SANBI), DWA, South African Institute of Aquatic Biodiversity (SAIAB) and South African National Parks (SANParks). The project responds to the reported degradation of freshwater ecosystem condition and associated biodiversity, both globally and in South Africa. It uses systematic conservation planning to provide strategic spatial priorities of conserving South Africa's freshwater biodiversity, within the context of equitable social and economic development.

The NFEPA project aims to identify a national network of freshwater conservation areas and to explore institutional mechanisms for their implementation. Freshwater ecosystems provide a valuable, natural resource with economic, aesthetic, spiritual, cultural and recreational value. However, the integrity of freshwater ecosystems in South Africa is declining at an alarming rate, largely as a consequence of a variety of challenges that are practical (managing vast areas of land to maintain connectivity between freshwater ecosystems), socio-economic (competition between stakeholders for utilisation) and institutional (building appropriate governance and co-management mechanisms).

The NFEPA database was searched for information in terms of conservation status of rivers, wetland habitat and wetland features present in the vicinity of or within the proposed study area.

2. Classification System for Wetlands and other Aquatic Ecosystems in South Africa

The freshwater features encountered within the proposed study area were assessed using the Classification System for Wetlands and other Aquatic Ecosystems in South Africa. User Manual: Inland Systems (Ollis *et al*., 2013), hereafter referred to as the "Classification System". A summary of Levels 1 to 4 of the classification system are presented in Table C1 and C2, below.

Table C1: Proposed classification structure for Inland Systems, up to Level 3.

WETLAND / AQUATIC ECOSYSTEM CONTEXT		
LEVEL 1: SYSTEM	LEVEL 2: REGIONAL SETTING	LEVEL 3: LANDSCAPE UNIT
Inland Systems	DWA Level 1 Ecoregions OR NFEPA WetVeg Groups OR Other special framework	Valley Floor
		Slope
		Plain
		Bench (Hilltop / Saddle / Shelf)

Table C2: Hydrogeomorphic (HGM) Unit for the Inland System, showing the primary HGM Types at Level 4A and the subcategories at Level 4B to 4C.

FUNCTIONAL UNIT		
LEVEL 4: HYDROGEOMORPHIC (HGM) UNIT		
HGM type	Longitudinal zonation/ Landform / Outflow drainage	Landform / Inflow drainage
A	**B**	**C**
River	Mountain headwater stream	Active channel
		Riparian zone
	Mountain stream	Active channel
		Riparian zone
	Transitional	Active channel
		Riparian zone
	Upper foothills	Active channel
		Riparian zone
	Lower foothills	Active channel
		Riparian zone
	Lowland river	Active channel
		Riparian zone
	Rejuvenated bedrock fall	Active channel
		Riparian zone
	Rejuvenated foothills	Active channel
		Riparian zone
	Upland floodplain	Active channel
		Riparian zone
Channelled valley-bottom wetland	(not applicable)	(not applicable)
Unchannelled valley-bottom wetland	(not applicable)	(not applicable)
Floodplain wetland	Floodplain depression	(not applicable)
	Floodplain flat	(not applicable)
Depression	Exorheic	With channelled inflow
		Without channelled inflow
	Endorheic	With channelled inflow
		Without channelled inflow
	Dammed	With channelled inflow
		Without channelled inflow
Seep	With channelled outflow	(not applicable)
	Without channelled outflow	(not applicable)
Wetland flat	(not applicable)	(not applicable)

Level 1: Inland systems

From the Classification System, Inland Systems are defined as aquatic ecosystems that have no existing connection to the ocean[1] (i.e. characterised by the complete absence of marine exchange and/or tidal influence) but which are inundated or saturated with water, either permanently or periodically. It is important to bear in mind, however, that certain Inland Systems may have had a historical connection to the ocean, which in some cases may have been relatively recent.

[1] Most rivers are indirectly connected to the ocean via an estuary at the downstream end, but where marine exchange (i.e. the presence of seawater) or tidal fluctuations are detectable in a river channel that is permanently or periodically connected to the ocean, it is defined as part of the estuary.

Level 2: Ecoregions & NFEPA Wetland Vegetation Groups

For Inland Systems, the regional spatial framework that has been included at Level 2 of the classification system is that of DWA's Level 1 Ecoregions for aquatic ecosystems (Kleynhans *et al.,* 2005). There is a total of 31 Ecoregions across South Africa, including Lesotho and Swaziland. DWA Ecoregions have most commonly been used to categorise the regional setting for national and regional water resource management applications, especially in relation to rivers.

The Vegetation Map of South Africa, Swaziland and Lesotho (Mucina & Rutherford, 2006) group's vegetation types across the country according to Biomes, which are then divided into Bioregions. To categorise the regional setting for the wetland component of the National Freshwater Ecosystem Priority Areas (NFEPA) project, wetland vegetation groups (referred to as WetVeg Groups) were derived by further splitting bioregions into smaller groups through expert input (Nel *et al*., 2011). There are currently 133 NFEPA WetVeg Groups. It is envisaged that these groups could be used as a special framework for the classification of wetlands in national- and regional-scale conservation planning and wetland management initiatives.

Level 3: Landscape Setting

At Level 3 of the Classification System, for Inland Systems, a distinction is made between four Landscape Units (Table C1) on the basis of the landscape setting (i.e. topographical position) within which an HGM Unit is situated, as follows (Ollis *et al.,* 2013):

- **Slope:** an included stretch of ground that is not part of a valley floor, which is typically located on the side of a mountain, hill or valley;
- **Valley floor:** The base of a valley, situated between two distinct valley side-slopes;
- **Plain:** an extensive area of low relief characterised by relatively level, gently undulating or uniformly sloping land; and
- **Bench (hilltop/saddle/shelf):** an area of mostly level or nearly level high ground (relative to the broad surroundings), including hilltops/crests (areas at the top of a mountain or hill flanked by down-slopes in all directions), saddles (relatively high-lying areas flanked by down-slopes on two sides in one direction and up-slopes on two sides in an approximately perpendicular direction), and shelves/terraces/ledges (relatively high-lying, localised flat areas along a slope, representing a break in slope with an up-slope one side and a down-slope on the other side in the same direction).

Level 4: Hydrogeomorphic Units

Seven primary HGM Types are recognised for Inland Systems at Level 4A of the Classification System (Table C2), on the basis of hydrology and geomorphology (Ollis *et al*., 2013), namely:

- **River:** a linear landform with clearly discernible bed and banks, which permanently or periodically carries a concentrated flow of water;
- **Channelled valley-bottom wetland:** a valley-bottom wetland with a river channel running through it;
- **Unchannelled valley-bottom wetland:** a valley-bottom wetland without a river channel running through it;
- **Floodplain wetland:** the mostly flat or gently sloping land adjacent to and formed by an alluvial river channel, under its present climate and sediment load, which is subject to periodic inundation by over-topping of the channel bank;
- **Depression:** a landform with closed elevation contours that increases in depth from the perimeter to a central area of greatest depth, and within which water typically accumulates.
- **Wetland Flat:** a level or near-level wetland area that is not fed by water from a river channel, and which is typically situated on a plain or a bench. Closed elevation contours are not evident around the edge of a wetland flat; and
- **Seep:** a wetland area located on (gently to steeply) sloping land, which is dominated by the colluvial (i.e. gravity-driven), unidirectional movement of material down-slope. Seeps are often located on the side-slopes of a valley but they do not, typically, extend into a valley floor.

The above terms have been used for the primary HGM Units in the classification system to try and ensure consistency with the wetland classification terms currently in common usage in South Africa.

Similar terminology (but excluding categories for "channel", "flat" and "valleyhead seep") is used, for example, in the recently developed tools produced as part of the Wetland Management Series including WET-Health (Macfarlane *et al*., 2008), WET-IHI (DWAF, 2007) and WET-EcoServices (Kotze *et al*., 2009).

3. WET-Health

Healthy wetlands are known to provide important habitats for wildlife and to deliver a range of important goods and services to society. Management of these systems is therefore essential if these attributes are to be retained within an ever-changing landscape. The primary purpose of this assessment is to evaluate the eco-physical health of wetlands, and in so doing to promote their conservation and wise management.

Level of Evaluation
Two levels of assessment are provided by WET-Health:

- Level 1: Desktop evaluation, with limited field verification. This is generally applicable to situations where a large number of wetlands need to be assessed at a very low resolution; or
- Level 2: On-site evaluation. This involves structured sampling and data collection in a single wetland and its surrounding catchment.

Framework for the Assessment
A set of three modules has been synthesised from the set of processes, interactions and interventions that take place in wetland systems and their catchments: hydrology (water inputs, distribution and retention, and outputs), geomorphology (sediment inputs, retention and outputs) and vegetation (transformation and presence of introduced alien species).

Units of Assessment
Central to WET-Health is the characterisation of HGM Units, which have been defined based on geomorphic setting (e.g. hillslope or valley-bottom; whether drainage is open or closed), water source (surface water dominated or sub-surface water dominated) and pattern of water flow through the wetland unit (diffusely or channelled) as described under the Classification System for Wetlands and other Aquatic Ecosystems above.

Quantification of Present State of a wetland
The overall approach is to quantify the impacts of human activity or clearly visible impacts on wetland health, and then to convert the impact scores to a Present State score. This takes the form of assessing the spatial *extent* of the impact of individual activities and then separately assessing the *intensity* of the impact of each activity in the affected area. The extent and intensity are then combined to determine an overall *magnitude* of impact. The impact scores, and Present State categories are provided in the table below.

Table C3: Impact scores and categories of Present State used by WET-Health for describing the integrity of wetlands.

Impact category	Description	Impact score range	Present State category
None	Unmodified, natural	0-0.9	A
Small	Largely natural with few modifications. A slight change in ecosystem processes is discernible and a small loss of natural habitats and biota may have taken place.	1-1.9	B
Moderate	Moderately modified. A moderate change in ecosystem processes and loss of natural habitats has taken place, but the natural habitat remains predominantly intact.	2-3.9	C
Large	Largely modified. A large change in ecosystem processes and loss of natural habitat and biota and has occurred.	4-5.9	D
Serious	The change in ecosystem processes and loss of natural habitat and biota is great, but some remaining natural habitat features are still recognisable.	6-7.9	E

Impact category	Description	Impact score range	Present State category
Critical	Modifications have reached a critical level and the ecosystem processes have been completely modified with an almost complete loss of natural habitat and biota.	8-10	F

Assessing the Anticipated Trajectory of Change
As is the case with the Present State, future threats to the state of the wetland may arise from activities in the catchment upstream of the unit or within the wetland itself or from processes downstream of the wetland. In each of the individual sections for hydrology, geomorphology and vegetation, five potential situations exist depending upon the direction and likely extent of change (table below).

Table C4: Trajectory of Change classes and scores used to evaluate likely future changes to the present state of the wetland.

Change Class	Description	HGM change score	Symbol
Substantial improvement	State is likely to improve substantially over the next 5 years	2	↑↑
Slight improvement	State is likely to improve slightly over the next 5 years	1	↑
Remain stable	State is likely to remain stable over the next 5 years	0	→
Slight deterioration	State is likely to deteriorate slightly over the next 5 years	-1	↓
Substantial deterioration	State is expected to deteriorate substantially over the next 5 years	-2	↓↓

Overall health of the wetland
Once all HGM Units have been assessed, a summary of health for the wetland as a whole needs to be calculated. This is achieved by calculating a combined score for each component by area-weighting the scores calculated for each HGM Unit. Recording the health assessments for the hydrology, geomorphology and vegetation components provide a summary of impacts, Present State, Trajectory of Change and Health for individual HGM Units and for the entire wetland.

4. Wetland Function Assessment

"The importance of a water resource, in ecological social or economic terms, acts as a modifying or motivating determinant in the selection of the management class".[2] The assessment of the ecosystem services supplied by the identified freshwater features was conducted according to the guidelines as described by Kotze *et al.* (2009). An assessment was undertaken that examines and rates the following services according to their degree of importance and the degree to which the service is provided:

- Flood attenuation;
- Stream flow regulation;
- Sediment trapping;
- Phosphate trapping;
- Nitrate removal;
- Toxicant removal;
- Erosion control;
- Carbon storage;
- Maintenance of biodiversity;
- Water supply for human use;
- Natural resources;
- Cultivated foods;

[2] Department of Water Affairs and Forestry, South Africa Version 1.0 of Resource Directed Measures for Protection of Water Resources, 1999

- Cultural significance;
- Tourism and recreation; and
- Education and research.

The characteristics were used to quantitatively determine the value, and by extension sensitivity, of the freshwater features. Each characteristic was scored to give the likelihood that the service is being provided. The scores for each service were then averaged to give an overall score to the freshwater features.

Table C5: Classes for determining the likely extent to which a benefit is being supplied.

Score	Rating of the likely extent to which the benefit is being supplied
<0.5	Low
0.6-1.2	Moderately low
1.3-2	Intermediate
2.1-3	Moderately high
>3	High

5. Ecological Importance and Sensitivity (EIS) (Rountree & Kotze, 2013)

The purposed of assessing importance and sensitivity of water resources is to be able to identify those systems that provide higher than average ecosystem services, biodiversity support functions or are especially sensitive to impacts. Water resources with higher ecological importance may require managing such water resources in a better condition than the present to ensure the continued provision of ecosystem benefits in the long term (Rountree & Kotze, 2013).
In order to align the outputs of the Ecoservices assessment (i.e. ecological and socio-cultural service provision) with methods used by the DWA (now the DWS) used to assess the EIS of other watercourse types, a tool was developed using criteria from both WET-Ecoservices (Kotze, *et, al,* 2009) and earlier DWA EIA assessment tools. Thus, three proposed suites of important criteria for assessing the Importance and Sensitivity for wetlands were proposed, namely:

- Ecological Importance and Sensitivity, incorporating the traditionally examined criteria used in EIS assessments of other water resources by DWA and thus enabling consistent assessment approaches across water resource types;
- Hydro-functional importance, taking into consideration water quality, flood attenuation and sediment trapping ecosystem services that the wetland may provide; and
- Importance in terms of socio-cultural benefits, including the subsistence and cultural benefits provided by the wetland system.

The highest of these three suites of scores is then used to determine the overall Importance and Sensitivity category (Table C8) of the wetland system being assessed.

Table C6: Ecological Importance and Sensitivity Categories and the interpretation of median scores for biota and habitat determinants (adapted from Kleynhans, 1999).

EIS Category	Range of Mean	Recommended Ecological Management Class
Very high Wetlands that are considered ecologically important and sensitive on a national or even international level. The biodiversity of these wetlands is usually very sensitive to flow and habitat modifications.	>3 and <=4	A
High Wetlands that are considered to be ecologically important and sensitive. The biodiversity of these wetlands may be sensitive to flow and habitat modifications.	>2 and <=3	B
Moderate	>1 and <=2	C

EIS Category	Range of Mean	Recommended Ecological Management Class
Wetlands that are considered to be ecologically important and sensitive on a provincial or local scale. The biodiversity of these wetlands is not usually sensitive to flow and habitat modifications.		
Low/marginal Wetlands that are not ecologically important and sensitive at any scale. The biodiversity of these wetlands is ubiquitous and not sensitive to flow and habitat modifications.	>0 and <=1	D

6. Recommended Management Objective (RMO) and Recommended Ecological Category (REC) Determination

"A high management class relates to the flow that will ensure a high degree of sustainability and a low risk of ecosystem failure. A low management class will ensure marginal maintenance of sustainability but carries a higher risk of ecosystem failure" (DWA, 1999).

The RMO (table below) was determined based on the results obtained from the PES, reference conditions and EIS of the freshwater resource (sections above), with the objective of either maintaining, or improving the ecological integrity of the freshwater resource in order to ensure continued ecological functionality.

