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Proposed Haakdoorndrift Opencast Project at Anglo American Platinum's Amandelbult Mine, Limpopo

Consultation Environmental Impact Assessment Report

Anglo American Platinum

7 March 2017

Revision: 0

Reference: 112544

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Document control record

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Glossary of Abbreviations

BID	Background Information Document
CA	Competent Authority

CEIR	Consultation Environmental Impact Assessment Report
CRR	Comment and Response Report
CSR	Consultation Scoping Report
DAFF	Department of Agriculture, Forestry and Fisheries
DEA	Department of Environmental Affairs
DMR	Department of Mineral Resources
DWS	Department of Water and Sanitation
EA	Environmental Authorisation
EAP	Environmental Assessment Practitioner
EIA	Environmental Impact Assessment
EIR	Environmental Impact Report
EMPr	Environmental Management Programme
FEIR	Final Environmental Impact Assessment Report
FRDCP	Final Rehabilitation, Decommissioning and Mine Closure Plan
FSR	Final Scoping Report
GN	Government Notice
HDPE	High Density Polyethylene
HIA	Heritage Impact Assessment
HOP	Haakdoorndrift Opencast Project
I&APs	Interested and Affected Parties
IAIA	International Association of Impact Assessment
ILASA	Institute for Landscape Architecture in South Africa
IWULA	Integrated Water Use Licence Application
kV	Kilovolts
LoM	Life of Mine
mamsl	Meters above mean sea level
MER	Merensky
MR	Mining Right
NEM: BA	National Environmental Management: Biodiversity Act (Act No. 10 of 2004)
NEMA	National Environmental Management Act (Act No. 107 of 1998)
NHRA	National Heritage Resources Act (Act No. 25 of 1999)
NWA	National Water Act (Act No. 36 of 1998)
PGE	Platinum Group Elements
PIA	Palaeontological Impact Assessment
PoS	Plan of Study
PPP	Public Participation Process
RoM	Run of Mine
SACLAP	South African Council for the Landscape Architectural Profession
SACNASP	South African Council for Natural Scientific Professions
SAHRA	South African Heritage Resources Agency
SCC	Species of Conservation Concern
SLP	Social Labour Plan
TLM	Thabazimbi Local Municipality
ToR	Terms of Reference
UG2	Upper Group 2
WDM	Waterberg District Municipality

mineral resources

Department:
Mineral Resources
REPUBLIC OF SOUTH AFRICA

CONSULTATION ENVIRONMENTAL IMPACT ASSESSMENT REPORT

and

ENVIRONMENTAL MANAGEMENT PROGRAMME REPORT

PROPOSED HAAKDOORNDRIFT OPENCAST PROJECT AT ANGLO AMERICAN PLATINUM'S AMANDELBULT MINE, LIMPOPO

SUBMITTED FOR ENVIRONMENTAL AUTHORISATIONS IN TERMS OF THE NATIONAL ENVIRONMENTAL MANAGEMENT ACT, 1998 AND THE NATIONAL ENVIRONMENTAL MANAGEMENT WASTE ACT, 2008 IN RESPECT OF LISTED ACTIVITIES THAT HAVE BEEN TRIGGERED BY APPLICATIONS IN TERMS OF THE MINERAL AND PETROLEUM RESOURCES DEVELOPMENT ACT, 2002 (MPRDA) (AS AMENDED).

NAME OF APPLICANT: Anglo American Platinum (Pty) Ltd

TEL NO: +27 (0) 14 784 1001

FAX NO: +27 (0) 14 784 1230

POSTAL ADDRESS: PO Box 02, Chromite, 0362

PHYSICAL ADDRESS: Rustenburg Platinum Mines Limited, Amandelbult Section, Dishaba Mine, Thabazimbi

DMR REFERENCE NO.: LP 30/5/1/2/3/2/1 (12767) EM

1. Pertinent information to this application

The Environmental Impact Assessment (EIA) process undertaken to date has culminated in the production of this Environmental Impact Assessment Report, which provides detailed information relevant to the project. Important information affecting this application is summarised in Table 1.

Table 1 | Information pertinent to this application

<table>
<tr><th>No.</th><th>Project aspect</th><th>Description</th></tr>
<tr><td>1</td><td>Description of the activity</td><td>Anglo American Platinum (Pty) Ltd (henceforth Anglo) proposes extending existing mine operations through the mining of shallow platinum group element (PGE) reefs within the Amandelbult Mining Right Boundary through its proposed Haakdoorndrift Opencast Project (HOP). The HOP is located to the east of the Dishaba mine near Thabazimbi in the Limpopo Province. The majority of the reefs envisaged for mining lies within the 1:100-year flood line of the Crocodile River. Strip mining is proposed for reef extraction, with an approximately 30 month-Life of Mine (LoM). Concurrent backfilling will take place as strip mining proceeds. The proposed mining operations will consist of the following main components:
Two parallel opencast pits for strip mining to a maximum depth of 60 m with concurrent rehabilitation and live material placement where possible;
Access- and haul roads for the removal of ore and overburden material from within the pit;
An overburden dump and topsoil stockpiling area;
Haul road crossing with the D1639 district road;
Dewatering of the pits when groundwater ingress occurs;
Re-use of the 62 East Decline Shaft infrastructure for mobile crusher, ore stockpiling area and plant storage;
Storm water management measures (clean/dirty water channels, berms, pumps and dams) around excavated and infrastructure areas to separate clean and dirty water areas including a new combined storm water surge- / pollution control dam;
Re-use of dirty water for haul road dust suppression and process requirements for the rest of Amandelbult Complex; and
Backfilling of the pits with boxcut topsoil and overburden material that could not be live-placed.</td></tr>
<tr><td>2</td><td>Municipality</td><td>Thabazimbi Local Municipality</td></tr>
<tr><td>3</td><td>Applicant</td><td>Anglo American Platinum (Pty) Ltd</td></tr>
<tr><td>4</td><td>Environmental consultants</td><td>Aurecon South Africa (Pty) Ltd</td></tr>
<tr><td>5</td><td>Competent authority</td><td>Department of Mineral Resources</td></tr>
<tr><td>6</td><td>Property details</td><td>Portion 2 of the farm Haakdoorndrift 374 KQ
Portion 4 of the farm Haakdoorndrift 374 KQ
Portion 1 of the farm Elandskuil 378 KQ
Portion 2 of the farm Elandskuil 378 KQ
<table><tr><th>Erf Number</th><th>Surveyor General 21 Digit Code</th></tr><tr><td>2/374</td><td>T0KQ00000000037400002</td></tr><tr><td>4/374</td><td>T0KQ00000000037400004</td></tr><tr><td>1/378</td><td>T0KQ00000000037800001</td></tr><tr><td>2/378</td><td>T0KQ00000000037800002</td></tr></table></td></tr>
<tr><td>7</td><td>Size of the site (approximate) for the preferred alternative</td><td>Pit: 33.5 ha
Haul road and berm area surrounding pit: 14.8 ha
Overburden dump and topsoil stockpiling areas: 29.6 ha
Mobile crushing and ore stockpiling area: 9 ha
Stormwater surge / pollution control dam: 4.4 ha</td></tr>
<tr><td>8</td><td>Development footprint</td><td>Approximately 91.3 ha</td></tr>
<tr><td>9</td><td>Site coordinates (centre points)</td><td>Pit: 24°43’21.42”S; 27°24’39.38”E</td></tr>
</table>

No.	Project aspect	Description
		• Mobile crushing area: 24°43'34.05"S, 27°24'01.28"E • Ore stockpile: 24°43'31.84"S, 27°24'10.48"E • Stormwater surge / pollution control dam: 24°43'43.06"S, 27°24'15.30"E • Overburden dumps and topsoil stockpiles: 24°43'53.69"S, 27°23'24.50"E • Haul roads: 24°43'38.83"S, 27°24'16.37"E Refer to Figure 2.
10	Type of mining	The pit area is divided into three equal portions. Topsoil and overburden material is stripped from the first portion, and dumped in the designated area. Extraction of exposed, shallow reefs of the Merensky formation can then proceed. The process of stripping and reef removal is repeated in a consecutive pit-portion. Overburden material from this portion is then backfilled to the latter portion, while reef extraction continues in the current portion, and so forth. Overburden material and topsoil from the first portion is then backfilled into the last portion, so that no material remains in the overburden dump area after the final portion is mined out.
11	Existing infrastructure	The following infrastructure will be relocated prior to the commencement of operations as it might inhibit mining activities: • A redundant Eskom 11 kV transmission line; • A vent shaft; • Three irrigation pivot points; and • A mine-owned transmission line crossing the pit area will be either deactivated for the LoM, or decommissioned entirely.
12	Environmental legal requirements	• Integrated Environmental Authorisation as per the environmental listed activities triggered in terms of the GNR982 of 2014 under the National Environmental Management Act (Act No. 107 of 1998) and listed waste activities triggered in terms of the GNR 921 of 2013 under the National Environmental Management: Waste Act (Act No. 59 of 2008). • Integrated Water Use License in terms of section 21 (a), (b), (c), (g), (i) and (j) of the National Water Act (Act No. 36 of 1998).
13	Project lifecycle	• Construction Phase: construction of temporary access and haul roads, a laydown and mobile crushing area, perimeter fencing, storm water management berms; vegetation clearing; grubbing, stripping and stockpiling of topsoil; and blasting and stockpiling of overburden material; • Operational Phase: extraction of PGE-containing reefs, loading, hauling and primary crushing of ore-containing run of mine (RoM), and concurrent backfilling of overburden material as mining progresses; and • Decommissioning Phase: rehabilitation of the proposed mining area by replacing topsoil in pit areas, and ripping and reshaping haul road areas.
14	Consideration of alternatives	*Three overburden stockpile layout alternatives have been considered:* 1. Locating overburden stockpiles within the 100-year flood line in a 223 ha area to reduce operational time and costs associated with the stockpiling of overburden material; 2. Locating overburden stockpiles to the southwest of the pit in a 61 ha area, outside the flood line, to reduce impacts on the water resource and arable land, and to avoid damage resulting from flooding. A safety risk exists in terms of shallow underground workings beneath this area; and 3. Locating overburden stockpiles to the west of the pit in a 31 ha area, to reduce the safety risk of locating overburden stockpiles on an area with shallow underground workings, and to reduce impacts on the water resource and arable land, and potential damage resulting from flooding. <u>Alternative (3) is preferred.</u> *Three pit size alternatives have been considered:* 1. Original 31 ha opencast pit (with significant potential impact on the Crocodile River); 2. Reduced 27 ha opencast pit (with reduced size and potential impact on the Crocodile River; and 3. Reduced 34 ha strip mining pit (with reduced *length* and potential impact on the Crocodile River). *It should be noted that Alternative 3 is a refinement of Alternative 2, which was approved by the DMR during the Scoping stage. The option is required as result of the shallower pits and strip mining method. It remains outside the riparian zone of the Crocodile River, as was the case with the 27 ha pit (Alternative 2).* <u>Alternative (3) is preferred.</u> *No-go alternative*

No.	Project aspect	Description
		The option of not implementing the activity was investigated. The main consequence of the "No-go" alternative is the potential closure of the Amandelbult mine altogether. In addition, a sizeable contribution to processed PGE resources will be lost, along with the opportunity for Anglo to provide of employment opportunities for mine workers.
15	Specialist assessments	The following specialist investigations were undertaken: • Groundwater impact assessment; • Soil, land use and land capability (agricultural) assessment; • Wetland and terrestrial ecological assessment; • Noise impact assessment; • Air quality assessment; • Phase 1 heritage impact assessment; • Palaeontological desktop study; • Blasting and vibration desktop study; • Traffic impact assessment; • Updated floodline determination of the Crocodile River and storm water management plan; • Water balance assessment; • Waste classification of ore, overburden and topsoil similar to the project area; • Social impact assessment; • Visual impact statement; and • A Consent Use Application for the temporary change of Land Use is also in process to the Thabazimbi Local Municipality (in terms of the Spatial Planning and Land Use Management Act (2013) [SPLUMA]).
16	Motivation for the proposed project	The proposed mining activities will provide economically extracted PGEs while commodity prices are low. In addition, employment and local procurement opportunities will become available, and mine employees will be able to take advantage of various upskilling opportunities as described in Amandelbult's Social and Labour Plan. The proposed activities' products will be processed at the existing concentrator at Amandelbult, meaning that the project scope / battery limits will be relatively small. If the project is not allowed to continue, the Amandelbult Complex may close down, resulting in numerous job losses. The environmental impact of the preferred alternative, if mitigation measures as listed are applied, can be lowered to an acceptable level.

2. NEMA Requirements With Reference To Relevant Sections of This Report

Details of how the structure of the Environmental Impact Assessment Report addresses applicable requirements for information in terms of the National Environmental Management Act (Act No. 107 of 1998) (NEMA) is outlined in Table 2.

Table 2 | Environmental Impact Assessment Regulations (GN No. 982 of 2014) requirements for Environmental Impact Assessment Reports

Content as required by NEMA EIA Regulations GN No. 982, Appendix 3, Section 3	Chapter / Section number
a) Details of– (i) The EAP who prepared the report and; (ii) The expertise of the EAP, including a curriculum vitae;	6.1, 6.2
b) The location of the activity, including– (i) The 21 digit Surveyor General code of each cadastral land parcel; (ii) Where available, the physical address and farm name; and (iii) Where the required information in items (i) and (ii) is not available, the coordinates of the boundary of the property or properties;	7
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– (i) A linear activity, a description and coordinates of the corridor in which the proposed activity or activities is to be undertaken; or (ii) On land where the property has not been defined, the coordinates within which the activity is to be undertaken;	8, Figure 2, Appendix 3
d) A description of the scope of the proposed activity, including– (i) All listed and specified activities triggered and being applied for; and (ii) A description of the associated structures and infrastructure related to the development;	9.1, 9.2, Appendix 4
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;	10
f) A motivation for the need and desirability for the proposed development footprint, including the need and desirability of the activity in the context of the preferred location;	11
g) A motivation for the preferred development footprint within the approved site;	22, 12
h) A full description of the process followed to reach the proposed development footprint within the approved site including:	12
(i) Details of the development footprint alternatives considered;	12.1
(ii) Details of the public participation process undertaken in terms of regulation 41 of the Regulations, including copies of the supporting documents and inputs;	12.2
(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;	12.3
(iv) The environmental attributes associated with the development footprint alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects;	12.4
(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; (bb) may cause irreplaceable loss of resources; and (cc) can be avoided, managed or mitigated;	12.5
(vi) The methodology used in determining and ranking the nature, significance, consequences, extent, duration and probability of potential environmental impacts and risks;	12.6
(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;	12.7

	(viii)	The possible mitigation measures that could be applied and level of residual risk;	12.5 and 12.8
	(ix)	If no alternative development locations for the activity were investigated, the motivation for not considering such and;	12.10
	(x)	A concluding statement indicating the preferred alternative development location within the approved site;	12.10
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 location through the life of the activity, including, including–		13, 14
	(i)	A description of all environmental issues and risks that were identified during the environmental impact assessment process; and	
	(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;	
j)	An assessment of each identified potentially significant impact and risk, including– (i) Cumulative impacts; (ii) The nature, significance and consequences of the impact and risk; (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;		23.1, 14
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;		23.2
l)	An environmental impact statement which contains–		16.1
	(i)	A summary of the key findings of the environmental impact assessment;	
	(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 site indicating any areas that should be avoided, including buffers; and	16.2
	(iii)	A summary of the positive and negative impacts and risks of the proposed activity and identified alternatives;	16.3
m)	Based on the assessment, and where applicable, recommendations from specialist reports, the recording of proposed impact management objectives, and the impact management outcomes for the development for inclusion in the EMPr as well as for inclusion as conditions of authorisation;		17
n)	The final proposed alternatives which respond to the impact management measures, avoidance, and mitigation measures identified through the assessment;		18
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;		19
p)	A description of any assumptions, uncertainties and gaps in knowledge which relate to the assessment and mitigation measures proposed;		20
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;		21
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;		22
s)	An undertaking under oath or affirmation by the EAP in relation to: (i) The correctness of information provided in the reports; (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;		23
t)	Where applicable, details of any financial provisions for the rehabilitation, closure, and ongoing post decommissioning management of negative environmental impacts;		24
u)	An indication of any deviation from the approved scoping report, including the plan of study, including–		25

	(i) Any deviation from the methodology used in determining the significance of potential environmental impacts and risks; and (ii) A motivation for the deviation;	
v)	Any specific information that may be required by the competent authority; and	26
w)	Any other matters required in terms of section 24(4) (a) and (b) of the Act.	27

3. Important Notice

In terms of the Mineral and Petroleum Resources Development Act (Act 28 of 2002 as amended), the Minister must grant a prospecting or mining right if among others the mining "will not result in unacceptable pollution, ecological degradation or damage to the environment".

Unless an Environmental Authorisation can be granted following the evaluation of an Environmental Impact Assessment and an Environmental Management Programme report in terms of the National Environmental Management Act (Act 107 of 1998) (NEMA), it cannot be concluded that the said activities will not result in unacceptable pollution, ecological degradation or damage to the environment.

In terms of section 16(3) (b) of the EIA Regulations, 2014, any report submitted as part of an application must be prepared in a format that may be determined by the Competent Authority and in terms of section 17 (1) (c) the Competent Authority must check whether the application has taken into account any minimum requirements applicable or instructions or guidance provided by the competent authority to the submission of applications.

It is therefore an instruction that the prescribed reports required in respect of applications for an environmental authorisation for listed activities triggered by an application for a right or a permit are submitted in the exact format of, and provide all the information required in terms of, this template. Furthermore please be advised that failure to submit the information required in the format provided in this template will be regarded as a failure to meet the requirements of the Regulation and will lead to the Environmental Authorisation being refused.

It is furthermore an instruction that the Environmental Assessment Practitioner (EAP) must process and interpret his/her research and analysis and use the findings thereof to compile the information required herein. (Unprocessed supporting information may be attached as appendices). The EAP must ensure that the information required is placed correctly in the relevant sections of the Report, in the order, and under the provided headings as set out below, and ensure that the report is not cluttered with un-interpreted information and that it unambiguously represents the interpretation of the applicant.

4. Objective 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 preferred location;
c. identify the location of the development footprint within the preferred site 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 preferred site 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 preferred location through the life of the activity;
g. identify suitable measures to manage, avoid or mitigate identified impacts; and
h. identify residual risks that need to be managed and monitored.

5. Part A: Scope of Assessment and Environmental Impact Assessment Report

5.1. Introduction

This section provides a brief overview of the project background and the legislated Environmental Impact Assessment (EIA) process to be followed and lists the assumptions and limitations that pertain to the compilation of this report.

5.1.1. The applicant: Anglo American Platinum

The Amandelbult Section of Rustenburg Platinum Mines Limited (RPM: AS), owned by Anglo American Platinum (Pty) Ltd (henceforth referred to as Anglo), holds a converted mining right (MR) in terms of Item 7 of Schedule 2 of the Mineral and Petroleum Resources Development Act (MPRDA) 2002 (Act 28 of 2002). The old order MR of Rustenburg Platinum Mines Limited (RPM – Reg. No. 1931/003380/06) in the Thabazimbi Magisterial District has been converted (MR no. LP 48 MR) on 23 July 2010, and will continue to be in force until 22 July 2040 during which mining operations must continue. Failure to continue with mining operations will result in the suspension or cancellation of the mining right. To continue with mining operations, Anglo proposes the mining of shallow reefs for Platinum Group Elements (PGE) through strip mining on a small section on the north-eastern corner within its MR boundary. The location of the proposed HOP pit, the extent of the MR, and the extent of the Amandelbult constituents, are shown in Figure 1.

The areal extent of the MR is 14,162.7388 hectares and most of the farm portions on which it is located is owned by RPM (thus located on the Anglo surface freehold). However, the farm portion (portion 2 of the farm Haakdoorndrift) on which the pit is proposed, is owned by Buitendag Boerderye Eiendomme (Pty) Ltd.

The reefs located on this farm portion has not yet been exploited by Anglo, even though it has an MR to recover mineral resources here. The proposed project will be referred to as the Haakdoorndrift Opencast Project (HOP).

5.1.2. Project background

The HOP is motivated by a recent decline in commodity prices, which shifted the focus from underground to opencast mining at RPM: AS. This project will enable Anglo to economically extract reef remnants of easily accessible PGE ounces, which will enable mining operations to continue at RPM: AS.

The reefs envisaged for extraction as part of this project form part of the Merensky (MER) and Upper Group (UG2) reefs. The majority of the proposed pit lies within the 100-year floodplain of the Crocodile River (Figure 2). Run of Mine (RoM) extracted at the proposed HOP pit will undergo primary crushing at a mobile crusher to the west of the pit area on RPM-owned property, where mining operations actively continue, and for which an Environmental Management Programme (EMPr) has been submitted to the Department of Mineral Resources (DMR).

The RPM: AS is divided into three core business units, namely the Dishaba Mine, Tumela Mine and Central Services, and the Amandelbult Concentrator Plant. The locations and extents of these business units within the MR boundary are shown in Figure 1 (the remainder of the MR area comprises the entire Amandelbult Section's production services component, which serves the entire mine and are not limited to any of the three core business units).

As indicated in Figure 1, the Dishaba Mine is located closest to the HOP, which will enable the HOP to take advantage of established infrastructure located at Dishaba, therefore limiting the project's environmental impact on the area surrounding the pit and associated haul roads. The Dishaba-infrastructure that will be employed as part of the HOP, is located at the so-called *62 East (62E) Decline Shaft*. For instance, the abovementioned mobile crusher will be located here. Ore extracted from the reefs will be placed here as well, together with a contractor's laydown area. A railway head is conveniently situated at the 62E Decline Shaft, from where crushed ore will be transported to the existing Amandelbult Concentrator Plant for further processing. As for overburden (which will be blasted prior to the extraction of ore from the pit), the material will be stockpiled on an area west of and adjacent to the 62E Decline Shaft.

The envisaged mining method for the HOP is strip mining of the MER and UG2 reefs, the total ore resource available being approximately 260,000 m^3. Ore will be extracted for approximately 30 months, if extracted at a rate of approximately 50,000 tons per month. Overburden material of approximately 9,326,000 m^3 (prior to a 25% bulking factor) will be removed and stockpiled in a designated overburden dump area of approximately 31 ha. Rehabilitation activities is expected to take another 8 months after mining has ceased.

This application for environmental authorisation (EA) includes (but is not limited to) the following main project components (indicated in Figure 2):

- a proposed opencast pit;
- overburden dump area;
- a mobile crushing and ore stockpile area at the existing 62E decline shaft;
- haul roads along the pit and between the pit, ore, and overburden dump area; and
- storm water control measures at the pit, ore, and overburden stockpile areas, including clean / dirty water channels, berms and a pollution control dam.

The HOP area lies approximately 14 km south of Thabazimbi and 29 km northeast of Northam, west of the R511, in the Thabazimbi Local Municipality (TLM) and Waterberg District Municipality (WDM), in the Limpopo Province.

5.1.3. Report structure

This report serves to document the Environmental Impact Assessment (EIA) process and is structured as follows, as per the Department of Mineral Resource templates for EIA reports and Environmental Management Programme Reports (EMPr):

Section 1: Pertinent information to this application

Section 2: NEMA requirements with reference to relevant sections of this report

Section 3: DMR Important notice

Section 4: DMR Objective of EIA Process

Part A

Section 5: Introduction

Section 6: Environmental Assessment Practitioner

Section 7: Description of the property

Section 8: Locality map

Section 9: Description of the scope of the proposed activity

Section 10: Policy and legislative context

Section 11: Need and desirability of the proposed activities

Section 12: Motivation for the preferred development footprint within the approved site, including a full description of the process followed to reach the proposed development footprint within the approved site

Section 13: Full description of the process undertaken to identify, assess, and rank the impacts and risks the activity will impose on the preferred site (in respect of the final site layout plan) through the life of the activity

Section 14: Assessment of each identified potentially significant impact and risk

Section 15: Summary of specialist reports

Section 16: Environmental impact statement

Section 17: Proposed impact management objectives and impact management outcomes for inclusion in EMPr

Section 18: Final proposed alternatives

Section 19: Aspects for inclusion as conditions of authorisation

Section 20: Description of any assumptions, uncertainties and gaps in knowledge

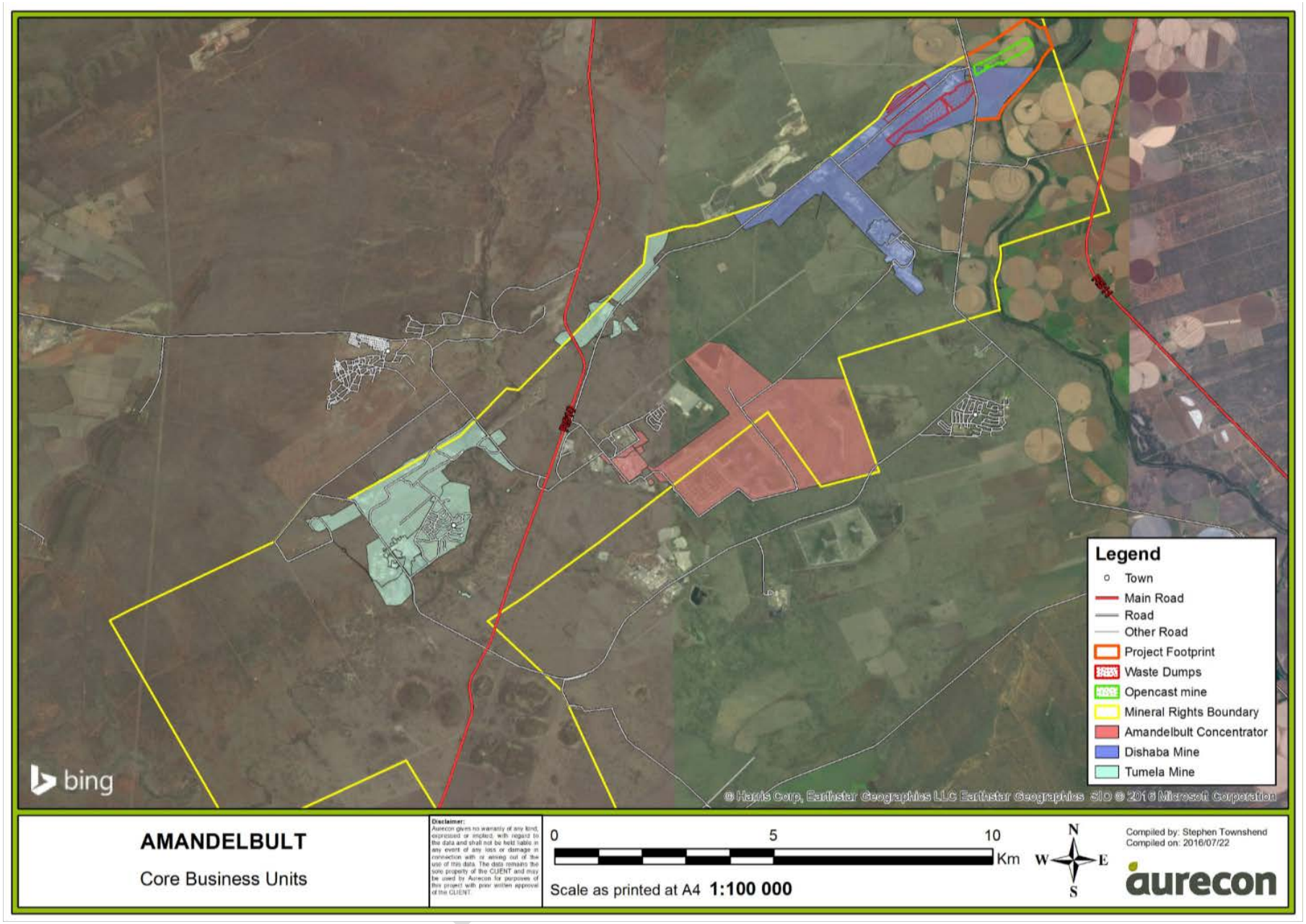


Figure 1 | Proposed Haakdoorndrift Opencast Project location relative to the existing Amandelbult Section operations.

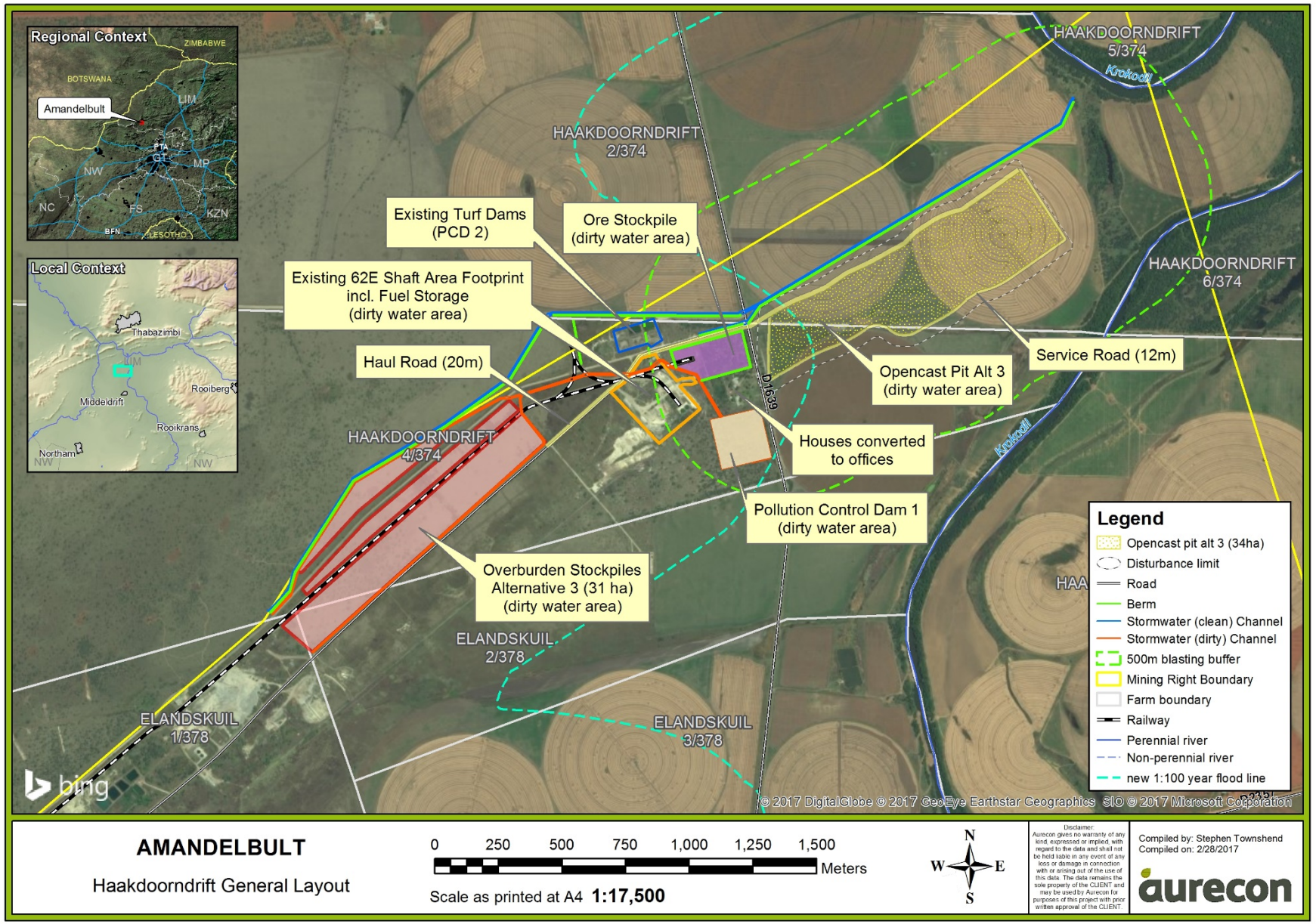


Figure 2 | Proposed Haakdoorndrift Opencast pit, overburden stockpile areas, ore stockpile area, mobile crushing area, and haul roads.

6. Environmental Assessment Practitioner

This section provides details of the EAP undertaking the EIA process on behalf of the applicant (Anglo) and specialist assessments undertaken.

Anglo appointed Aurecon South Africa (Pty) Ltd (henceforth, Aurecon) as an independent Environmental Assessment Practitioner (EAP) to undertake the necessary EA application processes required by the applicable legislation. In terms of the National Environmental Management Act (No. 107 of 1998 – NEMA), and the Environmental Impact Assessment (EIA) Regulations (Government Notice [GN] No. 982 of 2014), an EIA is required to obtain an EA from the competent environmental authority before the project can proceed. In this regard, Anglo has submitted an EA application to the DMR, with the intention of obtaining an EA to accommodate both the NEMA and National Environmental Management: Waste Act (Act No. 59 of 2008 – NEM: WA) listed activities. An Integrated Water Use Licence Application (IWULA) process in terms of the National Water Act (Act No. 36 of 1998 – NWA) is being undertaken in parallel with the EIA process. The IWULA will be handled by the Department of Water and Sanitation (DWS).

The requirement for independence of the environmental consultant is aimed at reducing the potential for bias in the environmental process. Neither Aurecon nor any of its sub-consultants are subsidiaries of Anglo, nor is Anglo a subsidiary to Aurecon. Furthermore, none of these parties have any interests in secondary or downstream developments that may arise from of the authorisation of the proposed project.

6.1. Contact person and correspondence address of the EAP

Independent EAP:	Aurecon South Africa (Pty) Ltd
Responsible person:	Johan Goosen
Physical address:	Lynnwood Bridge Office Park 4 Daventry Street Lynnwood Manor 0081 Tshwane
Postal Address:	PO Box 74381 Lynnwood Ridge 0040
Telephone:	012 427 2378
Facsimile:	086 268 0200
E-mail:	johan.goosen@aurecongroup.com
Professional affiliation:	*PrLArch* with the South African Council for the Landscape Architectural Profession (SACLAP)

6.2. Expertise of the EAP

6.2.1. Qualifications of the EAP

Johan Goosen holds a Bachelor in Landscape Architecture, which he obtained from the University of Pretoria (UP) in 1998, and completed a Graduate Diploma in Environmental Engineering from the Witwatersrand University (WITS) in 2014. Copies of his qualifications are attached in Appendix 1.

6.2.2. Summary of the EAP's past experience

Johan Goosen is employed as an environmental planner and landscape architect at Aurecon. He has more than 15 years' experience in landscape architecture and environmental planning in a wide variety of sectors. His experience in the mining sector includes end land use planning for mining and waste facilities and brownfields site redevelopment. He has further been involved in numerous projects requiring environmental screening, impact assessment/permitting, construction monitoring and visual impact assessment (VIA) for rail, road, bulk water infrastructure, urban and rural land development. He has also been the co-writer and examiner of the environmental section of the SACLAP professional exam from 2009 to 2015, and regularly acts as external examiner for UP landscape architecture on environmental engineering aspects.

His experience in the mining and metals sector includes various clients:

- EIA/EMPr for Dragline Relocation Project of AngloCoal's Landau Colliery;
- Waste Licensing for hazardous waste sorting facility at Grootegeluk Coal Mine (Exxaro);
- EIA/EMPr (Anglo, Lonmin, Zululand Anthracite Colliery, Khutala Colliery);
- Visual Impact Assessment (Samancor, PMC, De Beers, Vanchem);
- Waste Buffer Zone Analysis (Cape Gate Vanderbijl);
- End Land Use Plans as part of Closure Plans (De Beers, Exxaro);
- Waste Licensing (Exxaro)
- EIA for relocation of services (Glencore)

His Curriculum Vitae (CV) is attached in Appendix 2.

6.2.3. Specialist team

To provide strategic mining and related environmental applications advice, Aurecon has partnered with Marietjie Eksteen from the consulting firm Jacana Environmentals cc, an environmental consultancy based in Polokwane, of which she is the Managing Director. She holds a Master's degree in Exploration Geophysics (MSc) from the University of Pretoria in 1993. She is an environmental scientist with 25 years' experience in the fields of water quality management, mine water management, environmental legal compliance and project management. She is a registered Professional Environmental Scientist (*PrSciNat*) with the South African Council for Natural Scientific Professions (Registration No. 400090/02).

Since establishing Jacana Environmentals in 2006, she has been involved in a variety of mine-related environmental projects serving clients such as Coal of Africa Limited, BHP Billiton Energy Coal SA, Xstrata Coal SA and Optimum Coal. Prior to 2006 she was employed by Pulles Howard & De Lange Inc. as an environmental consultant for 2 years. Before consulting, she was employed by BHP Billiton as a mine environmental manager at their operations in Mpumalanga, as well as the Department of Water Affairs where she was appointed as a water quality specialist for the mining industry. Her career started off as a geophysicist at Genmin in 1990. Her CV is available on request.

Various specialists undertook impact assessments of the biophysical and socio-economic environment. These impacts include:

- Impacts on soil, land use and land capability;
- Impacts on wetlands and terrestrial ecology;
- Impacts on geohydrology;
- Air quality impacts;
- Noise impacts;
- Impacts on heritage resources;
- Impacts on palaeontological resources;
- Traffic impacts; and

- A Consent Use Application for the temporary change of Land Use is also in process to the Thabazimbi Local Municipality (in terms of the Spatial Planning and Land Use Management Act (2013) [SPLUMA]).

In addition to the abovementioned impacts, the following potential impacts have been subjected to desktop assessment:

- Blasting and vibration impacts;
- Waste Classification of ore, overburden and topsoil similar to the project area;
- Social impacts;
- Visual impacts; and
- Flood line determination of the Crocodile River, storm water management measures and water balance assessments.

A synopsis of the qualifications and experience of the specialists appointed to assess these impacts, is provided in Table 3. Full CVs are available on request.

Table 3 | Specialist team

Environmental aspect	Specialist	Organisation	Qualifications	Professional registrations and affiliations
Soil, land use and land capability	Piet Steenekamp	Rehab Green Monitoring Consultants cc	NDip Agriculture Resource Utilisation	CertSciNat (SACNASP), Soil Science Society of SA
Wetland and terrestrial ecology	Kathy Taggart	Natural Scientific Services (NSS)	MSc Resource Conservation Biology; BSc Hons Botany, BSc (WITS)	PrSciNat (SACNASP), Competent Wetland Ecologist (DWA), International Association of Impact Assessors (IAIA)
Geohydrology	Gerhard Steenekamp	Groundwater Complete	MSc Geohydrology	PrSciNat (SACNASP)
Air quality	Uno Neveling	Environmental and Health Risk Consulting (EHRCON)	MSc Industrial Psychology (*cum laude*), BSc Hons, BSc (PUfCHO)	SAIOH
Noise	Morné de Jager	Enviro Acoustic Research (EAR)	BEng Chemical Engineering (UP)	-
Cultural heritage resources	Stephan Gaigher	G & A Heritage Properties (Pty) Ltd	BA Hons Archaeology (*cum laude*), BA Philosophy (*cum laude*), BA Archaeology (*cum laude*) (UP)	ASAPA (Site Director Status)
Palaeontology	JF Durand	Private	BSc Botany and Zoology (RAU), BSc Zoology (WITS), Museology Diploma (UP), Higher Education Diploma (RAU), PhD Palaeontology (WITS)	SciNat (SACNASP)
Blasting and vibration	Danie Zeeman	Blast Management and Consulting	Diploma: Explosives Technology, (Technikon Pretoria), BA (UP), National Higher Diploma: Explosives Technology, (Technikon Pretoria), Advanced Certificate in Blasting (Technikon SA)	International Society of Explosives Engineers
Socio-economic	Ilse Aucamp	Equispectives Research and Consulting Services	PhD	IAIA
Visual	Johan Goosen	Aurecon	As above	As above
Traffic	Werner Heyns	Aurecon	PhD	PrPln
Floodline determination and storm water management plan	Johan Hefer	Aurecon	BEng Hons (Civil)	PrEng
Water balance	Francois Lategan	Aurecon	BEng Hons	PrEng
Waste classification	Michele Muller	Aurecon	MSc Water Utilisation	PrSciNat (SACNASP)
Consent use application	Sanri Rademeyer	Aurecon	M Town and Regional Planning	PrPln

7. Description of the Property

This section intends to identify and/or describe the farm properties that will be affected by the proposed opencast mining activities.