Table C7: Recommended management objectives (RMO) for water resources based on PES & EIS scores.

			Ecological and Importance Sensitivity (EIS)			
			Very High	High	Moderate	Low
PES	A	Pristine	A Maintain	A Maintain	A Maintain	A Maintain
	B	Natural	A Improve	A/B Improve	B Maintain	B Maintain
	C	Good	A Improve	B/C Improve	C Maintain	C Maintain
	D	Fair	C Improve	C/D Improve	D Maintain	D Maintain
	E/F	Poor	D* Improve	E/F* Improve	E/F* Maintain	E/F* Maintain

***PES Categories E and F are considered ecologically unnacceptable (Malan and Day, 2012) and therefore, should a freshwater resource fall into one of these PES categories, an REC class D is allocated by default, as the minimum acceptable PES category.**

A freshwater resource may receive the same class for the REC as the PES if the freshwater resource is deemed in good condition, and therefore must stay in good condition. Otherwise, an appropriate REC should be assigned in order to prevent any further degradation as well as enhance the PES of the freshwater resource.

Table C8: Description of Recommended Ecological Category (REC) classes.

Class	Description
A	Unmodified, natural
B	Largely natural with few modifications
C	Moderately modified
D	Largely modified

APPENDIX D – Risk Assessment Methodology

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

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

- An **activity** is a distinct process or task undertaken by an organisation for which a responsibility can be assigned. Activities also include facilities or infrastructure that is possessed by an organisation.
- An **environmental aspect** is an 'element of an organizations activities, products and services which can interact with the environment'[3]. The interaction of an aspect with the environment may result in an impact.
- **Environmental risks/impacts** are the consequences of these aspects on environmental resources or receptors of particular value or sensitivity, for example, disturbance due to noise and health effects due to poorer air quality. In the case where the impact is on human health or wellbeing, this should be stated. Similarly, where the receptor is not anthropogenic, then it should, where possible, be stipulated what the receptor is.
- **Receptors** can comprise, but are not limited to, people or human-made systems, such as local residents, communities and social infrastructure, as well as components of the biophysical environment such as freshwater features, flora and riverine systems.
- **Resources** include components of the biophysical environment.
- **Frequency of activity** refers to how often the proposed activity will take place.
- **Frequency of impact** refers to the frequency with which a stressor (aspect) will impact on the receptor.
- **Severity** refers to the degree of change to the receptor status in terms of the reversibility of the impact; sensitivity of receptor to stressor; duration of impact (increasing or decreasing with time); controversy potential and precedent setting; threat to environmental and health standards.
- **Spatial extent** refers to the geographical scale of the impact.
- **Duration** refers to the length of time over which the stressor will cause a change in the resource or receptor.

The significance of the impact is then assessed by rating each variable numerically according to the defined criteria (refer to the table below). The purpose of the rating is to develop a clear understanding of influences and processes associated with each impact. The severity, spatial scope and duration of the impact together comprise the consequence of the impact and when summed can obtain a maximum value of 15. The frequency of the activity, impact, legal issues and the detection of the impact together comprise the likelihood of the impact occurring and can obtain a maximum value of 20. The values for likelihood and consequence of the impact are then read off a significance rating matrix and are used to determine whether mitigation is necessary[4].

The model outcome of the impacts was then assessed in terms of impact certainty and consideration of available information. The Precautionary Principle is applied in line with South Africa's National Environmental Management Act (No. 108 of 1997) in instances of uncertainty or lack of information, by

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

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

increasing assigned ratings or adjusting final model outcomes. In certain instances, where a variable or outcome requires rational adjustment due to model limitations, the model outcomes have been adjusted.

"RISK ASSESSMENT KEY" (Based on DWS 2015 publication: Section 21 c and i water use Risk Assessment Protocol)

Table D1: Severity (How severe does the aspects impact on the resource quality (flow regime, water quality, geomorphology, biota, habitat)

Insignificant / non-harmful	1
Small / potentially harmful	2
Significant / slightly harmful	3
Great / harmful	4
Disastrous / extremely harmful and/or wetland(s) involved	5
Where "or wetland(s) are involved" it means that the activity is located within the delineated boundary of any wetland. The score of 5 is only compulsory for the significance rating.	

Table D2: Spatial Scale (How big is the area that the aspect is impacting on)

Area specific (at impact site)	1
Whole site (entire surface right)	2
Regional / neighbouring areas (downstream within quaternary catchment)	3
National (impacting beyond secondary catchment or provinces)	4
Global (impacting beyond SA boundary)	5

Table D3: Duration (How long does the aspect impact on the resource quality)

One day to one month, PES, EIS and/or REC not impacted	1
One month to one year, PES, EIS and/or REC impacted but no change in status	2
One year to 10 years, PES, EIS and/or REC impacted to a lower status but can be improved over this period through mitigation	3
Life of the activity, PES, EIS and/or REC permanently lowered	4
More than life of the organisation/facility, PES and EIS scores, a E or F	5
PES and EIS (sensitivity) must be considered.	

Table D4: Frequency of the activity (How often do you do the specific activity)

Annually or less	1
6 monthly	2
Monthly	3
Weekly	4
Daily	5

Table D5: The frequency of the incident or impact (How often does the activity impact on the resource quality)

Almost never / almost impossible / >20%	1
Very seldom / highly unlikely / >40%	2
Infrequent / unlikely / seldom / >60%	3
Often / regularly / likely / possible / >80%	4
Daily / highly likely / definitely / >100%	5

Table D6: Legal issues (How is the activity governed by legislation)

No legislation	1
Fully covered by legislation (wetlands are legally governed)	5
Located within the regulated areas	

Table D7: Detection (How quickly or easily can the impacts/risks of the activity be observed on the resource quality, people and resource)

Immediately	1
Without much effort	2
Need some effort	3
Remote and difficult to observe	4
Covered	5

Table D8: Rating Classes

RATING	CLASS	MANAGEMENT DESCRIPTION
1 – 55	(L) Low Risk	Acceptable as is or consider requirement for mitigation. Impact to watercourses and resource quality small and easily mitigated.
56 – 169	M) Moderate Risk	Risk and impact on watercourses are notably and require mitigation measures on a higher level, which costs more and require specialist input. Licence required.
170 – 300	(H) High Risk	Watercourse(s) impacts by the activity are such that they impose a long-term threat on a large scale and lowering of the Reserve. Licence required.

A low risk class must be obtained for all activities to be considered for a GA

Table D9: Calculations

Consequence = Severity + Spatial Scale + Duration
Likelihood = Frequency of Activity + Frequency of Incident + Legal Issues + Detection
Significance\Risk = Consequence X Likelihood

The following points were considered when undertaking the assessment:

- Risks and impacts were analysed in the context of the *project's area of influence* encompassing:
  - Primary project site and related facilities that the client and its contractors develops or controls;
  - Areas potentially impacted by cumulative impacts for further planned development of the project, any existing project or condition and other project-related developments; and
  - Areas potentially affected by impacts from unplanned but predictable developments caused by the project that may occur later or at a different location.
- Risks/Impacts were assessed for construction phase and operational phase; and
  - Individuals or groups who may be differentially or disproportionately affected by the project because of their disadvantaged or vulnerable status were assessed.

Control Measure Development

The following points presents the key concepts considered in the development of mitigation measures for the proposed construction:

- Mitigation and performance improvement measures and actions that address the risks and impacts[5] are identified and described in as much detail as possible. Mitigating measures are investigated according to the impact minimisation hierarchy as follows:
  - Avoidance or prevention of impact;
  - Minimisation of impact;
  - Rehabilitation; and
  - Offsetting.
- Measures and actions to address negative impacts will favour avoidance and prevention over minimisation, mitigation or compensation; and

[5] Mitigation measures should address both positive and negative impacts

- Desired outcomes are defined and have been developed in such a way as to be measurable events with performance indicators, targets and acceptable criteria that can be tracked over defined periods, wherever possible*.*

Recommendations

Recommendations were developed to address and mitigate potential impacts on the freshwater ecology of the resources in traversed by or in close proximity of the proposed infrastructure.

APPENDIX E – Results of Field Investigation

PRESENT ECOLOGICAL STATE (PES) AND ECOLOGICAL IMPORTANCE AND SENSITIVITY (EIS) RESULTS

Table E1: Presentation of the results of the WET-Health PES assessment applied to CVB 1.

HGM Unit	Ha	Extent (%)	Hydrology		Geomorphology		Vegetation		Overall Score
			Impact Score	Change Score	Impact Score	Change Score	Impact Score	Change Score	
1	63	100	4.0	-1	2.0	-1	3.7	0	3.3
PES Category			**D**	↓	**C**	↓	**C**	→	**C**

Table E2: Presentation of the results of the WET-Health PES assessment applied to CVB 2 and HHS 4.

HGM Unit	Ha	Extent (%)	Hydrology		Geomorphology		Vegetation		Overall Score
			Impact Score	Change Score	Impact Score	Change Score	Impact Score	Change Score	
1	41	76	2.0	-1	1.2	-1	2.7	0	1.8
2	13	24	1.0	0	1.2	0	2.3	0	
PES Category			**B**	↓	**B**	↓	**C**	→	**B**

Table E3: Presentation of the results of the WET-Health PES assessment applied to HHS 1.

HGM Unit	Ha	Extent (%)	Hydrology		Geomorphology		Vegetation		Overall Score
			Impact Score	Change Score	Impact Score	Change Score	Impact Score	Change Score	
1	6	100	4.0	-1	2.9	-1	5.1	0	4
PES Category			**D**	↓	**C**	↓	**D**	→	**D**

Table E4: Presentation of the results of the WET-Health PES assessment applied to depression 1.

HGM Unit	Ha	Extent (%)	Hydrology		Geomorphology		Vegetation		Overall Score
			Impact Score	Change Score	Impact Score	Change Score	Impact Score	Change Score	
1	11	100	4.0	-1	3.3	-1	4.9	0	4
PES Category			D	↓	C	↓	D	→	D

Table E5: Presentation of the results of the Ecoservices assessment applied to the wetlands.

Ecosystem service	CVB 1	CVB 2	HHS 4	Depression 1	HSS 1
Flood attenuation	1.8	1.8	1.4	1.3	1.3
Streamflow regulation	2.2	2.2	2.0	1.2	1.2
Sediment trapping	1.2	1.4	1.0	0.8	0.8
Phosphate assimilation	1.7	1.7	1.9	1.7	1.7
Nitrate assimilation	1.9	1.9	1.9	1.7	1.7
Toxicant assimilation	1.9	1.9	1.9	1.8	1.8
Erosion control	2.1	2.3	1.9	1.5	1.8
Carbon Storage	1.5	1.5	0.8	0.8	0.8
Biodiversity maintenance	2.0	2.0	1.8	1.2	1.3
Water Supply	2.3	2.3	0.7	0.5	0.5
Harvestable resources	0.6	0.6	0.6	0.4	0.4
Cultivated foods	1.0	1.0	1.0	1.0	1.0
Cultural value	0.5	0.5	0.0	0.0	0.0
Tourism and recreation	1.1	1.1	0.5	0.3	0.1
Education and research	0.8	0.8	0.8	0.5	0.5
SUM	**22.5**	**22.9**	**17.9**	**14.6**	**14.7**
Average score	**1.5**	**1.5**	**1.2**	**1.0**	**1.0**

Table E6: Presentation of the results of the EIS assessment applied to the wetlands.

			FRESHWATER FEATURE:	CVB 1	CVB 2	HSS 4	Depression 1	HHS 1
Ecological Importance and Sensitivity				Score (0-4)	Score (0-4)	Score (0-4)	Score (0-4)	Score (0-4)
Biodiversity support				A (average)	A (average)	A (average)	A (average)	A (average)
				1.00	1.00	0.67	0.33	0.33
Presence of Red Data species				0	0	0	0	0
Populations of unique species				0	0	0	0	0
Migration/breeding/feeding sites				3	3	2	1	1
Landscape scale				B (average)	B (average)	B (average)	B (average)	B (average)
				2.00	2.00	1.40	1.00	1.00
Protection status of the wetland				1	1	1	1	1
Protection status of the vegetation type				1	1	1	1	1
Regional context of the ecological integrity				3	3	2	1	1
Size and rarity of the wetland type/s present				2	2	1	1	1
Diversity of habitat types				3	3	2	1	1
Sensitivity of the wetland				C (average)	C (average)	C (average)	C (average)	C (average)
				1.67	1.67	1.00	0.67	1.00
Sensitivity to changes in floods				2	2	1	0	1
Sensitivity to changes in low flows/dry season				2	2	1	1	1
Sensitivity to changes in water quality				1	1	1	1	1
ECOLOGICAL IMPORTANCE & SENSITIVITY (max of A,B or C)				**C**	**C**	**C**	**C**	**C**
Hydro-Functional Importance				Score (0-4)	Score (0-4)	Score (0-4)	Score (0-4)	Score (0-4)
Regulating & supporting benefits	Flood attenuation			2	2	1	1	1
	Streamflow regulation			2	2	2	1	1
	Water Quality Enhancement	*Sediment trapping*		1	1	1	1	1
		Phosphate assimilation		2	2	2	2	2
		Nitrate assimilation		2	2	2	2	2
		Toxicant assimilation		2	2	2	2	2
		Erosion control		2	2	2	2	2
	Carbon storage			2	2	1	1	1
HYDRO-FUNCTIONAL IMPORTANCE (average score)				2	2	2	2	2
Direct Human Benefits				Score (0-4)	Score (0-4)	Score (0-4)	Score (0-4)	Score (0-4)
Subsistence benefits	*Water for human use*			2	2	1	1	1
	Harvestable resources			1	1	1	0	0
	Cultivated foods			1	1	1	1	1
Cultural benefits	*Cultural heritage*			1	1	0	0	0
	Tourism and recreation			1	1	0	0	0
	Education and research			1	1	1	1	1
DIRECT HUMAN BENEFITS (average score)				1.17	1.17	0.67	0.50	0.50

APPENDIX F – Risk Assessment and Mitigation Measures

General construction management and good housekeeping practices

Latent and general impacts which may affect the freshwater ecology and biodiversity, will include any activities which take place in close proximity to the proposed development that may impact on the receiving environment. Mitigation measures for these impacts are highlighted below and are relevant to the freshwater system identified in this report:

Development footprint

- All development footprint areas should remain as small as possible and should not encroach into the freshwater areas unless absolutely essential and part of the proposed development. It must be ensured that the freshwater habitat is off-limits to construction vehicles and non-essential personnel;
- The boundaries of footprint areas, including contractor laydown areas, are to be clearly defined and it should be ensured that all activities remain within defined footprint areas. Edge effects will need to be extremely carefully controlled;
- Planning of temporary roads and access routes should avoid freshwater areas and be restricted to existing roads where possible;
- Appropriate sanitary facilities must be provided for the life of the construction phase and all waste removed to an appropriate waste facility;
- All hazardous chemicals as well as stockpiles should be stored on bunded surfaces and have facilities constructed to control runoff from these areas;
- It must be ensured that all hazardous storage containers and storage areas comply with the relevant SABS standards to prevent leakage;
- No fires should be permitted in or near the construction area; and
- Ensuring that an adequate number of waste and "spill" bins are provided will also prevent litter and ensure the proper disposal of waste and spills.

Vehicle access

- All vehicles must be regularly inspected for leaks. Re-fuelling must take place on a sealed surface area to prevent ingress of hydrocarbons into the topsoil;
- In the event of a vehicle breakdown, maintenance of vehicles must take place with care and the recollection of spillage should be practiced near the surface area to prevent ingress of hydrocarbons into topsoil and subsequent habitat loss; and
- All spills should they occur, should be immediately cleaned up and treated accordingly.