The site proposed for the HOP is located on four farm portions: farms Haakdoorndrift 374 KQ (portions 2 and 4) and Elandskuil 378 KQ (portions 1 and 2), to the northeast of the Anglo RPM: AS. The 21 digit Surveyor-General Codes of the properties on which the HOP is proposed, are listed in Table 4.

Table 4 | 21 digit Surveyor General Code of each cadastral land parcel for the proposed project

Farm name	■ Portion 2 of the farm Haakdoorndrift, 374 KQ ■ Portion 4 of the farm Haakdoorndrift, 374 KQ ■ Portion 1 of the farm Elandskuil, 378 KQ ■ Portion 2 of the farm Elandskuil, 378 KQ
Application area (ha)	■ Pit: approximately 33.5 ha ■ Haul road and berm area surrounding pit: approximately 14.8 ha ■ Overburden dumping and topsoil stockpiling area: approximately 29.6 ha ■ Mobile crushing and ore stockpile area: approximately 9 ha ■ Pollution Control Dam 1: approximately 4.4 ha Total: 91.3 ha
Magisterial district	Waterberg District Municipality
Distance and direction from nearest town	The proposed HOP is located approximately 14 km south of Thabazimbi.
21 digit Surveyor General Code for each farm portion	■ T0KQ00000000037400002 ■ T0KQ00000000037400004 ■ T0KQ00000000037800001 ■ T0KQ00000000037800002

8. Locality Map

The purpose of this chapter is to describe the location and/or extent of study area and various infrastructure directly affected by the Haakdoorndrift Opencast Project.

The site is located approximately 7.5 km north of Middeldrift (a small mine-related settlement, also known as Setaria),14 km south of Thabazimbi and 29 km northeast of Northam in the Thabazimbi Local Municipality (TLM), within the Waterberg District Municipality in the Limpopo Province and 137 km northwest of Pretoria. The project location within the TLM and WDM is shown in Figure 3. The proposed project area is located approximately 8 km east of the R510 and 2 km west of the R511. The Crocodile River is located approximately 0.3 km to the east of the pit boundary. Thabazimbi (nearest town) and the region's topography, at a scale of 1:250,000, are also shown in Figure 3 and is attached in Appendix 3.

The land use within the HOP area is mainly irrigated crop agriculture associated with the Crocodile River, grazing in various small areas between crop agriculture, a few dams used for agricultural purposes, and mining to the west.

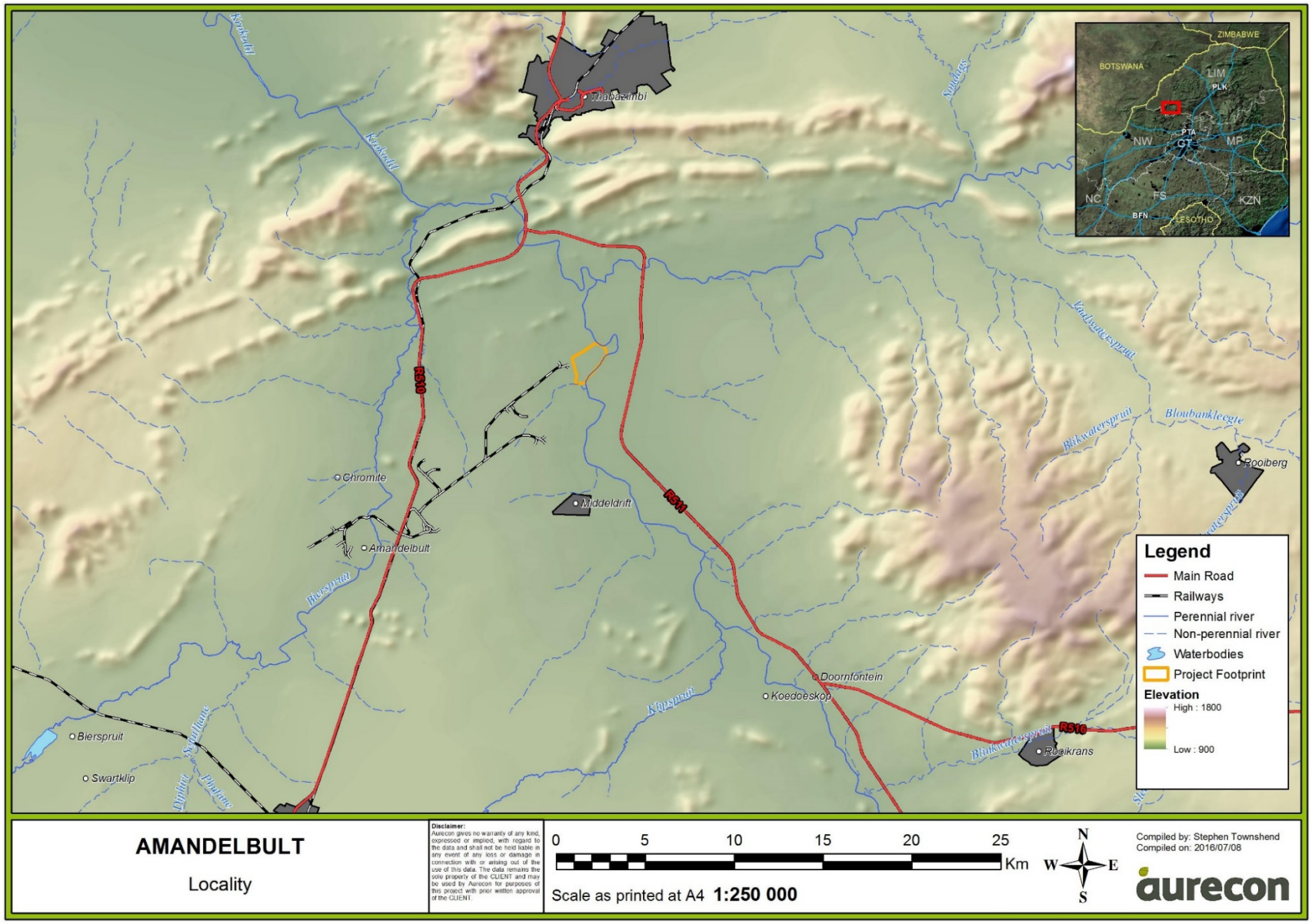


Figure 3 | The proposed Haakdoorndrift Opencast Project locality map showing the nearest towns, Thabazimbi and Middeldrift, and the topography of the region.

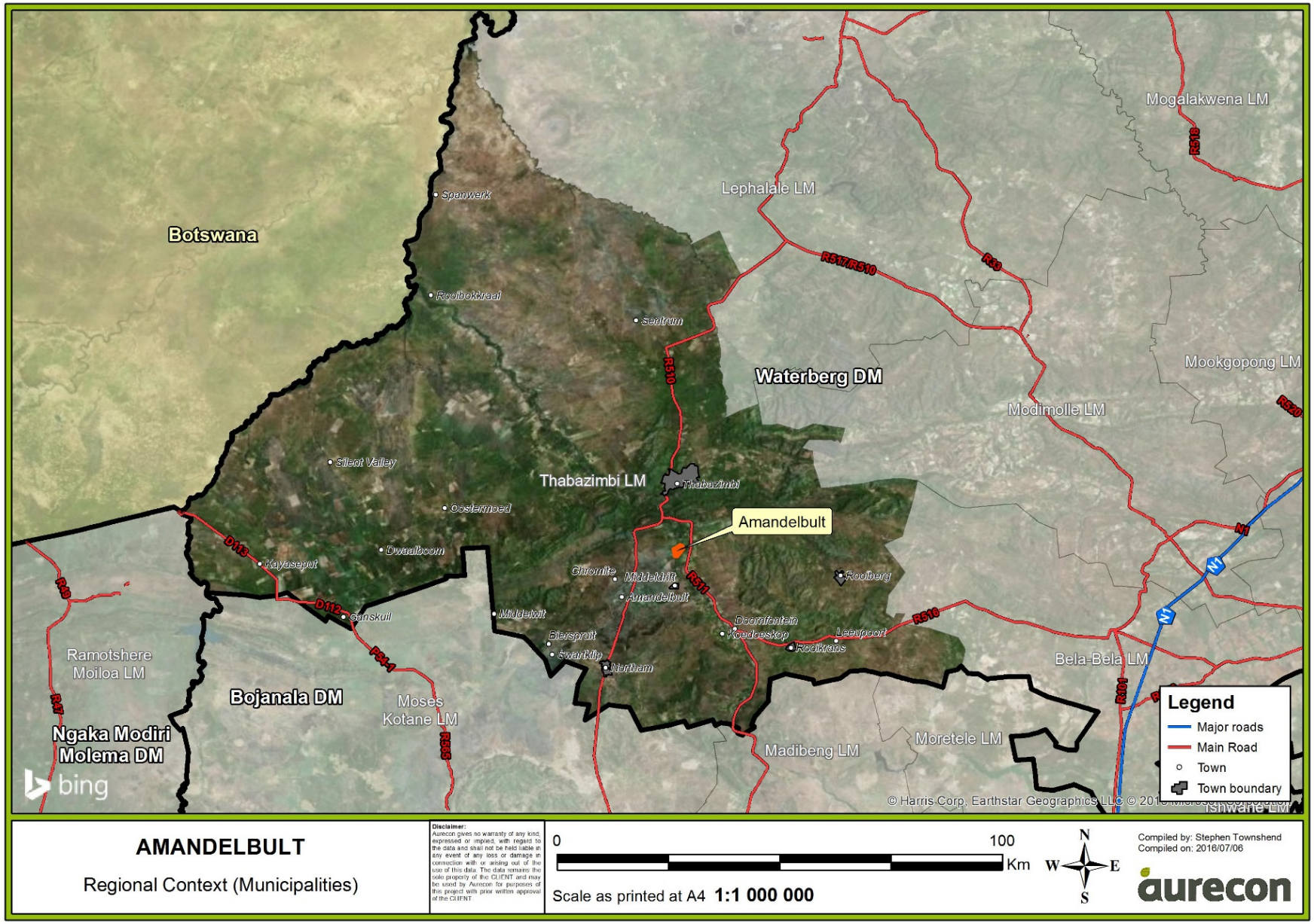


Figure 4 | The proposed Haakdoorndrift Opencast Project locality within the Thabazimbi Local Municipality.

9. Description of the Scope of the Proposed Overall Activity

This chapter details the NEMA listed activities associated with the project and activities to be undertaken during different phases of the project.

9.1. Listed and specified activities

Environmental Authorisation (EA) is being applied for in conjunction with a Water Use Licence (WUL). It is important that the activities associated with this project comply with relevant environmental legislation whether national, provincial or local. The NEMA and NEM: WA Listed Activities applicable to the HOP are shown in Table 5. The position of the location and area (hectares) of the main and listed activities and infrastructure to be placed on site are shown in Figure 5 attached in Appendix 4.1, drawn to a scale not less than 1:10,000.

Table 5 | Listed activities associated with the Haakdoorndrift Opencast Project according to 2014 NEMA EIA Regulations and NEM: WA GN 921 as amended

Name of activity (all activities including activities not listed, e.g. excavations, blasting, stockpiles, discard dumps or dams, loading, hauling and transport, water supply dams and boreholes, accommodation, offices, ablution, stores, workshops, processing plant, storm water control, berms, roads, pipelines, power lines, conveyors, etc.)	Aerial extent of the activity (ha or m^2)	Listed activity (mark with an X where applicable or affected)	Applicable Listing Notice (GNR 983, GNR 984, or GNR 985) or "not listed"
Storm water during preparation and mining activities will be managed by constructing turf / topsoil berms around excavated areas. The area to be excavated is around 1.3 km in length. Canals or pipes may be used which is larger than the threshold.	1.3 km	X	GNR 983 Listing Notice 1: Activity 9 (i), (ii)
A pollution control dam will be constructed southwest of the pit as a stormwater management measure to manage stormwater surges in the project area.	4.4 ha	X	GNR 983 Listing Notice 1: Activity 13
All project activities under the 1:100 year flood line may be construed as "within a watercourse".	Storm water: 1.3 km; guard cabins: >100 m^2	X	GNR 983 Listing Notice 1: Activity 12 (vi), (x) and (xii) (a)
Diesel stored in tanks in contractor's camp will likely exceed 80 m^3 but not 500 m^3.	100 m^2	X	GNR 983 Listing Notice 1: Activity 14
Overburden will be excavated prior to mining operations, and used to refill mined-out pits within the flood line.	34 ha	X	GNR 983 Listing Notice 1: Activity 19 (i)
A new haul road will be constructed for transporting material from the pit to the ore or overburden stockpiles.	1.3 km	X	GNR 983 Listing Notice 1: Activity 24
Indigenous vegetation (of more than 20 hectares) is likely to be cleared for the project.	31 ha	X	GNR 984 Listing Notice 2: Activity 15
An existing MR will be exercised for the extraction of minerals on an area exceeding 1.5 ha, and for a period exceeding two years.	34 ha	X	GNR 984 Listing Notice 2: Activity 17
A crushing facility is planned adjacent to the proposed opencast pit operations.	3 ha	X	GNR 984 Listing Notice 2: Activity 21
WASTE MANAGEMENT ACTIVITIES			
The overburden stockpiles are defined as **residue stockpiles** or **residue deposits** in terms of NEM: WA, including their management in terms of GNR 632 of 24 July 2015.	30 ha	X	Category B (11) of Waste Management Activities (GNR 921 of 2013 – updated on 2 May 2014)

9.2. Description of the activities to be undertaken

The envisaged mining method for the HOP is strip mining of the MER and UG2 reefs, the total ore resource available being approximately 260,000 m^3. Ore will be extracted for approximately 30 months, if extracted at a rate of approximately 50,000 tons per month. Overburden material of approximately 9,326,000 m^3 (prior to 25% bulking factor) will be removed and stockpiled in a designated overburden dump area of approximately 30 ha. Rehabilitation activities are expected to take another 8 months after mining has ceased.

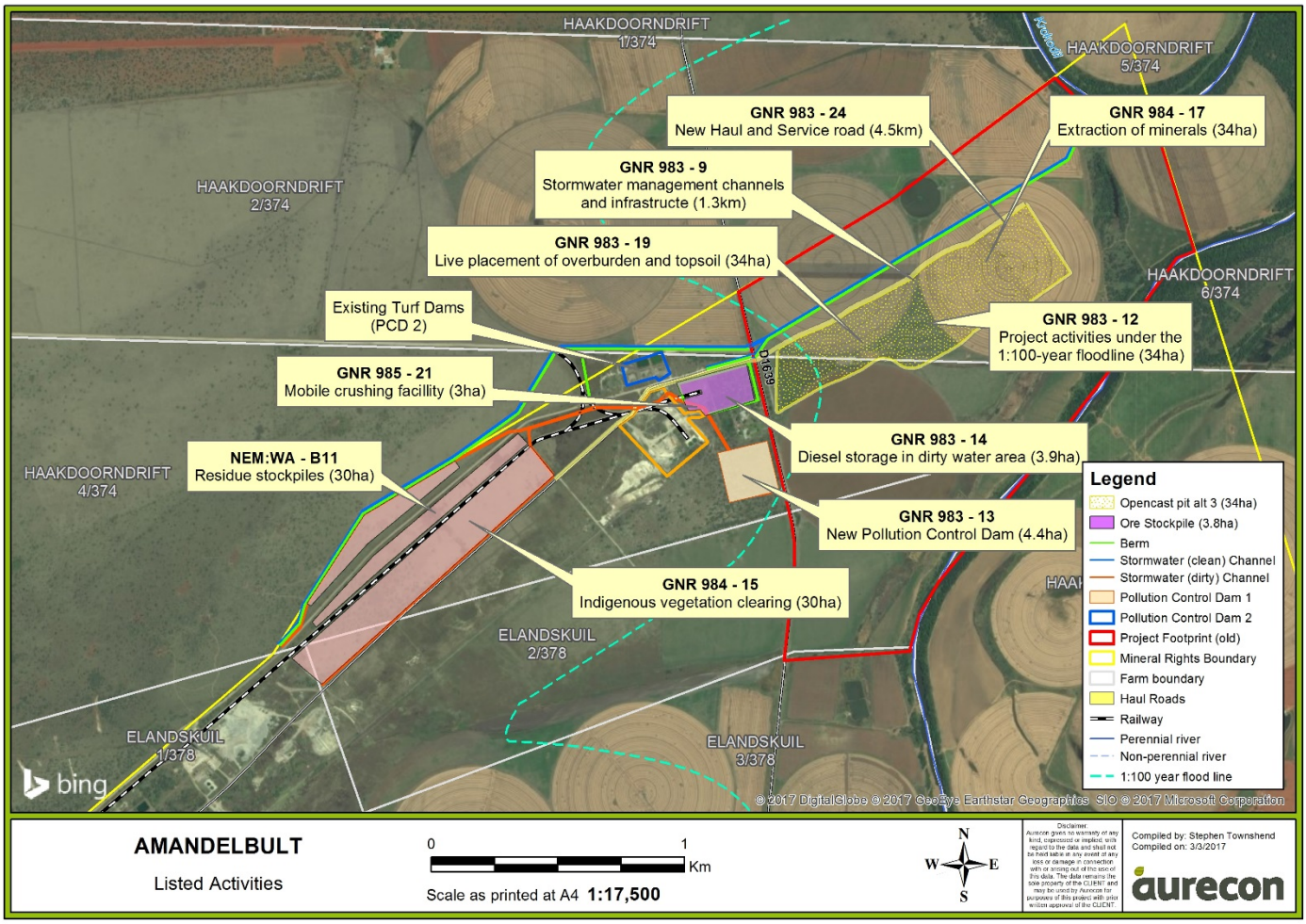


Figure 5 | Map of listed activities triggered by the HOP.

9.2.1. Mining methodology

Truck and shovel operations, in combination with an effective drill and blast plan, are employed at existing opencast operations at the Amandelbult Complex.

Project-specific method for the Haakdoorndrift Pit

The open pit will be mined using a conventional truck and shovel strip mining method. The process for the mining method involves stripping topsoil, drilling, blasting, loading and hauling of topsoil and overburden to the designated area, followed by the hauling of RoM to the ore stockpile area at the mobile crusher. The HOP will operate from 6AM to 4PM and 4PM to 2AM. No mining will take place between 2AM and 6AM. Blasting activities take place during the daytime, with no blasting occurring 30 minutes prior to dawn and 30 minutes prior to dusk. No blasting will take place on Sundays.

The proposed mining sequence for the HOP is shown in Figure 6 and Figure 7. Note that rehabilitation will occur concurrently, the exact incorporation explained in the **Pit development**-section below.

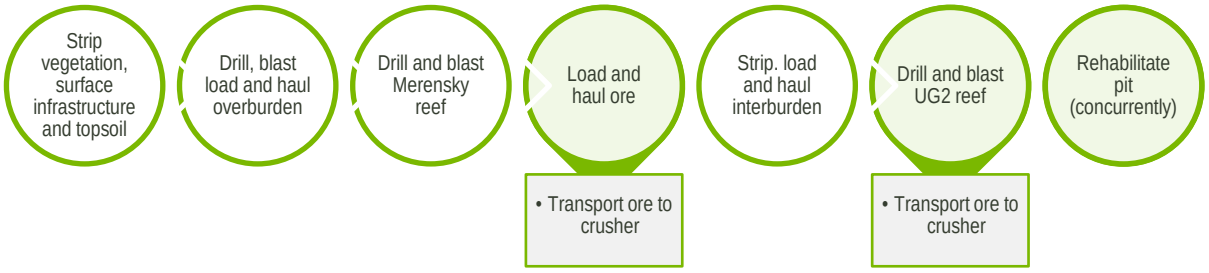


Figure 6 | Proposed mining sequence.

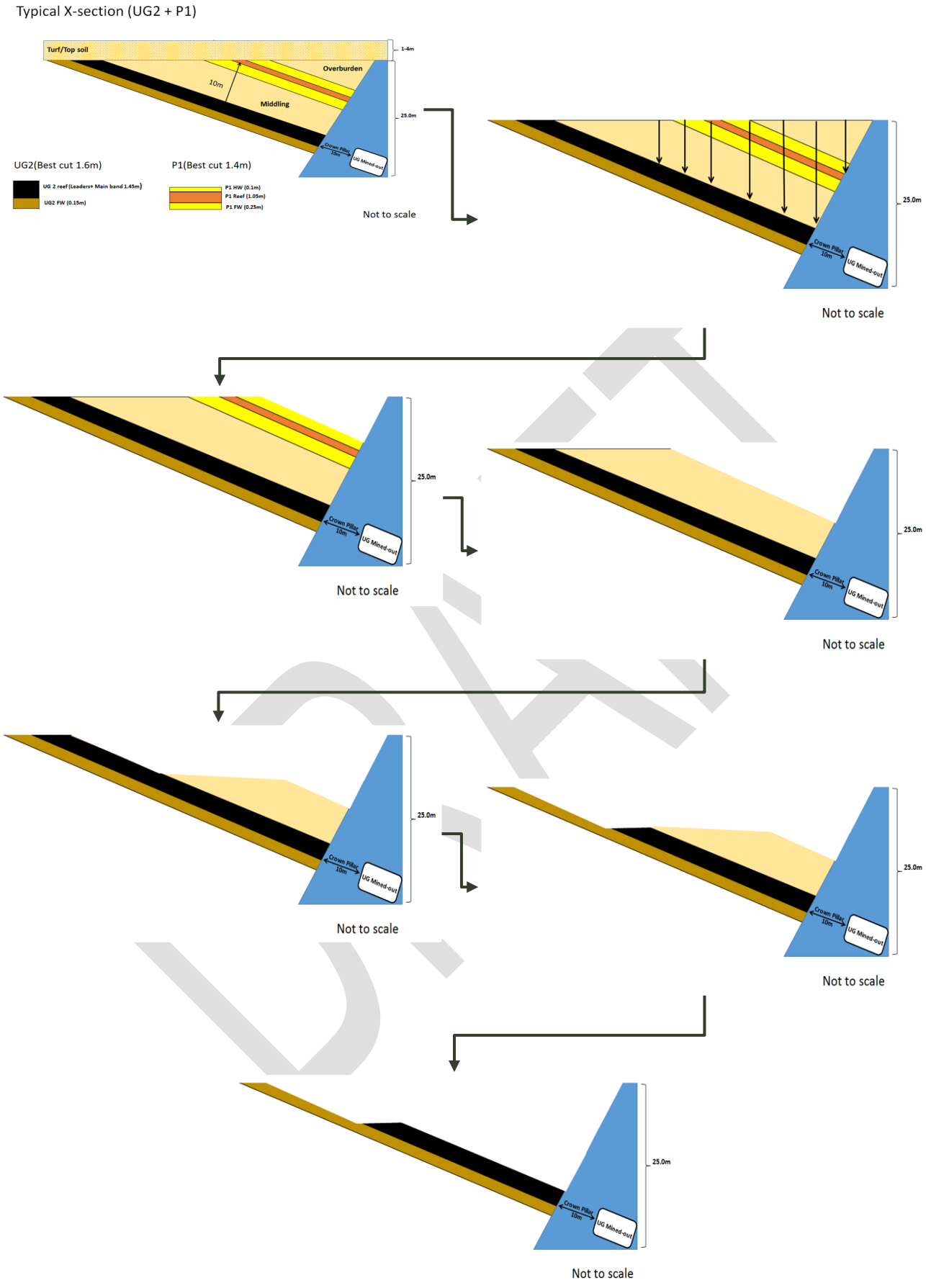


Figure 7 | Proposed opencast mining process.

The loading conditions are expected to correspond closely to a small scale open pit site, with a maximum pit depth of 60 m envisaged.

A cross section of the pit shell, reef positions and mining sequence is provided in Figure 8. The post mining landform contours are also indicated for the pit. The landform was developed though a dedicated modelling exercise to quantify the materials movement.

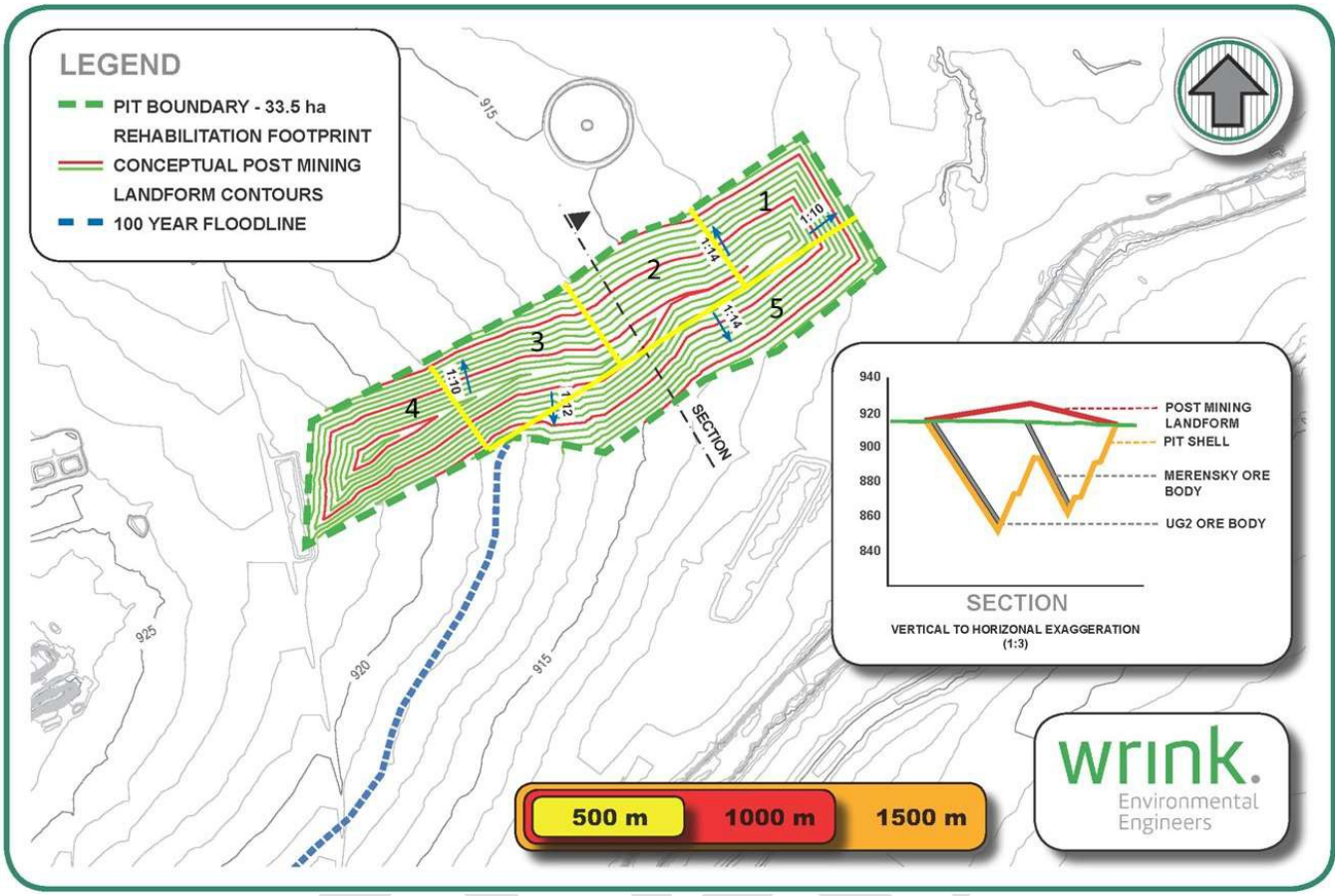


Figure 8 | Mining sequence and post mining landform contours and associated cross section (WRINK, 2017).

The pit is proposed at approximately 1,290 m in length, 230 m in width (eastern portion) / 330 m (western portion), and 60 m in depth. The pit surface area is approximately 33.5 ha. The regional topography in the project area is generally flat. The dip of the reef horizon ranges from 21° to 30°. Pit polygons have been adjusted to accommodate a 20 m crown pillar above underground workings.

Pit development

The pit will be developed from the north-western corner towards the south east, before coming back for cut 5 (see Figure 9):

- Topsoil for cut 1, 2 and 3 will be stripped as mining progresses and stockpiled in area 4;
- A base cut of weathered material is excavated to expose underlying rock;
- The rock is drilled to contact the top of the reef and then blasted;
- Once blasted, the overburden from the box cuts (cut 1 and 2 in Figure 9) is removed and stockpiled in area 4;
- Concurrent backfilling (to design elevations) of available void areas with overburden will commence in cut 3. Cut 3 material goes to cut 1/2, cut 4 to cut 2/3 and cut 5 to cut 3/4;
- Live placement of a portion of the topsoil stripped in cut 4 and 5 on backfilled areas, the remainder will be placed on stockpile;
- Ore bearing reef is removed separately and transported to the ore stockpile area to be crushed and screened;
- Front-end loaders will load crushed ore onto the train at the crushing facility, one week out of every month, to transport it to the Amandelbult Concentrator;
- The boxcut overburden, stockpiled in area 4 will be utilised to backfill the final void at the end of the life of mine (LOM); and
- All backfilling will be done to specified post mining landform levels, covered to the specified depth with topsoil and revegetated.

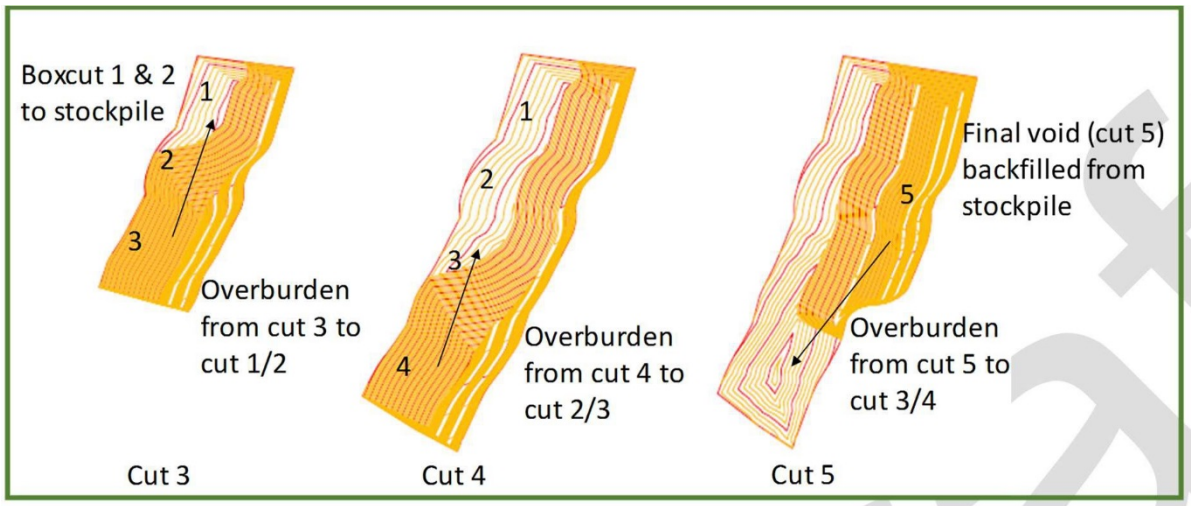


Figure 9 | Mining sequence with concurrent backfilling (WRINK, 2017).

Table 6 | Volumes and area for each stage of the mining sequence

Mining Stage	In-pit Vol. removed*	Cumulative topsoil stripped*	Topsoil stripped*	Area disturbed (ha)	Overburden Dump A Volume*	Overburden Dump B Volume*	Overburden Dump C Volume*	Concurrent backfill*	Final void backfill*	Topsoil dump cumulative*	Topsoil live placed*	Area rehabilitated (ha)
1	2 061 184	83 916	83 916	8,39	2 574 789					83 950		
2	1 482 454	136 721	52 805	5,28	3 627 094	314 770	487 842			136 505		
3	1 657 838	195 353	58 632	5,86	3 627 094	314 770	487 842	2 071 586		195 353		
4	1 680 280	254 782	59 428	5,94	3 627 094	314 770	487 842	2 095 350		221 295	33 486	3,4
5	2 444 095	335 142	80 360	8,04	3 627 094	314 770	487 842	3 044 108		180 419	154 579	12,1
6	0	0	0	0	0	0	0	0	4 421 748	0	0	18,06
Total	9 325 852		335 142	33,51				7 211 043	4 421 748		188 065	33,51

*All volumes indicated in cubic metres.

Life of Mine Schedule

The schedule runs over a period of approximately 30 months at a RoM production rate of 50,000 tons per month for the entire duration of the operation.

- The HOP will operate from 6AM to 4PM and 4PM to 2AM. No mining will take place between 2AM and 6AM. Blasting activities take place during the daytime, with no blasting occurring 30 minutes prior to dawn and 30 minutes prior to dusk. No blasting will take place on Sundays as per statutory requirements, and will, as far as possible, be limited to Mondays to Fridays. Blasting is planned to take place 2 to 3 times per month.
- Articulated dump trucks (ADTs) will be loaded daily (the fleet composition will be finalised in the detailed planning phase prior to construction).
- The ADTs will have to cross the D1639 road to the overburden stockpile area are regular intervals, depending on the fleet options, as per the Traffic Impact Assessment attached in Appendix 7 (Aurecon, 2016).
- Ore will then be stockpiled in the designated area next to a mobile crusher at the existing 62E Decline Shaft.
- Front-end loaders will load crushed ore onto the train at the crushing facility, at regular intervals, to transport it to the Amandelbult Concentrator.

PGE processing

Ore will be crushed to reduce its size at the primary, mobile crusher at the existing 62E Decline Shaft. It will then be transported to the existing Amandelbult Concentrator Plant via existing rail infrastructure. However, this project's scope in terms of processing is limited to:

- the extraction of ore;
- transportation of ore to the proposed primary crushing facility; and
- loading crushed ore onto the train at the 62E Decline Shaft for transportation to the Concentrator.

Rehabilitation

- Overburden and topsoil will be placed live where possible, and stored in separate stockpiles in the designated area.
- Rehabilitation of the HOP is estimated to continue for approximately 8 to 24 months after the 30-month LoM.
- Overburden material from the pit will be disposed of in the mined-out open pit and rehabilitated concurrently while mining continues.

9.2.2. New activities at the opencast pit area

The following new activities/infrastructure will be required for the HOP:

- The pit will have a 50 m working buffer around it, which will be fenced. This will accommodate:
  - 20 m wide haul road along the northern edge of the pit;
  - 1.5 m high soil berm for access control and health and safety reasons;
  - High-wall push-back on the south side of the pit;
  - Service road around the pit on the eastern, southern and western sides;
  - A guard cabin will be placed close to the pit. No other buildings/containers for, for instance, offices, will be placed in the HOP-area;
  - Perimeter fencing, 1.8 m high, will be erected around the proposed mining area. This will include access control, and a double gate for large vehicles entering the site; and
  - An open soil V-drain to cut off clean stormwater from the north, and transport the water in an easterly direction to the Crocodile River.
- Drills, which will be fitted with effective water mist and dust-suppression systems, installed and maintained to manufacturer's specifications. In particular, care will be taken to ensure that the dust extraction systems operate effectively whenever drilling occurs.

No other activities are expected outside the designated work area to the east of D1639 district road, in order to limit the disturbance to agricultural activities.

Removal of old infrastructure

- A redundant Eskom 11kV line towards the vent shaft (65 fan) will be disconnected.
- A mine-owned transmission line towards the vent shaft (65 fan) will be deactivated for the LoM, or decommissioned entirely.
- The existing vent shaft (65 fan) within the area to be mined will be removed prior to construction.

9.2.3. New supporting infrastructure requirements

- Overburden dump area;
- A haul road and ramps from the pit to the overburden dumps, crossing the D1639 district road;
- Mobile crushing plant and ore stockpile area at the existing 62E Decline Shaft;
  - The mobile crusher would typically be fitted with a dust suppression system through misting;
- Contractor's laydown area (including a parking area) at the existing 62E Decline Shaft;

- Diesel tank in contractor's camp for refuelling bowsers;

Clean water management

- A berm will separate a clean water earthen V-drain from a High Density Polyethylene (HDPE) lined dirty water channel north of the stockpile area.
- The clean water earthen V-drain will run along the northern edge of the stockpile areas, cross the D1639 road, along the pit area and drain into the Crocodile River.

Potable water

- Potable water will be brought to a temporary 5,000 L *JoJo* tank for use by personnel;

No other potable water will be used for the HOP site.

Dirty water management

- In-pit water management will mainly consist of run-off control and temporary sumps at the lowest elevation in the pit, capturing rainwater and ingress-groundwater.
- Minimal work on ADT plant will be done in the pit area.
- A mobile trailer-mounted pit-dewatering pump will pump excess water from the pit to Pollution Control Dam 1 (PCD 1).
- A berm will separate a clean water earthen V-drain from an HDPE lined dirty water channel north of the stockpile area.
- Two HDPE-lined V-drains will drain dirty water (from overburden dumps) in an easterly direction to the 62E Decline Shaft area, joining a concrete trapezoidal channel.
- The trapezoidal channels around the 62E Decline Shaft area will drain into a storm water surge dam / balancing dam / PCD.

Stormwater surge / pollution control dam

- The *storm water surge* function and *pollution control from dirty water areas* will be combined (PCD 1);
- PCD 1 will be situated to the south-east of the existing 62E Decline Shaft. It will collect dirty water from the ore stockpile, topsoil stockpiles, overburden dumps and 62E Decline Shaft area used for parking plant used for the pit's operation, all via gravitation.
- PCD 1 will have a 150 mm GEOCELL layer as lining (or as otherwise approved/recommended by DWS);
- The sizing of PCD 1 for storm water surge is approximately 66,000 m^3. The dirty water portion of PCD 1 has not yet been determined. The final sizing of PCD 1 depends on the water needs of the rest of the Amandelbult Complex.
- From PCD 1, dust suppression with bowsers will be done on the haul roads, at 5 mm depth per day, with an appropriate dust suppression product.
- The existing turf dams north of the 62E Decline Shaft will be used as PCD 2.
- Excess water will be pumped towards the existing turf dams (PCD 2) to the north of 62E Decline Shaft, for storage and use at the rest of the Complex.

Sewage

- Chemical toilets will be placed in the dirty water area of the pit, and at the 62E Decline Shaft area to be re-used.

Workshops / plant maintenance

- Most of the fixed infrastructure of the opencast contractor will not be on site, as the contractor's ADT fleet undergoes scheduled maintenance at the Central Workshops (or similar existing formal infrastructure) of the Complex.
- Emergency breakdown repairs will be done in the pit (regarded as a dirty water area).
- Minimal (mostly emergency) maintenance will be done on existing slab areas at 62E Decline Shaft area, where plant will also be parked if not in use.
- Existing concrete surfaces of 62E Decline Shaft will be used.

Refuelling and fuel storage

- No fuel storage currently takes place at opencast areas of the complex.

- The Amandelbult Complex has a central diesel depot at its Central Workshops, from which the opencast contractor will fill 5,000 L fuel bowsers, which will transport fuel to the HOP area being mined.
- For the HOP, refuelling will take place within the working area around the pit (regarded as a dirty water area).
- Due to the larger pit size of the Haakdoorndrift project, an above-ground fuel storage area of more than 30 m^3, but less than 500 m^3, may be required at the site itself. Should this be the case, it will be installed according the SANS standards with bunding and related measures, at the existing 62E Decline Shaft area.

9.2.4. Existing Surface Infrastructure at Dishaba Mine

Roads and Railways

A network of existing tarred and gravel roads in the Dishaba Mine will be used in the HOP. Access to Dishaba Mine is obtained via the R510 to the west. Access to the HOP site is via the D1639 district road.

An internal network of existing railway lines connects shafts with the Amandelbult Concentrator Plant, mostly used for the transport of ore. The railway line extending to the 62 East Decline Shaft will be used to transport ore from the HOP to the Amandelbult Concentrator Plant.

Powerlines

Power will be provided from existing connections to the Eskom grid. All Dishaba mine workings are fed from a consumer substation, fed by a 132 kV line from Lephalale.

9.2.5. Mine residue management

Mining waste (overburden and topsoil stockpiles)

The overburden stockpile arrangement during steady state production towards the end of the LoM is illustrated in Figure 10 and Appendix 4.1. Overburden and topsoil stockpiles will occupy approximately 30 hectares to the east of the existing 62E Decline Shaft area, in three stockpile areas.

- Overburden material will be disposed of at their natural repose angles.
- The overburden dump will progress by tipping from a higher level and progressively pushing the material out with a dozer.
- The proposed dump area is approximately 30 ha, with a maximum volume of 4 630 000 m^3 of material dumped in this designated area (at Stage 4 of the mine plan for HOP). The volume of material on the three overburden and one topsoil dump will change throughout the process.
- The height of these stockpiles will be approximately 26.5 m.
- Natural angle of repose will be used for side slopes.
- This will be regarded as a dirty water area.

The final arrangement at mine closure when overburden waste is returned to mined-out pits, calculated with a 6% doming factor is illustrated in Figure 8 and attached as Appendix 4.2.

Non-mining waste (industrial, domestic, and hazardous waste)

A dedicated, approved (registered) waste contractor is appointed at the mine to manage non-mining waste. At the established Amandelbult section (i.e. Dishaba, Tumela and Concentrator), only food and polystyrene containers go to Thabazimbi landfill via a contractor. A "Zero Waste-to-Landfill by 2020"-initiative is underway at RPM: AS. As part of this initiative, all general waste (paper, cardboard, glass, clear plastics, colour plastics, and cans) will be recycled; kitchen swill, food waste, and garden waste will be composted at a proposed new waste facility at the Maputo hostels at RPM: AS. This recycling facility will make use of balers to provide service to the *entire* mine (i.e. – not Haakdoorndrift exclusively). Therefore, a separate waste management licence will be applied for in this regard.

Industrial waste, such as tyres, scrap metal, wood, hoses, conveyor belts, bricks or concrete is salvaged for reuse, recycling, resale, or disposal as appropriate. All hazardous waste is collected by suitably qualified contractors and disposed of or recycled at appropriately licenced facilities.

Therefore, no landfill site will be established on the Haakdoorndrift site or any section of RPM: AS as part of the HOP.

No explosives will be stored on site for the HOP-site.

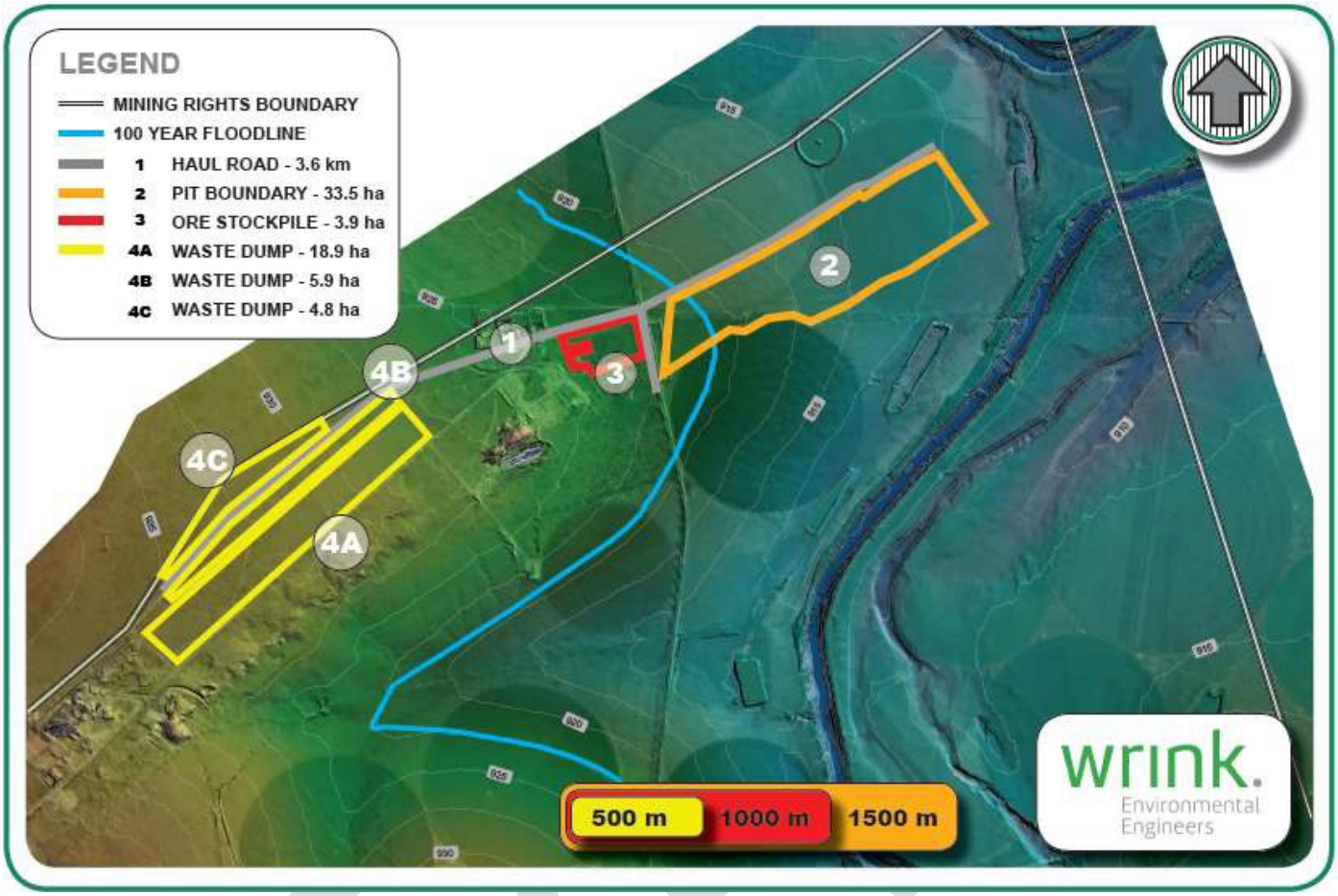


Figure 10 | Itemised layout plan for Haakdoorndrift at the time of closure (WRINK, 2017).

9.2.6. Closure planning and rehabilitation

Existing closure plan of the Amandelbult Complex

The rehabilitation of the proposed facility will be subject to conditions in the existing closure plan of the Amandelbult Complex, in which provision is made for the decommissioning of facilities such as the proposed one. The current closure liability assessment for the Amandelbult Complex has the following closure objectives:

- The rehabilitation of land to the satisfaction of the Regional Director and to leave the area in the best possible state for continuous use of land by future generations;
- Revegetated areas will be monitored and maintained until such time as a vegetation cover has been established and can be shown to be self-sustaining;
- Measures to control erosion of soil, such as contour drains and other erosion control structures, will be installed and maintained during the decommissioning phase and up to closure; and
- Grass will be monitored and maintained until such time as a suitable cover has been achieved and a closure certificate can be issued.

The following rehabilitation specifications have been designed to meet the closure objectives in (2):

- Surface infrastructure will be demolished;
- Foundations will be removed;
- Building rubble will be disposed of at a nearby suitable site;
- All areas cleared of surface infrastructure will be rehabilitated by placement of topsoil and revegetated;

- All roads that will not be used by the local population in the post-mining scenario will be ripped and vegetated; and
- Any soil contamination will be removed during demolition activities prior to topsoil replacement and revegetation.

The remainder of this section will, however, focus on rehabilitation phase (1), as it has been investigated for the first time during this EIA-process due to the proposed Haakdoorndrift pit area's location on non-mine-owned land.

Existing closure planning - demolition and reclamation (62E Decline Shaft)

A Closure Liability Assessment has been done for 62 East Decline shaft and is updated annually.

- Material will be recycled as far as possible and use will be made of contractors specialising in this field to dismantle the surface infrastructure and recycle the building material as far as possible.
- Non-recyclable building material will be disposed of at a registered landfill site.

Closure activities for the Haakdoorndrift Opencast Project

Closure planning for the Haakdoorndrift Opencast project will be led by the following overarching goals:

- Ensuring long term physical and chemical stability;
- Establishment of a post mining land use which can be sustained in the long term, preferably agriculture;
- Adherence to legislation relevant to mine closure; and
- Aligning rehabilitation planning with regional planning, company policies and agreements with stakeholders.

According to parts 3. (b) ii (aa) and (bb) of Appendix 4 of GNR1147, The final rehabilitation, decommissioning and mine closure plan (FRDCP) contains and considered the social and environmental baseline environment, which was based on the same specialist studies as chapter 2.4 of this report. The closure objectives are therefore aligned with the baseline environment.

Closure Vision

The proposed closure vision for the HOP is to develop a post mining landscape that is chemically and physically stable, that can be gainfully utilised for agriculture in the long run. The vision is the driver of all rehabilitation and closure activities.

Closure objectives

Rehabilitation objectives to underpin successful closure broadly include the following aspects:

- Design and construct a post mining landform that:
  - is free draining of surface water runoff;
  - has a drainage frame work aligned with the natural catchment;
  - has slopes consistent with the post mining land use; and
  - is designed based on geomorphic principles to ensure stability, combat erosion and limits the need for further storm water management measures;
- Rehabilitate all haul roads and operational storm water management measures to the required post mining land use;
- Remove all overburden and topsoil stockpiles and rehabilitate the footprints to the required post mining land use;
- Implement concurrent rehabilitation of the open pit and backfill to designed levels;
- Continually develop the "social licence' to operate through building pro-active relationships and involvement with local communities and fora;
- Monitor all aspects identified to demonstrate rehabilitation and closure success, mitigate as required and build towards a closure application once success criteria are met.

Rehabilitation and closure activities for HOP

The following actions will be implemented during the planning, operational and closure phases to achieve the rehabilitation objectives. The actions are aligned with the mitigations defined in the comparative risk assessment, form the basis of the closure cost assessment,

and stated closure objectives. The actions will commence at the end of mining activities once cut 5 has been mined out. These main actions include:

Area 1 – Haul Roads

Haul roads will remain intact and utilised during the final void backfilling operation, rehabilitation will commence after topsoil has been replaced on the opencast post mining landform. The following actions will be implemented:

- Remove all signage;
- Rip the compacted haul road surface;
- Load and haul road building material to be used as infill for the open pit and clean to the B-horizon;
- Rip the in-situ B-horizon;
- Replace the A-horizon from stockpile 4;
- Conduct fertility sampling, have the soils analysed at an accredited laboratory and define amelioration measures based on the results; and
- Establish vegetation (includes agricultural ripping, land preparation, specified amelioration and seed mix application).

Area 2 – Open pit

Due to concurrent rehabilitation during the operations, only cut 5 (final void) will require backfilling. A dedicated conceptual post mining landform model was developed to inform this FRDCP and Annual Rehabilitation Plan (ARP). The model will require calibration throughout the life of mine to ensure an accurate materials balance. Final rehabilitation and closure measures, once mining has ceased, include:

- Backfill the open pit final void with Load and haul material from waste stockpiles (area 4) to the elevations specified in the post mining landform design;
- Load, haul topsoil from stockpile area 4, tip at the correct spacing and level to the specified depths;
- Conduct fertility sampling, have the soils analysed at an accredited laboratory and define amelioration measures based on the results; and
- Establish vegetation (includes agricultural ripping, land preparation, specified amelioration and seed mix application).

Item 3 – Infrastructure, screening and ore stockpile

No closure allowances will be made for offices or crushing and screening areas. Infrastructure will be shared with the 62E Decline Shaft complex; the closure and rehabilitation liability is included under the Amandelbult authorisations and EMPr. Storage tanks and water filling points are included in this area while all vehicle servicing and maintenance will occur off site. The new PCD 1 is included in the FRDCP as part of the rehabilitation and decommissioning additions resulting from the HOP.

Area 4A, 4B and 4C – waste/topsoil stockpiles

The box cut overburden and topsoil stockpiles will be removed and used to rehabilitate the opencast pit final void (cut 5) at the end of the LOM. The actions include:

- Load and haul the overburden material from stockpiles in area 4 to be used as fill for the open pit (costs included in Item 2 – Open pit), and clean to A-horizon;
- Load and haul topsoil stockpiles from stockpile in area 4 and place on prepared haul road and open pit areas (costs included in Item 2 – Open pit and Item 1 – Haul roads) and clean to the A-horizon;
- Ensure that the footprint is cleared of rocks that could damage agricultural equipment;
- Cross rip in-situ A-Horizon with agricultural ripper to alleviate compaction;
- Conduct fertility sampling, have the soils analysed at an accredited laboratory and define amelioration measures based on the results; and
- Establish vegetation (includes land preparation, specified amelioration and seed mix application).

Storm water management measures

The storm water measures will be re-evaluated in the lead up to closure. The assessment should be conducted in consultation with the post mining land user to determine if certain structures should remain. The closure assumption currently is that all storm water measures will decommissioned and rehabilitated to reinstate the pre- mining surface water drainage framework. The following actions will be implemented:

- Grass lined V-Drains will be infilled with initial excavation material placed adjacent to the structures;
- Remove and dispose of the liners from the HDPE lined V-Drain, infill with initial excavation material placed adjacent to the structures;
- Demolish, remove and dispose of Concrete from HDPE lined V-drains and trapezoidal channels;
- Level, shape, and place topsoil over PCD 1;
- Rip all compacted surfaces;
- Infill with initial excavation material placed adjacent to the structures;
- Conduct fertility sampling, have the soils analysed at an accredited laboratory and define amelioration measures based on the results; and
- Establish vegetation (includes land preparation, specified amelioration and seed mix application).

General items

General items include the following actions:

- removal of all signage;
- dismantling and removal of fencing;
- Installation of a monitoring/extraction borehole into the rehabilitated open cast pit (area 2); and
- Rehabilitation of access tracks to the fences, this will require ripping to alleviate compaction, land preparation, amelioration and seed mix application.

Maintenance and Aftercare

Maintenance and aftercare will take place for a three-year period after final rehabilitation is completed. The activity is closely linked to the monitoring phase and actions will largely be driven by the monitoring outcomes. Allowances include the following:

- Soil amelioration and vegetation establishment contracts routinely includes monitoring and reseeding of areas as required to ensure vegetation establishment in the first year;
- Reseeding a total of 2ha across the rehabilitated areas to establish vegetation on areas where erosion has been addressed (should it be required);
- Site inspections during the rainy season to identify erosion and determine the cause;
- General maintenance of possible surface depressions, subsidence and erosion gullies (doming at 6% takes approximately 18 to 24 months to settle); and
- Addressing areas of continuous erosion.

Refer to Appendix 4.2 for the envisaged final waste dump arrangements and topography after rehabilitation.

Annual Rehabilitation Plan

This plan is broadly set out in section 9.2.1 (project specific method) of this report, and further detail is provided in the relevant specialist report attached in Appendix 7.9.

Latent and residual risk (groundwater)

The risk assessment regarding latent and residual impacts (particularly those relating to extraneous water requiring pumping and treatment), was conducted as part of the groundwater specialist study for the EIA phase of the project. The battery limits for the

FRDCP is all new disturbances relating to the Haakdoorndrift opencast pit including the pit, haul roads, stockpile areas and storm water management measures. The battery limits end at the existing infrastructure and footprints of the 62E Decline Shaft.

The Groundwater Report (Groundwater Complete, 2017) indicated the following:

- The expected decant rate of 16 040 m^3/y (0.5 l/s) is based on an isolated groundwater model, not taking into account evapotranspiration or linkages between the pit and other underground workings.
- The decant was modelled to occur 134 years after mining activities have ceased.

In practice, considering external factors to the isolated model:

- It is expected to be even lower due to water loss from evapotranspiration through the vegetated soil capping after rehabilitation.
- The majority of current and old opencast pits are linked with the underground workings (by means of mining activities or transmissive geological structures), which must be flooded first before any decanting can occur.
- Based on current experience of these additional factors, the decant is expected not to occur.

For this reason – the closure and rehabilitation and EIA report indicate that decant of the open pit is not expected.

Way forward:

- It is proposed that the relationship between the flooding of the underground workings, the actual recharge volume and quality through a 1m topsoil layer and the expected decant must be investigated as part of monitoring activities.
- Once better understood, the end use of such water (i.e. process water at the mine, or agricultural use) can be agreed.
- A plume of ground water with elevated Total Dissolved Solids (TDS) is predicted to migrate north east from the rehabilitated open pit. The direction is not towards the Crocodile River and indications are that no existing ground water users will be affected.

Based on the outcomes, no allowances have been made to deal with any latent or residual risks for this project. The need for continual monitoring throughout the operational phase and the refinement of the geohydrological model is recognised.

10. Policy and Legislative Context

This section provides an overview of the legal documents, policy documents, and guidelines to consider when undertaking an EIA process. The EIA is being undertaken in accordance with relevant South African environmental legislation and takes into consideration international best practice.

10.1. Applicable legislation

The main legal frameworks that require compliance in terms of EA and Water Use Authorisation are:

Applicable legislation and guidelines used to compile the report (a description of the policy and legislative context within which the development is proposed including an identification of all legislation, policies, plans, guidelines, spatial tools, municipal development planning frameworks and instruments that are applicable to this activity and are to be considered in the assessment process)	Reference where applied	How does this development comply with and respond to the Policy and Legislative context? (E.g. in terms of the national Water Act: Water Use Licence has/has not been applied for).
The Constitution of South Africa, Act No. 108 of 1996: Anglo will be required to adhere to the Environmental Management Programme (EMPr) requirements in order to ensure that social and environmental management considerations are taken into account and implemented throughout the lifecycle of the project. As per Section 25 the Constitution, a public participation process (PPP) will be undertaken as this is considered to be an essential mechanism for informing stakeholders of their rights and obligations in terms of the project.	EIA process; Section 12.2	An EMPr is included in this report as Part B. The condition that the EMPr must be adhered to is listed as a required condition in the Environmental Authorisation. A PPP was conducted during the Scoping phase and is being conducted during the EIA-phase.
Mineral and Petroleum Resources Development Act (MPRDA), as amended, Act No. 28 of 2002: Anglo is required to submit an EA application under the existing mining right issued in terms of Section 22 of the MPRDA.	EIA process	An application for Environmental Authorisation is being submitted to the Department of Mineral Resources for mining activities on the Mining Right area held by Rustenburg Platinum Mines.
National Environmental Management Act (NEMA), as amended, Act No. 107 of 1998; NEMA: EIA Regulations, GN No. R. 982-986 of 4 December 2014: A number of listed activities as per GN 9.1983, GN 984 and GN 985 are applicable, requiring an EIA.	Section 9.1	An application for Environmental Authorisation in terms of NEMA was submitted to the applicable competent authority, and an EIA is being conducted accordingly.
National Water Act (NWA), as amended, Act No. 36 of 1998: An IWULA is required for the Haakdoorndrift opencast mine in the 100-year flood line of the Crocodile River, and dewatering the pit: Anglo will apply for the following water uses: • Section 21 (a) Taking water from a water resource; • Section 21 (b) Storing water; • Section 21 (c) Impeding or diverting the flow of water in a watercourse; • Section 21 (g) Disposing of waste in a manner which may detrimentally impact on a water resource; • Section 21 (i) Altering the bed, banks, course or characteristics of a watercourse; and • Section 21 (j) removing, discharging or disposing of water found underground if it is necessary for the efficient continuation of an activity or for the safety of people.	Section 9.2	An Integrated Water Use Licence has been applied for.
National Environmental Management Laws Amendment Act (NEMLAA), Act No. 25 of 2014: The One Environmental System (OES) was introduced on 8 December 2014 by the enactment of NEMLAA. In terms of the OES every applicant who applies for a mining right in terms of Section 22 of the MPRDA must conduct an EIA and submit an Environmental Impact Report (EIR) and EMPr in terms of NEMA (amendments) and the EIA Regulations (2014). Under the OES these reports are submitted to the DMR who is the lead agent for any mining and related activities. The system requires all permitting applications to be conducted in parallel to facilitate integrated decision making at Government level	EIA process	This application for environmental authorisation of open pit activities on the Haakdoorndrift farm has been submitted to the DMR who, as the competent authority has approved the application and the Scoping Report predeceasing this EIA report.

and the EA application should therefore ideally include the requirements of the NEMA, the NWA, the NEMWA and others, as applicable.		
National Environmental Management: Waste Act (NEM: WA): Act No. 59 of 2008; National Environmental Management Act: Waste Amendment Act (WAA), Act No. 26 of 2014; NEMWA: Waste Management Activities, GN No. 921 of 29 November 2013; NEMWA: Waste Classification and Management Regulations, GN No. 634 of 23 August 2013 • Overburden dumps will require a waste management licence (WML). In particular, in terms of WAA Schedule 3, Category A (Hazardous Waste): *"A "residue stockpile" means any debris, discard, tailings, slimes, screening, slurry, waste rock, foundry sand, mineral processing plant waste, ash or any other product derived from or incidental to a mining operation and which is stockpiled, stored or accumulated within the mining area for potential re-use, or which is disposed of, by the holder of a mining right, mining permit or, production right or an old order right, including historic mines and dumps created before the implementation of this Act."*	Section 9.2	A Waste Management Licence is being applied for along with Environmental Authorisation for this project.
National Heritage Resources Act (NHRA), Act No. 25 of 1999: The Heritage Impact Assessment (HIA) and Palaeontological Impact Assessment (PIA) were conducted to identify important cultural heritage and palaeontological resources in the proposed mining area. SAHRA will review the heritage assessments and provide comments to the DMR, which would consider these comments in their final environmental decision. However, should a permit be required for the damaging or removal of specific heritage resources such as palaeontological or archaeological objects, a separate application for such destruction would need to be submitted to the relevant heritage agency for approval.	Section 12.5.11	The HIA and PIA reports conducted for this project were submitted to SAHRA on 3 March 2017.
NEMA: Biodiversity Act (NEMBA), Act No. 10 of 2004: An ecological baseline (and impact) assessment (floral, faunal and wetland) was undertaken to determine if any listed species are located on the proposed site.	Section 12.4.1	An ecological impact assessment has been undertaken to determine the impact that the proposed activities could have on Biodiversity on the proposed site. The report is attached as Appendix 7.
Conservation of Agricultural Resources Act (CARA), Act No. 43 of 1983: According to the Land Capability Assessment study, the opencast mine will cause a disturbance to the agricultural land on which it is proposed.	Section 12.5.1	A soil, land use and land capability assessment has been undertaken to determine the impact that the proposed activities could have on Agricultural Resources on the proposed site. The report is attached as Appendix 7.
National Environmental Management: Air Quality Act (AQA), Act No. 39 of 2004: The proposed mining and crushing activities may lead to dust generation, requiring an Air Quality Impact Assessment.	Section 12.5.5	An air quality assessment has been undertaken to determine the impact that the proposed activities could have on ambient air quality on the proposed site. The report is attached as Appendix 7.
Hazardous Substances Act, Act No. 15 of 1973: The use of hydrocarbons and explosives during the proposed mining activities will require its consideration in the EMPr.	EMPr (EIA Phase)	The EMPr, in Part B of this report, provides recommendations in terms of the use of hazardous substances on site.
Regulation on use of water for mining and related activities aimed at the protection of water resources, GN No. 704 of 4 June 1999 A storm water management system will need to be designed to manage water in the pit area within the Crocodile River flood line, as well as runoff from stockpiles in the proposed waste dump areas.	EIA Phase	Storm water management measures have been designed according to the mine plan, and approval under GN 704 is sought as part of the IWULA.
NEMBA: Threatened or Protected Species (TOPS) Regulations, GN No. R.152 of 2007	Section 12.4.1	The Conservation Important species identified to potentially occur on site will require the necessary permits for removal.
Limpopo Environmental Management Act (LEMA), Act No. 7 of 2003	EIA Process	The LEMA has been considered in the finalisation of this report.

10.1.1. Relevant guidelines and tools

This EIA process is informed by the series of national Environmental Guidelines[1], where applicable and relevant:

[1] Note that these Guidelines have not yet been subjected to the requisite public consultation process as required by Section 74 of R385 of NEMA.

- Scoping, Integrated Environmental Management Information Series 2 (DEAT, 2002).
- Stakeholder Engagement, Integrated Environmental Management, Information Series 3 (DEAT, 2002).
- Specialist Studies, Integrated Environmental Management, Information Series 4 (DEAT, 2002).
- Criteria for determining Alternatives in EIA, Integrated Environmental Management, Information Series 11 (DEAT, 2004).
- Environmental Management Plans, Integrated Environmental Management, Information Series 12 (DEAT, 2004).
- Guideline for involving biodiversity specialists in EIA processes. Edition 1 (Brownlie, 2005).
- Guideline for the review of specialist input into the EIA processes: Edition 1 (Keatimilwe and Ashton, 2005).
- Guideline for Environmental Management Plans (Lochner, 2005).
- Guideline for determining the scope of specialist involvement in EIA processes: Edition 1 (Münster, 2005).
- Guideline for involving visual and aesthetic specialists in the EIA processes: Edition 1 (Oberholzer, 2005).
- Guideline for involving heritage specialists in the EIA processes: Edition 1 (Winter and Baumann, 2005).
- Guideline on Need and Desirability, Integrated Environmental Management Guideline Series 9 (DEA, 2010).
- Public Participation 2010, Integrated Environmental Management Guideline Series 7 (DEA, 2010).
- Guideline on Need and Desirability, EIA Guideline and Information Document Series (Department of Environmental Affairs and Development Planning (DEA&DP), 2013).
- Guideline on Alternatives, EIA Guideline and Information Document Series (DEA&DP 2013).

Other tools considered include:

- National List of Threatened Terrestrial Ecosystems for South Africa, 2011
- The Mining and Biodiversity Guideline: Mainstreaming Biodiversity into the Mining Sector, 2013
- Implementation Manual for Freshwater Ecosystem Priority Areas, 2011
- Limpopo Conservation Plan Version 2, 2013

10.2. Approach to environmental authorisation and stakeholder engagement

An integrated EA application is being carried out for the HOP. A pre-application meeting was held with the DMR, an EA application in terms of NEMA, and a Waste Management Licence application in terms of NEM: WA, were submitted. In addition, the required Water Use Licence Application (WULA) in terms of the NWA will be submitted to the relevant authorities.

The EIA Process consists of three phases as outlined below:

1. *Screening:* During this phase, a site visit was undertaken by the project team and Applicant on 4 April 2016. In addition, desktop reviews of the biophysical and social characteristics of the area were undertaken. The necessary information were distributed to specialists to provide project context prior to commencement of specialist studies. In addition, the Screening Phase involved the:
    a. Identification and involvement of relevant authorities. The involvement included:
        i. a pre-application meeting with DWS. Aurecon, Anglo, and specialists, attended this meeting on 25 April 2016, in order to determine which additional specialist inputs would be required, as well as reconsidering the site layout for the mining operations so as not to disturb the nearby Crocodile River's course.
        ii. A pre-application meeting with the DMR on 19 July 2016.
    b. The identification of Interested and Affected Parties (I&APs), including affected and neighbouring land owners, tenants, and the local Leadership Development Forum (LDF) consisting of Tribal Authority heads and Ward Councillors. The current I&APs are attached in Appendix 5.1.
    c. Initial notification of affected and neighbouring land owners and tenants on or close to the proposed mining site.

d. The release of Background Information Documents (BIDs) in order to inform and elicit interests of I&APs in the project. The BID was translated into Afrikaans, and summarised in isiXhosa and Setswana.

The information gathered during the Screening Phase was used in refining the Plan of Study (PoS) for the EIA process.

2. *Scoping:* The first phase of the EIA process, the Scoping Phase had as its objective the description of the environment, and the identification of potential knowledge gaps. Fulfilling this objective ensured that the necessary information required for the EIA phase was generated. Specialists could then proceed to describe aspects of the baseline environment, including those of:

    a. Soil, land use, and land capability;

    b. Terrestrial ecology and wetlands;

    c. Groundwater;

    d. Air quality;

    e. Noise;

    f. Heritage and palaeontology;

    g. Blasting and vibration activities;

    h. Socio-economics; and

    i. The visual environment.

3. *EIA:* The EIA-phase is a comprehensive, independent assessment of all identified and potential environmental impacts, and includes a number of specialist impact studies. The aim of the EIA-phase is to ensure that the proposed development occurs in a sustainable manner, and to formulate ways to reduce or mitigate any negative impacts of the project whilst enhancing its benefits. The findings and mitigation measures will be recorded in the EMPr which becomes a legally binding document upon approval.

In parallel to the entire EIA process, a comprehensive PPP is being and will continue to be conducted. The PPP offers stakeholders the opportunity to learn about the project, to raise issues that they are concerned about, and to make suggestions for enhanced project benefits. The technical specialists and project team will evaluate relevant issues and suggestions during the EIA process. The diagram in Figure 11 indicates the entire EIA-process, where the process is now (◀) and the steps that are to follow.

10.3. Licensing requirements

The following preliminary licencing requirements have been identified:

Table 7 | Preliminary licencing requirements

Legislation	Comment	Requirements
NEMA, EIA Regulations (2014)	The proposed project triggers the GN No. 983, 984, and 985 listed activities, thus a full EIA is required.	Application for Environmental Authorisation to Limpopo DMR.
NEM: WA, Waste Regulations (2013)	Overburden stockpiles are considered.	Application for Waste Management Licence to DMR.
NWA, S21	Licences will be required for a number of water uses.	IWULA and IWWMP for submission to Limpopo DWS.

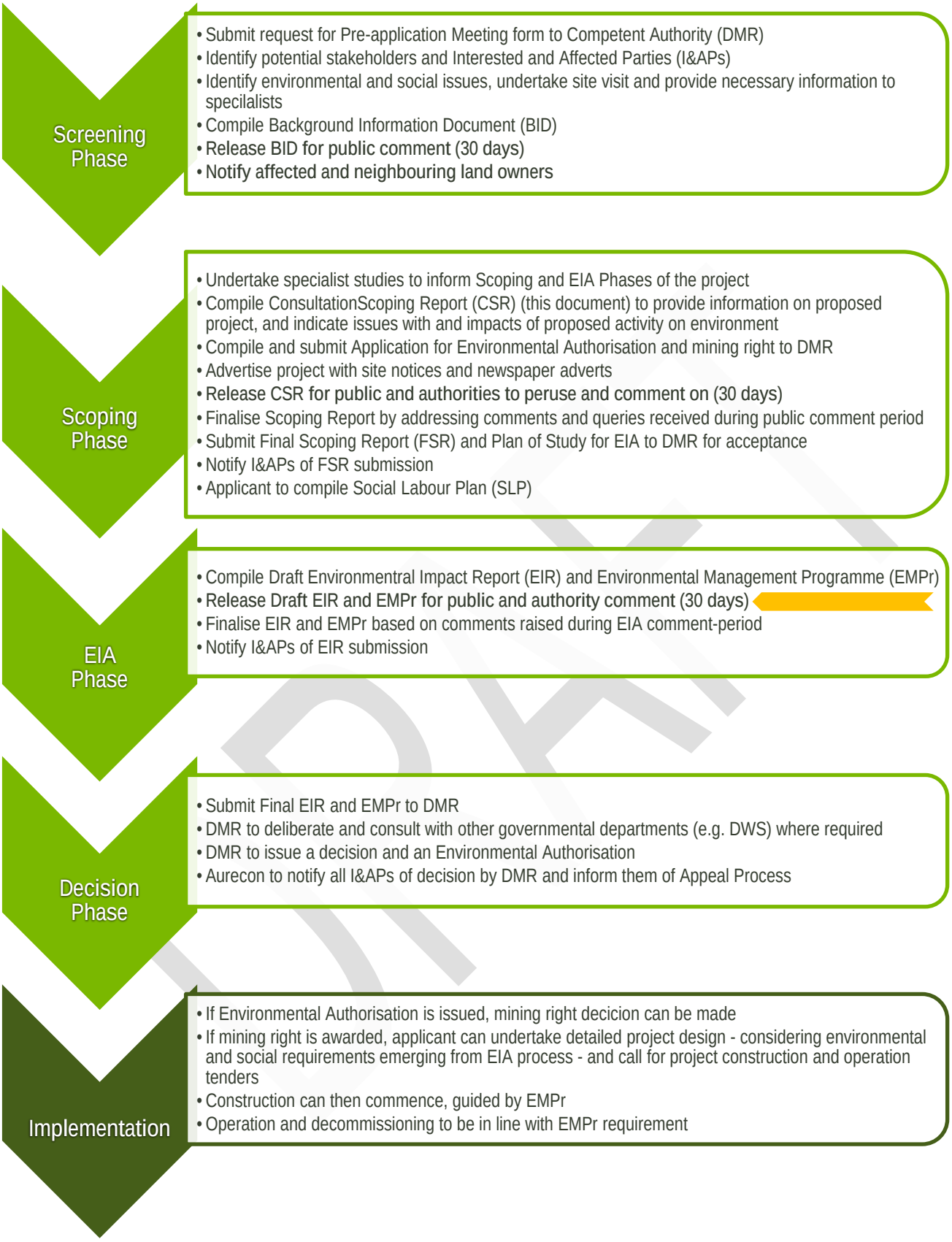


Figure 11 | EIA and Public Participation Process

11. Need and Desirability of the Proposed Activities

This section provides a motivation for the need and desirability of the proposed development, including the need and desirability of the activity in the context of the preferred location.

11.1. Economic Benefit

Opencast mining opportunities exist at Anglo's RPM: AS via the potential short-term mining of shallow PGE ounces. In light of this, the Haakdoorndrift Opencast Project has been initiated to economically extract these PGE-containing UG2 and MER reef remnants.

Various portions along the strike length of the Amandelbult Lease Area have been exploited through shallow opencast mining. The total Amandelbult mining area has a strike extent of ~20 km. The majority of the shallow opencast resources along this strike extent of both the UG2 and MER reefs have already been mined. However, a number of potential opencast blocks of ground were not mined due to either infrastructural constraints or a lack of surface rights. The proposed mining activities are located in such an area, and is proposed for extraction so as to provide economically extracted platinum group minerals while commodity prices are low.

The mining sector is a major contributor to the growth of the South African economy. The expansion of opencast operations to extract resources at a relatively low cost would contribute to the security of employment for mine workers. The subcontractor undertaking proposed mining activities will be determined upon project finalisation, which will unlock local procurement opportunities. The proposed activities' products will be processed at the existing Amandelbult Concentrator, meaning that the project scope / battery limits will be comparatively small.

In addition to the quantifiable economic benefits that will result from this development, there are also a number of qualitative benefits that should be considered. These benefits could include:

- *Technology*: Technology used on the mine will work towards improving knowledge on available technologies and skills in using such technology.
- *Local procurement and SMME opportunities*: Local communities will be provided with opportunities and capacity to participate in contracts that would become available during the construction and operational phases.

11.2. Social and Labour Plan

Anglo is committed to the optimisation of opportunities in local communities through the implementation of its Social and Labour Plan (SLP). The SLP for the entire Amandelbult Section will apply to the Haakdoorndrift Opencast project, and is in the process of being updated.

11.2.1. Workforce development

As part of the Anglo SLP, a comprehensive workforce development plan is being implemented through adult basic education and training (ABET), the provision of various learnerships, bursaries, internships, and a graduate development scheme, technical, services and portable skills training, management and leadership development, most of which will occur at on-site training facilities. The Haakdoorndrift project's workforce will fall under the same SLP and can take advantage of various programmes including:

- *ABET:* Amandelbult Section offers illiterate employees, inclusive of contractors and community members the opportunity to be functionally literate and numerate after completing ABET.
- *Learnerships*: Amandelbult Section provides mainly Mining and Engineering learnerships to its employees and contractors. Engineering learners, Artisans and Technicians are sent to the Engineering Skills Training Centre (ESTC), based in Randfontein. Mining learnerships are also conducted at Amandelbult Section.

- *Technical training and development for lower level employees*: a culture of lifelong learning is encouraged and sustained in lower level employees through training in mining and engineering disciplines, complemented by mentoring throughout.
- *Services training and development*: training opportunities are offered to lower level employees in the finance and human resource development disciplines.
- *Management and leadership development*: high potential candidates are identified from the talent pool and given the opportunity to attend further leadership programmes.
- *Portable skills training*: Amandelbult Section endeavours to provide portable skills for employees so that when they exit the mining industry, they can enter other sectors such as Building and Construction, Tourism and Manufacturing.

11.2.2. Community development

AAP's has also committed, through its SLP, to start up and sustain infrastructure and poverty eradication projects through measures addressing housing and living conditions and nutrition of mine employees. A plan is also in place to provide Historically Disadvantaged South Africans' (HDSA) companies with opportunities to supply to the mining operations. Various focus areas have been identified:

- *Job creation and poverty alleviation:* enterprise development, arts and crafts, agriculture and rural development, brick making project, Mantserre Youth Development Centre, and Mansterre clothing manufacturing.
- *Basic infrastructure:* multi-purpose community centre, traditional offices, provision of high mast lights, renovation of a soccer stadium, Schilpadnest overload station, provision of water infrastructure, provision of sanitation facilities at Schilpadnest, construction of a computer centre at Schilpadnest, water and sanitation at Regorogile, and agricultural cooperatives.
- *Community education and skills development:* education support programme, construction of a secondary school, construction of additional classrooms in Schilpadnest, community portable skills training programme, and community ABET.
- *Community safety, health and welfare:* construction of a clinic at Schilpadnest, construction of early learning centres, community peer education, and orphans and vulnerable children support.

12. Motivation for the Preferred Development Footprint within the Approved Site Including a Full Description of the Process Followed to Reach the Proposed Development Footprint within the Approved Site

This Section describes the process followed to select the mine site layout and the location of infrastructure and activities on site, having taken into consideration the issues raised by interested an affected parties, and the consideration of alternatives to the initially proposed site. This chapter also further details the approach to the PPP undertaken to date.

12.1. Details of development footprint alternatives considered

Infrastructure to support the HOP has been laid out and engineered to best suit the topography and mining pit layout, as well as the relatively small area available for overburden stockpiling due to the presence of 1:100-year flood line, and is described in Section 9.2 of this report.

Mining can only be undertaken in areas where economically mineable resources occur, which determines where the pit is located. This area was established through extensive prospecting and geological modelling.