Vegetation

- Proliferation of alien and invasive species is expected within any disturbed areas. Whilst not considered severe at this time, the vegetation component within the freshwater environment is already transformed to an extent as a result of alien plant invasion; therefore, these species should be eradicated and controlled to prevent their spread beyond the project footprint. Alien plant seed dispersal within the top layers of the soil within footprint areas, that will have an impact on future rehabilitation, has to be controlled;
- Removal of the alien and weed species encountered within the freshwater resources must take place in order to comply with existing legislation (amendments to the regulations under the Conservation of Agricultural Resources Act, 1983 and Section 28 of the National Environmental Management Act, 1998). Removal of species should take place throughout the construction, operational, and maintenance phases; and
- Species specific and area specific eradication recommendations:
  - Care should be taken with the choice of herbicide to ensure that no additional impact and loss of indigenous plant species occurs due to the herbicide used;
  - Footprint areas should be kept as small as possible when removing alien plant species; and

- No vehicles should be allowed to drive through designated sensitive wetland areas during the eradication of alien and weed species.

Soils

- Sheet runoff from access roads should be slowed down by the strategic placement of berms;
- As far as possible, all construction activities should occur in the low flow season, during the drier winter months;
- As much vegetation growth as possible (of indigenous floral species) should be encouraged to protect soils;
- No stockpiling of topsoils is to take place within close proximity to the river, and all stockpiles must be protected with a suitable geotextile to prevent sedimentation of the river;
- All soils compacted as a result of construction activities as well as ongoing operational activities falling outside of project footprint areas should be ripped and profiled; and
- A monitoring plan for the development and the immediate zone of influence should be implemented to prevent erosion and incision.

Rehabilitation

- Construction rubble must be collected and disposed of at a suitable landfill site; and
- All alien vegetation in the footprint area as well as immediate vicinity of the proposed development should be removed. Alien vegetation control should take place for a minimum period of two growing seasons after rehabilitation is completed.

Conditions for impeding or diverting the flow of water or altering the bed, banks, course or characteristics of a watercourse, as defined in GN 509 as published in the Government Gazette 40229 of 2016 as it relates to the National Water Act, 1998 (Act No. 36 of 1998):

- (1) The water user must ensure that:
  (a) impeding or diverting the flow or altering the bed, banks, course or characteristics of a watercourse do not detrimentally affect other water users, property, health and safety of the general public, or the resource quality;
  (b) the existing hydraulic, hydrologic, geomorphic and ecological functions of the watercourse in the vicinity of the structure is maintained or improved upon;
  (c) a full financial provision for the implementation of the management measures prescribed in this General Authorisation, including an annual financial provision for any future maintenance, monitoring, rehabilitation, or restoration works, as may be applicable; and
  (d) upon written request of the responsible authority, they implement any additional management measures or monitoring programmes that may be reasonably necessary to determine potential impacts on the water resource or management measures to address such impacts.
- (2) Prior to the carrying out of any works, the water user must ensure that all persons entering on -site, including contractors and casual labourers, are made fully aware of the conditions and related management measures specified in this General Authorisation.
- (3) The water user must ensure that –
  (a) any construction camp, storage, washing and maintenance of equipment, storage of construction materials, or chemicals, as well as any sanitation and waste management facilities -
    (i) is located outside the 1 in 100 year flood line or riparian habitat of a river, spring, lake, dam or outside any drainage feeding any wetland or pan, and
    (ii) is removed within 30 days after the completion of any works.
  (b) The water user must ensure that the selection of a site for establishing any impeding or diverting the flow or altering the bed, banks, course or characteristics of a watercourse works:
    (i) is not located on a bend in the watercourse;
    (ii) avoid high gradient areas, unstable slopes, actively eroding banks, interflow zones, springs, and seeps;
    (iii) avoid or minimise realignment of the course of the watercourse;
    (iv) minimise the footprint of the alteration, as well as the construction footprint so as to minimise the effect on the watercourse.
  (c) The water user must ensure that a maximum impact footprint around the works is established, clearly demarcated, that no vegetation is cleared or damaged beyond this demarcation, and that equipment and machinery is only operated within the delineated impact footprint.

(d) The water user must ensure that measures are implemented to minimise the duration of disturbance and the footprint of the disturbance of the beds and banks of the watercourse.
(e) The water user must ensure that measures are implemented to prevent the transfer of biota to a site, which biota is not indigenous to the environment at that site.
(f) The water user must ensure that all works, including emergency alterations or the rectification of incidents, start upstream and proceed in a downstream direction, to ensure minimal impact on the water resource.
(g) The water user must ensure that all material excavated from the bed or banks of the watercourse are stored at a clearly demarcated location until the works have been completed, upon which the excavated material must be backfilled to the locations from where it was taken (i.e. material taken from the bed must be returned to the bed, and material taken from the banks must be returned to the banks).
(h) The water user must ensure that adequate erosion control measures are implemented at and near all alterations, including at existing structures or activities with particular attention to erosion control at steep slopes and drainage lines.
(i) The water user must ensure that alterations or hardened surfaces associated with such structures or works –

(i) are structurally stable;
(ii) do not induce sedimentation, erosion or flooding;
(iii) do not cause a detrimental change in the quantity, velocity, pattern, timing, water level and assurance of flow in a watercourse;
(iv) do not cause a detrimental change in the quality of water in the watercourse;
(v) do not cause a detrimental change in the stability or geomorphological structure of the watercourse; and
(vi) does not create nuisance condition, or health or safety hazards.

(j) The water user must ensure that measures are implemented at alterations, including at existing structures or activities, to -

(i) prevent detrimental changes to the breeding, nesting or feeding patterns of aquatic biota, including migratory species;
(ii) allow for the free up and downstream movement of aquatic biota, including migratory species; and
(iii) prevent a decline in the composition and diversity of the indigenous and endemic aquatic biota.

(k) The water user must ensure that no substance or material that can potentially cause pollution of the water resource is being used in works, including for emergency alterations or the rectification of reportable incidents.
(I) The water user must ensure that measures are taken to prevent increased turbidity, sedimentation and detrimental chemical changes to the composition of the water resource as a result of carrying out the works, including for emergency alterations or the rectification of reportable incidents.
(m) The water user must ensure that in- stream water quality is measured on a weekly basis during construction, including for emergency alterations or the rectification of reportable incidents, which measurement must be by taking samples, and by analysing the samples for pH, EC/TDS, TSS/Turbidity, and /or Dissolved Oxygen ("DO ") both upstream and downstream from the works.
(n) The water user must ensure that in- stream flow, both upstream and downstream from the works, is measured on an ongoing basis by means of instruments and devices certified by the South African Bureau of Standards ("SABS "), and that such measurement commences at least one week prior to the initiation of the works, including for emergency alterations or the rectification of reportable incidents.
(o) During the carrying out of any works, the water user must take the photographs and video-recordings referred to in paragraph (p) below, on a daily basis, starting one (1) week before the commencement of any works, including for emergency structures and the rectification of reportable incidents, and continuing for one (1) month after the completion of such works:
(p) The following videos recordings and photographs must be taken as contemplated in paragraph (o) above:

(i) one or more photographs or video -recordings of the watercourse and its banks at least 20 meters upstream from the structure;

(ii) one or more photographs or video -recordings of the watercourse and its banks at least 20 meters downstream from the structure; and
(iii) two or more photographs or video -recordings of the bed and banks at the structure, one of each taken from each opposite bank.

APPENDIX G – Specialist information

DETAILS, EXPERTISE AND CURRICULUM VITAE OF SPECIALISTS

1. (a) (i) Details of the specialist who prepared the report

Stephen van Staden MSc (Environmental Management) (University of Johannesburg)

Lauren Robson MSc (Zoology: Aquatic Health) (University of Johannesburg)

1. (a). (ii) The expertise of that specialist to compile a specialist report including a curriculum vitae

Company of Specialist:	Scientific Aquatic Services		
Name / Contact person:	Stephen van Staden		
Postal address:	29 Arterial Road West, Oriel, Bedfordview		
Postal code:	1401	Cell:	083 415 2356
Telephone:	011 616 7893	Fax:	011 615 6240/ 086 724 3132
E-mail:	stephen@sasenvgroup.co.za		
Qualifications	MSc (Environmental Management) (University of Johannesburg) BSc (Hons) Zoology (Aquatic Ecology) (University of Johannesburg) BSc (Zoology, Geography and Environmental Management) (University of Johannesburg)		
Registration / Associations	Registered Professional Natural Scientist at South African Council for Natural Scientific Professions (SACNASP) Accredited River Health Practitioner by the South African River Health Program (RHP) Member of the South African Soil Surveyors Association (SASSO) Member of the Gauteng Wetland Forum		

1. (b) a declaration that the specialist is independent in a form as may be specified by the competent authority

I, Stephen van Staden, declare that -

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

----

Signature of the Specialist

SCIENTIFIC AQUATIC SERVICES (SAS) – SPECIALIST CONSULTANT INFORMATION
CURRICULUM VITAE OF STEPHEN VAN STADEN

PERSONAL DETAILS

Position in Company	Managing member, Ecologist with focus on Freshwater Ecology
Date of Birth	13 July 1979
Nationality	South African
Languages	English, Afrikaans
Joined SAS	2003 (year of establishment)
Other Business	Trustee of the Serenity Property Trust and emerald Management Trust

MEMBERSHIP IN PROFESSIONAL SOCIETIES

Registered Professional Scientist at South African Council for Natural Scientific Professions (SACNASP);
Accredited River Health practitioner by the South African River Health Program (RHP);
Member of the South African Soil Surveyors Association (SASSO);
Member of the Gauteng Wetland Forum;
Member of International Association of Impact Assessors (IAIA) South Africa;
Member pf the Land Rehabilitation Society of South Africa (LaRSSA)

EDUCATION

Qualifications	
MSc (Environmental Management) (University of Johannesburg)	2003
BSc (Hons) Zoology (Aquatic Ecology) (University of Johannesburg)	2001
BSc (Zoology, Geography and Environmental Management) (University of Johannesburg)	2000
Tools for wetland Assessment short course Rhodes University	2016

COUNTRIES OF WORK EXPERIENCE

South Africa – All Provinces
Southern Africa – Lesotho, Botswana, Mozambique, Zimbabwe Zambia
Eastern Africa – Tanzania Mauritius
West Africa – Ghana, Liberia, Angola, Guinea Bissau, Nigeria, Sierra Leone
Central Africa – Democratic Republic of the Congo

PROJECT EXPERIENCE (Over 2500 projects executed with varying degrees of involvement)

1 Mining Coal, Chrome, PGM's, Mineral Sands, Gold, Phosphate, river sand, clay, fluorspar
2 Linear developments
3 Energy Transmission, telecommunication, pipelines, roads
4 Minerals beneficiation
5 Renewable energy (wind and solar)
6 Commercial development
7 Residential development
8 Agriculture
9 Industrial/chemical

REFERENCES

- Terry Calmeyer (Former Chairperson of IAIA SA)
  Director: ILISO Consulting Environmental Management (Pty) Ltd
  Tel: +27 (0) 11 465 2163
  Email: terryc@icem.co.za

- Alex Pheiffer
  African Environmental Management Operations Manager
  SLR Consulting
  Tel: +27 11 467 0945
  Email: apheiffer@slrconsulting.com

- Marietjie Eksteen
  Managing Director: Jacana Environmental
  Tel: 015 291 4015

Yours faithfully

STEPHEN VAN STADEN

SCIENTIFIC AQUATIC SERVICES (SAS) – SPECIALIST CONSULTANT INFORMATION

CURRICULUM VITAE OF LAUREN ROBSON

PERSONAL DETAILS

Position in Company	Junior Field Ecologist
Date of Birth	20 January 1992
Nationality	South African
Languages	English
Joined SAS	2018

MEMBERSHIP IN PROFESSIONAL SOCIETIES

Registered Candidate Natural Scientist with the South African Council for Natural Scientific Professions

Member of the Gauteng Wetland Forum

EDUCATION

Qualifications

MSc Zoology (University of Johannesburg)	2017
BSc (Hons) Zoology (University of Johannesburg)	2014
BSc Life and Environmental Sciences (University of Johannesburg)	2013

COUNTRIES OF WORK EXPERIENCE

South Africa – Gauteng, Mpumalanga, Western Cape

SELECTED PROJECT EXAMPLES

Freshwater Assessments

- Freshwater Resource Ecological Assessment as part of the environmental assessment and authorisation process for the proposed further development of Erf 35531 and formalisation of the Kuils River adjacent to Erf 35531, Stikland, Western Cape.
- Peer Review of the Basic Assessment with specific focus on Freshwater Resource Impacts and Impact Assessment for the Jewellery Manufacturing Precinct near the OR Tambo Airport, Gauteng to determine adequacy for decision making on the Amendment Application.
- Freshwater Resource Verification of the environmental assessment and authorisation process for the proposed mixed-use development on a portion of Portion 62 of the Farm Witportjie 117 IR.
- Freshwater Resource Ecological Assessment as part of the Environmental Assessment and Authorisation Process for the Proposed Upgrade of Culverts along Protea Road and Waarburgh Road, Western Cape.
- Freshwater Ecological Assessment as part of the Water Use License process for the Daybreak Chickens Abattoir in Delmas, Mpumalanga Province.
- Freshwater Ecological Assessment for the proposed Densification of the Residential Development on Portion 230 of the Farm Driefontein 87-ir also known as Germiston Extension 46, Germiston, Gauteng Province.
- Freshwater Resource Assessment as part of the Environmental Authorisation and Water Use Licence process for the Proposed Development on Portion 22 and 202 of the Farm Knopjeslaagte as well as Holding 23 of Timsrand AH, Gauteng Province.

- Freshwater Resource Verification as part of the Basic Assessment Process for the Proposed Development of a Mixed-Use Township of the Remaining Extent of Portion 54 of the Farm Rietfontein 189 IQ, Gauteng Province.
- Freshwater Resource Assessment as part of the Environmental Authorisation and Water Use Licence Application process for the Proposed Rondebult Outfall Sewer, Germiston, Gauteng Province.

Rehab Green cc
Registration No: 2002/094339/23

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Rehab Green
Environmental and Rehabilitation Monitoring Consultant cc

Report No: RG/2018/08/07/1
Date: 8 July 2019
Status: Edition 1

REPORT

Soil, land capability, land use and hydropedology assessment of the proposed Wonderfontein road diversion servitude

Requested By

Jaco-K Consulting (Pty) Ltd

Compiled By

Rehab Green Monitoring Consultants CC
Environmental and Rehabilitation Monitoring Consultant cc
P.I. Steenekamp (Cert.Sci.Nat.)

Declaration of Independence

I, Piet Steenekamp (ID 680211 5009 08 9), hereby declare that I have no conflict of interest related to the work of this report. Specially, I declare that I have no personal financial interests in the property and/or development being assessed in this report, and that I have no personal or financial connections to the relevant property owners, developers, planners, financiers or consultants of the development. I declare that the opinions expressed in this report are my own and a true reflection of my professional expertise.

Declaration of Professional Registration

I, Piet Steenekamp, hereby declare that I am registered at The South African Council for Natural Scientific Professions (Reg. No. 200032/04) as a Certificated Natural Scientist in terms of section 20(3)(c) of the Natural Scientific Professions Act, 2003 (Act 27 of 2003) in the following field of practice (Schedule 1 of the Act): Soil Science.

P.I. Steenekamp

CONTENTS

TABLES:

FIGURES:

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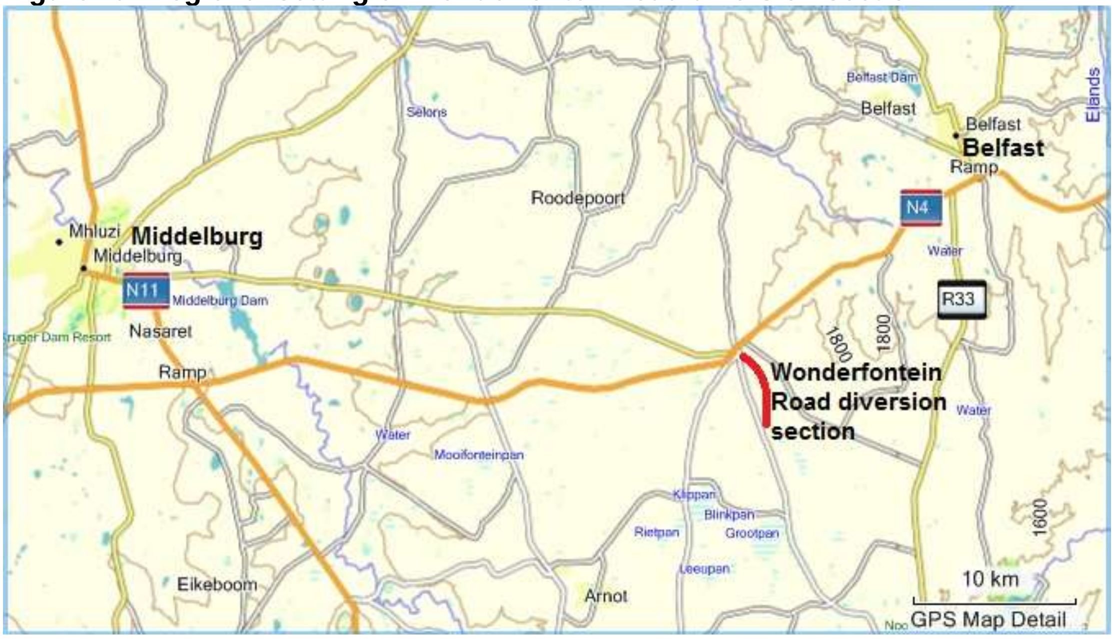
1. INTRODUCTION

1.1 Project background

The proposed Wonderfontein road diversion section is situated between Middelburg and Belfast on the eastern side of the unnumbered road stretching from Wonderfontein to Carolina in Mpumalanga province (Figure 1a). The proposed road diversion is due to the planned open pit mine across the existing road.

Figure 1a: Regional setting of Wonderfontein road diversion section



1.2 Applicable legislation

The study provides input to the Environmental Impact Assessment (EIA) as required in terms of the Mineral and Petroleum Resources Development Act (MPRDA), Act 28 of 2002 and the National Environmental Management Act (NEMA), Act 107 of 1998. The Acts require that pollution and/or degradation of the environment is to be avoided, or where either aspect cannot be avoided, is to be minimized and remedied.

1.3 Scope of work

Rehab Green Monitoring Consultants cc was appointed by Jaco-K Consulting (Pty) Ltd (Jaco-K) to conduct a detailed soil, land capability, land use and hydropedology assessment of the proposed road diversion servitude.

1.4 Study aims and objectives

Based on the scope of work the study objectives were to:

- Conduct a detailed soil assessment of the proposed road diversion footprint;
- Classify and map soil forms according to the South African Taxonomic Soil Classification System, 1991;
- Derive and map land capability based on soil properties;
- Identify soil properties related to wetness to enable the delineation of wetland or riparian zones based on guidelines of the Department of Water Affairs;

- Map all pre-mining/current land uses;
- Classify soil types according to their hydropedological behavior as recharge, interflow or responsive soils and describe the hydropedology of the mining site accordingly; and
- Determine all possible impacts by the proposed activities and provide associated mitigation measures.

1.5 Assumptions and limitations

The location and extent of the proposed study area was obtained from Jaco-K via email in electronic format and was assessed accordingly.

2. METHODOLOGY

2.1 Field preparation procedures

Geographic Information System (GIS) software from Esri (Environmental Systems Research Institute) called ArcGIS-ArcMap was used to generate spatial data and to store and process field data for map compilations.

Field observation points were generated along the centre line of the 40m wide proposed servitude at 150 m intervals. The coordinates of the observation points were calculated and loaded on a Geographic Positioning System (GPS) to accurately locate the position of the observation points in the field. The study area and field observation points were superimposed on Google Earth satellite imagery for the compilation of large scale field maps.

2.2 Field and soil classification procedure

The soils were investigated by means of auger holes at 150m intervals and to a maximum depth of 1 500 mm or to refusal. The soils were described and classified according to the South African Taxonomic Soil Classification System (Soil Classification Working Group, 2nd edition 1991). The system of soil classification is explained in Appendix A.

The following procedure was followed to note soil properties and classify soils accordingly:

i) Identify applicable diagnostic horizons by noting the physical properties such as:

- Effective depth (depth of soil suitable for root development);
- Colour (in accordance with Munsell colour chart);
- Texture (refers to the particle size distribution);
- Structure (aggregation of soil particles into structural units);
- Mottling (alterations due to continued exposure to wetness);
- Concretions (cohesion of minerals into hard fragments);
- Leaching (removal of soluble constituents by percolating water);
- Gleying (reduction of ferric oxides under anaerobic conditions, resulting in grey, low chroma soil colours); and
- Illuviation of colloidal matter from one horizon to another, resulting in the development of grey sandy E-horizons and grey clay G-horizons.

ii) Determine the appropriate soil Form and soil Family according to the above properties.

The soil properties that were used to map fairly homogeneous soil types are discussed in Appendix B.

2.3 Soil sampling and analyses

The A-horizons (0-250 mm) of the dominant soil types were sampled and analysed at the Institute for Soil, Climate and Water. The analyses were conducted according to methods set out in the Handbook of Standard Testing for Advisory Purposes (Soil Science Society of South Africa, 1990). The following analyses were conducted:

- Soil acidity (pH) in a 1:2.5 water solution;
- Extractable cations (Na, K, Ca and Mg) using the ammonium acetate method; and
- Phosphorus status according to the Bray 1 method.

2.4 Land capability assessment

Land capability was assessed according to the definitions outlined in the guidelines for the rehabilitation of mined land by the Chamber of Mines of South Africa and Coaltech Research Association (2007). Soil types were classified into the following categories for areas that exclude wetlands or riparian zones:

- Arable land;
- Grazing land; and
- Wilderness.

Criteria used for the above categories are given in Appendix F.

2.5 Dry land crop production potential

The classification of dry land crop production potential of soils was based on physical soil properties noted during auger observations, such as effective soil depth, texture, terrain unit, slope, soil wetness and disturbances. The effective soil depth and texture class are the main soil characteristics that determined the dry land crop production potential. The criteria applied for the classification of the crop production potential of soils are as follows:

- **High** – well-drained and moderately well-drained loamy sand to sandy clay loam soils with an effective depth deeper than 900 mm.
- **Moderate** - well-drained and moderately well-drained loamy sand to sandy clay loam soils with an effective depth of 600- 900 mm, including black clay soils with no signs of poor internal drainage in the lower soil profile.
- **Low** – shallow well-drained and moderately well-drained sandy or clay soils.
- **Very low** – Imperfectly to poorly drained, grey, sandy soils showing evidence of periodic percolating water tables, or black and grey clay soils showing evidence of poor internal drainage, any soils in extreme arid climatic conditions, shallow rocky areas, eroded areas or severely disturbed areas.

2.6 Wetland and riparian delineation

Wetland and riparian zones were delineated according to the practical field procedure for the identification and delineation of wetlands and riparian areas (Department of Water Affair and Forestry, 2005). Four indicators were used in the study to delineate wetland and riparian zones, namely:

- Terrain unit;
- Soil form;
- Soil wetness; and
- Wetland and riparian vegetation.

Further details on the delineation of wetland areas are included in Appendix C.

2.7 Land use mapping

The extents of land use practices were surveyed during the time of the soil assessment.

2.8 Erodibility evaluation

Erodiblity was broadly assessed based on soil texture, slope, chemical and physical stability usually inherent of the parent rock (geology) from which the soil originated.

Low: Soils with stable physical and chemical properties which occur on flat to gentle slopes to ensure low erosion susceptibility in the natural state. No or few erosion protection measures are necessary.

Moderate: Soils with low to moderately unstable physical or chemical properties or soils occurring on moderate to steep slopes. Sheet and rill erosion often occur in the natural state but may become severe when these soils are disturbed or due to any misuse such as overgrazing. Erosion protection measures are necessary.

High: Soils with unstable physical and/or chemical properties or soils occurring on very steep slopes. Rill and donga erosion often occur in the natural state and will become severe during any disturbance or misuse. Specialised erosion protection measures are necessary.

2.9 Map compilations

The field data was captured in shapefile format (shp) and processed and stored in a Geographic Information System called ArcGIS. The maps are compiled in a map extendable document format (mxd) and exported to Jpeg format. The shapefiles can be exported to a dxf or dwg format for CAD users. The shapefiles, dxf and dwg formats are available on request.

The maps were generated in a projected coordinate system using the longitude of origin (LO) coordinate system based on the 29° East meridian, WG1984 Ellipsoid and Hartebeesthoek 1994 Datum.

2.10 Methodology for rating of impacts

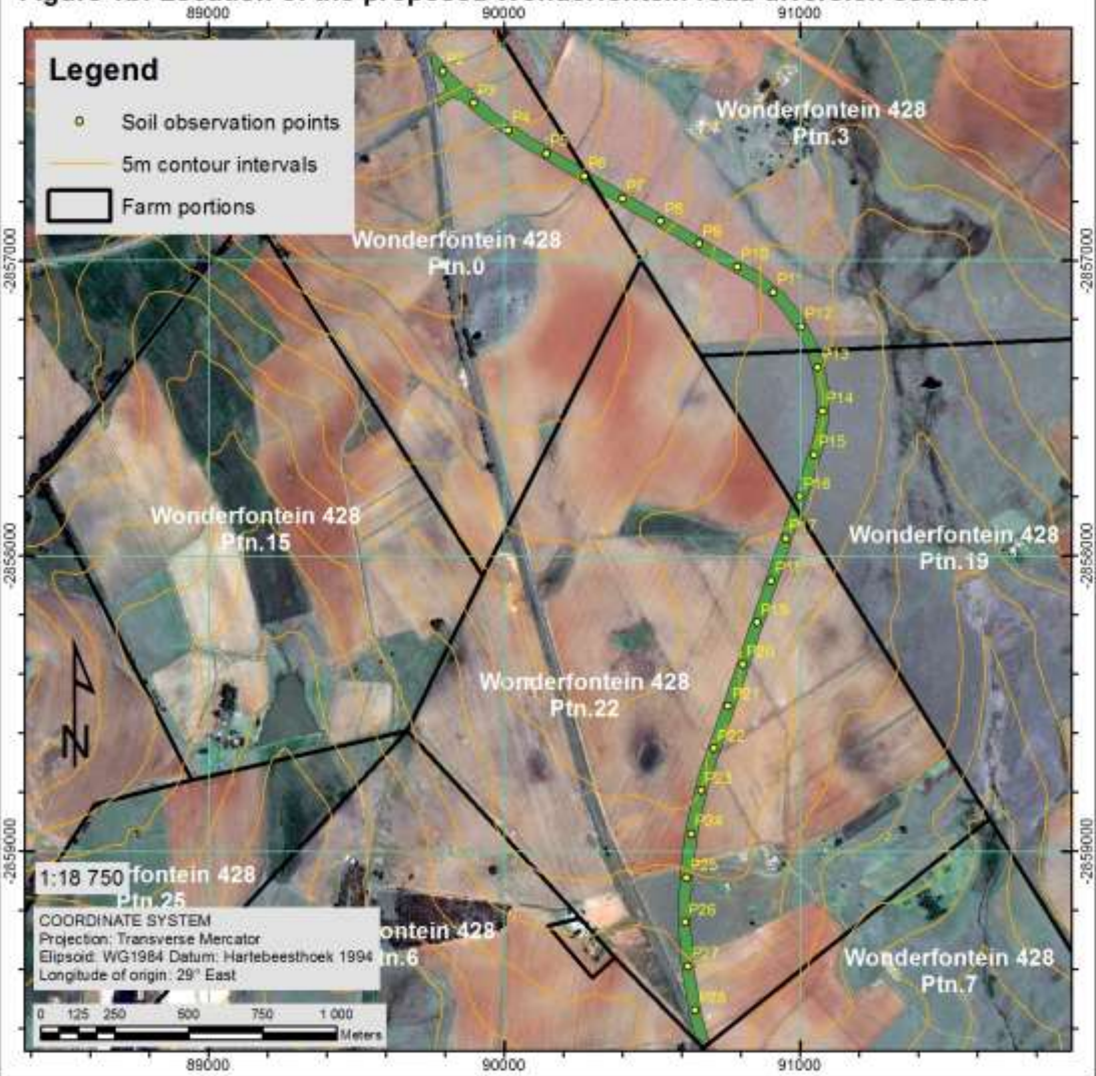
The methodology for rating of impacts is provided in Appendix G. The impacts are rated in a separate formulated Excel spreadsheet and the summary table is copied into this report in section 7. The Excel spreadsheet is available on request.

3. SURVEY RESULTS

3.1 Location of proposed road diversion section

The proposed road diversions servitude is 40m wide, stretches over a distance of 2.4 km and intersects portions 3, 19, 22 and the remaining extent of the farm Wonderfontein 428-JS (Figure 1b). The Figure also shows the positions of the auger observation points.

Figure 1b: Location of the proposed Wonderfontein road diversion section



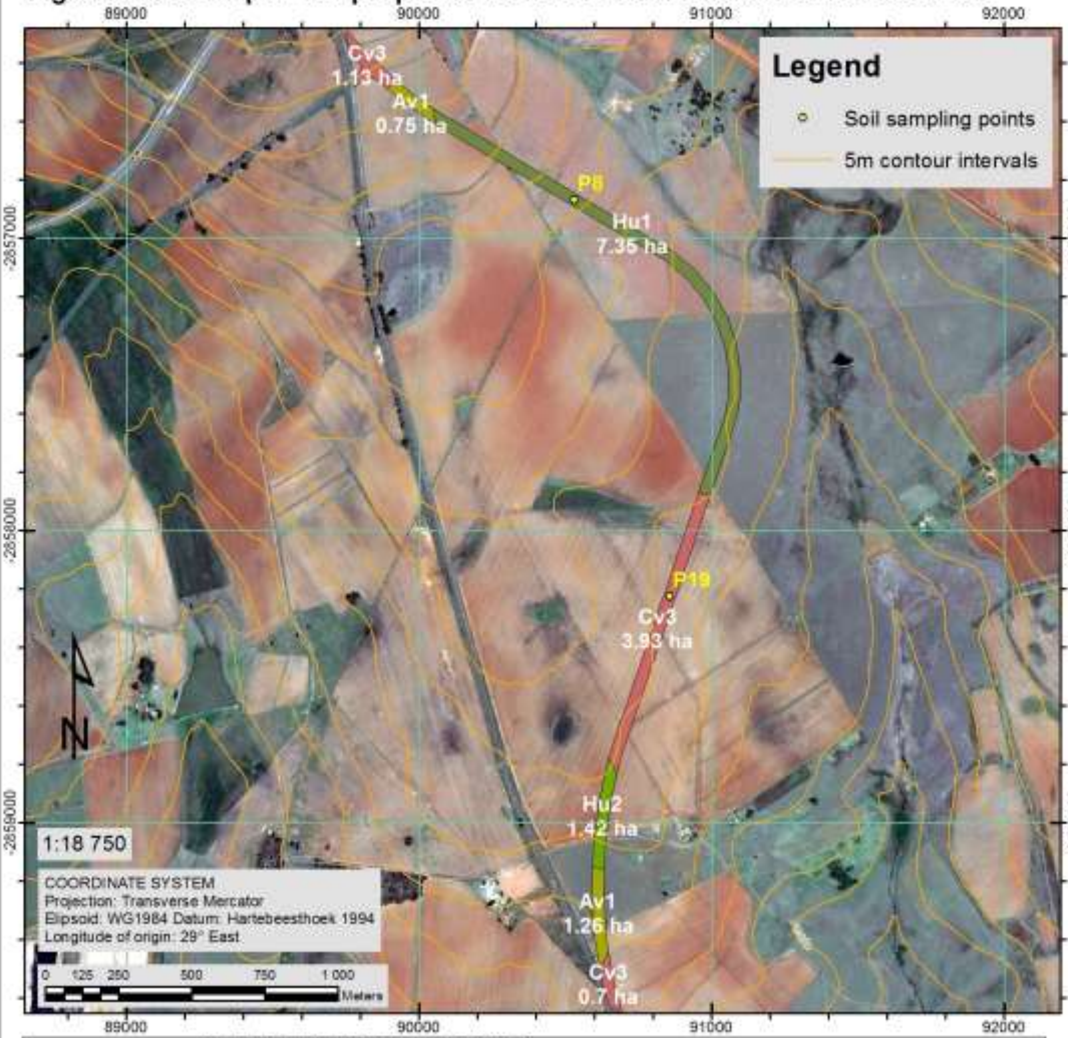
3.2 Dominant soil types

The filed survey was conducted during May 2019. Soil types within the proposed road servitude were mapped based on soil information gathered by means of auger observations at 150 meter intervals along the center line of the 40 m wide servitude. A total of 27 auger observations were made at pre-determined grid points in order to locate and accurately map soil boundaries.