Selection of a mining method is always dictated by the ore-body or resource. In the case of the Haakdoorndrift Project, the opencast method of extraction is considered to be the most economical, feasible and safe method of extraction. Underground mining was not considered feasible, as a large portion of the resource will be lost due to the safety risks associated with mining of shallow resources from underground. Additionally, underground mining is not economically viable considering current PGE prices. From an environmental perspective, extraction by underground method would limit the surface disturbance and impact on the biodiversity of the area, but remains a safety risk. The locations of the alternatives considered during the process are shown in Figure 12.

12.1.1. Alternatives considered

Three pit alternatives have been considered:

1) Original 31 ha opencast pit, mined to a maximum depth of 115 m. It had a high likelihood of intersecting and affecting the subterranean flow of the Crocodile River, with higher volumes of groundwater ingress into the pit from the Crocodile River system. An additional 200 ha around the pit was considered to accommodate the placement of soil berms, haul roads, fencing, topsoil, and overburden material. This was the original pit alternative associated with the *opencast mining method (requiring the entire overburden volume removed).*

2) Reduced 27 ha opencast pit, mined to a maximum depth of 115 m. Based on advice from groundwater and geology specialists, a smaller pit boundary (further away from the Crocodile River) will mean the subterranean flow of the Crocodile River is less likely to be affected. Lower volumes of groundwater ingress into the pit from the Crocodile River is expected in this case. This option translates to a 10% reduction in volume of ore and eventually, income to be generated. An additional 10 ha directly around the pit was added to accommodate the placement of soil berms, haul roads, and fencing. *This alternative included the opencast mining method (requiring the entire overburden volume removed).*

3) 34 ha strip-mined pit, mined to a maximum depth of 60 m. The shallow MER ore will be extracted first, after which the deeper lying UG2 layer will be extracted. Based on advice from groundwater and geology specialists, a smaller pit boundary (further away from the Crocodile River) will mean the subterranean flow of the Crocodile River is less likely to be affected. Lower volumes of groundwater ingress into the pit from the Crocodile River is expected in this case. This option translates to a 10% reduction in volume of ore, and eventually income to be generated. An additional 14.8 ha (50 m buffer) directly around the pit was added to accommodate the placement of soil berms, haul roads, and fencing. *This alternative includes the strip mining method (where concurrent rehabilitation is done with overburden / topsoil where possible).*

Alternative 3 is preferred.

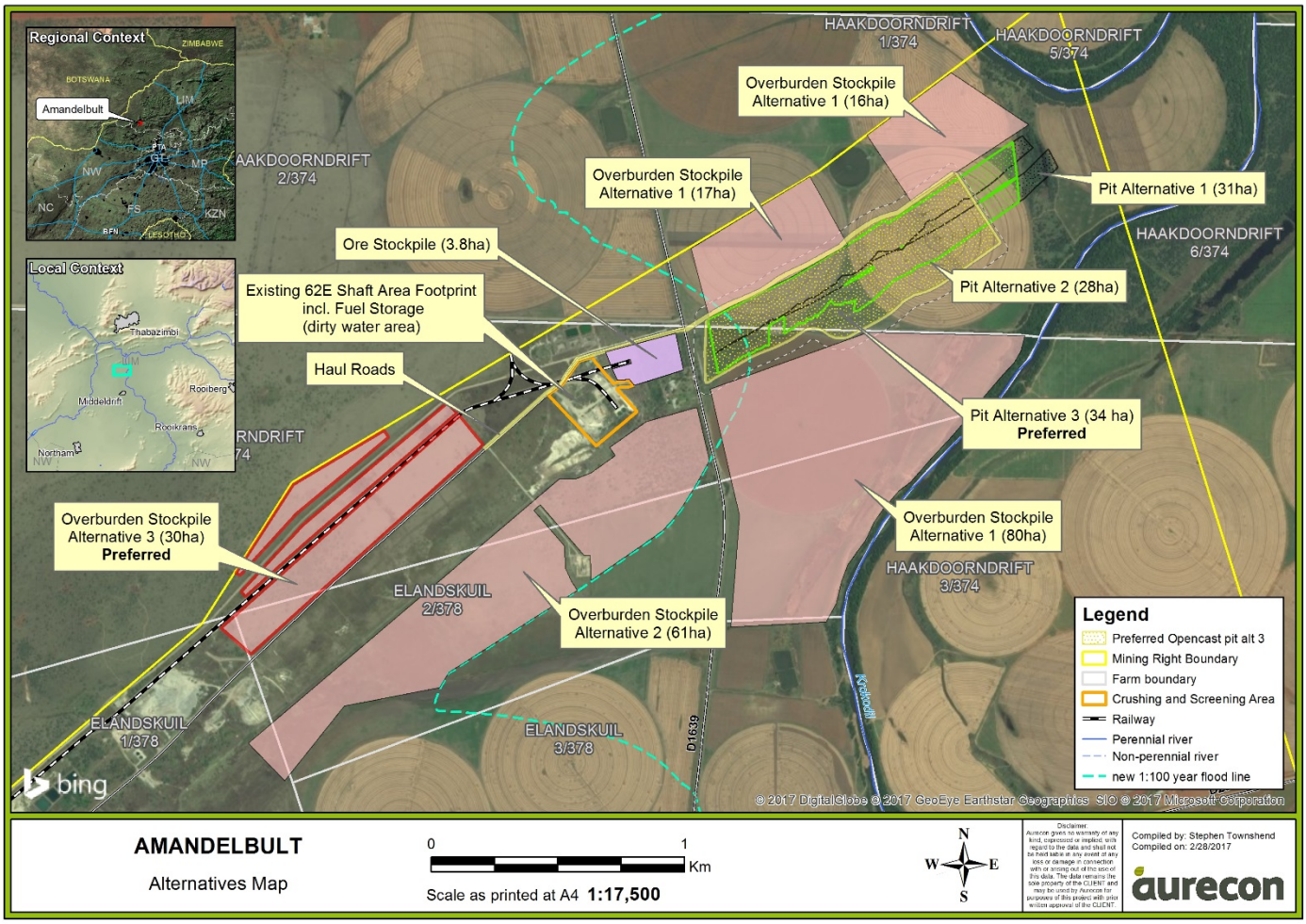


Figure 12 | Three pit alternatives, three overburden stockpile alternatives, and other infrastructure associated with the HOP.

Three overburden stockpile location alternatives have been considered:

1) Locating overburden stockpiles within the 100-year flood line to reduce operational time and costs associated with the stockpiling of overburden material. The likely impact of this proposal is an increased flood risk, as the 1:100 year flood line of the Crocodile River will be enlarged. The riparian zone of the Crocodile River will also likely be impacted upon. This option will have a low impact on traffic across the surfaced district road, as haul trucks only cross the road for ore transport, not overburden transport.

2) Locating overburden stockpiles to the southwest of the pit on a 61 ha area (due to large overburden volume), outside the flood line, so as to reduce impacts on the water resource and arable land, and potential damage resulting from flooding. The riparian zone of the Crocodile River will not be impacted upon for this alternative. This option will have a moderate impact on traffic across the surfaced district road – as haul trucks have to cross the road for ore transport, as well as overburden transport. This option had to be discarded due to the area being undermined, causing geotechnical instability.

3) Locating overburden stockpiles to the west of the pit on a 31 ha area outside the flood line, to reduce the safety risk of locating overburden stockpiles on an area with shallow underground workings (of Alternative 2), and to reduce impacts on the water resource and arable land, and potential damage resulting from flooding. This alternative will also have a moderate impact on traffic across the surfaced district road, as haul trucks have to cross the road for ore transport, as well as overburden transport.

Alternative (3) is preferred, in order to reduce the impact on the Crocodile River system and the safety risks associated with placing overburden material on undermined areas.

Two mining methods were considered:

1) Opencast mining, in which topsoil stripping and stockpiling takes place, with subsequent overburden rock blasting and ore handling. The total overburden material is placed in a designated dump-area and placed back into the open pit once-off only *after* mining of the entire pit has taken place to a maximum depth of 115m.

2) Strip mining, in which various box cuts are made of the pit area. Topsoil, overburden and ore is removed and placed in designated areas. After two box cuts have been mined to a 60m depth, overburden material from subsequent box cuts are placed in preceding box cuts, thereby allowing concurrent rehabilitation to take place (a detailed mining method explanation is provided in Section 9.2).

12.1.2. No-go alternative

The option of not implementing the activity was investigated. The current mining operations will continue, with no further opencast mining operations taking place through the HOP. The main consequence of the "No-Go Option" is the potential closure of the Amandelbult Section mine altogether. The opportunity to develop a high quality mineral resource with an estimated LoM of 30 months, which has the potential for economic benefits on local level in terms of employment, and a sizeable contribution to processed PGE resources, will be lost.

12.2. Details of Public Participation Process followed

Consultation with the public forms an integral component of the EA process. This process enables I&APs (e.g. directly affected landowners, national, provincial and local authorities, local communities), to raise concerns and comment on the proposed activities, which they feel should be addressed in the EIA process. The PPP has been structured to provide I&APs with an opportunity to gain more knowledge about the proposed project, to provide input through the review of documents / reports, and to voice any issues or concern at various stages throughout the EIA process.

The objectives of public participation are to provide information to the public, identify key issues and concerns at an early stage, respond to the issues and concerns raised, provide a review opportunity, and document the process. The PPP will be managed to meet these objectives throughout the EIA. The PPP to date is summarised in Table 8.

The PPP is in accordance with Chapter 6 of the EIA Regulations, 2014 published in GN No. 982 of 4 December 2014.

The following guideline documents published by the DEA were also used to inform the PPP approach:

- Integrated Environmental Management Guideline Series 7 – Public Participation in the EIA Process (DEA, 2010); and
- Public Participation Guidelines, Guideline Document 4 (DEA, 2006).

Table 8 | Details of the PPP to date

Task	Details	Date
Notification Phase		
I&AP identification	An I&AP database was developed for the project by establishing the jurisdiction of organisations, individuals and businesses in proximity to the project site or with an interest in the proposed development. The database of I&APs includes the landowner, the adjacent landowners, tenants, relevant district and local municipal officials, and relevant national and provincial government officials. This database is being augmented via chain referral during the EIA process and will be continually updated as new I&APs are identified throughout the project lifecycle.	March 2016
Background Information Document distribution	Background Information Documents (BIDs), written in English and Afrikaans, were distributed to the identified I&APs during individual and focus group meetings (Appendix 5.3 of the Final Scoping Report - FSR) for the proposed project for perusal and comment. Summaries of BIDs were generated in Setswana and isiXhosa. Authorities and I&APs were given 30 days within which to register and submit initial comments on the proposed project. The initial comment period was concluded on the June 2016.	May – June 2016
Focus group and individual meetings	■ A meeting was held on 12 May 2016 with the local Leadership Development Forum to notify them of the proposed development, various ward councillors and tribal authority leaders attended this meeting. ■ One-on-one meetings were held with farmers on the properties affected by and neighbouring the proposed project area to notify, inform and provide details on how they can comment on the proposed project beyond these meetings.	May – June 2016

Task	Details	Date
	In addition, focus group meetings were also held with tenants on these properties to explain the proposed project and distribute BIDs: ■ Meeting with affected land owners: – Mr Louis Scheepers – 16 and 27 May 2016 ■ Meeting with adjacent land owners: – Mr Frans Lourens – 27 May 2016 – Mr Marius Coetzee – 27 May 2016 – Mr Piet Human – 11 June 2016 ■ Telephonic conversation with adjacent land owners: – Mr Jaco du Toit – 9 June 2016 ■ Meeting with farm workers on the affected and adjacent land portions – 11 June 2016 Minutes, attendance registers, and photographs of these meetings are included in Appendix 5.1 of the FSR.	
Addressing comments received	Comments and responses received in the initial notification phase are summarised in Table 9. The Comments and Response Report (CRR) as at the time is attached as Appendix 5.5 of the FSR.	May – July 2016
Key authority meetings	A pre-application meeting was held with the competent authority (DMR), the Department of Water and Sanitation (DWS) (in April), and the Thabazimbi Local Municipality (attendance registers and presentations of which are attached in Appendix 5.1 of the FSR.	April and July 2016
Scoping Phase		
I&AP comment period	All potential I&APs were informed of the availability of the CSR by means of email, records of which are attached in Appendix 5.1 of the FSR. Relevant government departments were notified of the report and requested to submit comments. I&APs were given 30 calendar days (from 25 July 2016) within which to submit comments or raise any issues or concerns they have with regard to the proposed project or EIA process. The Consultation Scoping Report and comment sheets (so as to register as I&APs and provide comments or questions to be addressed) were left at the following locations (see Appendix 5.4 of the FSR): ■ Thabazimbi Municipality; ■ Northam Shoprite Centre Post Office; ■ Dishaba 2 Shaft mine entrance; and ■ Obaro Koedoeskop. Furthermore, a digital version of the CSR was uploaded onto the Aurecon website for perusal and download (Appendix 5.1 of the FSR). Online registration was required to access these documents. Electronic copies of the report would also have been made available upon request (on a CD).	25 July – 25 August 2016
Newspaper advertisements	Two advertisements were placed in the Platinum Bushvelder (in English and Setswana) during the comment period as notification of the availability of the CSR. Proof of the advertisements are included in Appendix 5.4 of the FSR.	22 July 2016
Site notices	Site notices with a size of 600 mm x 420 mm, in English and Setswana, will be put up to inform the general public of the proposed projects and the public participation process. These notices were placed at: ■ Thabazimbi municipality; ■ Thaba Mall Community Wall; ■ Northam Shoprite; ■ Obaro Koedoeskop;	July – August 2016

Task	Details	Date
	■ Tumela Training Centre; ■ On site (At the T- Junction at 62E Shaft); and ■ Dishaba No. 2 Shaft. Proof of site notices at these locations are included in Appendix 5.4 of the FSR.	
Addressing comments received	All comments received on the CSR were collated into the CRR. The responses to these comments from the applicant and the EAP are provided in the CRR, attached as Appendix 5.5 of the FSR.	July – August 2016
Meetings	One public and open house meeting was held with the affected stakeholders and communities. All registered I&APs were invited to the meeting via notification letters, proof of which is included in Annexure 5.1 of the FSR. The newspaper advert and site notices also included an invitation to the open house and public meeting. The presentation, attendance register, meeting record, and photographs of this meeting are included in Appendix 5.1 of the FSR. The BID was updated and made available at this meeting, a copy of which is included in Appendix 5.3 of the FSR.	12 August 2016
Decision	The DMR must, within 43 days of receipt of the FSR, consider it, and in writing – a) Accept the report and advise the EAP to proceed with the tasks contemplated in the plan of study (PoS) for EIA; b) Refuse EA if – *i. the proposed activity is in conflict with a prohibition contained in legislation, or* *ii. if the scoping report does not substantially comply with the objectives and content requirements for scoping reports in terms of the 2014 EIA Regulations and the applicant cannot ensure compliance with these regulations within the prescribed timeframe.* The Scoping report was accepted by the DMR, proof of which is attached in Appendix 6.3.	August 2016
Environmental Impact Phase		
Newspaper advertisements	Two advertisements were placed in the Platinum Bushvelder (in English and Setswana) during the comment period as notification of the availability of the Consultation EIA Report (CEIR). Proof of the advertisements will be included in the final EIR.	3 March 2017
I&AP comment period	All potential I&APs will be informed of the availability of the CEIR by means of email, SMS and phone calls. Relevant government departments were notified of the report and requested to submit comments. I&APs are given 30 calendar days within which to submit comments or raise any issues or concerns they have with regard to the proposed project or EIA process. The CEIR and comment sheets (so as to register as I&APs and provide comments or questions to be addressed) are being left at the following locations: ■ Thabazimbi Municipality; ■ Northam Shoprite Centre Post Office; ■ Tumela Main Office; and ■ Obaro Koedoeskop. Furthermore, a digital version of the CEIR is uploaded onto the Aurecon website for perusal and download. Online registration will be required to access these documents. Electronic copies of the report will be made available upon request (on a CD).	7 March – 6 April 2017
Addressing comments received	All comments received on the CEIR will be collated into the CRR. The responses to these comments from the applicant and the EAP will be provided in the CRR. The current version of the CRR is attached as Appendix 5.4.	April 2017

Task	Details	Date
Meetings	■ One public and open house meeting will be held with the affected stakeholders and communities. ■ Focus group meetings will also be held during the comment period with – The local LDF; – Farm workers on affected properties; and – Inhabitants of the Smashblock and Jabulani informal settlements. All registered I&APs will be invited to the meeting via notification letters. The newspaper advert and site notices also include an invitation to the open house and public meeting. The presentation, attendance register, meeting record, and photographs of this meeting will be included in the final EIR.	7 March – 6 April 2017

12.2.1. Authorities involved

In terms of Sections 24 (2) and (3) of NEMA (as amended), the following state departments and/or parastatal bodies will be informed of the availability of the CEIR for comment:

- Provincial, local authorities and parastatal organisations:
  - Limpopo Department of Mineral Resources;
  - Limpopo Department of Economic Development, Environment and Tourism (LEDET);
  - Limpopo Heritage Resources Authority (LIHRA);
  - Limpopo-Northwest Proto CMA (Department of Water and Sanitation – DWS); and
  - Limpopo Department of Agriculture, Forestry and Fisheries (DAFF).

This list is not exhaustive, and additional stakeholders may be included.

12.3. Summary of issues raised by I&APs

Comments and issues raised by I&APs, as well as responses thereto are listed in Table 9 (a detailed Comments and Response Report is attached in Appendix 5.5). The properties affected by and neighbouring to the proposed project are shown in Figure 13.

Table 9 | Summary of comments and issues raised by I&APs during initial project phases

Interested and Affected Party (list the names of persons consulted in this column; and mark with an X where those who must be consulted were in fact consulted)		Date comments were received	Issues raised	EAP's response to issues, and as mandated by applicant	Section and paragraph reference in this report where the issues and/ or responses were incorporated
AFFECTED PARTIES					
Landowner					
Louis and Sanet Scheepers (land owners; Buitendag Boerderye Eiendomme (Pty) Ltd)	X	27 May 2016	There is a chance that some people may lose their jobs as a result of the proposed mine, considering that about a quarter of the farming business lies on the farm, which will be lost for farming for five years. Two irrigation pivot points will be lost, and farmland for rent is virtually unobtainable in the region. The affected farm is the headquarters of the Buitendag Boerderye-business (which is located on more than one farm portion in the region). The farm is the livelihood of not only the landowners, but also that of their workers. Any impact on the productivity of the farm or the water will have severe economic spin-offs to all the farm workers, their residing families, and dependents.	Anglo will interact directly with the landowner on this matter. The necessary compensation needs to be considered as part of the lease agreement.	N/A
Louis and Sanet Scheepers	X	27 May 2016	The landowners are concerned about potential indirect impacts, such as impacts on the irrigation dam from blasting. There are other as yet unknown factors that may impact on the farming activities.	A blasting and vibration study was conducted during in the EIA team. The irrigation dam is likely to be affected by fly rock, and potentially ground vibration. Blast monitoring will be implemented during the operational phase to ensure that acceptable blasting charges are utilised.	12.5.7, Appendix 7.6
Louis and Sanet Scheepers	X	27 May 2016	The access route to the river will change as a result of the proposed project, and the land owners will need to build a new road.	Access to required infrastructure will not be prohibited by mining activities. Details of access arrangements close to the mining area will be negotiated the mine and the land owner as part of the lease agreement.	8
Louis and Sanet Scheepers	X	27 May 2016	There will be compensation for the loss of income, but what about the non-tangible aspects such as sense of place and sentiment? The compensation should also cover the costs incurred as a result of indirect impacts.	Anglo will interact directly with the landowner on this matter. The necessary compensation needs to be considered as part of the lease agreement.	N/A
Louis and Sanet Scheepers	X	27 May 2016	The mined land should be rehabilitated to the same quality as before.	A soil scientist, Rehab Green and a rehabilitation expert, Anthony Lamb has been appointed as part of the EIA team. Rehabilitation will be done according to their recommendations. The land capability /	12.5.1, Appendix 7.1

Interested and Affected Party (list the names of persons consulted in this column; and mark with an X where those who must be consulted were in fact consulted)		Date comments were received	Issues raised	EAP's response to issues, and as mandated by applicant	Section and paragraph reference in this report where the issues and/ or responses were incorporated
				soils report is available for public comment. The current preferred alternative for placement of the overburden stockpiles is outside the 1:100 year flood line – which will greatly reduce the impact of the project on agricultural land. Crop yields on areas where topsoil was removed will take some years after rehabilitation to return to acceptable levels. In addition, overburden and topsoil can be placed live where possible, thereby preserving its post-closure viability.	
Lawful occupiers of the land (Buitendag Boerderye Eiendomme farm workers)					
Obadias Muianga	X	10 June 2016	The influx of workers into the new open cast operations will impact on the local workers and could increase crime. It will be more difficult to trace criminals as there will be many workers in the area.	It is the intent that only current companies and workers as part of the existing opencast operations should be working at the proposed project – these persons are understood to be mostly local. Limited work opportunities will be created by HOP, and therefore influx is not envisaged.	11
Land owners or lawful occupiers on adjacent properties					
Marius Coetzee	X	27 May 2016	The landowner thinks that the proposed project would not have a significant impact on his farming activities. The landowner is not concerned about a potential influx of people, due to the limited opportunities currently available in the area. Currently, farm residents do not feel vibrations during mine blasting activities. Noise is also not a problem.	Noted – no response required.	N/A
Marius Coetzee	X	27 May 2016	Dust may have an impact on crops.	Air quality study was conducted, and dust deposition modelling indicated that the background dust levels will not be exceeded will not be exceeded on the relevant properties and associated pivot areas. The current and future opencast operations must comply with ambient air quality standards as set out in NEM: AQA and will be monitored and managed accordingly.	12.5.5, Appendix 7.4
Marius Coetzee	X	27 May 2016	The landowner's biggest issue is with water: if mining operations affect the water, farming activities will be compromised severely.	A groundwater specialist study was undertaken during the EIA phase. The perennial Crocodile River acts as a barrier (constant head or recharge boundary) between the proposed new Haakdoorndrift pit and groundwater users to the east of the river. Therefore, the groundwater levels in these user boreholes are expected to remain unaffected by the proposed new mining activities. The user borehole most likely to be affected by the proposed opencast mining activities is borehole LS01, which is located nearly 300 meters east of the Haakdoorndrift pit. This borehole was however not in use at the time of the hydrocensus. The maximum drawdown due to groundwater influx to the pit on LS01 borehole is 2 m (Refer Figure 96).	12.5.3, Appendix 7.3

Interested and Affected Party (list the names of persons consulted in this column; and mark with an X where those who must be consulted were in fact consulted)		Date comments were received	Issues raised	EAP's response to issues, and as mandated by applicant	Section and paragraph reference in this report where the issues and/ or responses were incorporated
Marius Coetzee	X	27 May 2016	The landowner is concerned about the visual impact and stressed the importance of the rehabilitation process.	A visual impact statement was prepared as part of the EIA specialist studies, and includes a view shed analysis of the project during peak operations and after closure. All overburden material will be placed back into the pit after the LoM.	12.5.9, Appendix 7.14, 9.2
Marius Coetzee's farm workers	X	10 June 2016	If farm workers have to be relocated whose responsibility will it be?	No relocation will be required, based on the current project description.	12.4.2
Jaco du Toit	X	9 June 2016	The landowner runs an aviation business (True North Aviation) from the affected property and is against the mine, as it will impact negatively on his business. Blasting is especially problematic. He has 24 aeroplanes and 13 choppers, and also operates a flying school on the premises. Having the aspirant-pilots flying around in the area with "rocks flying around" is a risk to his business.	Before any blasting operations can occur, the Civil Aviation Authority is to provide consent to Anglo. Thus the landowner will receive warnings well in advance of blasting activities, as well as information on zones of high risk that are to be avoided by aircraft. These authorisations are given for 6 month-periods. The aviation business location is located outside of any danger zone according to the blasting specialist report.	12.5.7, Appendix 7.6
Jaco du Toit's farm workers	X	10 June 2016	Concerns were raised about any negative impacts on water as this will impact on farming. Also, the aviation institution's runway runs parallel to the proposed mine.	The runway is further than the 1 km safety zone from the mine, and not parallel to the proposed pit or mining activities. In terms of the impacts on water, please refer to the similar comment by Marius Coetzee, and the response given, above.	12.5.7, Appendix 7.6, 12.5.3, Appendix 7.3
Frans Lourens	X	27 May 2016	The landowner is concerned about the shallow water table.	Please refer to the similar comment by Marius Coetzee, and the response given, above.	12.5.3, Appendix 7.3
Frans Lourens	X	27 May 2016	The landowner does not like the idea of an opencast mine adjacent to his property. Currently, he hears Amandelbult's crushers during the day and at night-time. There are also sirens going off regularly, jackhammers, blasting and other sources of noise.	A noise specialist study was done as part of the EIA, and the modelling indicated that no sensitive receptors (i.e farmsteads) are located within the night-time sensitive noise contour (900 m radius from the open pit operations).	12.5.6, Appendix 7.5
Frans Lourens' farm workers	X	10 June 2016	No comments.	N/A	N/A
Piet Human	X	10 June 2016	No comments.	N/A	N/A
Piet Human's farm workers	X	10 June 2016	No comments.	N/A	N/A
Municipal Councillors (Leadership Development Forum, including Traditional Authorities)					
Leadership Development Forum	X	12 May 2016	Will communities benefit from this project?	When and if labour is needed the communities will be informed through the LDF and they will have the opportunity to apply for available positions. Local recruitment will be done. For example, Zizwe is a local company who is currently working on a project and assists with open cast mining. There will be a formal process to select appropriate local SMME's for the project.	11

Interested and Affected Party (list the names of persons consulted in this column; and mark with an X where those who must be consulted were in fact consulted)		Date comments were received	Issues raised	EAP's response to issues, and as mandated by applicant	Section and paragraph reference in this report where the issues and/ or responses were incorporated
Leadership Development Forum	X	12 May 2016	Open cast voids will be created and they need to be closed – can it be left open so that it can be used as a dam?	Open cast mining areas cannot be left open after mining. The area will be rehabilitated to the original state because the land owners will use it for farming and it needs to be declared a safe environment afterwards.	9.2
Leadership Development Forum	X	12 May 2016	Will local small companies and subcontractors from the area be used during the project?	Yes. Local procurement processes are ongoing and joint ventures (JVs) will be established with small local businesses.	11
Leadership Development Forum	X	12 May 2016	Which villages are affected by the project? The affected villages need to be identified so that they can be informed about the project and so that they can benefit as well.	The project site is on a privately owned farm and no villages will be directly affected. The EIA team will, however, consult with surrounding areas and verify if they are impacted by the project, e.g. the informal settlement a few kilometres away from the project area (e.g. Smashblock and Jabulani), during the comment period of the CEIR.	Figure 13
Leadership Development Forum	X	12 May 2016	Are there any land claims on the Haakdoorndrift Farm?	No land claims have been detected up to this point, according to Anglo and the land owners' records.	-
Leadership Development Forum	X	12 May 2016	Zizwe provides nothing to local communities – they don't communicate via mails or adverts about jobs. This will have to be rectified during this project.	Zizwe has not been chosen as a preferred partner for this project. Procedure will be followed to choose a local partner and a consultative process will be followed to include local people in jobs and SMME opportunities.	11
Leadership Development Forum	X	12 May 2016	Development is needed by everyone in the area. But, the Baphalane claim the whole area as well as all opportunities at the mine. How is it going to be different in this project?	There will be no prioritisation of Baphalane. It will be a fair and open process for all to participate.	11
Leadership Development Forum	X	12 May 2016	Are there any job opportunities during the EIA phase?	The EIA phase includes specialist studies that will be done by experts in their respective fields. No opportunities are available during this phase of the project.	6.2.3
Leadership Development Forum	X	12 May 2016	Two children drowned in one of the previous open casts that was not rehabilitated correctly and some holes have been left open – will it happen on this project as well?	No open cast mining areas will be left open. The mining area will be rehabilitated according to the set criteria and standards.	9.2
Leadership Development Forum	X	12 May 2016	When will mining start?	Preferably in October 2017, but it depends on the timing of the environmental authorisation. The mining lifetime will be 30 months.	5.1.2
Leadership Development Forum	X	12 May 2016	What skills will be needed in this project?	There is emphasis on the local skills market during recruitment. Only when certain skills are not found locally will the project employ people from outside the area. The number and level of skills required is as yet unknown. There will be a formal process to select appropriate local SMME's for the project.	
Municipality					

Interested and Affected Party (list the names of persons consulted in this column; and mark with an X where those who must be consulted were in fact consulted)		Date comments were received	Issues raised	EAP's response to issues, and as mandated by applicant	Section and paragraph reference in this report where the issues and/ or responses were incorporated
Tshepo Makutu (Thabazimbi Local Municipality: town planner)	X	12 August 2016	What is the exact location of the proposed project, relative to Thabazimbi?	Directions were provided and the location of the proposed activity were explained to the commentator with the aid of a map used throughout the meeting.	Figure 3, Figure 4
Tshepo Makutu	X	12 August 2016	Is the proposed project located within the existing Amandelbult Mine Right area?	The proposed project does, indeed, fall within the Amandelbult Mine Right area, just not within the farm lease area, which belongs to BBE.	Figure 1, 5.1
Tshepo Makutu	X	12 August 2016	A Spatial Development Framework (SDF) is being developed for the Amandelbult Complex. Does the proposed project form part of this SDP?	Anglo staff present on the day were not aware of an SDF for the Complex. However, Anglo has developed a *Spatial Development Strategy*, which has not yet been approved. Consideration is being given to the requirements of SPLUMA, and an application for consent use in terms of SPLUMA is being prepared for the HOP.	
Tshepo Makutu	X	12 August 2016	No ward councillors have been selected. Therefore, there is no point in notifying the current ward councillors of the proposed projects, as they might not be in office anymore after the 22nd of August, which is the date by which new councils have to be decided. I can, however, notify the chosen councillors of the proposed projects once they are elected.	Ward councillors have to be notified of proposed projects, as per regulation 41 of the NEMA EIA Regulations (GN 982).	12.2
Organs of State					
Limpopo Road Agency (RAL)	X	14 October 2016	Aurecon discussed the scope and methodology of the study with the RAL. There was no objection to the proposed study area and methodology. However, RAL requested that the Cronimet mine access, off the D1639, be included in the Haakdoorndrift planning.	The suggested intersection was agreed with RAL.	The Traffic Impact Assessment report is attached in Appendix 7.11.
Communities					
Sandra Jacobs (Thabazimbi District Agriculture Union)	X	8 August 2016	Please provide all correspondence in Afrikaans. If documentation is not provided in Afrikaans, I cannot, as owner / occupier, be held responsible for any decisions that are made, and all correspondence, conversations or any other contact, in whatever format, will not be regarded as consultation. I hereby request that the *Thabazimbi Distriks Landbou Unie* is registered as an I&AP in terms of the proposed project.	*Thabazimbi Distriks Landbou Unie* (TDLU) will receive all communications, where feasible, in Afrikaans. Note that Afrikaans Background Information Documents (BIDs) have been made available to Afrikaans-speaking landowners, and engagements with these parties have been conducted in Afrikaans. TDLU has been registered as an Interested and Affected Party.	Appendix 5.1.
Sandra Jacobs	X	8 August 2016	Considering the daily increase in farm-murders- and attacks, and that farm tenants are subject to a significant safety risk, admission to farms will be organised according to the accepted Farm Visitation Protocol (attached). Please adhere to the guidelines stipulated therein.	The Farm Protocol will be considered upon future visitations to affected landowners, in the interest of stakeholder security.	
Dept. Land Affairs					

Interested and Affected Party (list the names of persons consulted in this column; and mark with an X where those who must be consulted were in fact consulted)	Date comments were received	Issues raised	EAP's response to issues, and as mandated by applicant	Section and paragraph reference in this report where the issues and/ or responses were incorporated
Not applicable				
Traditional Leaders				
Please refer to "Municipal Councillors (Leadership Development Forum, including Traditional Authorities)"				
Dept. Environmental Affairs				
R. Nelutshindwi (Limpopo Department of Economic Development, Environment and Tourism)	18 August 2016	The LEDET received and reviewed the consultation Scoping Report and commented that: a) In terms of the Limpopo Conservation Plan of 2013, the proposed site falls within the Ecological Support Area (ESA) 2, areas with no natural habitat is important for supporting ecological processes. Avoid additional / new impacts on ecological processes, intensification of land use and fragmentation of the natural landscape; b) In terms of the Environmental Management Frameworks for the Waterberg District, this site falls within the Environmental Management Zone 4, representing areas where significant mineral resources of strategic national importance occur within largely natural environments; c) Groundtruthing of the environmental attributes must be undertaken during the EIA-phase and appropriate mitigation and/or biodiversity offset measures that can be used to compensate for the loss of biodiversity as a result of the proposed activities must be submitted to the DMR for consideration; d) The onus is on the applicant to prevent possible illicit actions by ensuring compliance to other requirements of other government departments (i.e. National Provincial, and Local) and all Municipal by-laws; and Please note that in terms of section 24F (1) of the NEMA and notwithstanding the provisions of any other Act; "no person may commence an activity listed in terms of section 24(2) (a) or (b) unless the competent authority has granted an environmental authorisation for the activity, and no person may continue an existing activity listed in terms of section 24(2) (d) if an application for an environmental authorisation is refused".	a) The Terrestrial Biodiversity and Wetland Assessment undertaken for the project area by Natural Scientific Services (NSS) confirm that the project area falls mainly within an ESA, according to the Limpopo Conservation Plan. Additionally, to the east of the site, the Crocodile River floodplain is classified a Critical Biodiversity Area 2. Based on the Limpopo Biodiversity Conservation Plan, Mining and Biodiversity Guideline, the national Water Act of 1998), National Freshwater Ecosystem Priority Areas (NFEPAs), National Spatial Biodiversity Assessment Priority Areas and Threatened Ecosystems, and terrestrial field surveys, a buffer zone was determined by NSS to avoid areas that support ecological processes. Additional mitigation measures are provided in the consultation EIR, along with full specialist reports. b) According to the Waterberg District Environmental Management Framework of 2010, the proposed project area falls within Zone 10: *Agriculture areas with commercial focus* (the western half of the mine right area is located within Zone 4). In terms of the desired state for Zone 10 areas, the proposed activities' potential impacts on aspects affecting the efficient continuation of Zone 10-activities will be limited. In particular: the Crocodile River is considered a "losing stream", thus water *naturally* flows from the River to the aquifer in the project area – water abstraction is not anticipated to have a significant impact on the water available for irrigation; no water will be placed back into the Crocodile River, thus limiting the potential for water quality deterioration; employment will be provided to mine employees for the relatively short project duration, after which the land will be rehabilitated for agricultural use; impacts anticipated on the affected district road (D1639) will be assessed during the EIA-phase; overburden dumps (regarded as waste for the duration of the project), will be located to the west of the pit, on the existing mine, in Zone 4 (*Mining focus area*), and all other waste will be removed from and	a) 12.4.1, 12.5.2, Appendix 7.2 b) 12.4.1 c) 12.4.1, 12.5.2, Appendix 7.2 d) 10

Interested and Affected Party (list the names of persons consulted in this column; and mark with an X where those who must be consulted were in fact consulted)	Date comments were received	Issues raised	EAP's response to issues, and as mandated by applicant	Section and paragraph reference in this report where the issues and/ or responses were incorporated
			managed off-site, on the existing mine area; and, no housing (farmsteads) exist within the project area. c) "On-the-ground" investigations have been undertaken by various specialists to describe the environmental attributes of the project area. Mitigation measures for impacts will be included as part of an additional study to be undertaken by NSS during the EIA-phase, and as part of the EMPr. d) Applicable national and provincial legislation have been listed in the EIR, and applicable municipal by-laws have been considered during the EIA-phase. The applicant will regularly monitor compliance to all applicable legislation during the project duration as per the Anglo environmental management system (EMS). The proposed activities requiring EA will not be undertaken prior to it being granted.	
Other Competent Authorities affected				
Clement Mokgotho (Department of Agriculture, Forestry and Fisheries; Directorate: Land Use and Soil Management)	30 August 2016	• The area proposed for mining is classified as having relatively good agricultural potential • The area is currently under active and profitable agricultural production • Several scientific studies have shown that mined agricultural land has never been successfully returned to its pre-mining condition, even where good rehabilitation programs are carried out. As the directorate of Land Use and Soil Management, our main objective is to protect agricultural land and to ensure that other developments do not compromise agricultural development and food security.	Closure and rehabilitation provision and soil and land capability specialist studies have been undertaken for the proposed area. Options for limiting the footprint of the proposed project activities on agricultural land were considered. The DAFF will be consulted with mitigation measures proposed, in order to address the concern raised.	9.2.6, 12.5.1, Appendix 7.1, Appendix 7.9
Limpopo Heritage Resources Authority (LIHRA)	-	No comments.	N/A	N/A
Limpopo-Northwest Proto CMA (Department of Water and Sanitation – DWS)	-	No comments.	N/A	N/A
OTHER AFFECTED PARTIES				
All potentially affected parties have been consulted with as shown above.				
INTERESTED PARTIES				

Interested and Affected Party (list the names of persons consulted in this column; and mark with an X where those who must be consulted were in fact consulted)	Date comments were received	Issues raised	EAP's response to issues, and as mandated by applicant	Section and paragraph reference in this report where the issues and/ or responses were incorporated
Groden Shai (Thabazimbi Public Office)	12 August 2016	I have a small business offering paving and car wash-services. Will there be any opportunities for enterprises, like mine, to be employed in the proposed activity?	Local procurement opportunities will be unlocked upon finalisation of the project. Local communities will be provided with opportunities to participate in contracts that could become available during construction and operational phases of the proposed project.	11

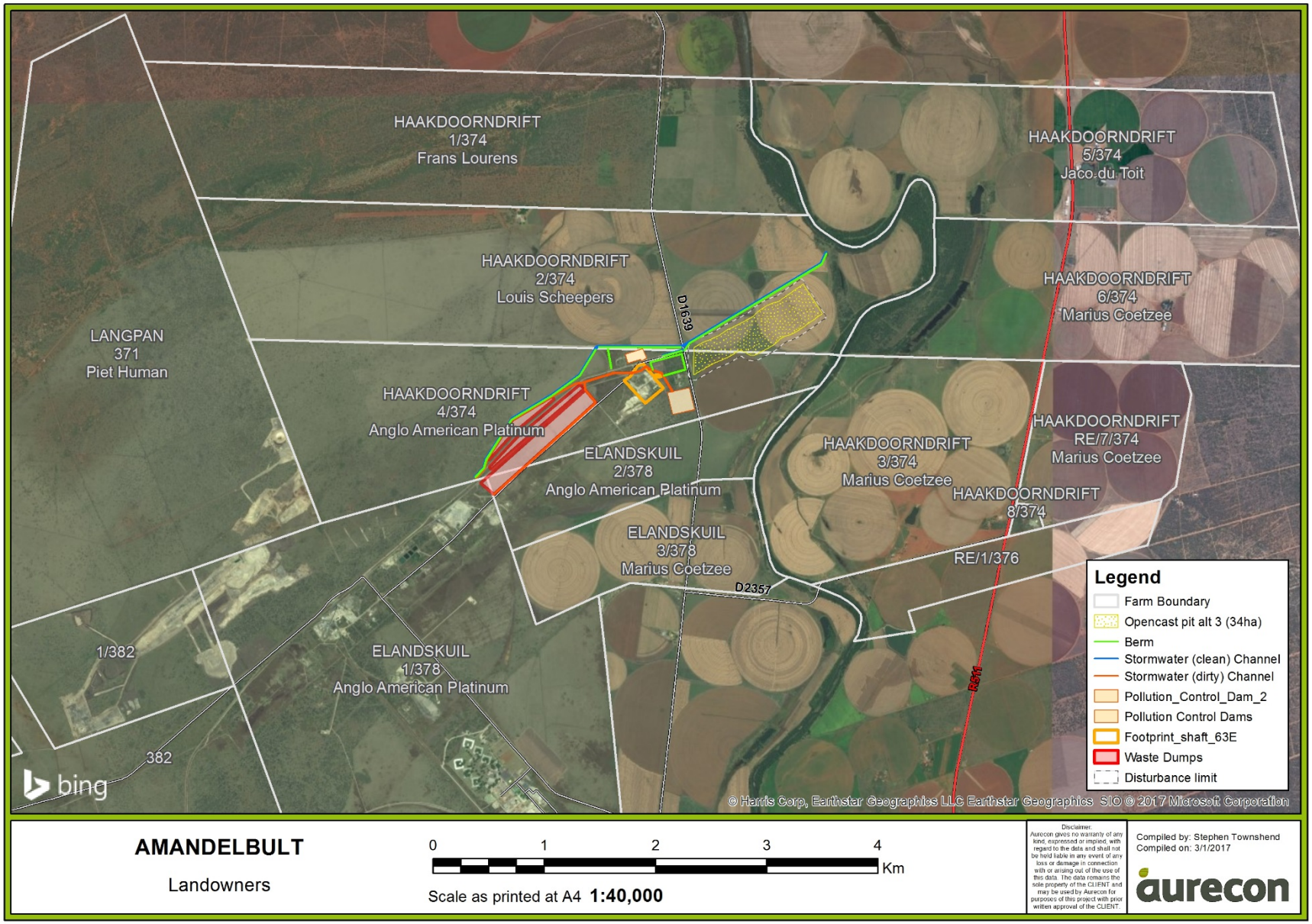


Figure 13 | Affected and adjacent properties to the project.