A total of 4 homogeneous soil units, based on dominant soil form, effective soil depth, internal drainage, terrain unit and slope percentage were identified during field observations and were symbolised as Hu1, Hu2, Cv3 and Av1. The homogeneous soil units are referred to as soil types and are shown in Figure 2, which contains an abbreviated soil legend. A comprehensive soil legend is provided in Table 1, which described the soils in terms of the following aspects.

- Dominant soil forms and families and subdominant soil forms;
- The estimated clay content of the A and B horizons;
- A broad description of the dominant soil form and terrain in terms of the effective soil depth, internal drainage, soil colour, soil texture class, terrain unit and average slope percentage range;
- The derived erodibility class and dry land crop production potential;
- The land capability class, wetland and hydropedology zone classification; and
- The area and percentage comprised by each soil type.

Figure 2: Soil map of the proposed Wonderfontein road diversion servitude



ABBREVIATED SOIL LEGEND (for full legend refer to Table 1 of the soil report)

Soil Type Code	Dominant & subdominant Soil Form and Family	Summarized Description of Dominant Soil Forms in terms of effective depth, soil colour, soil texture and terrain unit	Land Capability	Hydro-pedology zone	Area (ha)	Area (%)
Hu1	*Hutton 2100 Bloemdal	Very deep (1400-1600+mm), red, apedal, well-drained, sandy loam to sandy clay loam soils, situated on gentle midslopes (2-3% slopes).	Arable	Recharge	47.06	11.44
Hu2	*Hutton 2100 Bloemdal, Bainsvley	Deep (900-1200 mm), red, apedal, well-drained, sandy loam to sandy clay loam soils, situated on gentle crests and footslopes (1-3% slopes).	Arable	Recharge	176.27	42.83
Cv3	*Clovelly 2100, Avalon, Glencoe	Moderately deep (600-1000 mm), yellow brown, apedal, well-drained, loamy sand to sandy loam soils, situated on gentle midslopes (2-3% slopes).	Arable	Recharge	18.05	4.38
Av1	*Avalon 2100 Clovelly, Glencoe	Moderately deep (700-1000 mm), yellow brown, moderately well-drained, loamy sand to sandy loam soils underlain by soft plinthite, situated on gentle midslopes (2-4% slopes).	Arable	Recharge	4.99	1.21
* Dominant soil form and family				Total	411.65	100.0

Table 1: Detailed soil legend

SOIL LEGEND										
Soil Type Code	Dominant & subdominant Soil Form and Family	% Clay per horizon A, E, G, B	Summarized Description of Dominant Soil Forms in terms of effective depth, soil colour, soil texture and terrain unit	Erodibility	Dry land crop production potential	Land Capability	Terrestrial / Wetland zone	Hydro-pedology zone	Area (ha)	Area (%)
Hu1	***Hutton 2100** Bloemdal	A: 15-20 B: 15-30	Very deep (1400-1600+mm), red, apedal, well-drained, sandy loam to sandy clay loam soils, situated on gentle midslopes (2-3% slopes).	Low	High	Arable	Terrestrial	Recharge	7.35	44.43
Hu2	***Hutton 2100** Bloemdal, Bainsvley	A: 12-18 B: 15-25	Deep (900-1200 mm), red, apedal, well-drained, sandy loam to sandy clay loam soils, situated on gentle crests and footslopes (1-3% slopes).	Low	High	Arable	Terrestrial	Recharge	1.42	8.60
Cv3	***Clovelly 2100,** Avalon, Glencoe	A: 10-15 B: 12-18	Moderately deep (600-1000 mm), yellow brown, apedal, well-drained, loamy sand to sandy loam soils, situated on gentle midslopes (2-3% slopes).	Low	Moderate	Arable	Terrestrial	Recharge	5.76	34.79
Av1	***Avalon 2100** Clovelly, Glencoe	A: 10-14 B: 12-18	Moderately deep (700-1000 mm), yellow brown, moderately well-drained, loamy sand to sandy loam soils underlain by soft plinthite, situated on gentle midslopes (2-4% slopes).	Low	Moderate	Arable	Terrestrial	Recharge	2.01	12.18
*** Dominant soil form and family**								**TOTAL**	**16.54**	**100.0**

3.2.1 Soil chemistry

The positions of the 12 soil sampling points are shown on Figure 2 and the coordinates are included in Appendix D, Table D1.

A sample of the A-horizon of different soil types was taken at 2 localities and the analytical results are shown in Table 2. The average values of the cations, potassium (K), calcium (Ca), magnesium (Mg) and sodium (Na) as well as phosphorus (P), pH and resistance (R_S) were calculated and highlighted in orange in Table 2.

Table 2: Soil chemical analyses

Samp Point	Soil Form	Hor	Depth	K mg/kg	Ca mg/kg	Mg mg/kg	Na mg/kg	*Titr.Acid	*Acid saturat.	R_S (resistance)	P (Bray1) mg/kg	pH (H_2O)
				Ammonium acetate				cmol(+)/kg	%	ohm		
Undisturbed red sandy clay soils												
P8	Hutton	A	0 - 200	60	458	105	3.4	-	-	2300	41.3	5.86
P19	Clovelly	A	0 - 200	53	458	85	3.5	-	-	2960	62.6	5.97
Average				**57**	**458**	**95**	**3.45**	-	-	**2630**	**52**	**5.92**
*Analyses done when pH is below 5.5												

3.2.2 Soil fertility status

The average concentration values of the cations (K, Ca, Mg and Na) as well as phosphorus, pH and resistance (highlighted in orange, Table 2) were compared to general fertility guidelines in Table 3.

Table 3: Soil fertility compared to broad fertility guidelines

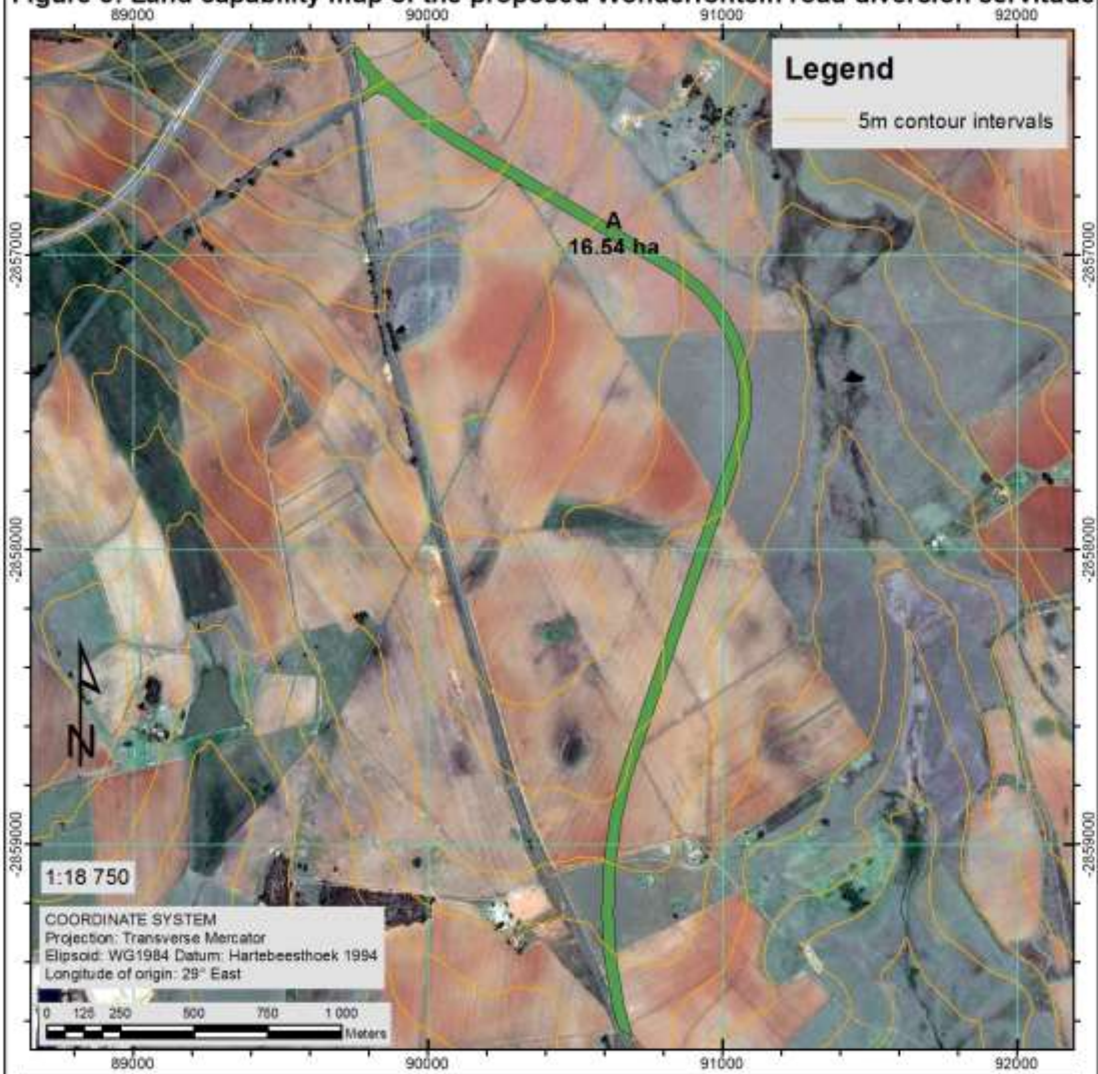
Element or measurement	Unit	Guidelines: Low	Guidelines: High	Current status rating: Median value	Current status rating: Rating	Preferred status
Potassium (K)	mg/kg	<40	>250	**57**	Low to moderate	80-150
Calcium (Ca)	mg/kg	<200	>3000	**458**	Low to moderate	600-1000
Magnesium (Mg)	mg/kg	<50	>250	**95**	Low to moderate	80-150
Ca:Mg (cmol(+)/kg)	Ratio	<2	>4	**2.9**	Ideal	2-4
Acid saturation	%	<10	>30	**-**	-	<20
Sodium (Na)	mg/kg	<50	>200	**3.45**	Low (positive in terms of sodicity)	<50
Resistance	ohm	<200	>300	**2630**	High (positive in terms of salinity)	>300
Phosphorus (P)	mg/kg	<5	>35	**52**	High	*10-20 **30-50
pH(H_2O)	Very acid Acid Moderately acid Neutral Moderately alkaline Alkaline		<=4.9 5.0-5.9 6.0-6.8 6.8-7.2 7.2-8.1 >=8.2	**5.92**	Acid to moderately acid	5.8-6.8
* pastures ** crop farming						

The average K, Ca and Mg concentrations are low to moderate and indicate a fairly fertile chemical status in terms of cations. The average Na concentration of 3.45 mg/kg is low (which is positive) and indicates no accumulation of sodium in the soil profile and implies an absence of sodic soil conditions. The high average resistance value of 2630 ohm confirms low salt concentrations and subsequent the absence of saline soil conditions. The average P concentration of 52 mg/kg is high and indicates a very well build-up status by fertilizers. The average ration of Ca to Mg is 2.9 and indicates sufficient concentrations of Ca to buffer the destabilization effect of Mg on soil structure.

3.3 Land Capability classes and wetland delineation

The location and extent of land capability and wetland classes is shown in Figure 3 and summarized in Table 4. Land capability was assessed in categories of arable land, grazing land, wetlands and wilderness land. Wetland zones were therefore delineated as part of the soil and land capability assessment, based on soil properties.

Figure 3: Land capability map of the proposed Wonderfontein road diversion servitude



LEGEND: LAND CAPABILITY AND WETLAND DELINEATION						
Land Capability Code	**Land Capability Class**	***Soil Types**	**Broad Soil Description**	**Unit Count**	**Area (ha)**	**Area (%)**
A	Arable	Hu1, Hu2, Cv3 and Av1	Moderately deep to very deep yellow brown and red, loamy sand to sandy clay loam soils	1	16.54	100.0
G	Grazing	-	-	0	0	0
W	Wetland	-	-	0	0	0
WDN	Wilderness	-	-	0	0	0
*See soil map, Figure 2			**Total**	1	16.54	100.0

The land capability and wetland classes is summarized in Table 4, which shows the soil types that are grouped into each land capability class, a broad description of the soil group, the number of units per land capability class and the area and percentage comprised by each land capability or wetland class.

Table 4: Land capability and wetland classes

LEGEND: LAND CAPABILITY AND WETLAND DELINEATION						
Land Capability Code	**Land Capability Class**	***Soil Types**	**Broad Soil Description**	**Unit Count**	**Area (ha)**	**Area (%)**
A	**Arable**	Hu1, Hu2, Cv3 and Av1	Moderately deep to very deep yellow brown and red, loamy sand to sandy clay loam soils	1	16.54	100.0
G	**Grazing**	-	-	0	0	0
W	**Wetland**	-	-	0	0	0
WDN	**Wilderness**	-	-	0	0	0
*See soil map, Figure 2			**Total**	**1**	**16.54**	**100.0**

3.3.1 Derived dry land crop production potential and long term potential yields

The dry land crop production potential and potential crop yields was estimated based on soil properties and an annual precipitation of 650-750 mm and is summarised in Table 5.

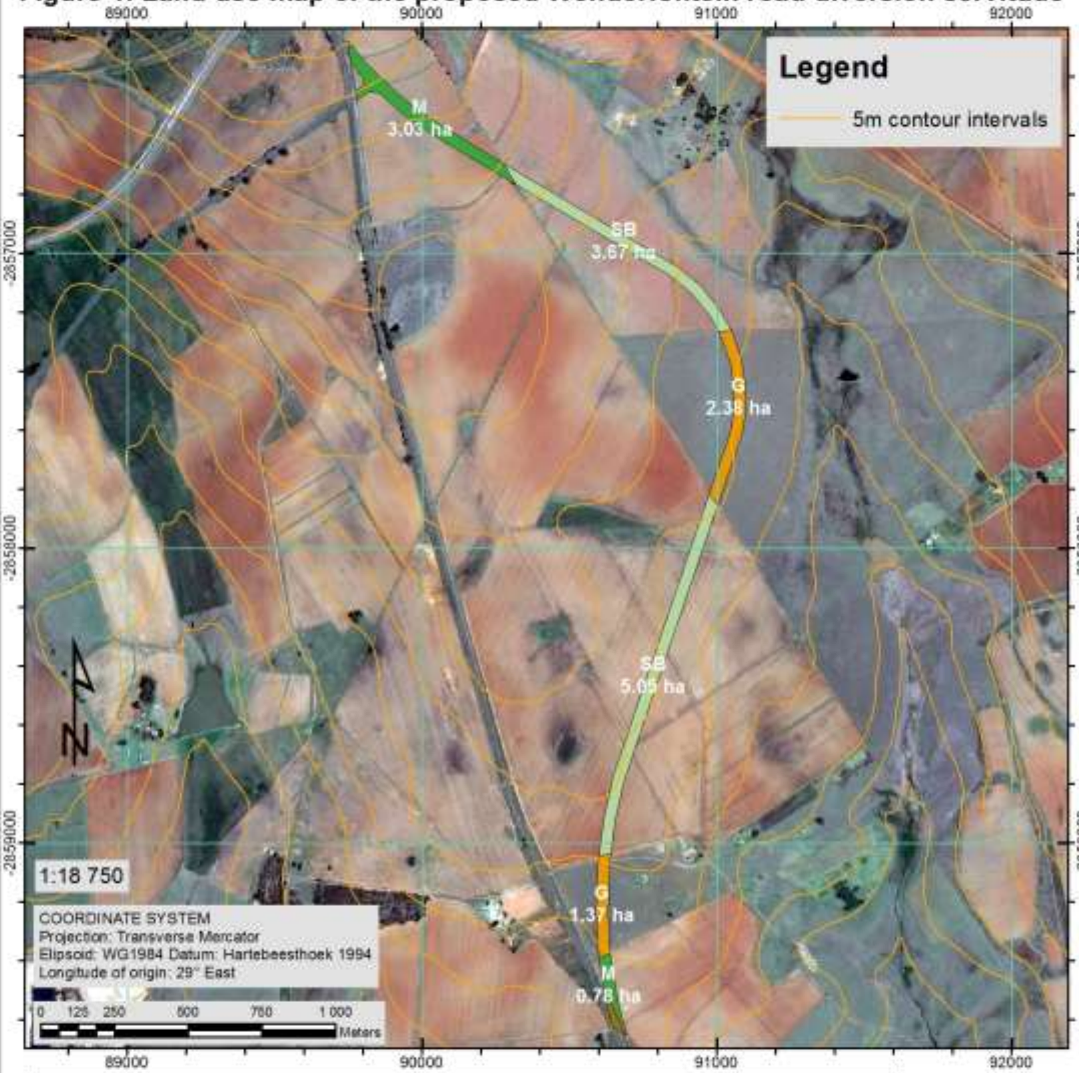
Table 5: Derived dry land crop potential and long term potential yields

Soil Type Code	Dry land crop production potential class	Potential long term yields (t/ha/a)	
		Maize	**Soybeans**
Hu1, Hu2	High	5-7	1.8-2.5
Cv3, Av1	Moderate	3-5	1.5-2.0

3.4 Current land uses

The extents of current land uses are shown in Figure 4 and are summarized in Table 6.

Figure 4: Land use map of the proposed Wonderfontein road diversion servitude



LEGEND – PRE-MINING LAND USE				
Land Use Code	Pre-mining Land Use	Unit Count	Area (ha)	Area (%)
M	Maize	2	3.81	23.00
SB	Soybeans	2	8.72	52.68
G	Grazing	2	3.75	22.63
R	Tar road	1	0.28	1.69
	TOTAL	**7**	**16.56**	**100.0**

Table 6: Current land uses

LEGEND – PRE-MINING LAND USE				
Land Use Code	**Pre-mining Land Use**	**Unit Count**	**Area (ha)**	**Area (%)**
M	Maize	2	3.81	23.00
SB	Soybeans	2	8.72	52.68
G	Grazing	2	3.75	22.63
R	Tar road	1	0.28	1.69
	TOTAL	**7**	**16.56**	**100.0**

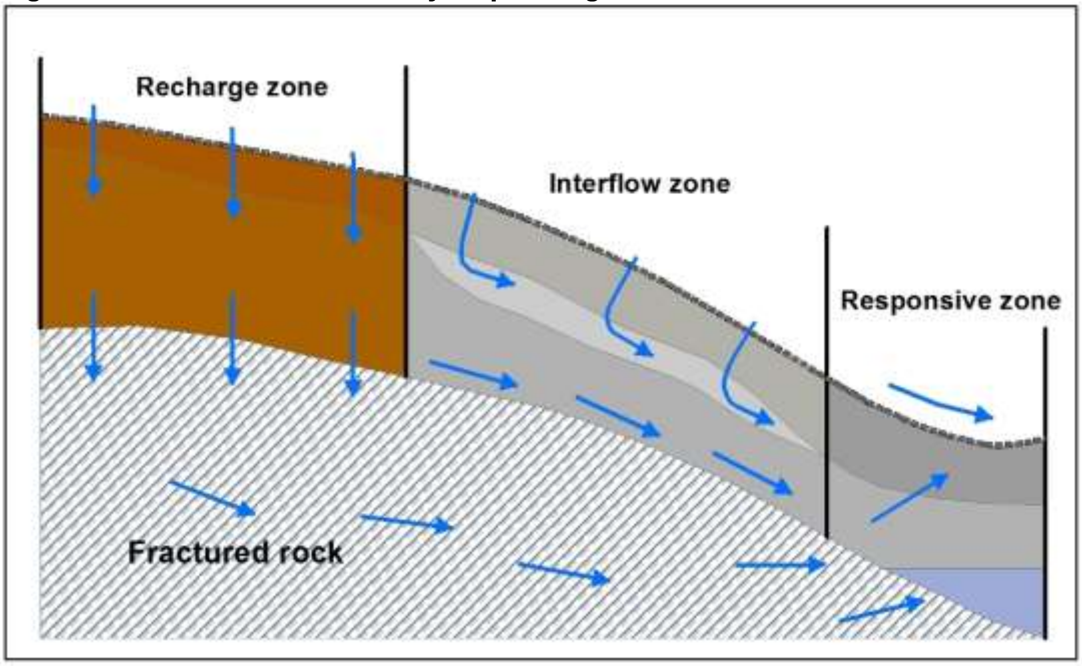
4. HYDROPEDOLOGICAL ASSESSMENT

4.1 Basics of hydropedology

The hydropedological behaviour of soils can be grouped into the following three hydropedological zones as illustrated in Figure 5 and summarised in Table 7:

- *Recharge zone* characterised by vertical infiltration through the soil profile and weathered subsoil strata and lateral flow at the bedrock interface during the rainy season;
- *Interflow zone* characterised by lateral flow in higher permeable layer(s) in the soil profile underlain by lower permeable soil/subsoil material; and
- *Responsive zone* characterised by saturated and near saturated conditions of the soil profile for most of the year and exfiltration (return flow) of upslope interflow flow during the rainy season.

Figure 5: Zones based on soil hydropedological behaviour[1]



Note 1: Figure presented by van Tol, le Roux and Lorentz, 2017.

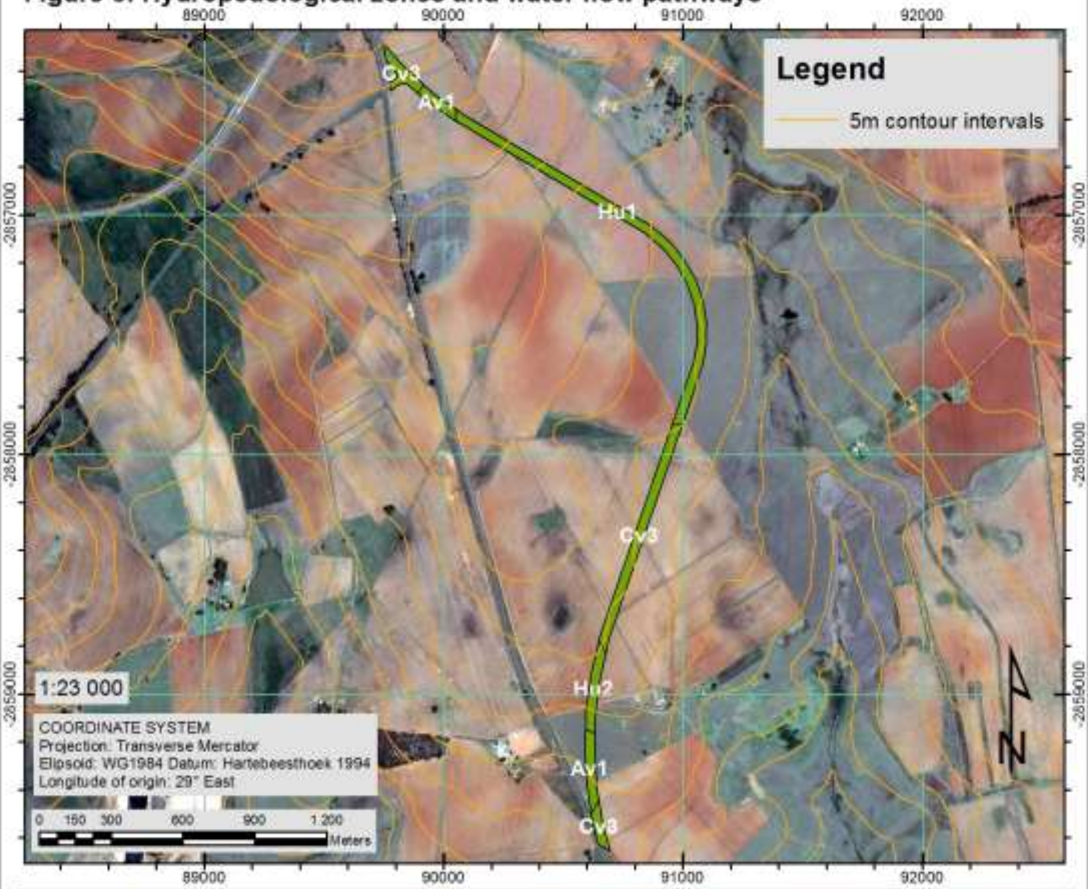
Table 7: Hydropedological zones

<table>
<tr><th rowspan="3">Hydro-pedological zone</th><th colspan="4">Hydropedological behaviour / dominant flow mechanism</th><th rowspan="3">Wetland system</th></tr>
<tr><th rowspan="2">Soil profile</th><th colspan="3">Vadose zone (zone between ground surface and groundwater table)</th></tr>
<tr><th>Weathered subsoil strata</th><th>Bedrock</th><th>Perched aquifer</th></tr>
<tr><td>Recharge</td><td>High surface infiltration
Vertical infiltration through well-drained soil profile</td><td>Vertical infiltration through weathered subsoil strata</td><td>Lateral flow of deep infiltration above low permeable / impermeable bedrock</td><td>Perched aquifer develops above bedrock during or after prolonged wet periods</td><td>Terrestrial</td></tr>
<tr><td>Interflow</td><td>Vertical infiltration through surface horizon
Lateral flow in high permeable E-horizon (2nd soil horizon)
Restricted vertical flow through lower permeable 3rd soil horizon (G- or B_2 horizon) or fluctuating water table in 3rd soil horizon (soft plinthic)</td><td>Restricted vertical flow through low permeable subsoil strata</td><td>Lateral flow of deep drainage and lateral flows from upslope soils above low permeable / impermeable bedrock</td><td>Thicker perched aquifer develops into weathered subsoil strata during wet season with additional recharge from upslope soil and/or subsoil weathered strata</td><td>Temporary
Seasonal</td></tr>
<tr><td>Responsive</td><td>Reduced infiltration into soil and exfiltration (return flow) of up-gradient perched aquifer during wet periods
Restricted vertical infiltration through low permeable subsoil</td><td>Restricted vertical flow through low permeable subsoil strata
Strata saturated or near saturated throughout year</td><td>Lateral flow into ephemeral stream and/or increased surface exfiltration (return flow) with shallow bedrock</td><td>Relative shallow perched aquifer during dry season
Perched aquifer develops to ground surface and exfiltrate (return flow) during wet periods</td><td>Permanent</td></tr>
</table>

4.2 Hydropedological zones

The detailed soils map (Figure 2), was used to class the soil types according to their hydropedology as a recharge, interflow or responsive soil. Figure 6 shows the hydropedological zones and associated soil types. Table 8 summarizes the soil types within the recharge, interflow and responsive zones and also describe the water flow pathways of each soil type.

Figure 6: Hydropedological zones and water flow pathways



Legend: Soil types within hydropedological zones intersected by proposed open pit and infrastructure areas

Hydropedological zones	Soil Type Code	Dominant & subdominant Soil Form and Family	Summarized description of dominant soil type, effective depth, colour, texture, internal drainage, terrain and slope percentage range	Wetland/Terrestrial zone	Wetness indicators (wetness within 500 mm)	Water flow pathways
Recharge soils	Hu1	***Hutton 2100** Bloemdal, Bainsvley	Moderately deep to very deep (900-1600+ mm), red to dark red, well-drained, sandy loam to clay loam soils, underlain by highly weathered rock. Situated on gently sloping crests, midslopes and footslopes (1-3% slopes).	Terrestrial	Well-drained soil profile - no signs of wetness	Mainly vertical through soil profile and weathered subsoil strata to flow limiting bedrock. Lateral flow at interface of bedrock and weathered subsoil strata
	Hu2					
	Cv3	**Clovelly 2100,** Avalon, Glecoe	Moderately deep (600-1000 mm), yellow brown, apedal, well-drained, loamy sand to sandy loam soils, situated on gentle midslopes (2-3% slopes).			
	Av1	***Avalon 2100** Clovelly, Glencoe	Moderately deep (700-1000 mm), yellow brown, moderately well-drained, loamy sand to sandy loam soils underlain by soft plinthite, situated on gentle midslopes (2-4% slopes).	Terrestrial	Well-drained upper soil profile - Signs of wetness below 500 mm in plinthic horizon	Mainly vertical through soil profile and weathered subsoil strata to flow limiting bedrock. Somewhat restricted in soft plinthic B2-horizon. Lateral flow at interface of bedrock and weathered subsoil strata
Interflow soils	None	-	-	-	-	-
Responsive soils	None	-	-	-	-	-

*Dominant soil form and family

Table 8: **Soil types and water flow pathways within hydropedological zones**

Legend: Soil types within hydropedological zones intersected by proposed open pit and infrastructure areas						
Hydropedological zones	**Soil Type Code**	**Dominant & subdominant Soil Form and Family**	**Summarized description of dominant soil type, effective depth, colour, texture, internal drainage, terrain and slope percentage range**	**Wetland/Terrestrial zone**	**Wetness indicators (wetness within 500 mm)**	**Water flow pathways**
Recharge soils	**Hu1**	***Hutton 2100** Bloemdal, Bainsvley	Moderately deep to very deep (900-1600+ mm), red to dark red, well-drained, sandy loam to clay loam soils, underlain by highly weathered rock. Situated on gently sloping crests, midslopes and footslopes (1-3% slopes).	Terrestrial	Well-d rained soil profile - no signs of wetness	Mainly vertical through soil profile and weathered subsoil strata to flow limiting bedrock. Lateral flow at interface of bedrock and weathered subsoil strata
	Hu2					
	Cv3	**Clovelly 2100,** Avalon, Glecoe	Moderately deep (600-1000 mm), yellow brown, apedal, well-drained, loamy sand to sandy loam soils, situated on gentle midslopes (2-3% slopes).			
	Av1	***Avalon 2100** Clovelly, Glencoe	Moderately deep (700-1000 mm), yellow brown, moderately well-drained, loamy sand to sandy loam soils underlain by soft plinthite, situated on gentle midslopes (2-4% slopes).	Terrestrial	Well-d rained upper soil profile - Signs of wetness below 500 mm in plinthic horizon	Mainly vertical through soil profile and weathered subsoil strata to flow limiting bedrock. Somewhat restricted in soft plinthic B2-horizon. Lateral flow at interface of bedrock and weathered subsoil strata.
Interflow soils	None	-	-	-	-	-
Responsive soils	None	**-**	-	-	-	-
***Dominant soil form and family**						

4.2.1 Impact of structures on soils and site hydropedology

Figure 6 shows that the total planned structure (tar road) resides in the recharge hydropedological zone and interflow and responsive zones and not intersected anywhere. The planned structures will therefore have no reduction in water quantities to the nearby wetlands via lateral flow within the soil profile.