12.4. The environmental attributes associated with the development footprint alternatives

12.4.1. Baseline environment: Type of environment affected by the proposed activity

The following section is a summary of the specialist baseline work and relevant environmental attributes associated with the mining site. Note that the areas shown in certain sections describe detailed baseline investigations of the Haakdoorndrift study area where no previous mining activities have taken place. In particular, the larger project footprint surrounding the proposed pit is described in detail in the following sections. Note that the areas in which *overburden stockpiles are proposed for location* to the west of the pit, are already covered in the existing Amandelbult Mining Right's environmental management programme and will not be described again here in detail. However, the proposed overburden stockpile areas in particular were reinvestigated during the EIA phase of the project for the sake of assessing the *impacts* on it. These additional specialist impact assessments focused on soil and land capability impacts, as well as terrestrial biodiversity. A heritage impact assessment for this area will not be undertaken during the EIA phase, as it would be a repetition of the survey conducted by the National Cultural History Museum (Van Schalkwyk, 2006). All specialist studies are included in Appendix 7.

National Freshwater Ecosystem Priority Area

National Freshwater Ecosystem Priority Areas (NFEPAs) provides guidance on how many rivers, wetlands and estuaries, and which ones, should remain in a natural or near-natural condition. It supports the implementation of the National Water Act (NWA), the Biodiversity Act (NEM: BA) and the Protected Areas Act (NEM: PAA). For the study area, the NFEPA Project recognises the Crocodile System as a Non - FEPA River, as shown in Figure 14 (Natural Scientific Services, 2017).

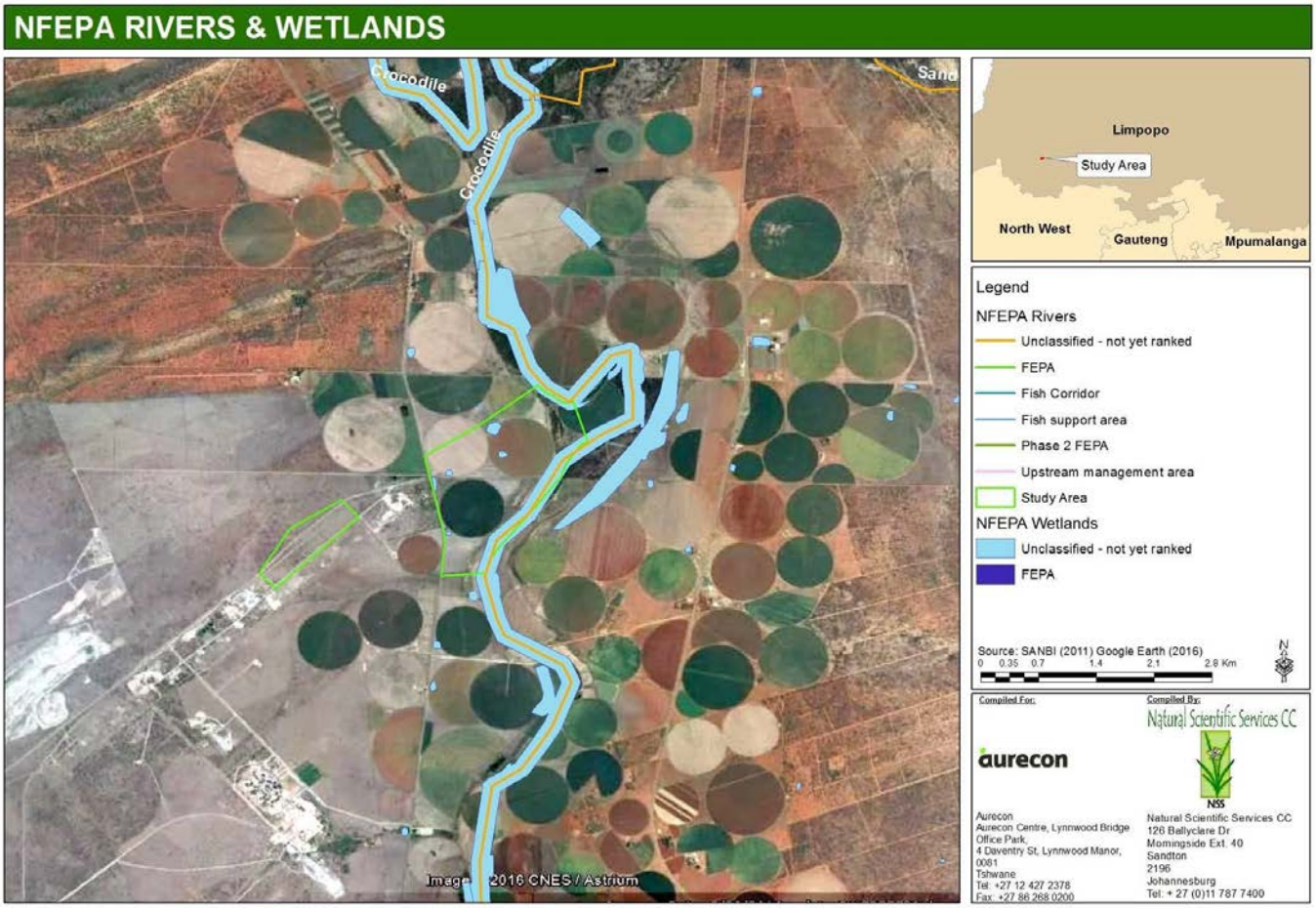


Figure 14 | National Freshwater Ecosystem Priority Areas in the Haakdoorndrift opencast pit region (Natural Scientific Services, 2017). The Crocodile River is not ranked as an NFEPA.

Mining and Biodiversity Guideline: Mainstreaming Biodiversity into the Mining Sector (2003)

The Mining and Biodiversity Guidelines (MBG) (DEA *et al.* 2013) highlights the Crocodile River near the site and surrounding habitat as High Importance for Biodiversity (see Figure 15).

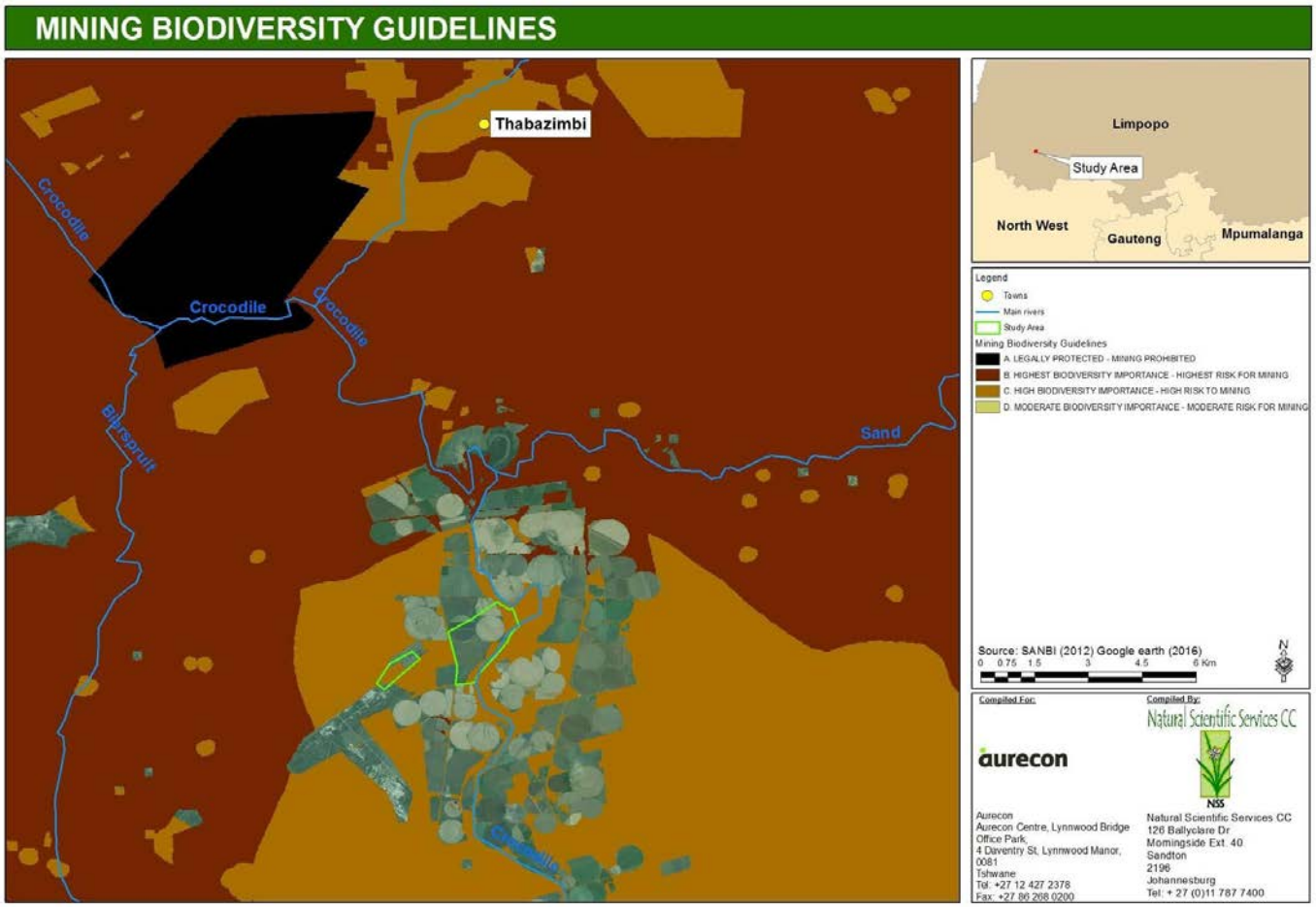


Figure 15 | The Crocodile River is regarded as having *Highest Importance* for biodiversity (Natural Scientific Services, 2017).

Limpopo Biodiversity Conservation Plan (C-Plan 2)

From the Limpopo C-Plan, the study area is situated within an Ecological Support Area (ESA) (Natural Scientific Services, 2017). ESAs "*are not essential for meeting biodiversity targets but play an important role in supporting the ecological functioning of Critical Biodiversity Areas (CBA) and/or in delivering ecosystem services."* Species-specific ESAs are "*required for the persistence of specific species*". Immediately to the east of the site, the Crocodile River floodplain, is ranked as a Critical Biodiversity Area 2. CBA's *"are the portfolio of sites that are required to meet the region's biodiversity targets, and need to be maintained in the appropriate condition for their category."* This CBA forms a Landscape Corridor along the Crocodile River, linking other CBA sites together. Landscape Corridors provide the best landscape connectivity to support and enable biodiversity to adapt to the impacts of climate change. Local corridors represent "*fine scale connectivity pathways that contribute to connectivity between climate change focal areas*." These areas are shown in Figure 16.

Local Conservation Significance

A map was compiled based on an initial terrestrial field survey and wetland assessment undertaken by NSS to depict local Areas of Significance for the conservation of terrestrial flora and fauna and the wetland systems identified on site (

Figure 17 | Local Areas of Conservation Significance (Area 1) (Natural Scientific Services, 2017)). Areas of significance include areas that have been highlighted because of their:

- Ecological sensitivity (including renewability/success for rehabilitation);
- Level/Extent of disturbance;

- Presence of Conservation Important species (identified at the vegetation unit/habitat level); and
- Conservation value (at a regional, national, provincial and local scale).

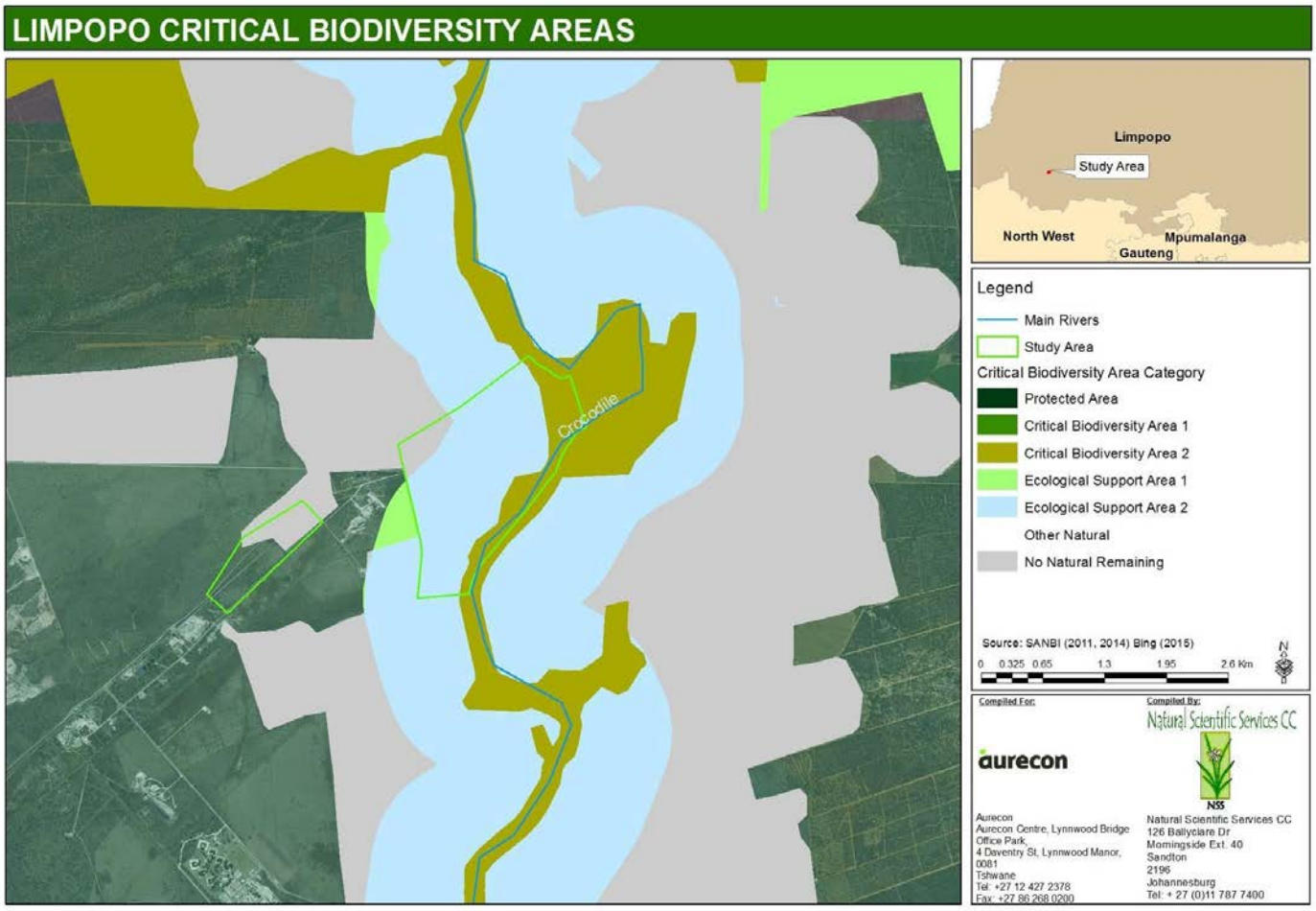


Figure 16 | Limpopo Critical Biodiversity Areas in the study site (Natural Scientific Services, 2017).

Identified habitat units within the study site were ranked into Very High, High, Medium-high, Medium, Medium-low or Low classes in terms of significance. This was undertaken according to a sensitivity-value analysis and included input based on knowledge of the area, on the ground investigations and experience when dealing with ecological systems and processes. In terms of buffer zones, a preliminary buffer determination has resulted in a recommended 100 m buffer off the *Acacia – Combretum* Riparian Fringe and a 50 m buffer off the floodplain depression and flats (Natural Scientific Services, 2017). These buffer zones will have a High and Moderate – High Conservation rating respectively. The remaining area within the 1:100 year flood line has a Moderate rating.

Waterberg District Environmental Management Framework: Environmental Management Zones

According to the Waterberg District Environmental Management Framework of 2010, the proposed project area falls within Zone 10: Agriculture areas with commercial focus (the majority of the mine right area is located within Zone 4: Mining Focus Area) (Waterberg District Municipality, 2010). The Environmental Management Zones of the Waterberg District are shown in Figure 19 and in Figure 20 for the Thabazimbi region, where the project is proposed.

In terms of the desired state for Zone 10 areas, the proposed activities' potential impacts on aspects affecting the efficient continuation of Zone 10-activities will be limited. In particular: the Crocodile River is considered a "losing stream", thus water naturally flows from the River to the aquifer in the project area – water abstraction is not anticipated to have a significant impact on the water available for irrigation; no water will be placed back into the Crocodile River, thus limiting the potential for water quality deterioration; employment will be provided to mine employees for the relatively short project duration, after which the land could be rehabilitated for agricultural use; impacts anticipated on the affected district road (D1639) will be mitigated as per the Traffic Impact Assessment (included in Appendix 7); overburden dumps (regarded as waste for the duration of the project), will be located to the west of the

pit, on the existing mine, and all other waste will be removed from and managed off-site, on the existing mine area; and, no housing (farmsteads) exist within the project area, thus no relocation of residents will be required for project continuation.

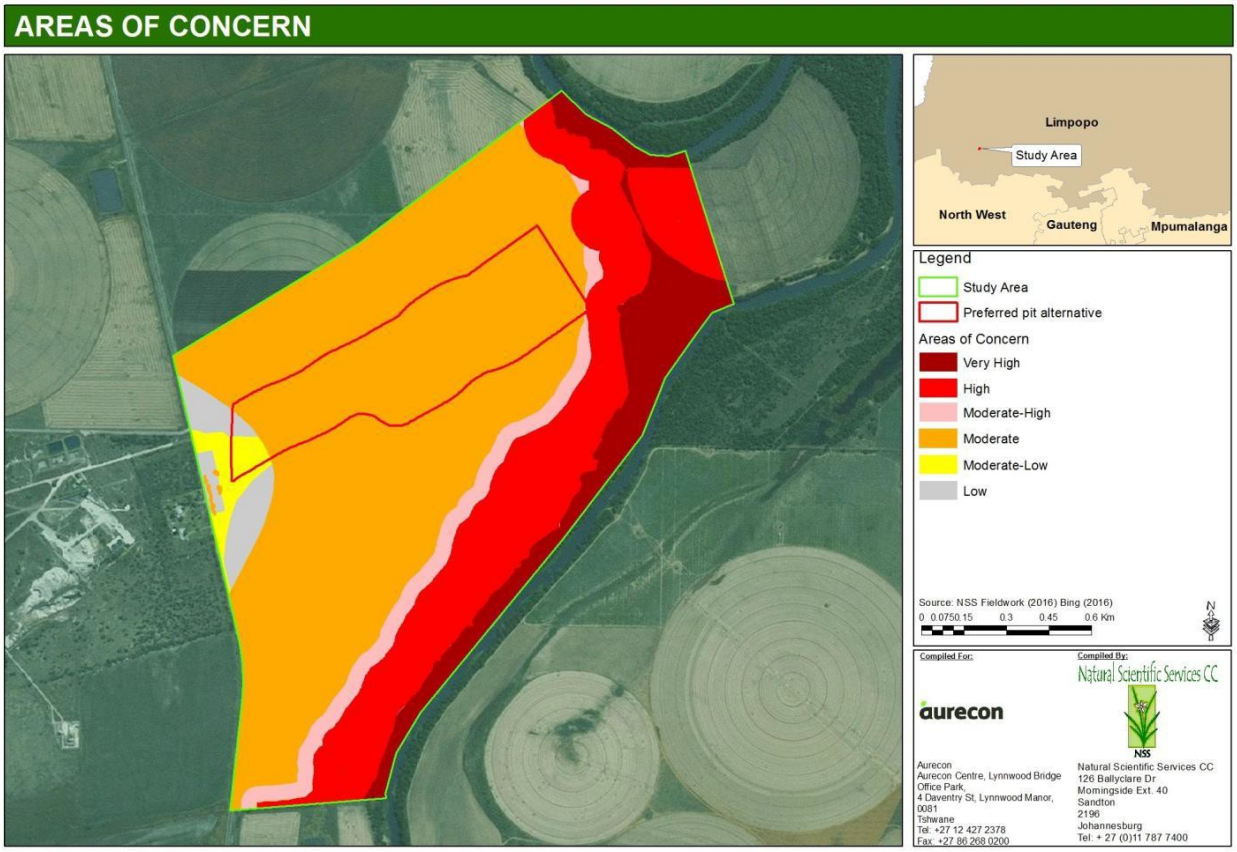


Figure 17 | Local Areas of Conservation Significance (Area 1) (Natural Scientific Services, 2017).

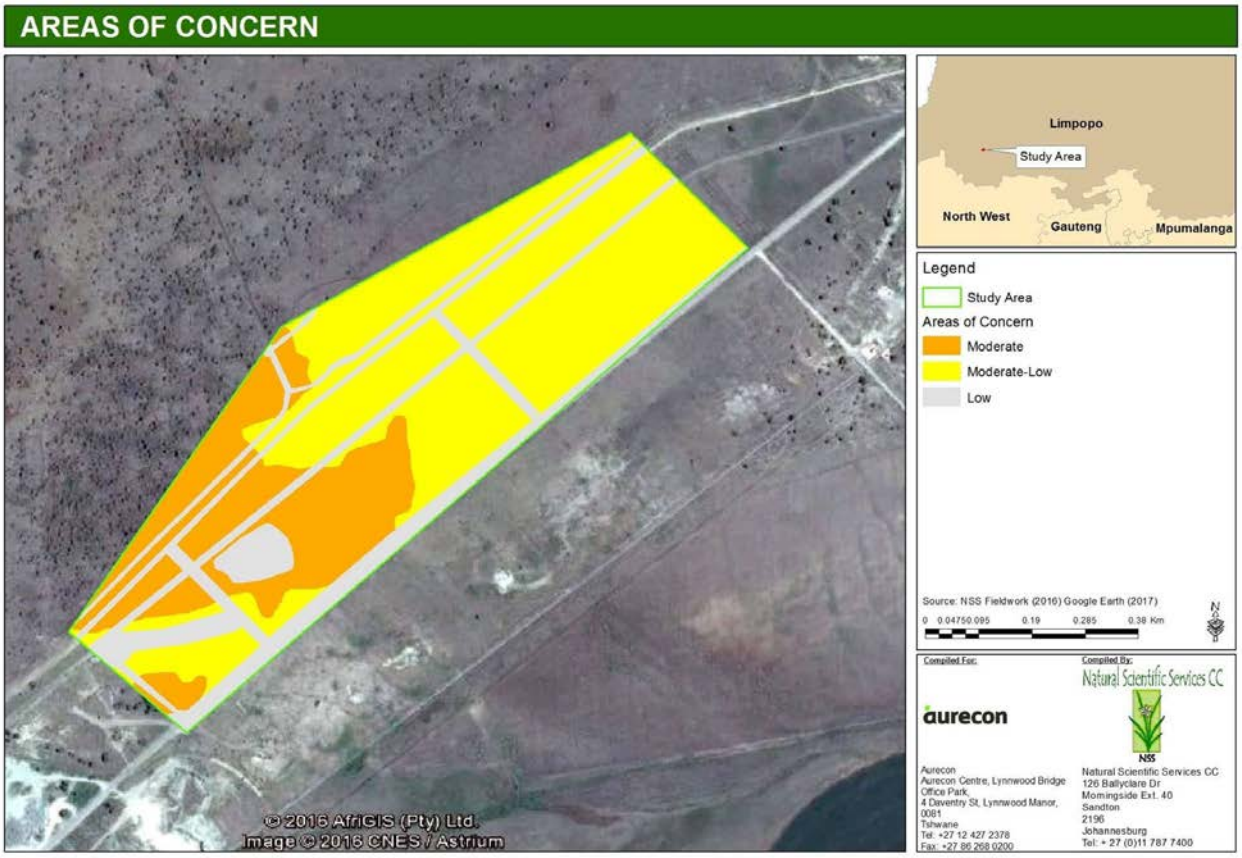


Figure 18 | Local areas of conservation significance (Area 2) (Natural Scientific Services, 2017).

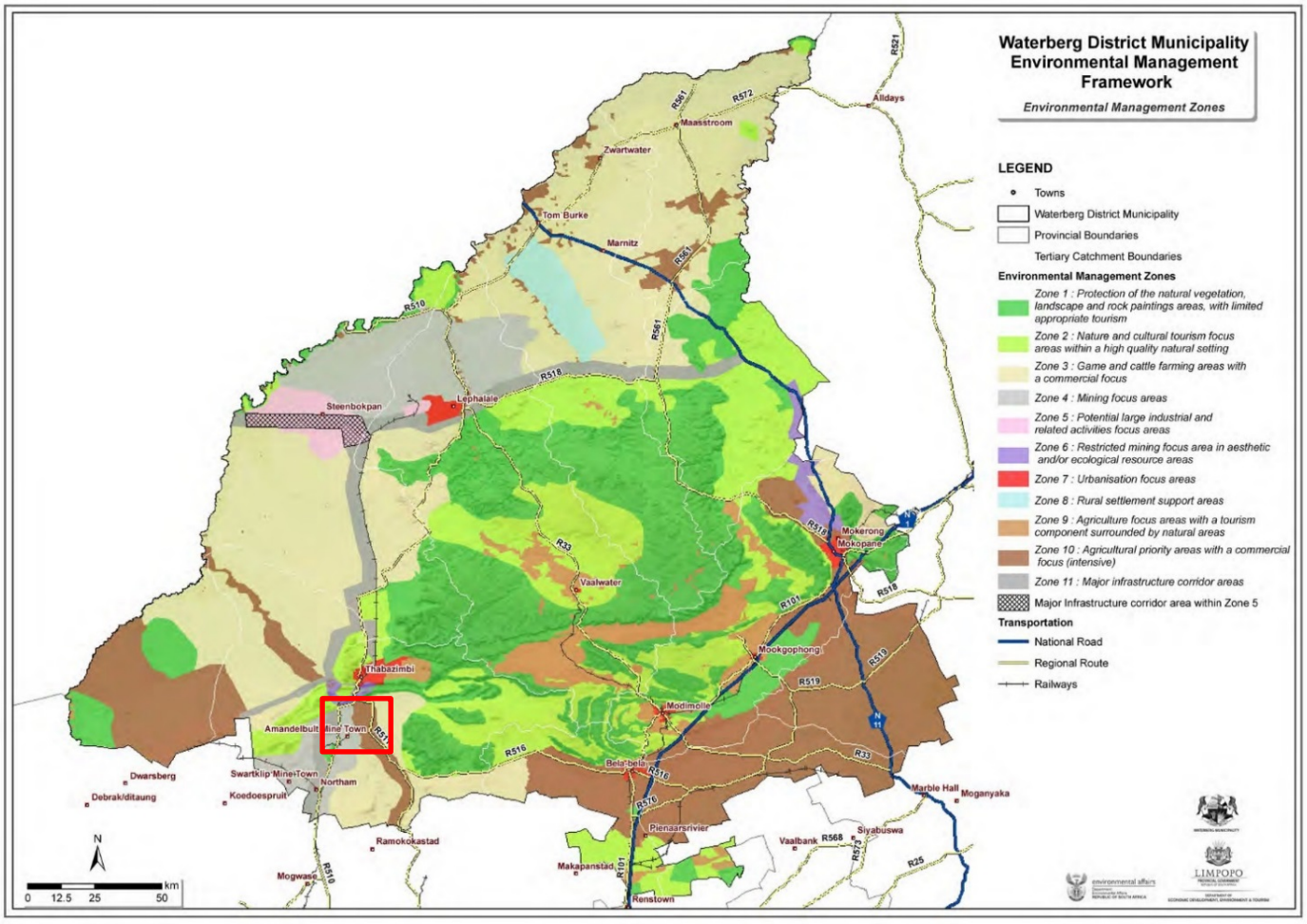


Figure 19 | Waterberg District Environmental Management Framework: Environmental Management Zones (Waterberg District Municipality, 2010).

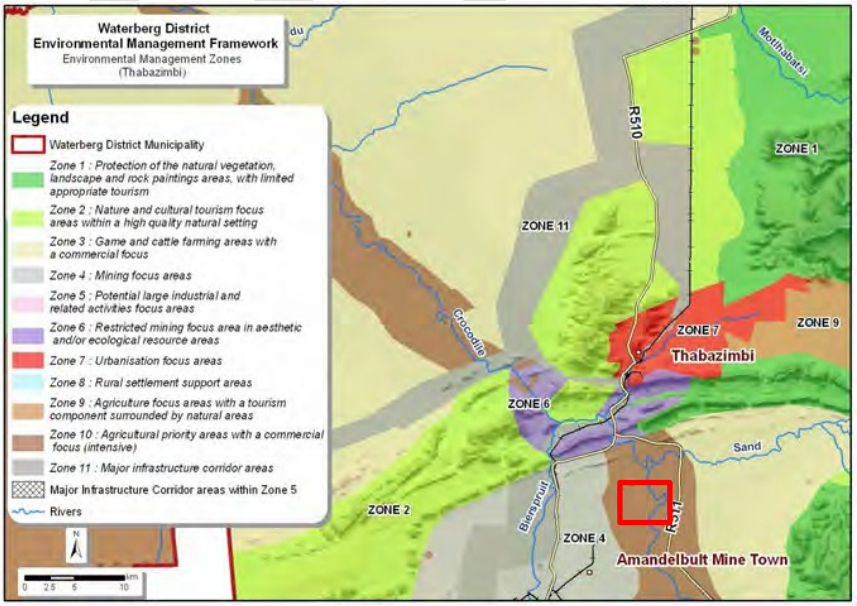


Figure 20 | Thabazimbi Environmental Management Zones (Waterberg District Municipality, 2010).

Surface Water

The study area falls within the Crocodile-Marico River catchment and within quaternary catchments A24C (Figure 21) (Natural Scientific Services, 2017). The Crocodile River impacted on by the proposed project is perennial in nature and classified as a critically

endangered system (Nel *et al*, 2007 in Natural Scientific Services, 2017). The Ecoregions level 1 and 2 for this study area are classified as Bushveld Basin 8.06 (Figure 21).

The River Health Programme (RHP) was initiated in 1994 in response to the need to monitor, assess and report on the ecological state of river ecosystems based on their biological condition in relation to all the human-induced disturbances affecting them. The RHP makes use of a suite of ecological indicators that have specifically been selected for their ability to integrate the impact of multiple disturbances on the state of rivers. The ecological status (EcoStatus) of a river refers to its overall condition or health, i.e. the totality of the features and characteristics of the river and its riparian areas, which manifests in its ability to support a natural array of species. This ability relates directly to the capacity of the system to provide a variety of goods and services. The overall Ecostatus for this study unit is poor (largely modified – D) which means that large losses of natural habitat, biota and basic ecosystem functions have occurred. This was determined in 2005 by the following DWS indices: In stream Habitat Integrity (IHI), Riparian Habitat Integrity (RHI), Riparian Vegetation Response Assessment Index (VEGRAI), Fish Assessment Integrity Index (FAII), South African River Scoring System version 5 (SASS5), Macro-invertebrate Assessment Index (MIRAI) and Water Quality Assessments (WQ) (River Health Programme, 2005).

According to the RHP (2005), the main drivers of change for the Crocodile River include:

- Extensive water use for agricultural purposes – abstraction for irrigation impacts on natural flow regime of the river;
- Dams and weirs act as barriers to flow and the migration of fauna; and
- Reduced WQ due to agricultural return flows.

As part of the Amandelbult Water Monitoring Program, surface water resources are monitored on a monthly basis using 23 monitoring localities (dams, waste streams, canals, pipelines and streams/rivers), whereas 20 groundwater localities are currently being monitored on a quarterly frequency. Water sampling is conducted according to recognised standards and procedures. Water quality analyses are performed by the Aquatico Laboratory in Garsfontein, Pretoria. Aquatico is a SANAS Accredited Testing Laboratory, No T0685. Water quality reporting is conducted on a monthly, quarterly and annual frequency. Very low impact on the Crocodile River due to current mining operations was recorded (Aquatico, 2015).

Crocodile River Flood Line

The study area is abutted by the Crocodile River on its eastern boundary. A flood line study was done for the Crocodile River by SRK in February 1995. At a pre-application meeting with DWS in April 2016, it was requested that this flood line should be recalculated as it was more than 5 years old. The catchment exceeds 21,000 km^2, with its southern boundary in the middle of Johannesburg. Urban expansion, related hardening of previously natural areas, and the contribution of large volumes of water from Wastewater Treatment Works (WWTW), such as Johannesburg's Northern Works, have contributed to the increase of the 1:100 year flood line over the last 20 years.

The Standard Design Flood method yielded a value of 9,300 m^3/s flow for a 1:100 year storm event (Aurecon, 2016). This decision was supported by the Empirical method where the RMF is at 10,645 m^3/s. The flood line was calculated using the 9,300 m^3/s value. Considering the rapid development of the catchment, as well as the impacts of climate change the more conservative value appeared to be the most appropriate. The 1995 1:100 flood lines and the latest (2016) 1:100 year flood lines are depicted in Figure 2.

The floodplain system of the Crocodile River was categorised in terms of wetland ecology as shown in Figure 22. No geomorphologically active wetlands were identified within the proposed opencast mine pit layout.

Wetland Classification

According to the terrestrial ecology study conducted by Natural Scientific Services, two broad types of inland systems were identified within the study area: rivers and wetlands:

- *Rivers*: A linear landform with clearly discernible bed and banks, which permanently or periodically carries a concentrated flow of water. A river is taken to include both the active channel and the riparian zone as a unit. The perennial Crocodile River runs adjacent to the site on the eastern boundary. The system is a Lowland River, having a low-gradient, alluvial sand-bed channel. This river has a U-shaped channel and main habitats include pools, alluvial banks, grassy edges, riparian trees and shrubs, off-channel pools and backwaters, reeds and reed islands (Department of Water and Sanitation, 2014).

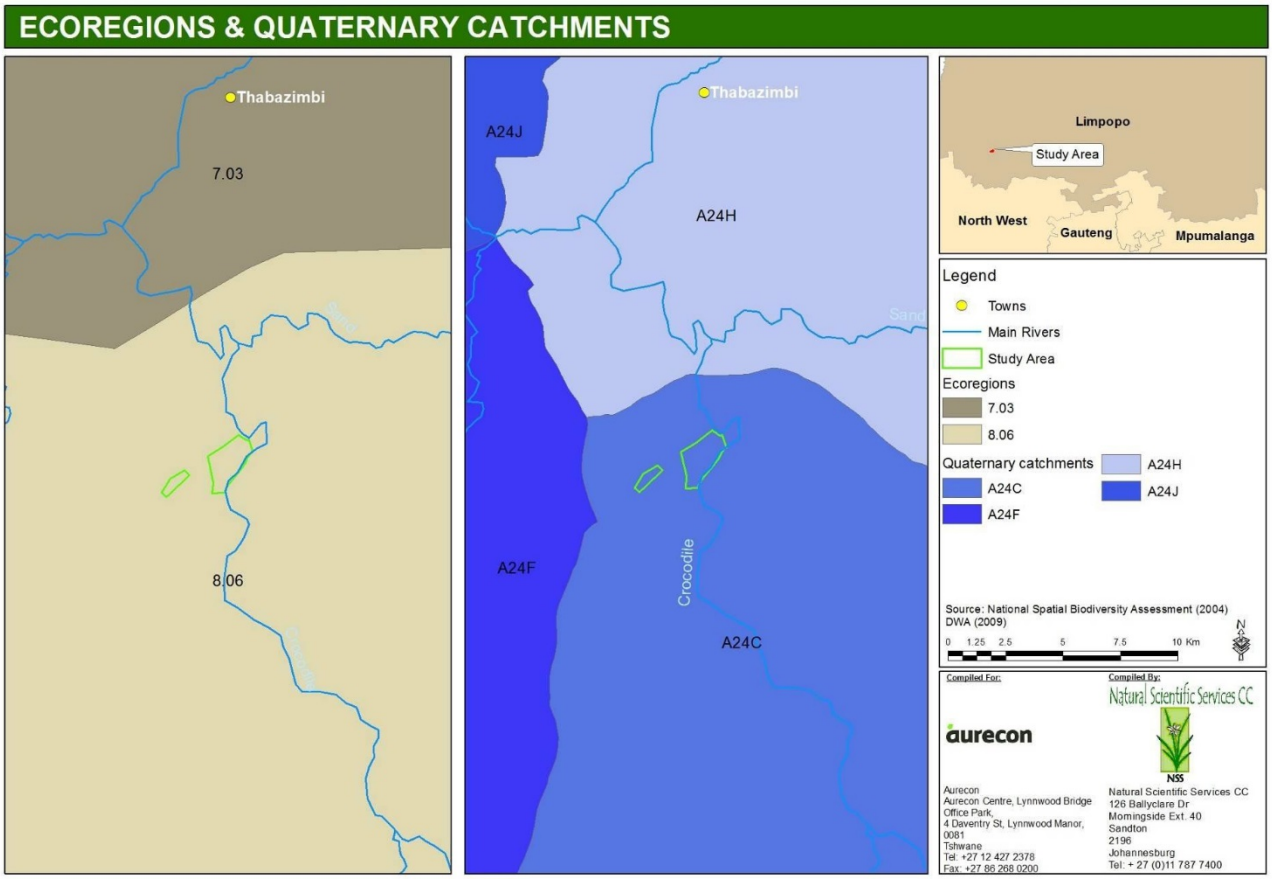


Figure 21 | Quaternary Catchments and Ecoregion in the Haakdoorndrift Opencast project area (Natural Scientific Services, 2017).