5. REHABILITATION / MITIGATION

The soil horizons and properties influencing stripping and stockpiling procedures are discussed in Appendix E.

5.1 Handling of topsoil from construction to decommissioning phase

Handling of topsoil from construction to decommissioning phase should be based on the following principles. **However, some deviation of the principles may take place in order to accommodate the engineering design and requirements for each specific structure.**

5.1.1 Procedures for structures not involving coalliferous or discard ore material such as roads, explosives magazines, buildings, parking areas:

- The engineering design of some of these structure may require removal of a thin soil layer and others not. All topsoil which might be removed for the foundations of these structures should be stored for later rehabilitation.
- During the decommissioning phase the footprint should be thoroughly cleaned.
- The footprint should be ripped to alleviate compaction
- Stored topsoil should be replaced (if any) and the footprint graded to a smooth surface.
- The topsoil should be ameliorated according to soil chemical analysis.
- The footprint should be re-vegetated with a grass seed mixture.

5.1.2 Soil amelioration and re-vegetation

- After replacement and levelling of topsoil the soil fertility status should be determined by soil chemical analysis (before seeding/re-vegetation).
- Soil amelioration should be done according soil analyses as recommended by a soil specialist, in order to correct the pH and nutrition status before re-vegetation.
- The footprint should preferably be re-vegetated with a grass seed mixture and the soil stability and erosion should be monitored.
- Re-vegetation should be done as soon as possible and preferably in spring and early summer to stabilize the soil and prevent soil loss during the rainy season.
- A short term fertilizer program should be based on the soil chemical status after the first year in order to maintain the fertility status for 2 to 3 years after rehabilitation until the area can be declared as self-sustaining.

6. CONCLUSION

Soils and land capability

The total proposed servitude footprint (16.54 ha) consists of moderately deep to deep, well-drained, non-structured, red and brownish yellow soils (soil types Hu1, Hu2, Cv3 and Av1), which were classed as **arable** land with moderate to high agricultural potential.

No soil types occurred in **grazing**, **wetland** or **wilderness** land capability classes.

Current land use

The majority of the study area is utilized for agriculture where currently maize occupies 23% and soybeans 52.68% of the footprint. The remaining 22.63% (3.75 ha) is utilized for grazing purposes and the tar road occupies 1.69% (0.28 ha).

Hydropedology

Figure 6 shows that the total planned structure (tar road) resides in the recharge hydropedological zone and interflow and responsive zones and not intersected anywhere. The planned structures will therefore have no reduction in water quantities to the nearby wetlands via lateral flow within the soil profile.

Impact assessment

All identified impacts on soils, land capability and land use can be mitigated to acceptable levels (Table 10)

7. ENVIRONMENTAL IMPACT ASSESSMENT

The environmental impacts in terms of soils, land capability and land use for the construction, operational and decommissioning phases including mitigation measures is compiled and rated in a formulated MS Excel spreadsheet. The methodology for rating of impacts is provided in Appendix G. The summary table of the spreadsheet is copied and paste below (Table 10).

Table 9: Summary of impact assessment

Code	Impact	Pre-mitigation: Duration	Pre-mitigation: Extent	Pre-mitigation: Intensity	Pre-mitigation: Consequence	Pre-mitigation: Probability	Pre-mitigation: Significance	Recommended mitigation	Post-mitigation: Duration	Post-mitigation: Extent	Post-mitigation: Intensity	Post-mitigation: Consequence	Post-mitigation: Probability	Post-mitigation: Significance
1	Compaction and sterilisation of undisturbed topsoil underneath tar road	Long-term	Site-specific		Moderately detrimental	Certain	Moderate - negative	- Contain the tar road extent to the smallest required size; - Remove the tar road (if ever) as soon as it is not used anymore; - After removal of the road, the surface should be thoroughly cleaned and non-soil materials should be removed to a suitable disposal facility; - The cleaned footprint should be deep cross-ripped to alleviate compaction caused during construction of the road and traffic thereafter; - Ripping to be done when the soil is dry to maximise the loosening effect of ripping and reduce re-compaction; - The soil should then be ameliorated according to soil chemical analysis of samples taken after replacement; - The footprint should be re-vegetated with a grass seed mixture.	Short-term	Site-specific	Low - negative	Negligible	Certain	Low - negative
2	Topsoil contamination with hydrocarbons and chemical	Medium-term	Site-specific	Moderate - negative	Slightly detrimental	Fairly likely	Low - negative	- Prevent any spills from occurring as far as possible; - If a spill occurs it is to be cleaned up immediately and	Short-term	Site-specific	Low - negative	Negligible	Fairly likely	Very low

	compounds from mechanical equipment							reported to the appropriate authorities; - Contaminated soil should be disposed at a suitable disposal facility; - All vehicles are to be serviced in a correctly bunded area or at an off-site location; and - Leaking vehicles will have drip trays place under them where until repaired.						
3	Cease in land capability at road footprint during mine constructio n and operation	Long-term	Site-specif ic	Very high - negativ e	Highly detrimental	Certain	High - negative	- No mitigation of loss in land capability is possible during the construction and operational phase as the land use is changed from agriculture to structures that prohibit any land capability; - Mitigation of land capability loss during decommissioning/rehabil itation phase includes: - Closure plan to specify clear targets on medium to long term post mining land capability influencing possible land uses - Soil quality be investigated through representative sampling and laboratory analysis, analytical results evaluated by qualified expert, and soil fertility be corrected prior to establishing vegetation on rehabilitated soil;	Short-term	Site-specif ic	Modera te - negativ e	Slightly detrimental	Certain	Low - negative
4	Cease in current land use at	Long-term	Site-specif ic	Very high - negativ	Highly detrimental	Certain	High - negative	- No mitigation of change in current land use is possible during	Short-term	Site-specif ic	Modera te - negativ	Slightly detrimental	Certain	Low - negative

	road footprint during mine construction and operation			e				the construction and operational phase as the land use is changed from agriculture to structures that prohibit any other land use. - Mitigation of loss in current land use during decommissioning/rehabilitation phase includes: * Closure plan to specify clear targets on medium to long term post mining land capability influencing land use.			e			
5	Cease in agricultural production at road footprint during mine construction and operation	Long-term	Site-specific	Very high - negative	Highly detrimental	Certain	High - negative	- No mitigation of loss in agricultural production is possible during the construction and operational phase as the land use is changed from agriculture to structure that prohibit any agriculture. - Mitigation of loss in agricultural production potential during decommissioning/rehabilitation phase includes: * Closure plan to specify clear targets on medium to long terms post mining land capability to re-instate broad pre-mining land capability class (arable land) * Find ways of rendering land rehabilitated to arable standards suitable for the economic production of cash crops in support of national food security.	Short-term	Site-specific	Moderate - negative	Slightly detrimental	Certain	Low - negative

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APPENDIX A
SOIL CLASSIFICATION SYSTEM

The classification system categorizes soil types in an upper soil Form level which is subdivided into a number of lower Family levels. Each soil Form (higher level) is defined by a unique vertical sequence of soil horizons with specific defined properties. The soil Families (lower level) are a subdivision of the soil Form (higher level), differentiated on the basis of specific characteristics such as leaching status, calcareousness, structure types and sizes etc.

In this way, standardised soil identification and communication is allowed by use of soil Form names and family numbers or names e.g. Hutton 2100 or Hutton Hayfield. The soil Form and soil Family together are referred to as soil types.

The soil Forms are indicated by the name and the Family by its appropriate number e.g. Hutton 2100. The soil Form and Family are then symbolized e.g. Hu and referred to as soil type Hu. The soil Form and Family are often further categorized based on effective soil depth, terrain unit and slope and a numerical number is added to the symbol e.g. Hu1. For example, where the Hutton 2100 soil Form and Family occurs at an effective depth of 900-1200 mm, it is symbolized and referred to as soil type Hu1, and where this soil Form and Family occurs at an effective depth of 600-900 mm it is symbolized and referred to as soil type Hu2.

APPENDIX B
SOIL PROPERTIES AND CHARACTERISTICS

Various terms in the soil legend are used to describe a series of soil properties and characteristics such as the dominant soil Form and Family, effective soil depth, internal drainage, and clay content per soil horizon and texture class.

1. Effective soil depth

Effective soil depth can be considered as the depth freely permeable to plant roots and water. Effective soil depth categories used in the soil legend are as follows:

Very shallow	< 300mm
Shallow	300-600 mm
Moderately deep	600-900 mm
Deep	900-1500 mm
Very deep	> 1500 mm

2. Internal drainage

Internal drainage is the flow of water (annual precipitation) through the soil profile. Soils with the ability to drain annual precipitation though the profile without waterlogged periods within certain parts of the profile are called **well-drained** soils. Soils which lack this ability will display properties indicating temporary to permanent water logged conditions in parts of the soil profile in the form of mottling, leaching or gleying.

Moderately well-drained soils mostly display impeded internal drainage in the lower profile e.g. soft plinthic horizons, which is the result of periodically fluctuating water tables which are characterized by mottling and accumulation of iron and manganese oxides.

Imperfectly drained soils mostly display impeded internal drainage in the upper and lower parts of the profile e.g. E and plinthic horizons, which is the result of periodic lateral flow of water in the profile and fluctuating water tables. Such soils are characterized by grey, leached, sandy horizons and mottled plinthic horizons.

Poorly drained soils mostly display impeded internal drainage in the upper and lower parts of the soil profile e.g. E, plinthic and G-horizons and are the result of long term to permanent wetness in the soil profile, which is characterized by grey, leached, sandy horizons, mottled plinthic horizons and gleyed clay horizons.

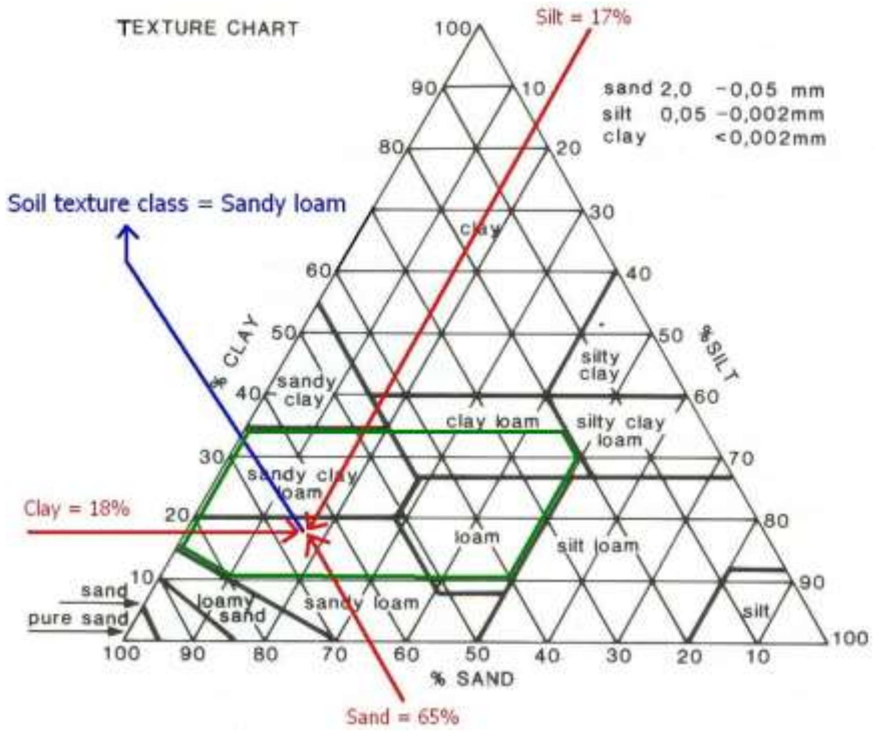
3. Texture class

Soil texture refers to the relative proportions of the various particle size separates in the soil. Particle sizes are defined in the following **fractions**.

Sand – (2.0 – 0.05 mm)
Silt – (0.05 – 0.002 mm)
Clay – (< 0.002 mm)

The relative proportions of these 3 fractions (as illustrated by the red arrows in Figure B1) determines 1 of 12 soil texture classes e.g. sandy loam, loam, sandy clay loam etc. The different texture class zones are demarcated by the thick black lines in the diagram. The green zone can be used as a guideline for moderate to high agricultural potential, but needs to be evaluated together with other soil properties.

Figure B1: Soil texture chart



APPENDIX C
WETLAND DELINEATION

1. Legal framework

In order to determine the existence and extent of a wetland in the proposed mining area the legal framework on what classifies as a wetland should be applied. The National Water Act, 1998 (Act 36 of 1998), (NWA), includes a wetland in the definition of a watercourse. A watercourse is:

- *"a river or spring;*
- *a natural channel in which water flows regularly or intermittently;*
- *a wetland, lake or dam into which, or from which, water flows, and*
- *any collection of water which the Minister may, by notice in the Gazette, declare to be a watercourse."*

A wetland is then further defined by the NWA as *"land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil".*

Based on the above definition, the Department of Water Affairs and Forestry (DWAF), now the Department of Water Affairs (DWA), published a set of guidelines describing field indicators and methods for determining whether an area is a wetland or riparian area, and for finding its boundaries (DWAF, 2005). These guidelines state that wetlands must have one or more of the following attributes:

- *Wetland (Hydromorphic) soils* that display characteristics resulting from prolonged saturation;
- The presence, at least occasionally, of *water loving plants (hydrophytes)*; and
- A *high water table* that results in saturation at or near the surface, leading to anaerobic conditions developing in the top 50cm of the soil.

Based on the NWA definition of a wetland, four indicators were identified within the DWAF (2005) guidelines to assist in identifying wetland areas:

- *Terrain Unit Indicator*. The topography of the area is usually used to determine where in the landscape the wetland is likely to occur.
- *Soil Form Indicator*. Certain soil forms, as defined by the Soil Classification Working Group (1991), are associated with prolonged and frequent saturation.
- *Soil Wetness Indicator*. The soil wetness indicator identifies the morphological "signatures" developed in the soil profile as a result of prolonged and frequent saturation.
- *Vegetation Indicator*. The vegetation indicator identifies hydrophilic vegetation associated with frequently saturated soils.

2. Processes in wetland soils and associated properties

The following processes normally take place under anaerobic/saturated or so-called wetland conditions:

- Mottling (localized colouring and alterations due to continued exposure to wetness);
- Concretions (accumulation and cohesion of minerals into hard fragments).
- Leaching (removal of soluble constituents by percolating water);
- Gleying (reduction of ferric oxides under anaerobic conditions resulting in grey, low chroma soil colours); and
- Illuviation of colloidal mater from one horizon to another, resulting in the development of grey sandy E-horizons and grey clay G-horizons.

These processes usually result in soil properties which provide undisputable evidence of temporary to permanent wetness such as:

Dark grey coloured A-horizons

The A-horizon is the upper 200-300 mm of the soil profile and is usually defined by a slightly darker colour due to a greater or lesser amount of humified organic matter. The dark grey A-horizon is common to almost all the soils found in permanent and seasonal zones. The dark grey colour usually appears only in the moist state and rapidly fades in to a plain grey colour when it dries out. The dark appearance is due to higher organic carbon content which builds up under the long term moist conditions in a wetland system. The carbon and also fine organic matter loses its dark colour in the dry state and the grey colour of the soil particles becomes prominent. The grey soil colour is the result of the removal of soluble constituents (iron oxides, silicate clay) by percolating water. The dark grey A-horizon is common in permanent, seasonal and temporary wetland zones.

Grey to pale grey E-horizons

The E-horizon underlies the A-horizon, having a lower content of colloidal matter (clay, sesquioxides, organic matter) usually reflected by a pale colour and a relative accumulation of quartz and/or other resistant minerals of sand or silt sizes. The E-horizon develops under high lateral flow (permanent or periodic) of water in the soil profile, which removes some colloidal matter to the lower soil profile and some further down the wetland system. The E-horizon is thus the flow path for shallow groundwater in the wetland zone. The grey and pale grey E-horizon is common in permanent and seasonal wetland zones and less common in temporary zones.

Yellowish grey E-horizons

The colour of the E-horizon reflects the intensity of removal of colloidal matter from the horizon. This results in the phenomenon that some E-horizons have a yellowish colour in the moist state but become grey in the dry state. The yellowish colour in the moist state is due to an incomplete covering of the mineral soil particle by ferric oxides and indicates a less leached state and less anaerobic (saturated conditions) conditions. The yellowish E-horizons are therefore strongly related to temporary wetland zones and occur less in seasonal or permanent wetland zones.

Plinthic horizons

Plinthic horizons are characterised by localization and accumulation of iron and manganese oxides under conditions of a fluctuating water table, resulting in distinct reddish brown, yellowish brown and/or black mottles, with or without hardening to form sesquioxide concretions. Plinthic horizons are the result of fluctuating water tables which implies wetter and dryer phases and are therefore found commonly in seasonal and temporary wetland zones and less in permanent wetland zones.

G-horizons

Gleying is the process of reduction of ferric oxides and hydrated oxides under anaerobic conditions, resulting in grey, low chroma matrix colours. This usually goes along with clay illuviation from the upper horizon which results in a grey clay horizon and is called a G-horizon. G-horizons are commonly found in permanent wetland zones, occasionally in seasonal zones and rarely in temporary wetland zones.

APPENDIX D
COORDINATES OF SOIL SAMPLING POINTS

Table D1: Coordinates of soil sampling points

Coordinates of Soil Sampling Points				
Soil sampling point	Projected Coordinate System LO 29, Wgs 1984, Hartebeesthoek 1994		Geographic Coordinate System Wgs 1984, Hartebeesthoek 1994	
	X (m)	Y (m)	X/Lat (dd)	Y/Long (dd)
P8	90530.0	-2856868.3	-25.816974	29.902818
P19	90855.3	-2858225.4	-25.829201	29.906155

APPENDIX E
SOIL HORIZON PROPERTIES INFLUENCING STRIPPING AND STOCKPILING PROCEDURES

The stripping procedures aim, with consideration of practical limitations, to reconstruct the original horizon sequences. This is the only way to re-establish 70% or more of the pre-mining land capability. It is important to bear in mind that the natural soil horizons developed over thousands of years in a specific sequence and is the result of soil genesis (weathering) of the parent rock driven by climatic conditions (temperature and moisture) within a specific topography. Stripping and replacing of soil will always result in a moderate to severe disturbance of the natural balances in the soil's physical and chemical properties. This implies that, even with precise execution of well-defined rehabilitation procedures, a degradation from pre-mining to post-mining land capability is unavoidable. This implies that, without precise stripping and replacing of topsoil, substantial degradation from pre-mining to post-mining land capability will probably take place.

The term topsoil in these guidelines refers to the A, B, E and G-horizons of the soil profile as defined in the Taxonomic Soil Classification system for South Africa. The A-horizon comprises the upper part (0-300 mm) of the soil profile and the B1 and B2-horizon from 300 mm up to the stripping depth specified per soil type as shown on Figure 6 and Table 10.

The A-horizon is characterised by a darker colour due to a higher organic carbon content, caused by decomposition of organic matter and roots of crops or natural vegetation. The organic carbon provides higher fertility and water holding capacity. It also improves infiltration and provides a natural buffer against compaction and hard setting. It also serves as a seed source of natural species which can re-establish after rehabilitation. It is therefore crucial to strip the A-horizon separately and replace it in the same position.

Well-drained, red and yellow brown B-horizons usually contain significantly lower organic carbon and have a higher clay content which gradually increases lower in the soil profile. The increasing clay content plays a significant role in soil potential and the soil's ability to sustain crops and plants, because it provides higher water storage capacity and prevents groundwater from rapidly leaching out of the rooting zones of plants. Red and yellow brown B-horizon materials which are placed on the surface (in the natural A-horizon position) tend to seal and compact severely, which leads to lower germination rates of seeds, restricted root development and higher runoff which triggers soil erosion.

Imperfectly to poorly drained plinthic B-horizons commonly have significantly higher clay contents than the well-drained horizons above them. They are characterised by prominent mottling and sesquioxide concretions which indicate impeded internal drainage. These materials are prone to severe compaction and sealing which result in low infiltration, higher runoff and consequent erosion when placed on the surface (in the natural A-horizon position).

Poorly drained G-horizons are clayey, very slowly permeable horizons. Placing this horizon on the surface will result in high runoff, very low infiltration and poor plant growth.

APPENDIX F
CRITERIA USED FOR ARABLE, GRAZING AND WILDERNESS LAND CAPABILITY CATEGORIES

The land capability classes are defined as follows:

Class I: Wetland

Wetland and riparian zones were delineated according to the practical field procedure for the identification and delineation of wetlands and riparian areas (Department of Water Affair and Forestry, 2005).

Class II: Arable land

Land which conforms to all of the following requirements is designated as Class II: Arable:

- does not qualify as wetland
- has soil that is readily permeable[4] to the roots of common cultivated plants throughout a depth of 0.75 m from the surface
- has a soil pH value between 4,0 and 8,4
- has electrical conductivity of the saturation extract less than 400mS/m at 25°C and an exchangeable sodium percentage less than 15 through the upper 0,75 m of soil
- has a permeability of at least 1,5 mm per hour in the upper 0.5 m of soil
- has less than 10 percent by volume of rocks or pedocrete fragments larger than 100 mm in diameter in the upper 0,75 m of soil
- has a slope (in percent) and erodibility factor[5] (K) such that their product is less than 2,0
- occurs under a climate regime which permits, from soils of similar texture and adequate effective depth (0,75 m), the economic attainment of yields of adapted agronomic or horticultural crops that are at least equal to the current national average for those crops, or
- is either currently being irrigated successfully or has been scheduled for irrigation by the Department of Water Affairs.

Class III: Grazing land

Grazing land conforms to all of the following requirements:

- does not qualify as wetland or as arable land
- has soil or soil-like material, permeable to the roots of native plants, that is more than 0.25 m thick and contains less than 50 % by volume of rocks or pedocrete fragments larger than 100 mm diameter
- supports or is capable of supporting a stand of native or introduced grass species or other forage plants utilisable by domesticated livestock or game animals on a commercial basis.

Class IV: Wilderness land

This is land which has little or no agricultural capability by virtue of being too arid, too saline, too steep or too stony to support plants of economic value. Its uses lie in the fields of recreation and wildlife conservation. It does, however, also include watercourses, submerged land, built-up land and excavations. Wilderness land is defined by exclusion, namely:

- land which does not qualify as wetland, arable land or grazing land.

APPENDIX G
METHODOLOGY FOR RATING OF IMPACTS

Method of Assessing the Significance of Potential Environmental Impacts

The assessment of the significance of impacts for a proposed development is by its nature, a matter of judgement. To deal with the uncertainty associated with judgement and ensure repeatable results, Aurecon rates impacts using a standardised and internationally recognised methodology adhering to ISO 14001 and World Bank/IFC requirements.

For each predicted impact, criteria are applied to establish the **significance** of the impact based on likelihood and consequence, both without mitigation being applied and with the most effective mitigation measure(s) in place.

The criteria that contribute to the **consequence** of the impact are **intensity** (the degree to which pre- development conditions are changed); the **duration** (length of time that the impact will continue); and the **extent** (spatial scale) of the impact. The sensitivity of the receiving environment and/or sensitive receptors is incorporated into the consideration of consequence by appropriately adjusting the thresholds or scales of the intensity, duration and extent criteria, based on expert knowledge. For each impact, the specialist applies professional judgement to ascribe a numerical rating for each criterion according to the examples provided in Table 1, Table 2 and Table 3 below. The consequence is then established using the formula:

Consequence = intensity x (+ duration + extent)

Depending on the numerical result, the impact's consequence would be defined as either extremely, highly, moderately or slightly detrimental; or neutral; or slightly, moderately, highly or extremely beneficial. These categories are provided inTable 5.

To determine the significance of an impact, the **probability** (or likelihood) of that impact occurring is also taken into account. In assigning probability the specialist takes into account the likelihood of occurrence but also takes cognisance of uncertainty and detectability of the impact. The most suitable numerical rating for probability is selected from Table 4 below and applied with the consequence according to the following equation:

Significance = consequence x probability

When assigning **probability** to an impact, it is vitally important to distinguish this from the concepts of **frequency and confidence,** with which it is sometimes confused.

- **Probability** refers to the likelihood that an impact will occur.

- **Frequency** refers to the regularity with which an impact occurs. To illustrate the difference between frequency and probability, it must be considered that something that happens infrequently may still be a certainty (i.e. have a high probability). For instance, Halley's Comet only comes close to the sun every 75 to 76 years (i.e. it has a very low frequency), but it is still a certainty. Table 7) refers to the degree of certainty of a prediction. Confidence may be related to any of the impact assessment criteria (extent, intensity, duration or probability) and is not necessarily only related to probability. Confidence may be influenced by any factors that introduce uncertainty into a prediction.

Depending on the numerical result of this calculation, the impact would fall into a significance category of negligible, minor, moderate or major, and the type would be either positive or negative. Examples of these categories are provided inTable 6.

Once the significance of an impact occurring without mitigation has been established, the specialist must apply his/her professional judgement to assign ratings for the same impact after the proposed mitigation has been implemented.

Lastly, two further points are important when applying these criteria to impacts:

- Specialists need to assess the impact, **not** the source or origin of the impact (i.e. the activity that causes the impact). For instance, although the activity that causes a specific impact may take place over a long period of time, this does not necessarily imply that the impact itself will persist for the same length of time. The assessment must focus on the impact (the change in the environment) rather than on the activity that causes an impact.
- When assessing impacts, consider the **proposed project design** rather than assuming that the project will necessarily affect highly sensitive resources, even if those resources occur on a part of the site that is left unaffected by the design. If the design of a project avoids an area where a highly sensitive or irreplaceable resource occurs, it would be a mistake to assume that this resource would experience an impact, simply because the resource occurs within the boundaries of the site. As an example, if a wetland or archaeological site occurs on portion A, but the project is located on portion B, then clearly the wetland or archaeological site would not be affected, hence, there would be no direct impact on these resources.

The tables on the following pages show the scales used to classify the above variables, and define each of the rating categories.

Table 1: Definition of **Intensity** ratings

Rating	Criteria	
	Negative impacts (-)	**Positive impacts (+)**
Very high **(-/+ 4)**	Very high degree of damage to natural or social systems or resources. These processes or resources may restore to their pre-project condition over very long periods of time (more than a typical human life time).	Great improvement to ecosystem or social processes and services or resources.
High **(-/+ 3)**	High degree damage to natural or social system components, species or resources.	Intense positive benefits for natural or social systems or resources.
Moderate **(-/+ 2)**	Moderate damage to natural or social system components, species or resources.	Average, on-going positive benefits for natural or social systems or resources.
Low **(-/+ 1)**	Minor damage to natural or social system components, species or resources. Likely to recover over time. Ecosystems and valuable social processes not affected.	Low positive impacts on natural or social systems or resources.
Negligible **(0)**	Negligible damage to individual components of natural or social systems or resources, such that it is hardly noticeable.	Limited low-level benefits to natural or social systems or resources.

Table 2: Definition of **Duration** ratings

Rating	Criteria
2	**Long-term**: The impact will continue for 6-15 years.
1	**Medium-term:** The impact will continue for 2-5 years.
0	**Short-term:** The impact will continue for between 1 month and 2 years.

Table 3: Definition of **Extent** ratings

Rating	Criteria
2	**Regional:** The impact will affect the entire region
1	**Local:** The impact will extend across the site and to nearby properties.
0	**Site specific:** The impact will be limited to the site or immediate area.

Table 4: Definition of **Probability** ratings

Rating	Criteria
4	**Certain/ Definite:** There are sound scientific reasons to expect that the impact will definitely occur.
3	**Very likely:** It is most likely that the impact will occur.
2	**Fairly likely:** This impact has occurred numerous times here or elsewhere in a similar environment and with a similar type of development and could very conceivably occur.
1	**Unlikely:** This impact has not happened yet but could happen.
0	**Very unlikely:** The impact is expected never to happen or has a very low chance of occurring.

Table 5: Application of Consequence ratings

Rating	Consequence rating
-8	Extremely detrimental
-7 to -6	Highly detrimental
-5 to -4	Moderately detrimental
-3 to -2	Slightly detrimental
-1 to 1	Negligible
2 to 3	Slightly beneficial
4 to 5	Moderately beneficial
6 to 7	Highly beneficial
8	Extremely beneficial

Table 6: Application of significance ratings

Rating	Significance rating
-4	Very high - negative
-3	High - negative
-2	Moderate - negative
-1	Low - negative
0	Very low
1	Low - positive
2	Moderate - positive
3	High - positive
4	Very high - positive

Despite attempts at ensuring objectivity and impartiality, environmental assessment remains an act of judgement and can never escape the subjectivity inherent in attempting to define significance. The determination of the significance of an impact depends on context (spatial and duration) and intensity of that impact. Since the rationalisation of context and intensity will ultimately be prejudiced by the observer, there can be no wholly objective measure by which to judge the components of significance, let alone how they are integrated into a single comparable measure.

This notwithstanding, in order to facilitate informed decision-making, environmental assessments must endeavour to come to terms with the significance of the environmental impacts. Recognising this, Aurecon has attempted to address potential subjectivity in the current ESIA process as follows:

- Being explicit about the difficulty of being completely objective in the determination of significance, as outlined above;
- Developing an explicit methodology for assigning significance to impacts and outlining this methodology in detail. Having an explicit methodology not only forces the specialist to come to terms with the various facets that contribute to significance (thereby avoiding arbitrary assessment), but also provides the reader with a clear summary of how the specialist derived the significance;
- Wherever possible, differentiating between the significance of potential environmental impacts as experienced by the various affected parties; and
- Utilising a team approach and internal review of the assessment to facilitate a rigorous and defendable system.

Although these measures may not totally eliminate subjectivity, they provide an explicit context within which to review the assessment of impacts.

The specialists appointed to contribute to this impact assessment have empirical knowledge of their respective fields and are thus able to comment on the confidence they have in their findings based on the availability of data and the certainty of their findings (Example provided in **Error! Reference source not found.**).

Table 7: Definition of Confidence ratings

Rating	Criteria
Low	Judgement is based on intuition and there some major assumptions used in assessing the impact may prove to be untrue.
Medium	Determination is based on common sense and general knowledge. The assumptions made, whilst having a degree of uncertainty, are fairly robust.
High	Substantive supportive data or evidence exists to verify the assessment.