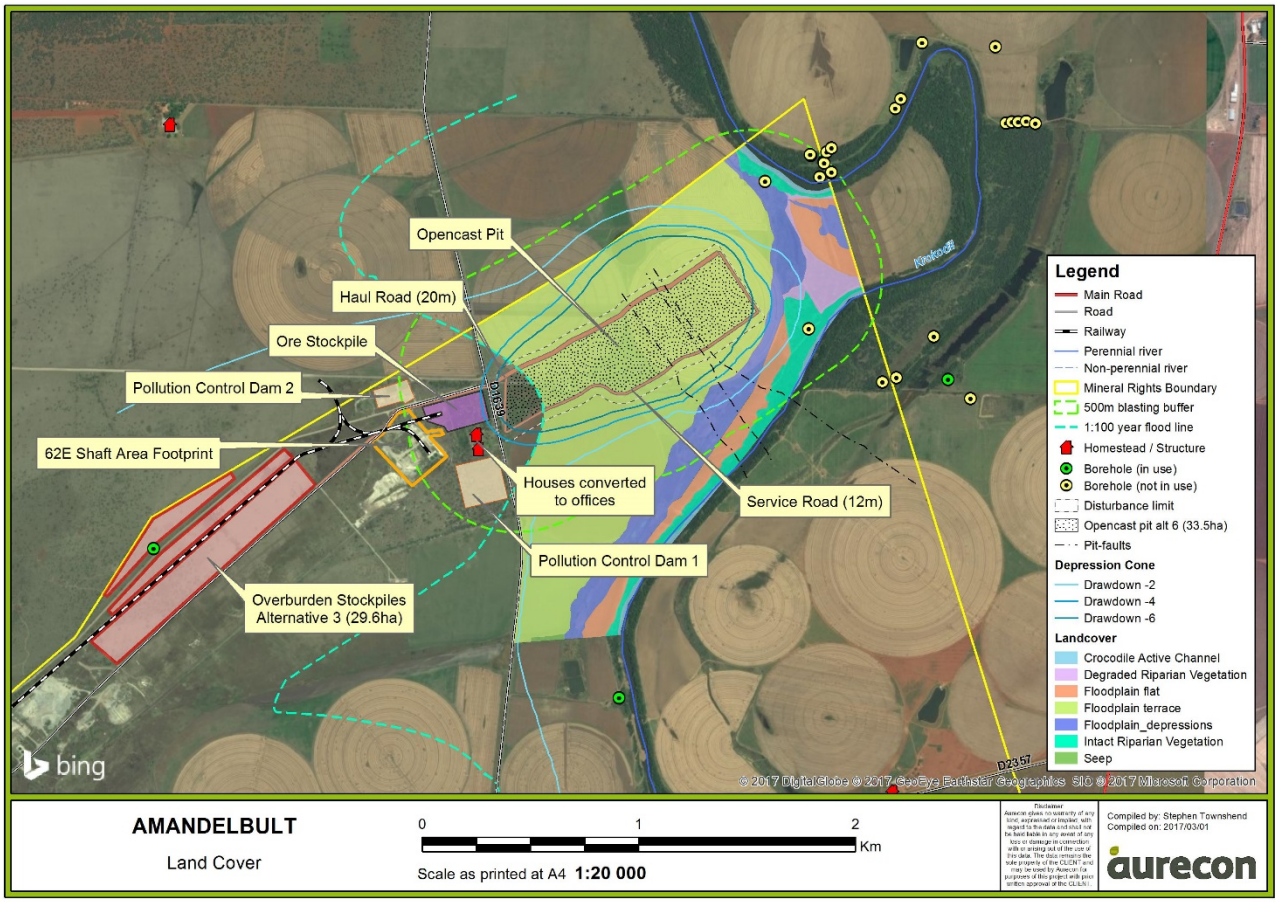


Figure 22 | Crocodile River Floodplain categorisation.

- *Floodplain Wetland*: a wetland area on the mostly flat or gently-sloping land and adjacent to and formed by an alluvial river channel, which is subject to periodic inundation by over-topping of the channel bank. The floodplain wetland must be considered as a wetland system that is distinct from yet associated with the adjacent Crocodile River. An important aspect to note is that the floodplain is formed under its present climate and sediment load. The floodplain wetland associated with the Crocodile River had many geomorphological features associated with river-derived depositional processes such as:
    - floodplain flats;
    - floodplain depressions;
    - levees; and
    - floodplain terraces.

Apart from the first three categories associated with the river and its directly riparian zone, floodplain terraces deserves being highlighted. Terraces may be overtopped, but only by larger less frequent floods for example the 1:100 year flood. The area outside the active floodplain and within the 1:100 year flood line has been demarcated as the Floodplain terrace due to the presence of rounded pebbles within the soil profile, indicative of historic depositional processes.

Present Ecological State of the Crocodile River

In accordance with a recent study by the DWS (2014) on the Present Ecological State (PES) of the Crocodile River, the river is classified as Largely Modified (D category) which means that large losses of natural habitat, biota and basic ecosystem functions have occurred. NSS (2016) assessed the PES of the riparian vegetation at 3 localities along the system. The findings highlighted that the riparian vegetation was Moderately Modified (C) at two of the sites and Largely Natural to Moderately Modified at the third (B/C) (Natural Scientific Services, 2017).

The NSS assessment of the floodplain wetlands associated with the Crocodile River assessed both hydrology and geomorphology as Moderately Modified (C), whilst the vegetation driver was Largely Modified (D). The main factors impacting the hydrology of the floodplain include the reduced surface roughness and increased water usage associated the agricultural activities and the dams constructed within the floodplain depressions. The vegetation is impacted mainly due to the clearing of natural vegetation for agricultural fields (over 25% of the active floodplain).

Ecological Importance of the Crocodile River

The Ecological Importance (EI) of the Crocodile River as defined by DWS (2014) is Moderate because there are a 100 species in the secondary catchment (A2), as well as 47 species which include one wetland, eight riparian habitat types, 14 different types of vegetation cover and three protected species in this sub-quaternary catchment (Natural Scientific Services, 2017).

The NSS assessment of the Ecological Importance and Sensitivity (EIS) of the Crocodile River and associated riparian fringe was found to be Very High; the hydrological/functional importance to be High; and the direct human benefits to be *High*. The Very High rating for the EIS is mainly due to the presence of Red Data species, the Critically Endangered Status of the Crocodile River, and the sensitivity of the system to a change in floods and low flow conditions. The EIS of the floodplain was assessed separately by NSS and scored a High, hydrological/functional importance and direct human benefits.

The main factors contributing the *High* ratings include the sensitivity of the floodplain to changes in floods, the High likelihood of provision of services such as sediment trapping and phosphate assimilation, the provision of resources and cultivated foods. Maintenance of biodiversity and the current and potential use of the system for education and research purposes are the two services that scored a *High* likelihood of being supplied by the Crocodile River and associated riparian fringe. For the Crocodile River floodplain, sediment and phosphate trapping are the two services that scored a High likelihood of being supplied. Both services scored *High* for the opportunity to supply the service, afforded it by the agricultural activities in the area, and Moderate High for the effectiveness.

Surface water quality

Diagrammatic presentations of the water quality monitoring localities are presented in Figure 23. The monitoring localities and descriptions are of Dishaba (closest to the HOP), are presented in Table 10. This table also indicates the schedule and status of the sampling performed by both Amandelbult personnel and (Aquatico, 2016). The surface water localities at Dishaba Shaft consist of

Mine water localities (7) and Receiving water localities (4) (Mine water localities are mostly water within the mining area and discharges from the mining area, whereas Receiving localities include all surface water points in the receiving environment (Bierspruit and Crocodile River).

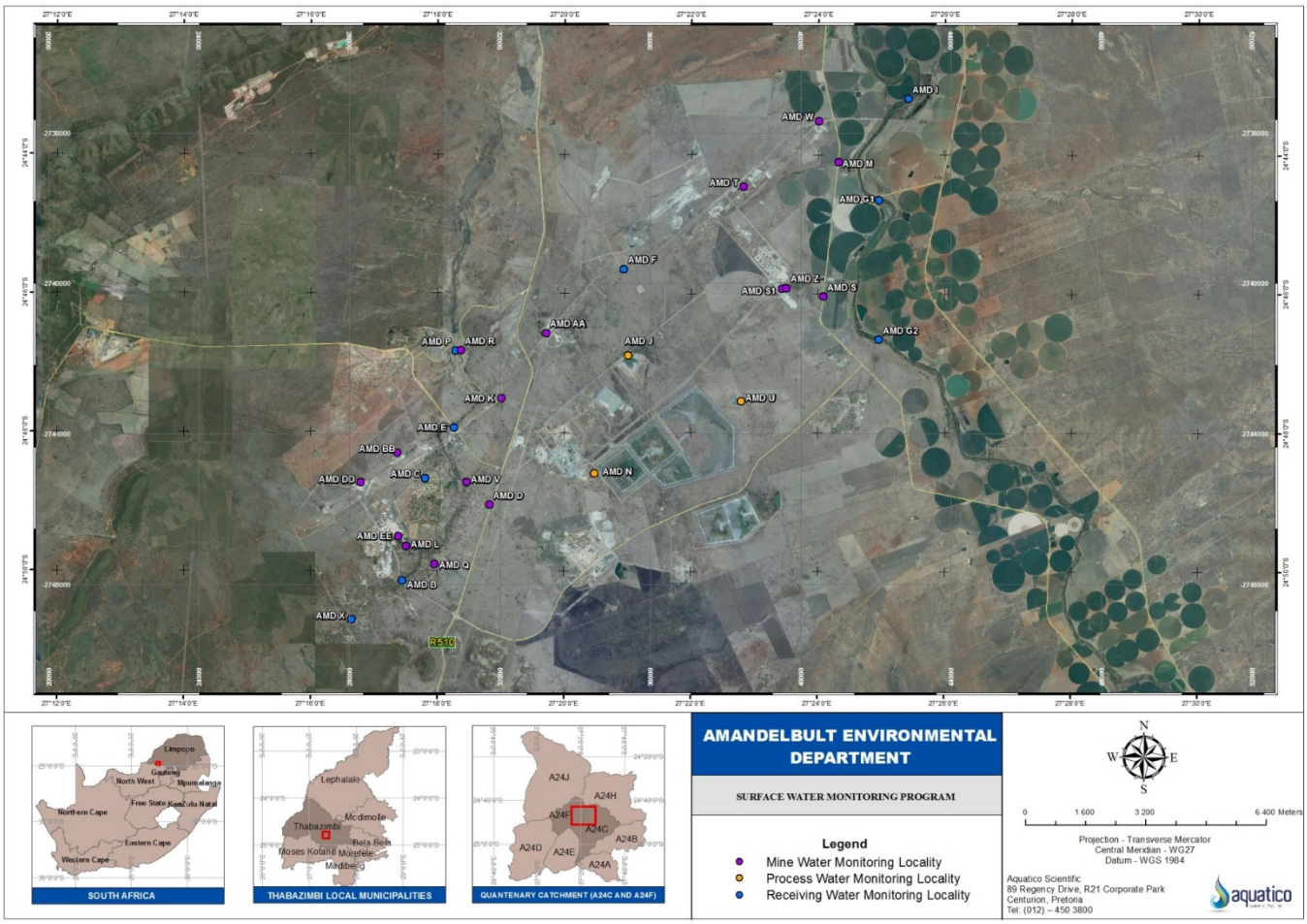


Figure 23 | Diagrammatic presentations of Surface Water monitoring localities at Amandelbult (Aquatico, 2016).

Table 10 | Amandelbult, Dishaba Shaft: Mine water and receiving water monitoring localities description and status for the annual period (Aquatico, 2016)

Dishaba Shaft - Mine Water													
Monitoring Localities		Jan 2016	Feb 2016	Mar 2016	Apr 2016	May 2016	Jun 2016	Jul 2016	Aug 2016	Sep 2016	Oct 2016	Nov 2016	Dec 2016
AMD M	62e Stream - Water discharge from 49e area)	•	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
AMD S	Dishaba shaft east lower discharge	•	Stagnant	•	•	•	•	•	•	•	•	•	•
AMD S1	Dishaba Shaft fridge plant discharge into settling dams	•	•	•	•	•	•	•	•	•	•	•	•
AMD T	49 Turf settling dam	•	•	•	•	•	•	•	•	•	•	•	•
AMD W	62 Turf Dam	Dry	•	•	•	•	•	•	•	•	•	•	•
AMD Y	44 R/B Turf Dam	•	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
AMD Z	2 # Settling Dam	•	•	•	•	•	•	•	•	•	•	•	•
Dishaba Shaft - Receiving Water													
Monitoring Localities		Jan 2016	Feb 2016	Mar 2016	Apr 2016	May 2016	Jun 2016	Jul 2016	Aug 2016	Sep 2016	Oct 2016	Nov 2016	Dec 2016
AMD F	Middelaagte tributary from the RWD	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
AMD G1	Crocodile river upstream	•	•	•	•	•	•	•	•	•	•	•	•
AMD G2	Crocodile River further upstream	•	•	•	•	•	•	•	•	•	•	•	•
AMD I	Crocodile river downstream	•	•	•	•	•	•	•	•	•	•	•	•

Sampling localities AMD M and AMD Y were dry from February to December 2016. Only three sampling localities (AMD S1, AMD T and AMD Z) were sampled every month during the period from January to December 2016. AMD S was stagnant during February 2016, while AMD W was dry during January 2016.

Mine Water

In general, stable neutral to alkaline conditions were observed at the mine water monitoring localities. The average salinity (TDS) component was very saline at all sampling localities. Furthermore, the hardness quality of the mine water monitoring localities was classified as very hard to extremely hard.

Three of the Mine water sampling localities water quality were compared against the AMD WUL Waste Water Discharge (AMD M, AMD S and AMD S1) and the other four (4) Mine water sampling localities (AMD T, AMD W, AMD Y AND AMD Z) water qualities were compared against the General Limit, Section 21f and h, 2013.

The average physical and chemical composition of several process water monitoring localities exceeded the target values specified in the WUL Waste Water Discharge in terms of EC, Na, Cl and NO_3 concentrations. The average electrical conductivity (EC) levels, NO_3 and suspended solids (SS) concentration exceeded the General Limit during the annual period at AMD T, AMD W, AMD Y and AMD Z.

Receiving Environment

The average water quality profile of the Amandelbult, Dishaba Shaft receiving environment monitoring localities can be described as neutral. Salinity conditions were saline, while the average hardness quality can be classified as hard. The average physical and chemical composition of the receiving environment water quality exceeded the WUL Surface water resource at several monitoring localities in terms of EC, Total Alkalinity, SAR, SS, Turbidity and dissolved oxygen (DO).

Calculated impact on the Bierspruit could only be determined during April and May 2016 as it was the only time that both sampling localities were sampled. Low impact on the Bierspruit was recorded and continual monitoring is important.

Groundwater

Groundwater quality

Groundwater monitoring localities are shown in Figure 24, and monitoring scheduling of the boreholes in Table 11. The monitoring results discussed below cover February to November 2016. Local groundwater flow directions are also indicated in Figure 25 with the use of light blue arrows and are generally towards the northeast and northwest in the direction of the Crocodile River and Bierspruit, respectively. The Groundwater quality situation is summarised below:

- Groundwater in the Crocodile River drainage direction is of much better quality compared to the western Bierspruit direction. However, historical monitoring data suggests that borehole HT31 is affected by sulphate contamination to a lesser extent.
- All source monitoring boreholes displayed high levels of nitrate pollution. Elevated nitrate concentrations are typically associated with the usage of nitrate based explosives and are therefore expected to originate from shaft areas, stockpiles or backfilled opencast areas (wherever groundwater/recharge has been in contact with material exposed to nitrate based explosives).
- Average groundwater levels of ± 11 and 6 mbs were measured in the Crocodile River drainage direction in boreholes HT31 and HT32 respectively. Source monitoring boreholes displayed average groundwater levels of between ± 4 and 14 mbs.

Five boreholes were drilled during May 2016 in the Haakdoorndrift project area. These boreholes should be included in the quarterly monitoring program so that a pre-mining groundwater baseline is developed (Groundwater Complete, 2017).

According to the groundwater specialist study conducted by Groundwater Complete, the proposed Haakdoorndrift pit's location in relation to the perennial Crocodile River necessitated a comprehensive investigation of the potential interaction between the pit and the river. The assessment of the geohydrological environment provides an understanding of the potential groundwater impacts associated with the proposed mining activities (Groundwater Complete, 2017).

Hydrocencus

A hydrocensus/groundwater user survey was conducted by Aquatico Scientific on farms located closest to the proposed Haakdoorndrift pit. The objective of a hydrocencus is to locate groundwater users in the area and to collect information on the use of groundwater from the borehole. A total of 33 boreholes were located and their positions are indicated in Figure 26. Borehole information is also provided in Table 12.

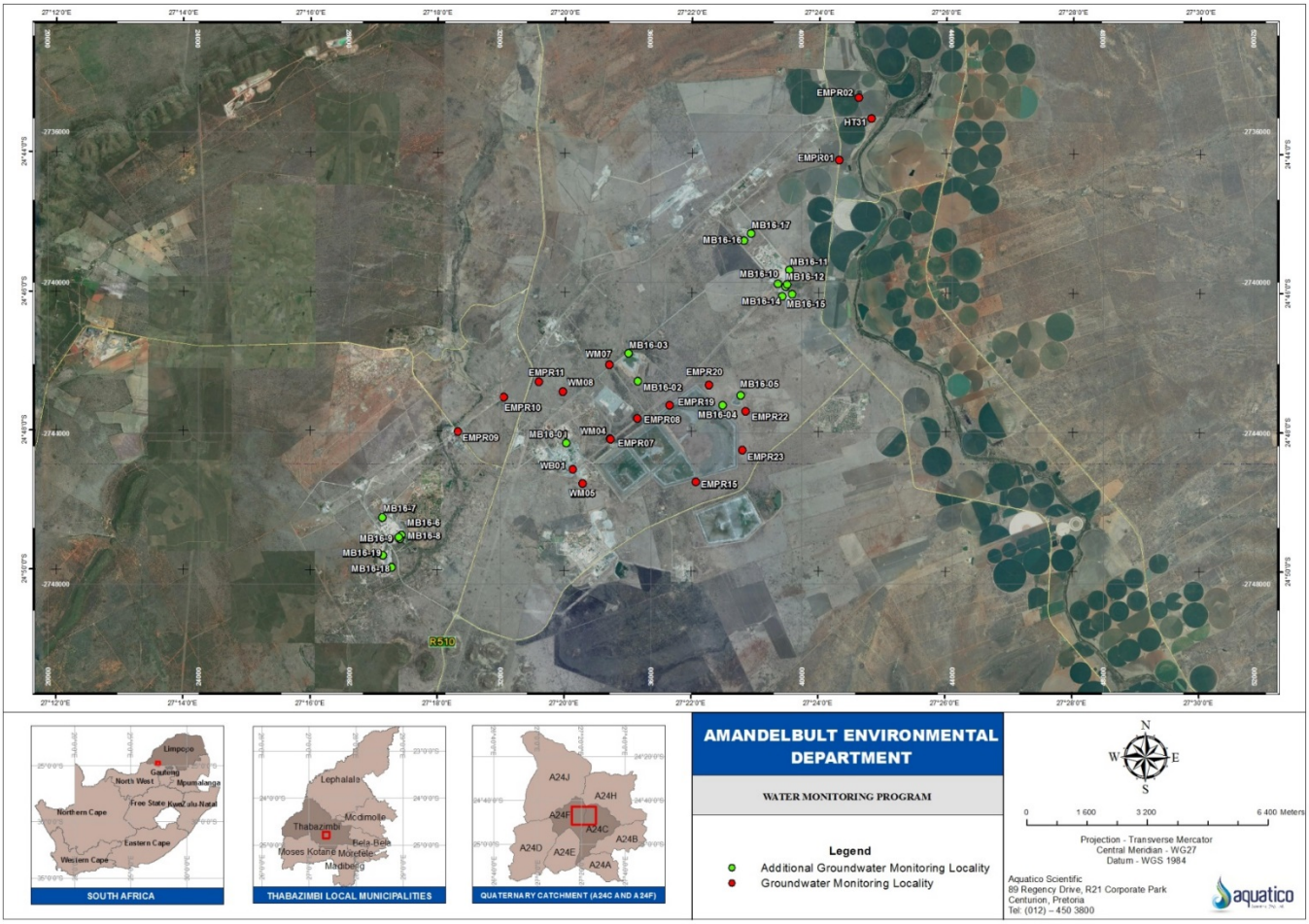


Figure 24 | Diagrammatic presentations of Groundwater monitoring localities at Amandelbult (Aquatico, 2016).

Table 11 | Amandelbult Environmental Groundwater monitoring localities description and status table for the annual period (Aquatico, 2016)

Amandelbult Environmental Department													
Borehole													
Monitoring Localities		Jan 2016	Feb 2016	Mar 2016	Apr 2016	May 2016	Jun 2016	Jul 2016	Aug 2016	Sep 2016	Oct 2016	Nov 2016	Dec 2016
EMPR 01	Borehole west of Koedoeskop dirt road		Dry			Blocked			Dry			Blocked	
EMPR 02	Borehole east of the Koedoeskop dirt road		Bees			Blocked			Dry			Blocked	
EMPR 09	Borehole next to road at Bier Spruit		•			•			•			•	
EMPR 10	Borehole at Zero Dam		•			•			•			•	
EMPR 11	Borehole at 4 Shaft area		•			•			•			•	
HT 31	Borehole at Crocodile River downstream		•			•			•			•	
HT 32	Borehole at Crocodile River upstream		•			•			•			•	
MB16-06	Upgradient from Tumela Mine	These Monitoring Boreholes was added to the Monitoring Program in November 2016										Dry	
MB16-07	Downgradient from Tumela Mine											Dry	
MB16-08	Upgradient from the Tumela Shaft Slurry Dam											•	
MB16-09	Downgradient from the Tumela Shaft Slurry Dam											Not sampled	
MB16-10	Upgradient from Dishaba Mine											•	
MB16-11	Downgradient from Dishaba Mine											•	
MB16-12	Upgradient from Dishaba Slurry Dam											•	
MB16-13	Downgradient from Dishaba Slurry Dam											•	
MB16-14	Upgradient from Dishaba Waste Dump											•	
MB16-15	Downgradient from Dishaba Wase Dump											•	
MB16-16	Upgradient from 44 East Wase Dump											•	
MB16-17	Downgradient from 44 East Waste Dump											Dry	
MB16-18	Upgradient from Tumela Waste Dump											Not sampled	
MB16-19	Downgradient from Tumela Waste Dump											Dry	

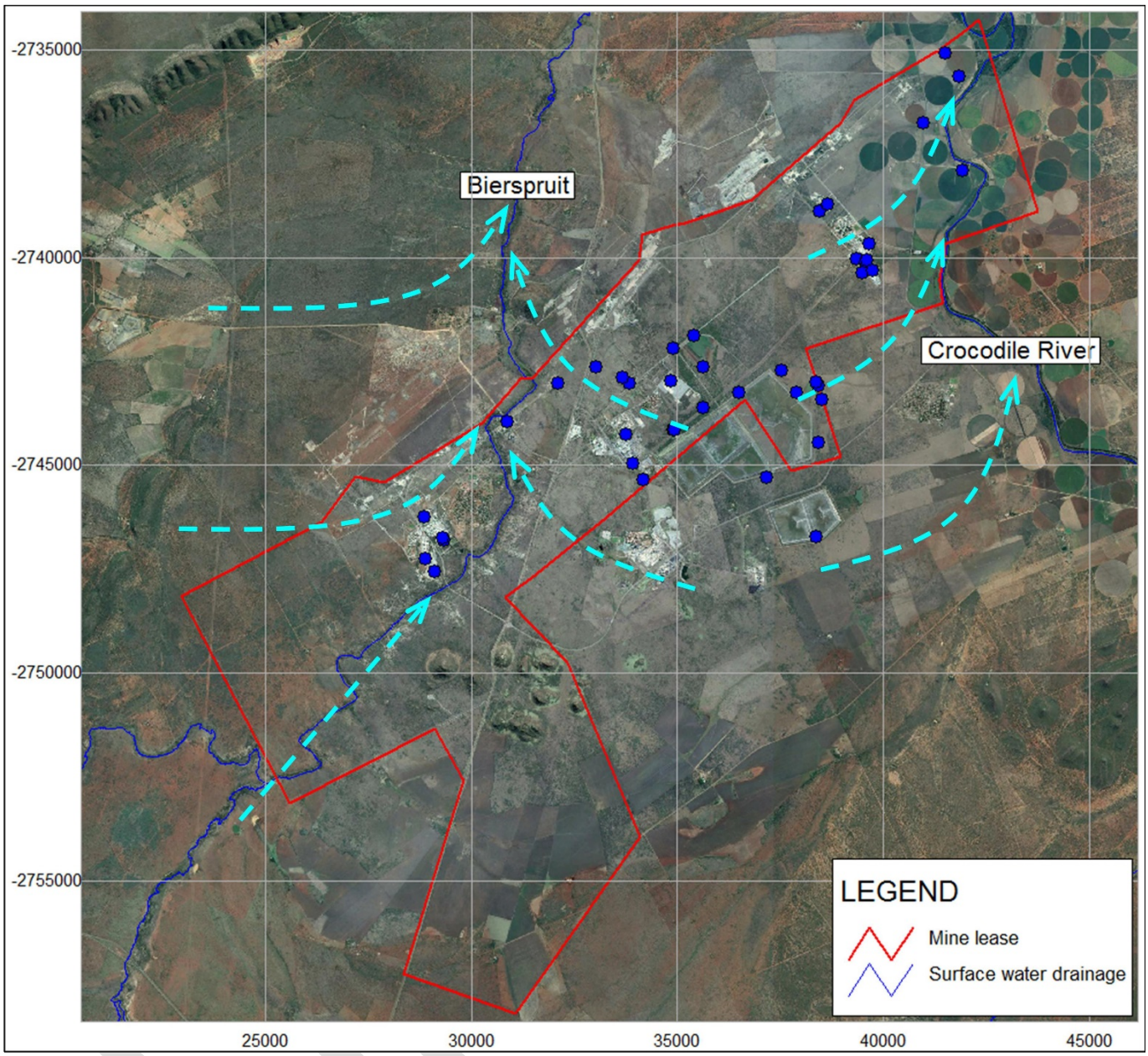


Figure 25 | General groundwater flow directions across the Amandelbult Mining Right area (Groundwater Complete, 2017).

Only six of the 33 located boreholes are currently being used for domestic purposes and/or irrigation/livestock watering (Table 12). Worth mentioning is the fact that the nearest of these six boreholes (MC04) is located nearly 1 kilometre away from the proposed Haakdoorndrift pit and on the opposite side (east) of the perennial Crocodile River. The Crocodile River acts as a constant head boundary between the proposed Haakdoorndrift mining activities and users to the east of the river, i.e. effectively shielding these users from any potential adverse impacts (Groundwater Complete, 2017).

Aquifer delineation

Topographic highs/lows (no-flow boundary) and the perennial Crocodile River (constant head boundary) were used to roughly delineate the aquifer system underlying the project area (Figure 27). Delineating an alluvial aquifer is a fairly simple exercise, whereas the delineation of fractured rock aquifers can be trickier, as transmissive fractures (of which some underlie the pit area, as indicated in Figure 31) could assume any geometry and orientation. To delineate the 'ends' of these aquifers, the following boundary conditions were considered:

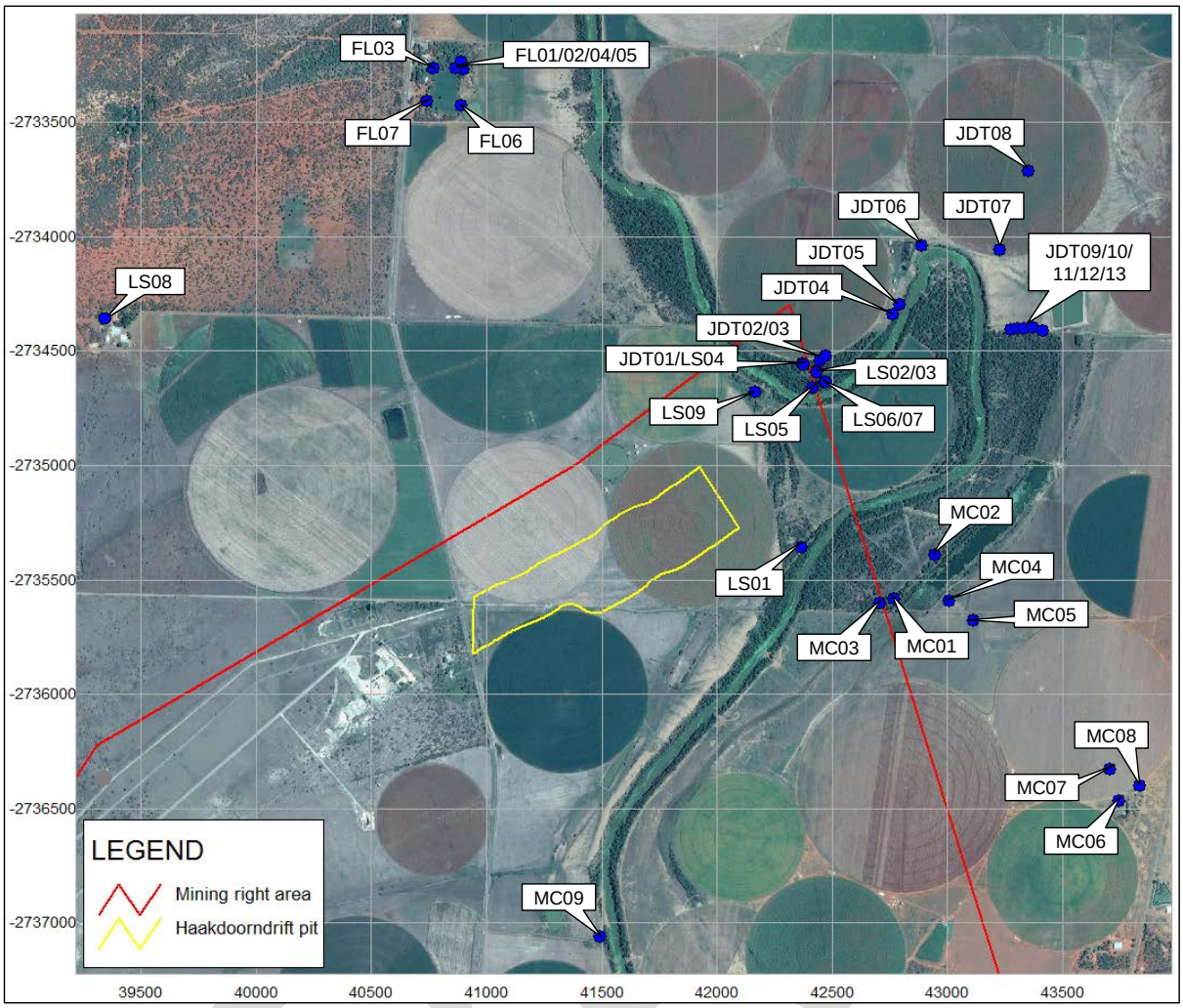


Figure 26 | Positions of user boreholes located during hydrocensus (Groundwater Complete, 2017).

Table 12 | Hydrocensus results (Groundwater Complete, 2017)

Locality	Coordinates *(WGS 84)*		Static WL	In Use	Comments
	South	East			
Mr. Louis Scheepers: Haakdoorndrift 374, portion 2					
LS01	24.72230	27.41874	N/A	N	Old mono pump installed
LS02	24.71534	27.41940	N/A	N	Open borehole, blocked at 1.20m
LS03	24.71539	27.41941	5.87	N	Open borehole with old steel frame
LS04	24.71508	27.41881	5.35	N	Open borehole near power box, next to gravel road leading down to river
LS05	24.71598	27.41922	5.95	N	Open borehole, possibly blocked at 6.12m
LS06	24.71580	27.41974	5.35	N	Open borehole with white steel frame
LS07	24.71577	27.41975	5.24	N	Open borehole next to LS06, smaller casing
LS08	24.71354	27.38888	25.92	Y	Borehole near house, submersible pump fitted for domestic use (household water supply)
LS09	24.71617	27.41673	3.97	N	Open borehole, borehole yield and aquifer testing performed
Mr. Marius Coetzee: Haakdoorndrift 374, portions 3 and 6					
MC01	24.72433	27.42274	4.45	N	Open borehole, will soon be equipped for irrigation
MC02	24.72261	27.42445	3.80	N	Open borehole, will soon be equipped for irrigation
MC03	24.72451	27.42211	4.21	N	Open borehole, will soon be equipped for irrigation
MC04	24.72440	27.42511	N/A	Y	Pump installed, used for irrigation
MC05	24.72519	27.42613	4.22	N	Open borehole

MC06	24.73226	27.43241	8.24	N	Open borehole
MC07	24.73102	27.43203	7.80	N	Open borehole in corn field
MC08	24.73168	27.43328	8.30	Y	Pump installed
MC09	24.73771	27.41013	N/A	Y	Submersible pump installed
Mr. Jaco du Toit: Haakdoorndrift 374, portion 5					
JDT01	24.71505	27.41878	5.66	N	Open borehole situated near river
JDT02	24.71494	27.41953	5.96	N	Open borehole situated near river
JDT03	24.71477	27.41975	5.56	N	Open borehole situated near river
JDT04	24.71310	27.42265	5.60	N	Broken mono pump
JDT05	24.71271	27.42290	6.01	N	Old bee hive in borehole
JDT06	24.71037	27.42386	2.05	N	Open borehole
JDT07	24.71053	27.42721	6.42	N	Open borehole
JDT08	24.70743	27.42842	0.56	N	Open borehole
JDT09	24.71370	27.42771	4.44	N	Open borehole
JDT10	24.71365	27.42798	4.20	N	Open borehole
JDT11	24.71366	27.42826	N/A	N	Borehole blocked
JDT12	24.71362	27.42863	4.45	N	Open borehole
JDT13	24.71371	27.42905	4.31	N	Open borehole
Mr. Frans Lourens: Haakdoorndrift 374, portion 1					
FL01	24.70348	27.40418	14.05	Y	Irrigation, livestock and domestic use
FL02	24.70345	27.40384	N/A	Y	Irrigation, livestock and domestic use
FL03	24.70346	27.40292	N/A	N	Blocked at 9.82m
FL04	24.70322	27.40410	13.68	N	Open borehole
FL05	24.70320	27.40409	13.06	N	Open borehole
FL06	24.70492	27.40409	N/A	N	Blocked
FL07	24.70473	27.40265	N/A	N	Blocked

- *No-flow boundaries:* topographic highs or lows and impermeable geological structures across which groundwater flow is not possible; and
- *Constant head boundaries:* positions or areas where the groundwater level is fixed at a certain elevation and does not change (perennial rivers/streams or dams/pans) (Groundwater Complete, 2017).

The project area stretches over three main aquifers, which for the purpose of this investigation are referred to as the Crocodile River Aquifer (green polygon in Figure 27) and the Bierspruit Aquifer 1 and 2 (yellow and orange polygons respectively in Figure 27).

The Crocodile River Aquifer was estimated to cover an area of approximately 530 km^2, Bierspruit Aquifer 1 covered an area of ± 390 km^2, and Bierspruit Aquifer 2 covered an area of ± 170 km^2. Geological structures such as dykes are known to occur within the project area and have the ability to act as aquifer boundaries, thus subdividing the regional aquifers into various 'sub-aquifers' or compartments. Therefore, the aquifer boundaries indicated in Figure 27 are considered to be conceptual and based on topographical controls and perennial surface water features.

Groundwater level depth

Groundwater levels in the immediate pit vicinity are indicated in Figure 28. Through Bayesian interpolation, these levels provide an indication of the overall groundwater elevations. Results show that, despite historical and current mine dewatering activities and artificial aquifer recharge, groundwater still follows natural flow patterns. The highest static water level elevation is approximately 990 mamsl and occurs along the western border of the mining right area. The lowest static water level elevation where no impact from groundwater abstraction occurs is at approximately 900 mamsl in the northern down gradient direction towards the Crocodile River (Figure 29). Groundwater flow directions in the project area are indicated in Figure 29 with the use of blue arrows.

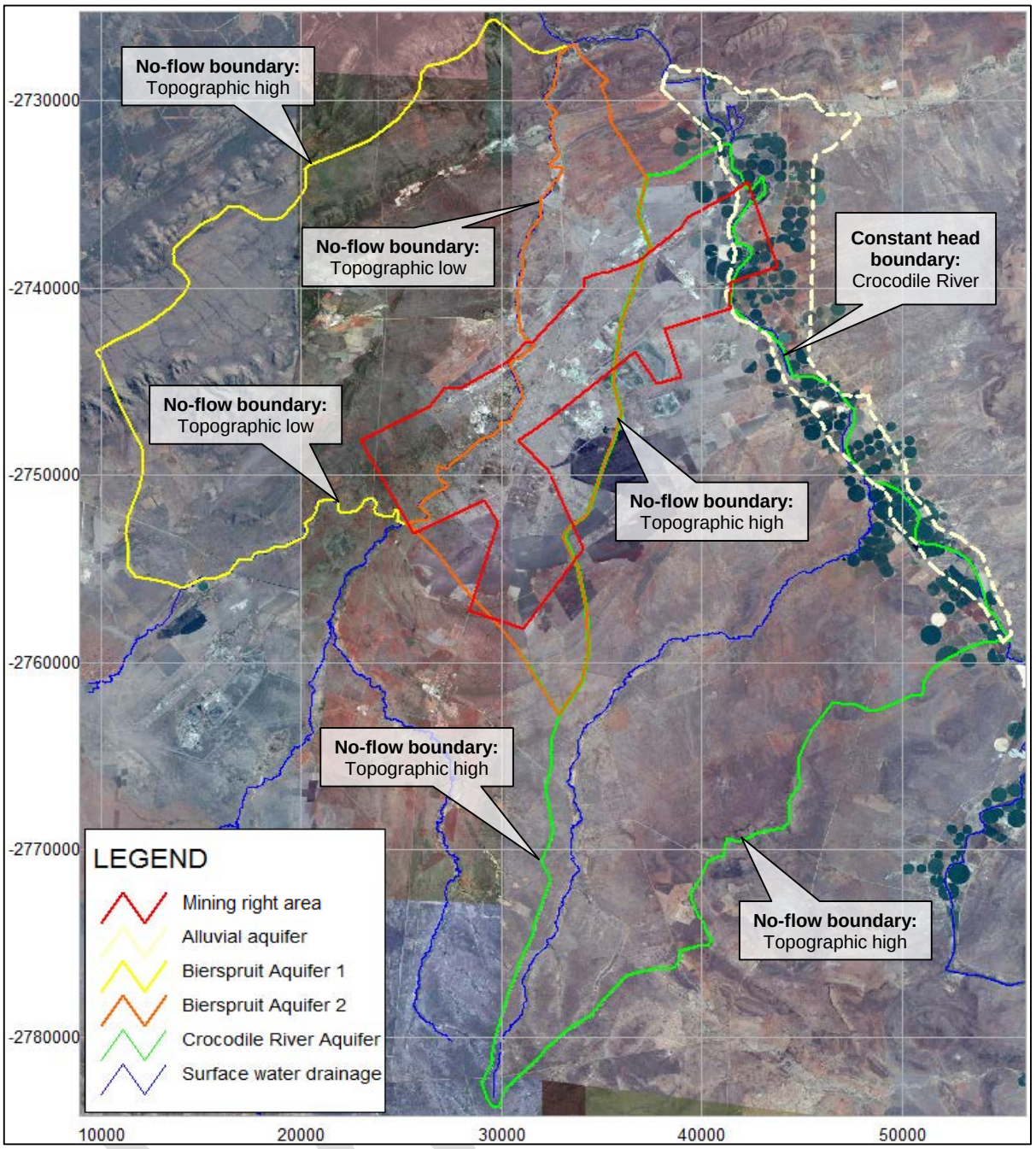


Figure 27 | Aquifer delineation of the project area.

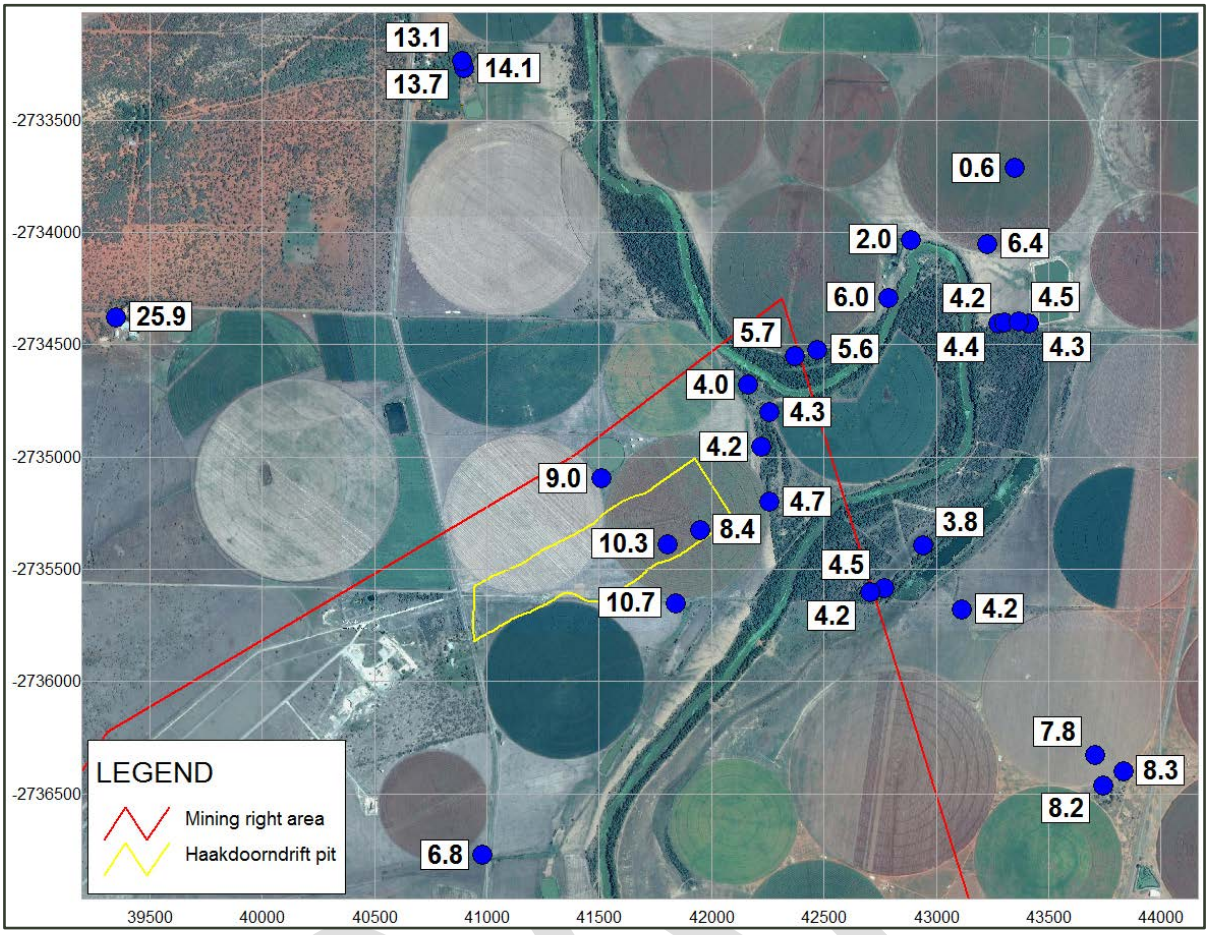


Figure 28 | Groundwater level depths (m) below surface at user- or monitoring boreholes.

Contours of the static water levels or piezometric[2] heads in and around the project area are indicated in Figure 29. Path lines or flow lines of groundwater particles are lines perpendicular to the contours, indicated by arrows. Flow occurs faster where contours are closer together and gradients are thus steeper. The groundwater flow gradients were used to calculate the rate of groundwater movement (the so-called 'Darcy flux') in the project area, also indicated in Figure 29. The average steady state flow velocity (Darcy flux) in the project area was calculated to vary between ± 2.6 and 6.4 m/y (Groundwater Complete, 2017).

Aquifer types

Three possible aquifer[3] types are present in the project area:

1. A *primary porosity aquifer*, hosted in the unconsolidated alluvial sediments deposited by the Crocodile- and Bierspruit Rivers. The aquifer is unconfined and according to geological logs its thickness may vary between 0 and 10 meters. This aquifer receives recharge from rainfall and through infiltration from the rivers directly, especially during times of high flow levels. This aquifer has the potential to yield significant volumes of groundwater, especially in areas of greater sediment deposition, and is therefore regarded as a border line major aquifer system.
2. A shallow, *semi-confined or unconfined aquifer* that occurs in the transitional soil and weathered bedrock zone or sub-outcrop horizon. Sustainable yields in this aquifer are generally low (less than 0.5 l/s) and the aquifer is usually not fit for supplying groundwater on a sustainable basis. According to geological logs the thickness of this aquifer may vary between 0 and ± 20 meters. In the two boreholes drilled on the proposed Haakdoorndrift footprint the aquifer thickness was less than

[2] Piezometric head (or hydraulic head pressure), is the pressure that exists in a confined aquifer and, more specifically, is the elevation above a datum plus the pressure head.

[3] A geological formation or group of formations that can yield groundwater in economically useable quantities.

5 meters. Consideration of the shallow aquifer system becomes important during seepage estimations from pollution sources to receiving groundwater and surface water systems. The shallow weathered zone aquifer plays the most important role in mass transport simulations from process and mine induced contamination sources because the lateral seepage component in the shallow weathered aquifer often dominates the flow. This aquifer is usually regarded as a minor- and, in some cases, a non-aquifer system.

3. The third aquifer system is the deeper *secondary fractured rock aquifer* that is hosted within the igneous rocks of the Bushveld Complex. Groundwater within this aquifer is entirely restricted to open fractures and discontinuities due to the crystalline and non-porous nature of the igneous rock. This aquifer system usually displays semi-confined or confined characteristics with piezometric heads often significantly higher than the water-bearing fracture position. The aquifer could be regarded as a minor aquifer system, but also a sole aquifer system in some cases where groundwater is the only source of domestic water.

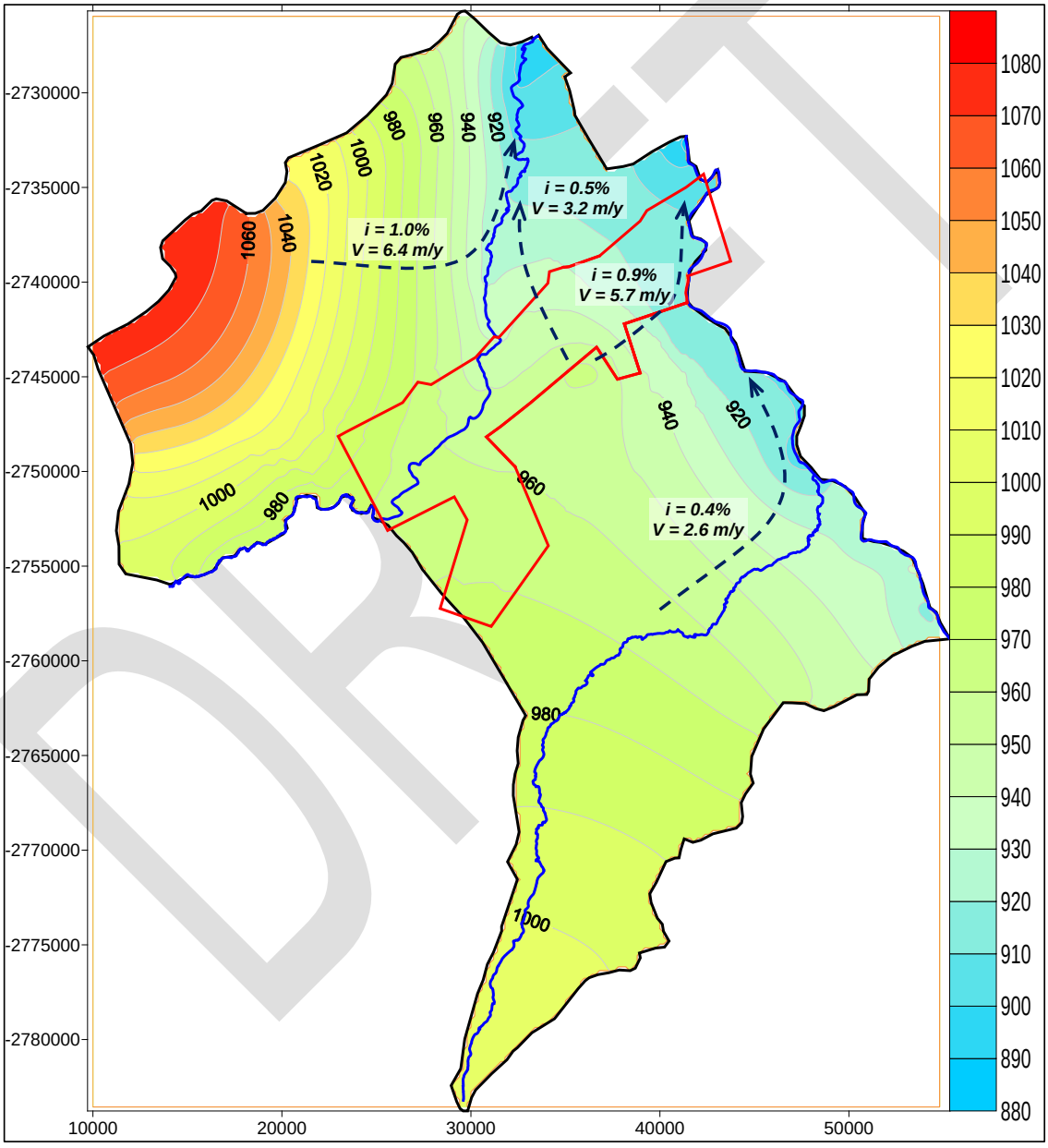


Figure 29 | Direction and rate of groundwater movement (Groundwater Complete, 2017).

There is interconnection (vertically) between all the aquifer types distinguished mainly by porosity. The alluvial aquifer progresses with depth to the weathered zone aquifer and the weathered zone aquifer in turn is linked directly with transmissive fractures to the deeper, secondary aquifer.

Mean annual recharge rates of the aquifers shown in Figure 27 are listed in Table 13:

Table 13 | Mean annual aquifer recharge rates of project area aquifers

Aquifer system	Area (km²)	Mean annual aquifer recharge (Mm³/a)
Bierspruit Aquifer 1	390	7.8
Bierspruit Aquifer 2	170	3.4
Crocodile River Aquifer	520	10.4
Total mining right area	140	2.8

Interaction between groundwater and Crocodile River

Hydraulic interaction between the pit and the river is governed by the presence of the following two factors, further described below:

- Hydraulic *gradient* from the river to the adjacent aquifer/s and the proposed new pit; and
- A *pathway* that hydraulically connects the river with the pit.

Hydraulic gradient

Elevations of surrounding groundwater levels and the head in the Crocodile River were accurately surveyed and are indicated in Figure 30. Gravity dictates that both groundwater and surface water flow from high to low elevations. This means that rather than groundwater flowing towards and discharging into the river, water from the river (at ± 907 mamsl) discharges into the adjacent aquifer/s from where it flows in the direction of the proposed new pit (between 906 and 903 mamsl). This flow direction is indicated in Figure 30 with the use of blue arrows.

Therefore, the portion of the Crocodile River adjacent to the proposed pit, is a losing (influent) stream. This concept is further illustrated with the vertical cross sections provided in Figure 32, Figure 33, and Figure 34. In all three sections the elevation of the river head is higher than the surrounding groundwater elevation, resulting in surface water from the river currently being discharged into the adjacent aquifer/s. This volume was calculated (Section 12.5.3) for a portion of the river directly adjacent the proposed new pit (yellow dotted line in Figure 30) to be in the order of 300 m³/d (± 3.5 l/s). This volume is based on the average transmissivity calculated for the alluvial aquifer.

Pathway

A hydraulically connecting pathway could be a:

- *transmissive geological structure*;
- weathered rock; or
- loose / unconsolidated *sedimentary deposits*.

In the proposed mining area, *transmissive geological structures* are present as faults and the area surrounding the Crocodile River contains permeable *sedimentary deposits* as alluvium or weathered material. Five boreholes were drilled to investigate the groundwater pathways affecting the project area:

- Two boreholes targeted north-west by south-east trending faults, which have been interpreted by the mine to intersect both the proposed new pit and Crocodile River;
- The remaining three boreholes were drilled into the sediments that have been deposited by the Crocodile River through the millennia and also underlie the proposed pit.

The boreholes were pump tested to calculate the hydraulic properties of the geological structures and sedimentary deposits. The results of the pump tests revealed that the geological structures as well as the sediment deposits are definite permeable pathways for groundwater flow.

Note that, while the depth-to-groundwater level increases further away from the river, the depth/thickness of the paleochannel[4]/weathered zone decreases, resulting in this pathway being dry directly underneath most of the proposed new pit (Figure 32, Figure 33, and Figure 34). The paleochannel is believed to be saturated in the easternmost corner of the Haakdoorndrift pit (Figure 35). Therefore, surface water from the river is expected to interact with the pit via the transmissive geological structures and the saturated paleochannel/weathered zone (to a lesser extent).

A grid was constructed of the current groundwater elevations and another of the floor of the paleochannel in the immediate vicinity of the proposed new Haakdoorndrift pit. The paleochannel grid was subtracted from the groundwater elevation grid to show the vertical relationship between the two (Figure 35). The red line in Figure 35 represents the position where the groundwater elevation is equal to the elevation of the paleochannel floor (i.e. zero line). East of this zero line the floor of the paleochannel is lower than the groundwater elevation, whereas the opposite holds true for areas west of the zero line (i.e. paleochannel west of zero line is mostly dry). The findings of Figure 35 are in agreement with the vertical cross sections in Figure 32, Figure 33, and Figure 34 and the results of the drilling and pump tests.

Measured groundwater and surface water elevations and the results of pump tests suggest that there will be interaction between the proposed new pit and Crocodile River via the saturated paleochannel/weathered zone and geological structures. Yearly groundwater influx volumes were estimated with the numerical groundwater flow model and the results are discussed in detail in Section 12.5.3 of the report.

The paleochannel/weathered zone underneath most of the Haakdoorndrift pit footprint area is dry. The only area where a definite risk of groundwater influx occurs from the paleochannel/weathered zone is at the far eastern corner of the pit as illustrated in Figure 35. This risk will increase at times when the river is in flood and the paleochannel/weathered zone is recharged by the higher head in the river. Geological structures (faults) are known to occur within the proposed new mining area, two of which have been interpreted by the mine to intersect both the proposed new pit and Crocodile River.

[4] "Paleochannel" refers to an old river channel, which has been filled with alluvial deposits. Depending on the type of infill material and position of groundwater table, the paleochannel may be able to store and yield significant volumes of groundwater (Groundwater Complete, 2017).

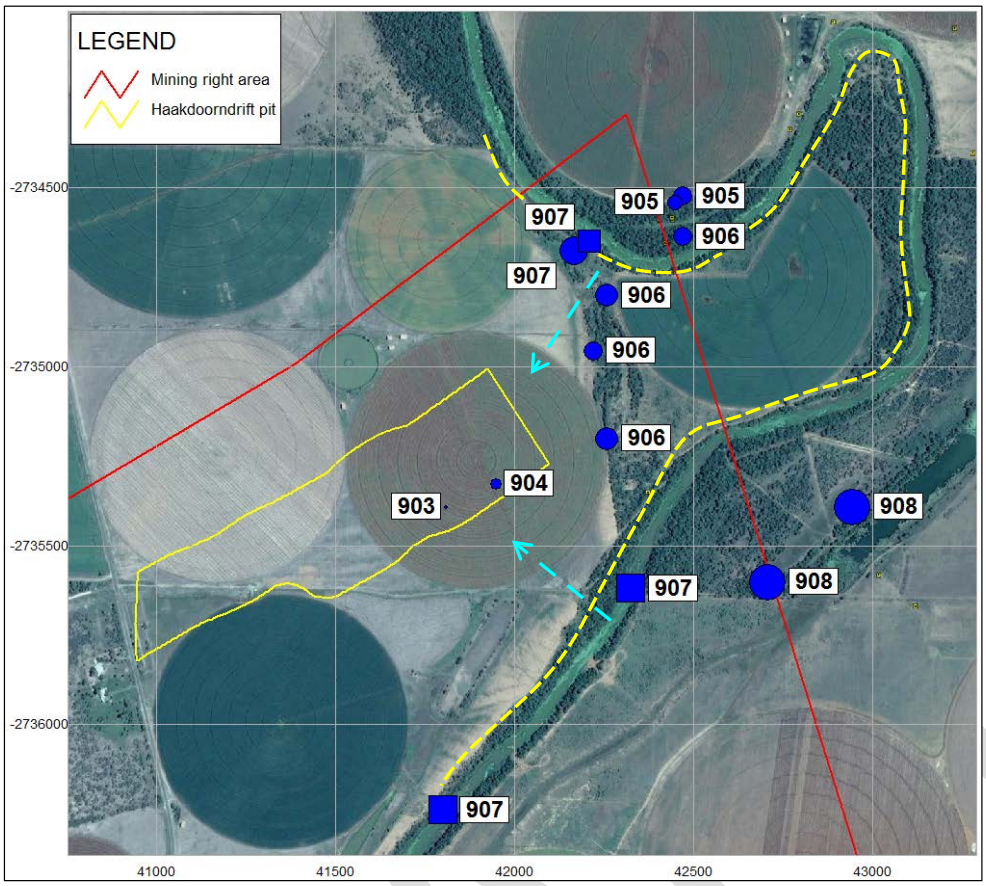


Figure 30 | Map showing groundwater and surface water elevations. Relative sizes of blue circles indicate elevations in mamsl, while squares indicate heads in the river (Groundwater Complete, 2017).

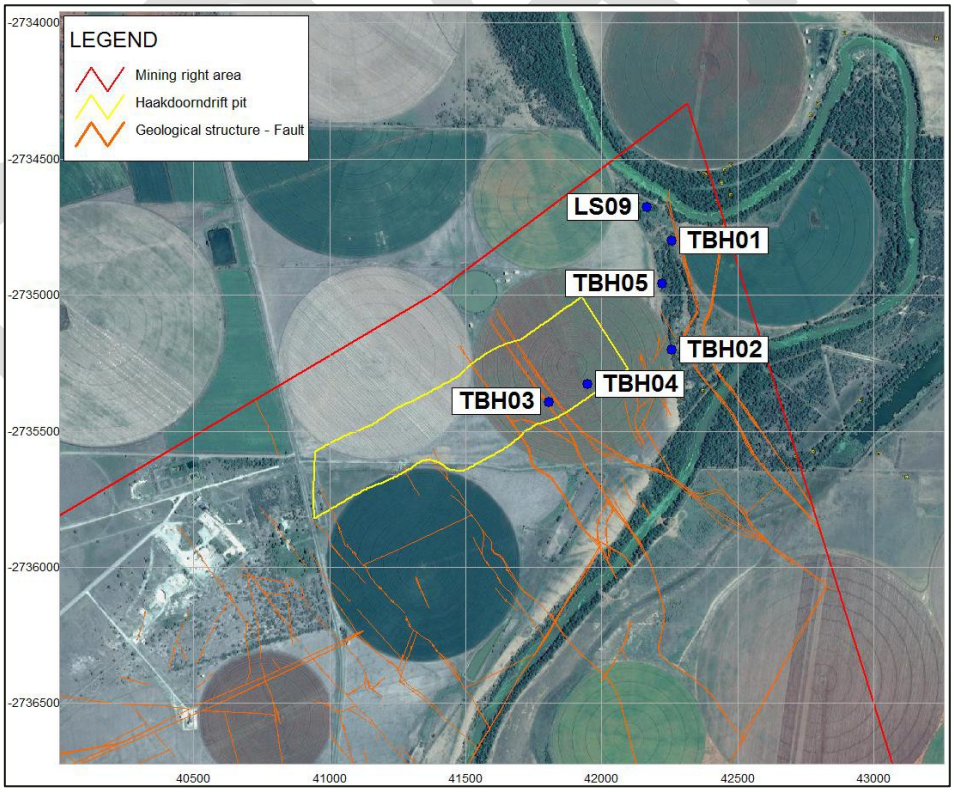


Figure 31 | Geological structures (faults) affecting the Haakdoorndrift project area and positions of pump tested boreholes.

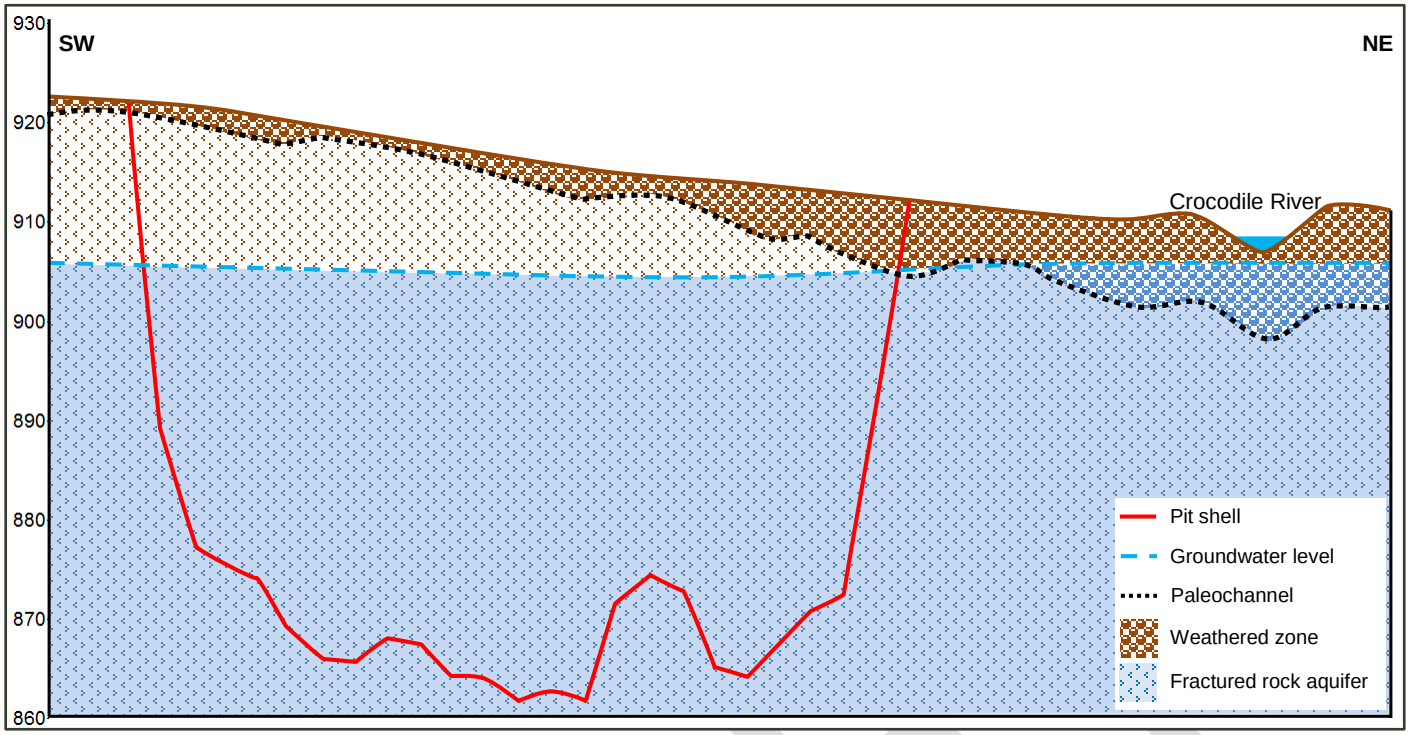


Figure 32 | South-West/North-East vertical cross section through Crocodile River and proposed Haakdoorndrift pit.

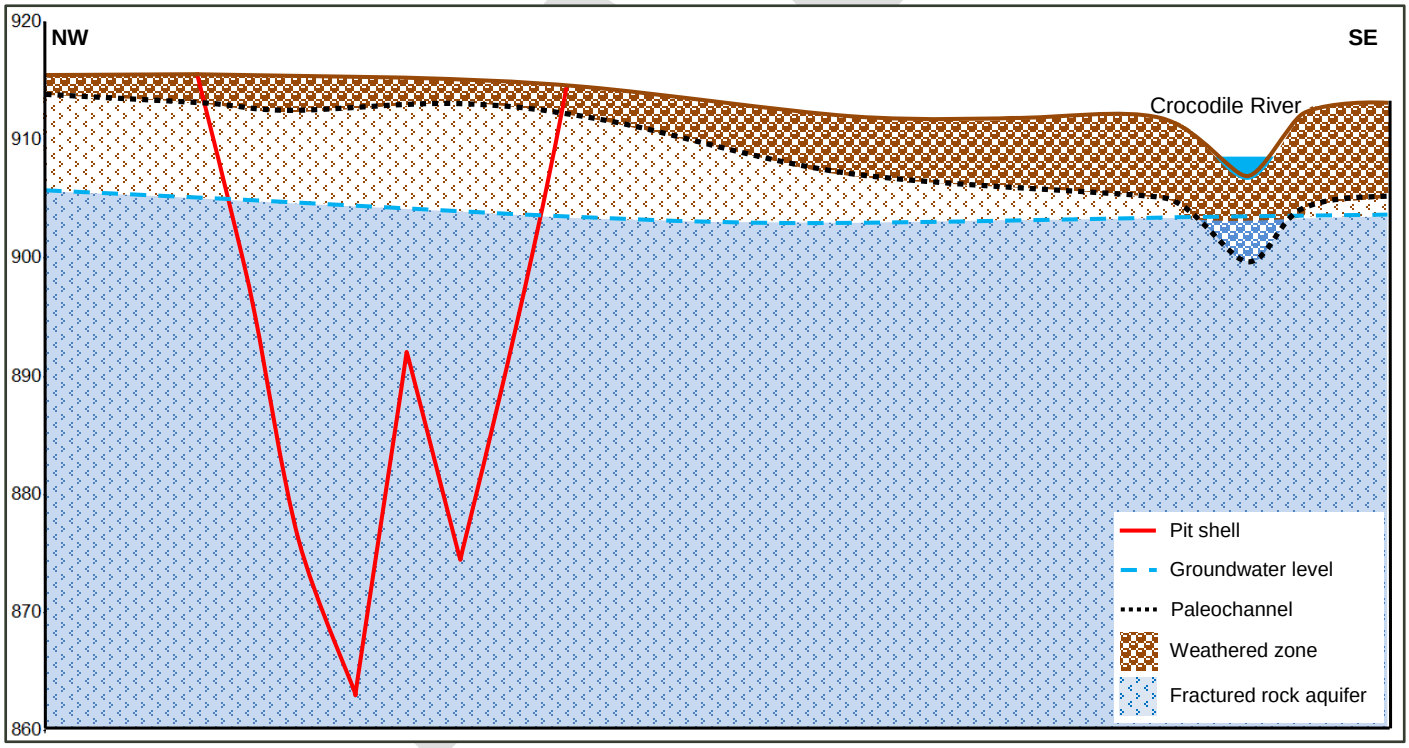


Figure 33 | North-West/South-East vertical cross section through Crocodile River and proposed Haakdoorndrift pit.

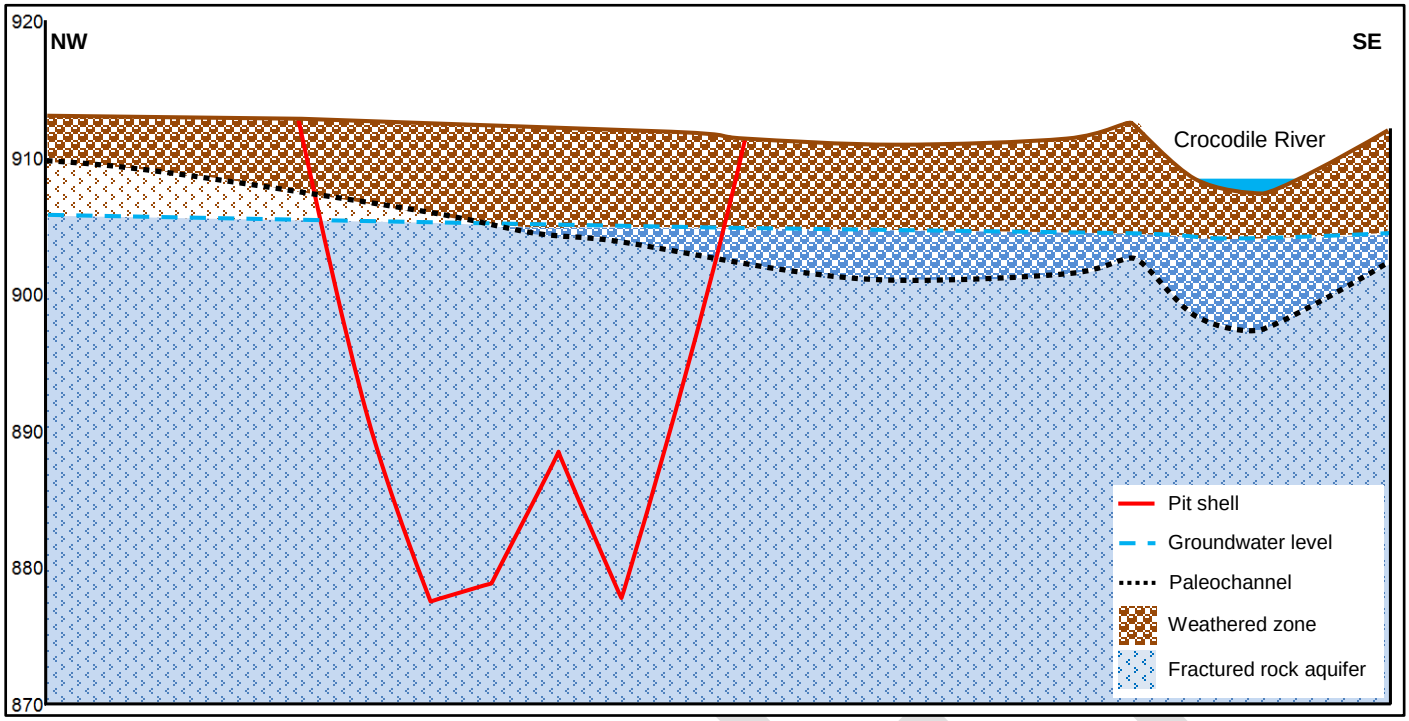


Figure 34 | North-West/South-East vertical cross section through Crocodile River and proposed Haakdoorndrift pit.

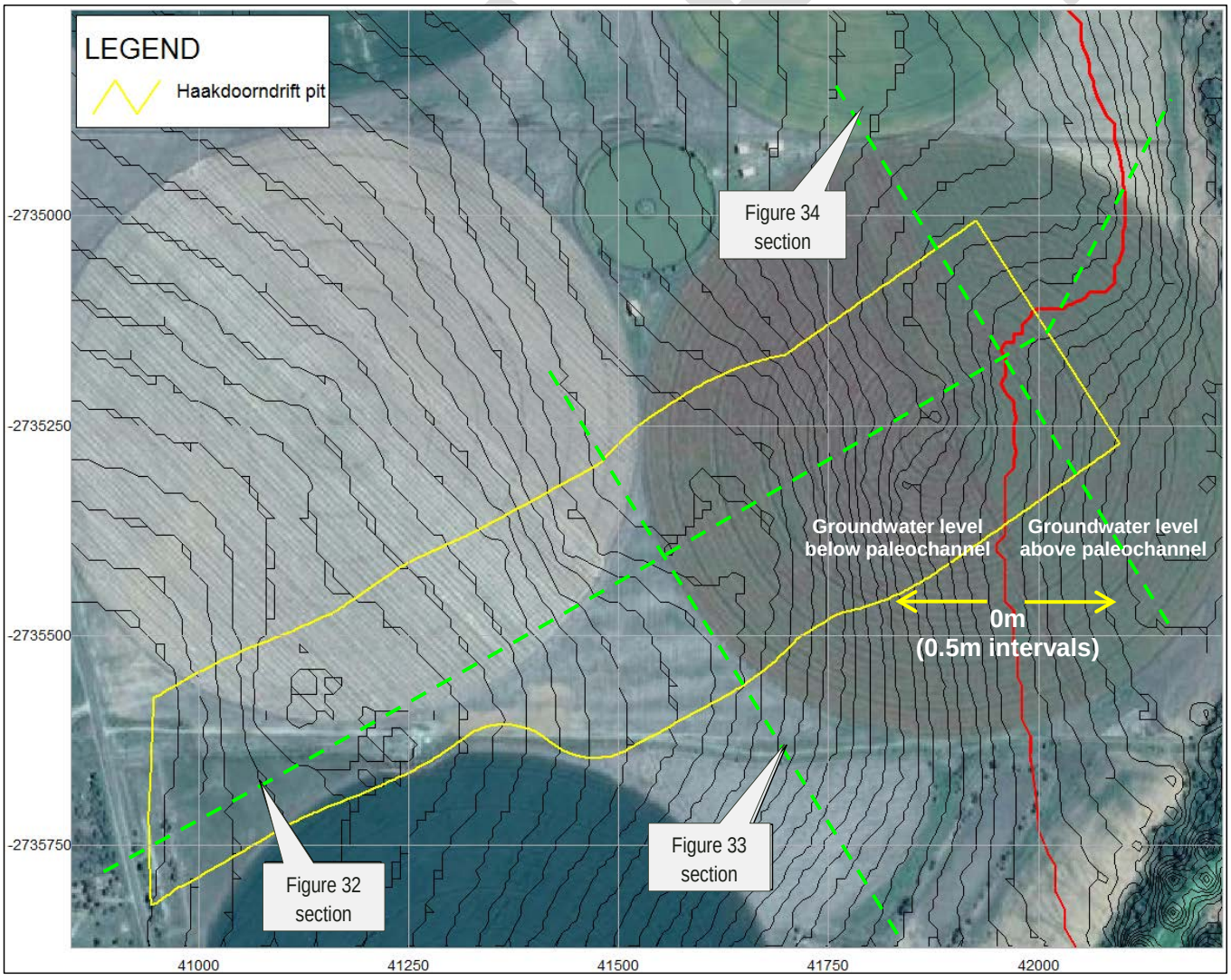


Figure 35 | Relationship between groundwater elevation and elevation of paleochannel floor (Groundwater Complete, 2017).

Soil

A soil, land use, and land capability specialist investigation was undertaken in 2016 by Rehab Green for the proposed project.

Soil types within the entire project area

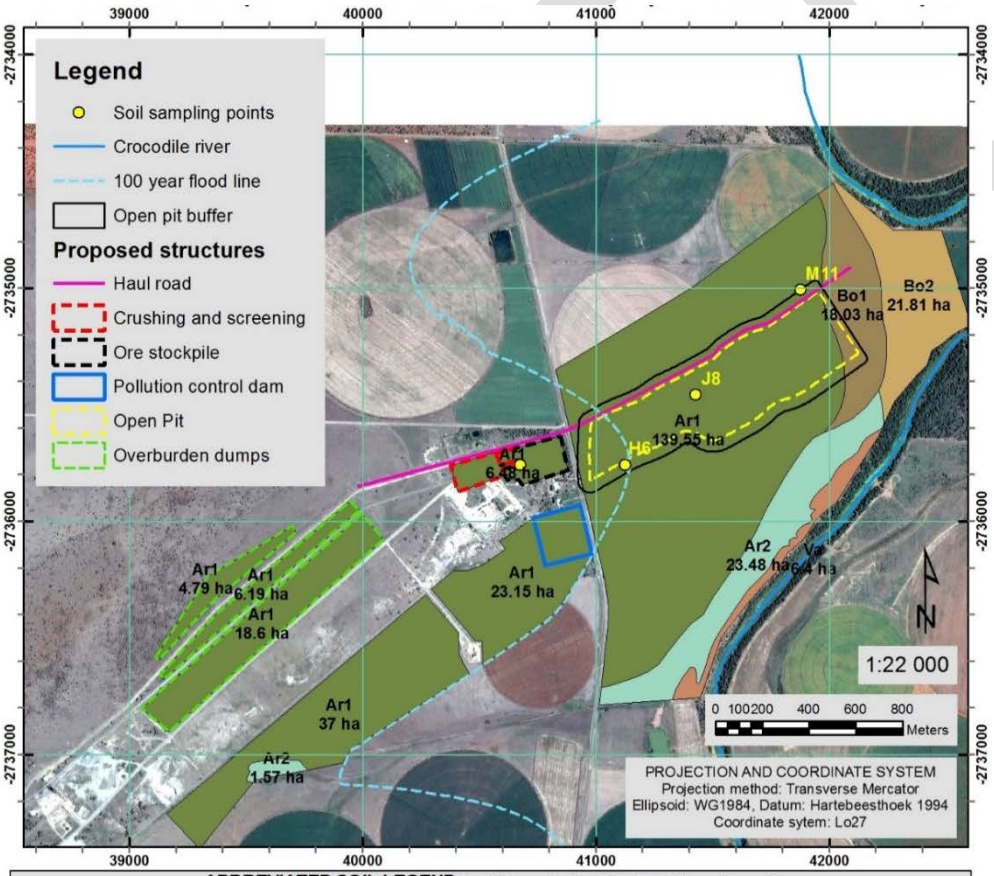
It was found that a total of five (5) homogeneous soil units, based on dominant soil form, effective soil depth, internal drainage, terrain unit and slope percentage were identified during field observations (Rehab Green, 2017). The homogeneous units are referred to as soil types, and are shown in Figure 36. A comprehensive soil legend is provided in Table 14 in which the soils are described in terms of the following aspects:

- Dominant and subdominant soil forms and families;
- The estimated clay content of the A, E, G or B-horizons;
- A broad description of the dominant soil form in terms of the effective soil depth, colour, texture, and terrain unit;
- A description of the soil horizon sequences;
- Derived erodibility class
- Dryland crop production potential;
- Land capability classification
- Wetland zone classification;
- Area of the particular soil form in hectares; and
- Area percentage comprised by each soil type.

Table 14 | Descriptions of soil types present on the proposed Haakdoorndrift project area (Rehab Green, 2017)

Soil Type Code	Dominant and subdominant soil form and family	% clay per horizon A, E, G, B	Summarised description of dominant soil forms in terms of effective depth, soil colour, soil texture and terrain unit	Description of soil horizon sequences of dominant soil forms	Erodibility	Dry land crop production potential	Land Capability	Wetland zone	Area (ha)	Area (%)
Ar1	*Arcadia 1100	A: 40-50	Deep (900-1200 mm), black, structured clay soils with strong shrink and expand properties, mostly underlain by whitish soft weathered rock; situated on gentle foot slope (0.5-1% slope).	Black, well-drained, strongly structured, clay vertic A-horizon directly underlain by whitish soft weathered rock or via a thin (300 mm) clayey, greyish yellow subsoil layer.	Moderate	Moderate	Arable	Terrestrial	235.76	76.79
Ar2	*Arcadia 1100	A: 40-50	Very deep (mostly > 1500 mm), black structured clay soils with strong shrink and expand properties; Situated on flat to gentle valley bottom (0-0.5% slope) and subject to frequent surface disturbances such as dams and trenches.	Black, well-drained, strongly structured, clay vertic A-horizon mostly exceeding 1500 mm or often underlain by a clayey, greyish yellow subsoil layer.	Moderate	Moderate	Riparian	Riparian	25.05	8.16
Bo1	*Bonheim 3110; Arcadia 1100, Rensburg 1000	A: 40-50 B: 50-60	Deep (800-1200 mm), dark brown to dark grey, structured clay soils with moderate shrink and expand properties often underlain by a brownish to orange yellow paleosol (buried soil) layer; Situated on gentle footslope (0.5% slope).	Dark brown, moderately structured, clay melanic A-horizons underlain by strongly structured, dark brown to grey pedocutanic B-horizons underlain by a brownish to orange yellow paleosol (buried soil) layer.	Moderate	Moderate	Arable	Terrestrial	18.03	5.87
Bo2	*Bonheim 3110, Arcadia 1100	A: 40-50 B: 40-50	Moderately deep (600-900 mm), dark brown to black structured clay soils with moderate shrink and expand properties underlain by a red paleosol (buried soil) layer;	Brown to dark brown, weak to moderately structured, clay melanic A-horizons underlain by strongly structured, dark brown pedocutanic B-horizons underlain by a	Moderate	Moderate	Riparian	Riparian	21.81	7.10

Soil Type Code	Dominant and subdominant soil form and family	% clay per horizon A, E, G, B	Summarised description of dominant soil forms in terms of effective depth, soil colour, soil texture and terrain unit	Description of soil horizon sequences of dominant soil forms	Erodibility	Dry land crop production potential	Land Capability	Wetland zone	Area (ha)	Area (%)
			Situated on flat to gentle valley bottom (0-0.5% slope).	red paleosol (buried soil) layer.						
Va	*Valsrivier 1121; Bonheim 1210, Oakleaf 1120	A: 20-30 B: 35-45	Very deep (>1500 mm) alluvium consisting of yellowish brown, non-structured sandy clay loam A-horizons underlain by dark brown, clayey, structured pedocutanic B-horizons; Situated on flat to gentle valley bottom (0-0.5% slopes) along the river channel.	Yellowish brown to brown, non-structured, sandy clay loam orthic A-horizons underlain by various (stratified), clayey, brown to dark brown, strongly structured pedocutanic B-horizons.	Moderate	Moderate	Riparian	Riparian	6.40	2.09
*Dominant soil form and family								TOTAL	307.05	100.0



ABBREVIATED SOIL LEGEND (for full legend refer to Table 2 of the soil report)

Soil Type Code	Dominant & subdominant Soil Form and Family	Summarized description of soil type and terrain	Land Capability	Wetland zone	Area (ha)	Area (%)
Ar1	*Arcadia 1100	Deep (900-1400 mm), black, structured clay soils with strong shrink and expand properties, mostly underlain by whitish soft weathered rock; Situated on gentle footslope (0.5-1% slope).	Arable	Terrestrial	235.76	76.79
Ar2	*Arcadia 1100	Very deep (mostly > 1500 mm), black structured clay soils with strong shrink and expand properties; Situated on flat to gentle valley bottom (0-0.5% slope) and subject to frequent surface disturbances such as dams and trenches.	Riparian	Riparian	25.05	8.16
Bo1	*Bonheim 3110; Arcadia 1100, Rensburg 1000	Deep (800-1200 mm), dark brown to dark grey, structured clay soils with moderate shrink and expand properties often underlain by a brownish to orange yellow paleosol (buried soil) layer; Situated on gentle footslope (0.5% slope).	Arable	Terrestrial	18.03	5.87
Bo2	*Bonheim 3110, Arcadia 1100	Moderately deep (600-900 mm), dark brown to black structured clay soils with moderate shrink and expand properties underlain by a red paleosol (buried soil) layer; Situated on flat to gentle valley bottom (0-0.5% slope).	Riparian	Riparian	21.81	7.10
Va	*Valsrivier 1121; Bonheim 1210, Oakleaf 1120	Very deep (>1500 mm) alluvium consisting of yellowish brown, non-structured sandy clay loam A-horizons underlain by dark brown, clayey, structured pedocutanic B-horizons; Situated on flat to gentle valley bottom (0-0.5% slopes) along the river channel.	Riparian	Riparian	6.40	2.09
* Dominant soil form and family				Total	307.05	100.0

Figure 36 | Location and extent of various soil types on the proposed Haakdoorndrift project area (Rehab Green, 2017).

Soil types within the pit area

The soil types within the proposed open pit area were extracted from the larger project area. Two of the soil types, Ar1 and Bo1 occur within the proposed open pit as shown in Figure 37, which contains an abbreviated soil legend. A comprehensive soil legend is provided in Table 15 which described the soils in terms of the aspects as referred to in the "*Soil types within the entire project area*"-section above.

Table 15 | Detailed soil legend for the proposed pit area (Rehab Green, 2017)

Soil Type Code	Dominant and subdominant soil form and family	% clay per horizon A, E, G, B	Summarised description of dominant soil forms in terms of effective depth, soil colour, soil texture and terrain unit	Description of soil horizon sequences of dominant soil forms	Erodibility	Dry land crop production potential	Land Capability	Wetland zone	Area (ha)	Area (%)
Ar1	*Arcadia 1100	A: 40-50	Deep (900-1200 mm), black, structured clay soils with strong shrink and expand properties, mostly underlain by whitish soft weathered rock; situated on gentle foot slope (0.5-1% slope).	Black, well-drained, strongly structured, clay vertic A-horizon directly underlain by whitish soft weathered rock or via a thin (300 mm) clayey, greyish yellow subsoil layer.	Moderate	Moderate	Arable	Terrestrial	32.39	96.66
Bo1	*Bonheim 3110; Arcadia 1100, Rensburg 1000	A: 40-50 B: 50-60	Deep (800-1200 mm), dark brown to dark grey, structured clay soils with moderate shrink and expand properties often underlain by a brownish to orange yellow paleosol (buried soil) layer; Situated on gentle footslope (0.5% slope).	Dark brown, moderately structured, clay melanic A-horizons underlain by strongly structured, dark brown to grey pedocutanic B-horizons underlain by a brownish to orange yellow paleosol (buried soil) layer.	Moderate	Moderate	Arable	Terrestrial	1.12	3.34
*Dominant soil form and family								TOTAL	33.51	100.0

Soil chemistry and fertility status

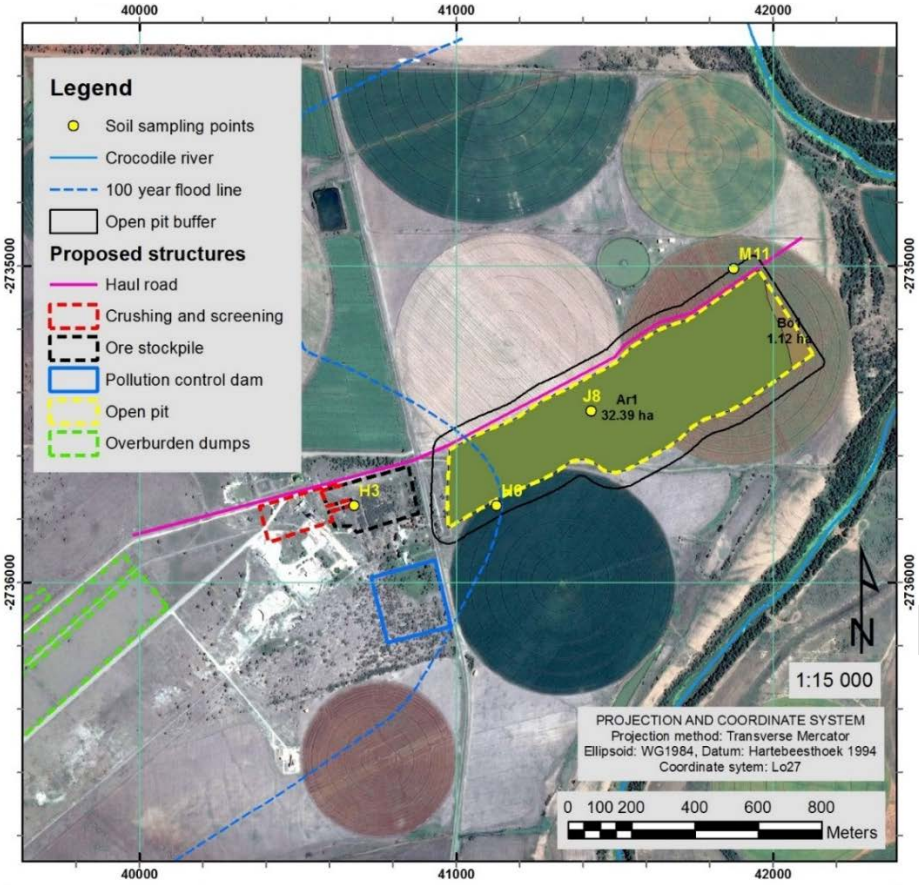
Four samples of the A-horizons of the dominant soil types were taken, the locations of which are shown in Figure 36 and Figure 37 as yellow dots (H3, H6, J8 and M11). The results of analytical tests are shown in Table 16. These results include information on the cations potassium (K), calcium (Ca), magnesium (Mg) and sodium (Na), as well as phosphorus (P), pH and resistance of the soils.

Table 16 | Chemical analysis results of soils at the Haakdoorndrift project site

Sample Point	Soil Form	Horizon	Depth	K	Ca	Mg	Na	*Titr. Acid	*Acid saturat.	R_S (resistance)	P (Bray1) mg/kg	pH (H_2O)
				mg/kg	mg/kg	mg/kg	mg/kg					
				Ammonium acetate				cmol(+)/kg	%	ohm		
Sampling points in cultivated land												
H3	Ar 1100	A	0-250	264	6554	1493	57.9	-	-	270	2.2	7.93
H6	Ar 1200	A	0-250	243	8733	1508	566.9	-	-	470	0.24	8.32
J8	Ar 1200	A	0-250	348	6347	2093	469.9	-	-	240	2.2	8.42
M11	Ar 1100	A	0-250	406	4024	2290	335.4	-	-	320	12.7	7.98
Mean/Averages				315	6415	1846	358	-	-	325	4.3	8.16
Median				306	6451	1801	403	-	-	295	2.2	8.15
*Analyses done when pH is below 5.5.												

The median values of the cations (K, Ca, Mg and Na), P, pH and resistance (highlighted in green, Table 16) were compared to general fertility guidelines in Table 17. The median values of K, Ca and Mg are high and imply a very fertile and well built-up chemical status, which is probably strongly influenced by fertilisers, since 3 of the 4 sampling points are situated within cultivated fields. The medium to high median resistance value of 295 ohm indicates a fair amount of salts in the soil profile which is confirmed by a high median Na value of 403 mg/kg, which indicates a build-up of salts and somewhat sodic soil conditions. The median P value of 2.2 mg/kg is low and is more or less similar to concentrations found in uncultivated land. The median pH value of 8.15 indicates alkaline

soil conditions which is associated with low leaching of elements in these clayey soils, especially within a fairly low rainfall region (Rehab Green, 2017).



ABBREVIATED SOIL LEGEND (for full legend refer to Table 2 of the soil report)

Soil Type Code	Dominant & subdominant Soil Form and Family	Summarized description of soil type and terrain	Land Capability	Wetland zone	Area (ha)	Area (%)
Ar1	*Arcadia 1100	Deep (900-1400 mm), black, structured clay soils with strong shrink and expand properties, mostly underlain by whitish soft weathered rock; Situated on gentle footslope (0.5-1% slope).	Arable	Terrestrial	32.39	96.66
Bo1	*Bonheim 3110; Arcadia 1100, Rensburg 1000	Deep (800-1200 mm), dark brown to dark grey, structured clay soils with moderate shrink and expand properties often underlain by a brownish to orange yellow paleosol (buried soil) layer; Situated on gentle footslope (0.5% slope).	Arable	Terrestrial	1.12	3.34
* Dominant soil form and family				Total	33.51	100.0

Figure 37 | Detailed soil map of the proposed open pit area (Rehab Green, 2017).

Table 17 | Fertility guidelines for cultivated land with a comparison of soils at the proposed project site (Rehab Green, 2017)

	Guidelines (mg/kg)						Fertility rating	
Element or measurement	Low			High			Median calculated in Table 16 (mg/kg)	Rating
Potassium (K)	<40			>250			306	High
Calcium (Ca)	<200			>3000			6451	High
Magnesium (Mg)	<50			>300			1801	High
Sodium (Na)	<50			>200			403	High
Phosphorus (P)	<5			>35			2.2	Low
Resistance (R_S)	<200			>300			295	Medium to high
pH(H_2O)	Very acidic	Acidic	Slightly acidic	Neutral	Slightly alkaline	Alkaline		
	<4	5-5.9	6-6.7	6.8-7.2	7.3-8	>8	8.15	Alkaline

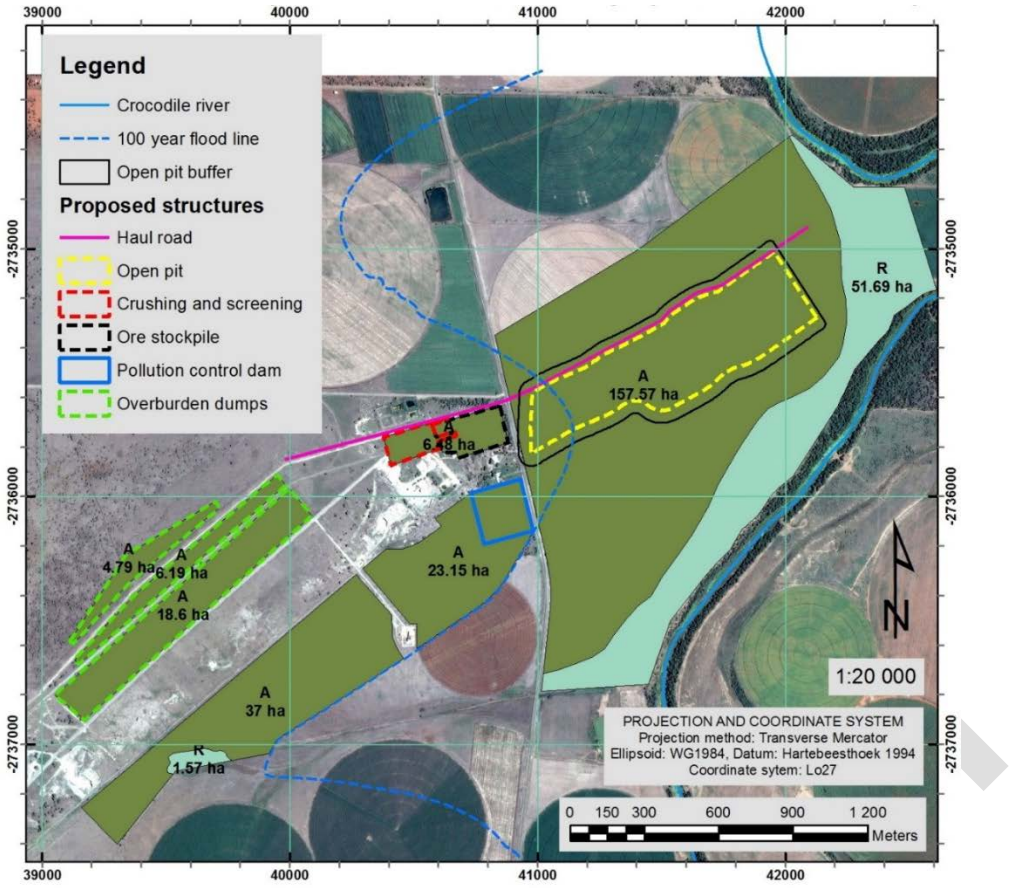
Land capability

The location and extent of land capability classes within the project area are shown in Figure 38. The land capability of the project area is summarised in Table 18. Soil types are grouped according to their:

- Land capability class;
- Broad soil group descriptions;
- Numbers of units per land capability class; and
- Area and percentage comprised by each land capability class.

Table 18 | Land capability classes in the Haakdoorndrift project area (Rehab Green, 2017)

Land Capability Code	Land Capability Class	*Soil Types	Broad Soil Description	Unit Count	Area (ha)	Area (%)
A	Arable	Ar1, Bo1	Black, dark brown to dark grey, structured clay soils, situated on gentle footslopes (0.5-1% slopes).	7	253.78	82.66
R	Riparian	Ar2, Bo2, Va	Black to dark brown, structured clay soils, situated in flat to gentle sloping valley bottoms (0-0.5% slopes).	2	53.26	17.34
W	Wetland	-	-	0	0	0
G	Grazing	-	-	0	0	0
WDN	Wilderness	-	-	0	0	0
*See soil map, Figure 38			Total	2	212.33	100.0

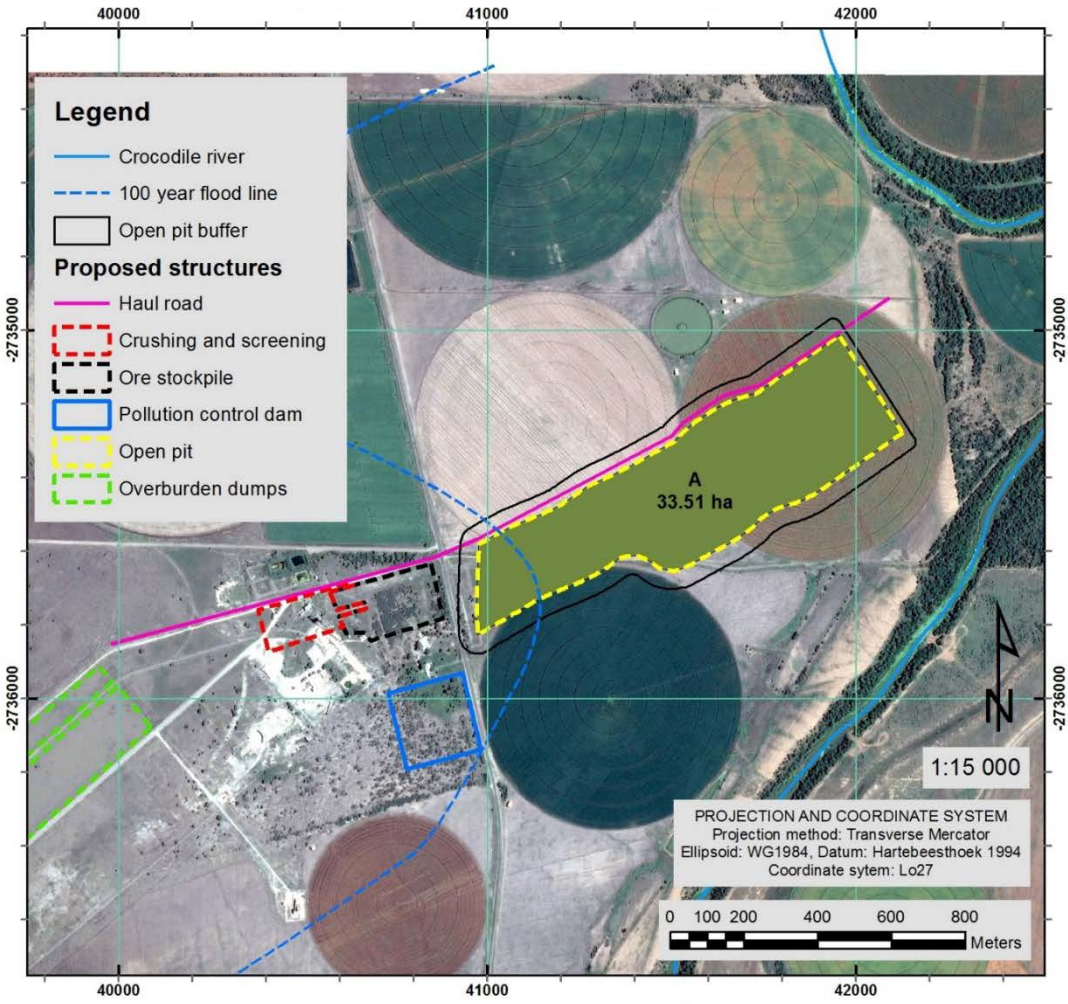


LEGEND: LAND CAPABILITY						
Land Capability Code	Land Capability Class	*Soil Types	Broad Soil Description	Unit Count	Area (ha)	Area (%)
A	Arable	Ar1, Bo1	Black, dark brown to dark grey, structured clay soils, situated on gentle footslopes (0.5-1% slopes).	7	253.78	82.66
R	Riparian	Ar2, Bo2, Va	Black to dark brown, structured clay soils, situated in flat to gentle sloping valley bottoms (0-0.5% slopes).	2	53.26	17.34
W	Wetland	-	-	0	0	0
G	Grazing	-	-	0	0	0
WDN	Wilderness	-	-	0	0	0
*See soil map, Figure 3a			Total	9	307.04	100.0

Figure 38 | Land capability of the proposed project area (Rehab Green, 2017).

Table 19 | Land capability classes for the proposed pit area (Rehab Green, 2017)

Land Capability Code	Land Capability Class	*Soil Types	Broad Soil Description	Unit Count	Area (ha)	Area (%)
A	Arable	Ar1, Bo1	Black, structured clay soils, situated on gentle footslopes (0.5-1% slopes).	1	33.51	100.00
R	Riparian	-	-	0	0	0
W	Wetland	-	-	0	0	0
G	Grazing	-	-	0	0	0
WDN	Wilderness	-	-	0	0	0
*See soil map, Figure 39			Total	2	212.33	100.0



LEGEND: LAND CAPABILITY

Land Capability Code	Land Capability Class	*Soil Types	Broad Soil Description	Unit Count	Area (ha)	Area (%)
A	Arable	Ar1, Bo1	Black, structured clay soils, situated on gentle footslopes (0.5-1% slopes).	1	33.51	100.0
R	Riparian	-	-	0	0	0
W	Wetland	-	-	0	0	0
G	Grazing	-	-	0	0	0
WDN	Wilderness	-	-	0	0	0
*See soil map, Figure 3b			Total	1	33.51	100.0

Figure 39 | Land capability map of the proposed pit area (Rehab Green, 2017).

Wetland and riparian delineation

Land capability was assessed in categories of arable land, grazing land, wetlands, riparian land and wilderness. Wetlands and riparian zones were delineated as part of the soil and land capability assessment *based on soil properties*. Auger observations were made systematically towards wetlands and riparian zones in order to locate the point where soil properties reflect signs of wetness within 500 mm from the surface or where soil, topography or vegetation indicate the boundary of the riparian zone.

No wetlands were found in the project area. However, intermittent stream are present, channelling surface water into local dams. During periods when the dam is full, the water rises upstream and causes wetland appearances at some places.

A riparian zone was mapped based on topography, vegetation and soils. The soil types associated with riparian zones are summarised in Table 20. These soil qualities were rated as high, moderate and low with classifications in-between these (Rehab Green, 2017).

Table 20 | Derived dryland crop potential and long term potential yields (Rehab Green, 2017)

Soil Type (Code)	Dry land crop production potential class	Potential long term yields for dryland maize (t/ha/a)	Potential long term yields for dry land soybeans (t/ha/a)	Potential long term yields for dry land sunflower (t/ha/a)
Ar1, Ar2	Moderate	4	1.5	2
Bo1, Bo2, Va	Moderate to low	4	1.5	1.5

Biodiversity: Flora

Vegetation communities on site:

The survey Area was divided into two:

- Area 1: The area adjacent to the Crocodile River set aside for the Pit Alternatives and Overburden Alternative 1; and
- Area 2: The area further west and closer to the existing mining operations set aside for the Overburden Alternative 3.

From the field investigations (conducted during 27-28 April 2016) the study area was divided typically into the transformed agricultural areas (over 74%), recovery areas (11%) to the thornveld and riparian vegetation (over 15%). The majority of the western and central sections of the site is transformed through agricultural land use (Figure 40). Broad habitat groups were defined and included:

- Wetland / Riparian Habitat;
- Thornveld Habitat;
- Transformed Habitat - In recovery;
- Transformed Habitat: Current Agriculture; and
- Transformed Habitat: Mining and related.

From the December 2016 field investigations, Area 2 was divided typically into the *Acacia* Thornveld (over 23%), recovery grassland habitat (53%) and transformed through mining (less than 23%). The following broad habitat groups were defined:

- *Acacia tortilis* Woodland Habitat
- Transformed Grasslands
- Transformed Habitat: Mining and related

From both areas, of the Vegetation units identified, only a few remain in a semi to natural state. These included the *Acacia-Combretum* Riparian Fringe; *Bothriochloa* Hydromorphic Grass Patch, the scattered *Acacia* patches (including the *Acacia tortilis* Thornveld on Overburden Alternative 3) and the *Acacia - Zizphus* Transition Thornveld (Riparian Remnants).

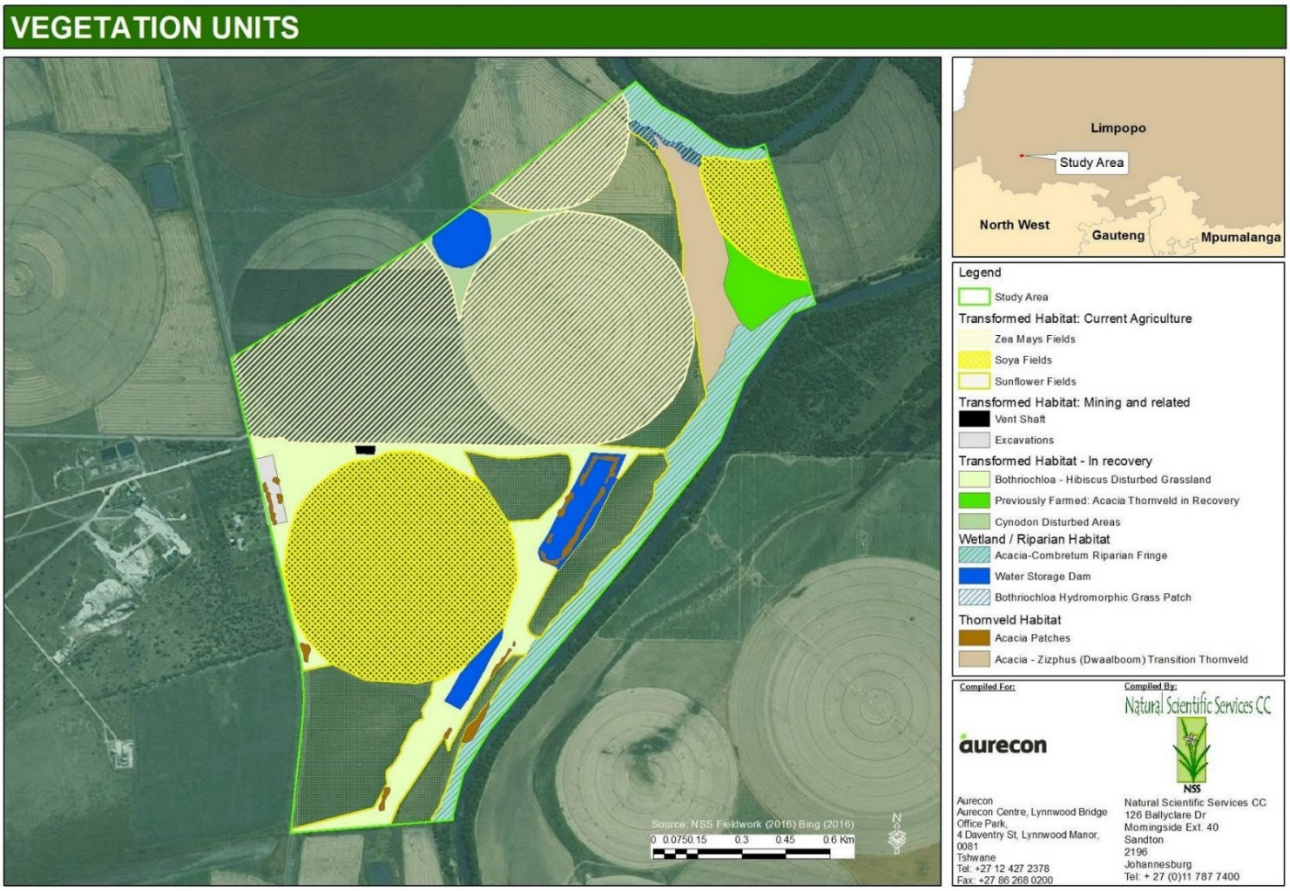


Figure 40 | Vegetation units within the study area (Area 1) (Natural Scientific Services, 2017).

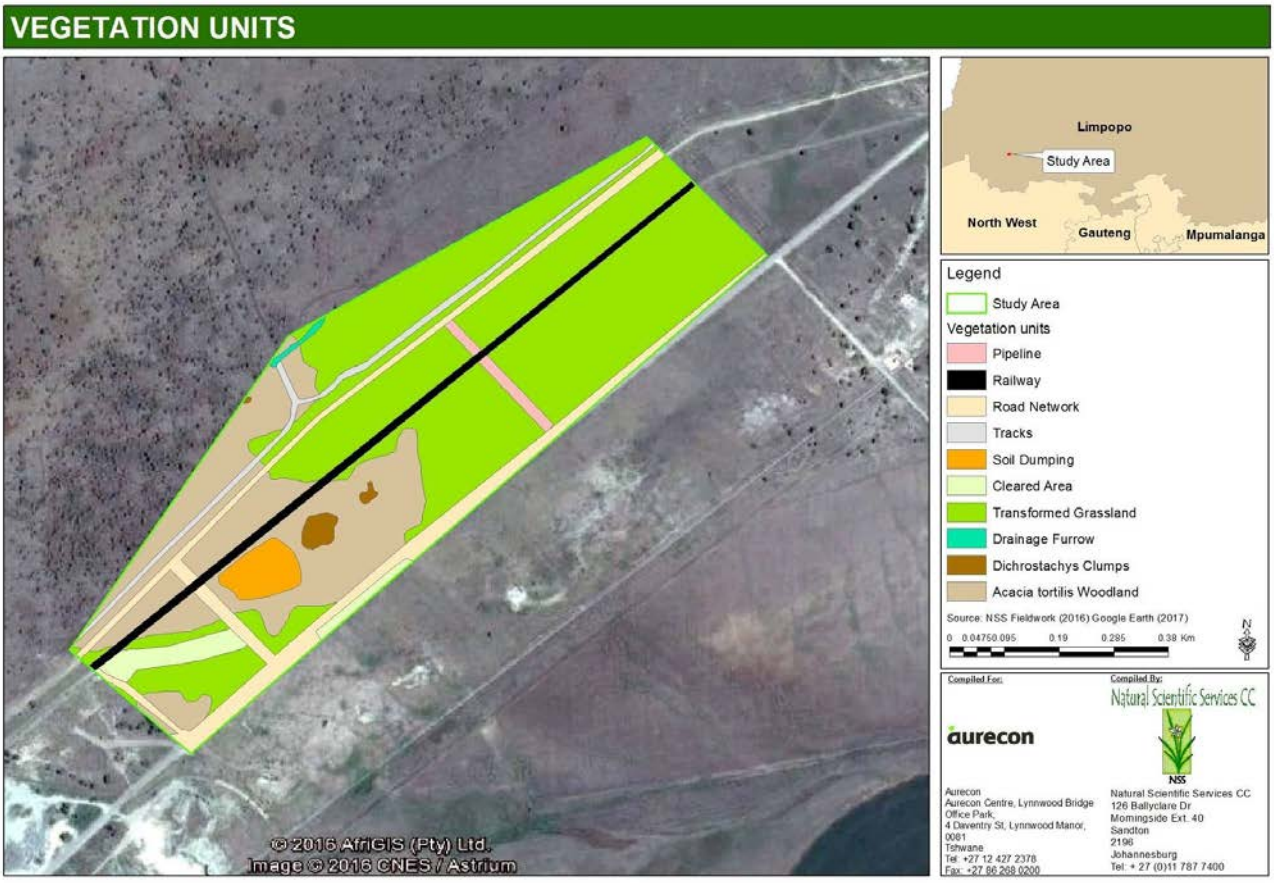


Figure 41 | Vegetation communities within the study area (Area 2) (Natural Scientific Services, 2017).

Conservation Important Species

A section on Conservation Important (CI) species that were detected or could possibly be detected on site is included. These include the National Threatened Plant Species Programme (TSP) lists, any Protected species according to the Nature Conservation Ordinance (12 of 1983) and any specific Endemic or Rare species.

The Threatened Plant Species Programme (TSP) is an ongoing assessment that revises all threatened plant species assessments made by Craig Hilton-Taylor (1996), using IUCN Red Listing Criteria modified from Davis *et al.* (1986). According to the TSP, Red Data list of South African plant taxa (accessed March 2016), there are 96 Red Data listed species out of a possible 4799 species within Limpopo Province (including Data Deficient species) of which 16 species are Critically Endangered (CR), 17 Endangered (EN), 40 are Vulnerable (VU) and 21 are Near Threatened.

From the POSA website, two listed CI species have been recorded in the 2427CB QDS – one Vulnerable and one Rare species. However, habitat potentially exists for only the Rare species *Freylinia tropica* Figure 45. Additional species that could potentially occur, (data collected from various sources) are listed in Table 21, with images thereof provided thereafter. From the field assessment, no Red listed species were recorded on site. The Vulnerable *Jamesbrittenia bergae* was first discovered in 2002 in the Thabazimbi region (Lemmer, 2003) and is found associated with rock crevices on a southern aspect, so the likelihood of occurring on site is small. Initially from SANBI sources, agriculture was listed as an impact on this species (no habitat descriptions provided) and is expected to be found in habitats similar to that found on site. NSS found specimens of *Jamesbrittenia bergae* off site (north towards Thabazimbi) within south slope rocky crevices during the December 2016 assessment (Figure 46).

In addition to this, Protected Species (including Protected Trees) were not found during the assessment. If found, these may not be cut, disturbed, damaged, destroyed without obtaining a permit from Limpopo Province or a delegated authority. The survey was conducted in late summer (April 2016) and within a severe drought (December 2016), when a number of the species were not in their flowering time or had been consumed by cattle.

Table 21 | Potential CI species based on information obtained from 2427CB QDG

FAMILY	SPECIES	STATUS	FLOWERING TIME	HABITAT	LoO
MYROTHAMNACEAE	*Myrothamnus flabellifolius Welw.* (Figure 42)	DDT	Spring-Summer	In shallow soil over sheets of rock	No habitat present on site
APOCYNACEAE	*Brachystelma discoideum* R.A.Dyer	EN	November	Savanna in gravelly sandy soil	Unlikely
CRASSULACEAE	*Crassula cymbiformis* Toelken (Figure 44)	Critically Rare		Savanna, found in shallow soils among rocks	Unlikely
SCROPHULARIACEAE	*Freylinia tropica* S.Moore (Figure 45)	Rare	Spring	Evergreen forest and along streams	Possible
SCROPHULARIACEAE	*Jamesbrittenia bergae* P.Lemmer (Figure 46)	VU	Summer – December	Rocky outcrops	Unlikely
ORCHIDACEAE	*Ansellia Africana* (Figure 47)	Dec	Winter	Tall trees	Possible

Alien and Invasive Species

Due to the current and past disturbances and transformation of the study area, 23 alien species were detected. Six of these were Category 1b Invasive species (

Figure 17 | Local Areas of Conservation Significance (Area 1) (Natural Scientific Services, 2017)). Within the remaining wooded areas species such as *Achyranthes aspera* and *Bidens pilosa* were present within the shade of the trees. The Category 1 species *Nicotiana glauca*, *Eichhornia crassipes* and the weedy species *Flaveria bidentis* were associated with the Marginal and Lower Riparian Zones. *Pennisetum setaceum* (Category 1b) was found within Area 2 (Overburden Alternative 3), specifically along the railway line route.

Table 22 | Alien and Invasive Species detected during the survey

FAMILY	SPECIES	GROWTH FORM	CARA	NEM:BA
AMARANTHACEAE	*Achyranthes aspera* L. *var. aspera* (Figure 49)	Herb	1	
AMARANTHACEAE	*Amaranthus hybridus* L. *subsp. hybridus var. hybridus*	Herb	Weed	
CHENOPODIACEAE	*Chenopodium album L.*	Herb	Weed	

ASTERACEAE	*Conyza bonariensis* (L.) Cronquist	Herb	Weed	
ASTERACEAE	*Bidens pilosa*	Herb	Weed	
EUPHORBIACEAE	*Euphorbia heterophylla L.*	Herb	Weed	
ARACEAE	*Eichhornia crassipes* L. (Figure 48)	Hydrophyte	1	1b
ASTERACEAE	*Flaveria bidentis (L.) Kuntze*	Herb	Weed	1b
ASTERACEAE	*Helianthus annuus* L.	Herb	Weed	
AMARANTHACEAE	*Gomphrena celosioides* Mart.	Herb	Weed	
MELIACEAE	*Melia azedarach* L. (Figure 51)	Tree	3	1b, 3 in urban areas
MALVACEAE	*Malvastrum cf coromandelianum* (L.) Garcke	Dwarf shrub		
SOLANACEAE	*Nicotiana glauca* Graham	Shrub, tree	1	1b
ONAGRACEAE	*Oenothera tetraptera* Cav.	Herb		
POACEAE	*Paspalum dilatatum* Poir.	Graminoid	Weed	
POACEAE	*Pennisetum setaceum*	Graminoid	1	1b
PORTULACACEAE	*Portulaca spp* L.	Succulent		
SOLANACEAE	*Physalis peruviana* L. (Figure 50)	Perennial	Weed	
RUBIACEAE	*Richardia brasiliensis* Gomes	Herb	Weed	
FABACEAE	*Sesbania bispinosa (Jacq.)* W.Wight *var. bispinosa*	Herb, tree	Weed	
LAMIACEAE	*Salvia reflexa* Hornem.	Herb		
VERBENACEAE	*Verbena brasiliensis* Vell.	Herb	Weed	1b
ASTERACEAE	*Zinnia peruviana*	Herb	Weed	

Figure 42 | *Myrothamnus flabellifolius Welw.*

Figure 43 | *Brachystelma discoideum*

Figure 44 | *Crassula cymbiformis*

Figure 45 | *Freylinia tropica*

Figure 46 | *Jamesbrittenia bergae*

Figure 47 | *Ansellia africana*

Biodiversity: Fauna

In total the two NSS surveys (including anecdotal reports from local farmers) at Amandelbult have yielded 23 mammal, 116 bird, six reptile, two frog, 20 butterfly, 13 odonata and two megalomorph spider species. Context for these baseline figures is provided in Table 23 which compares the observed species richness on site with that expected at a regional scale. Despite lacking significant rocky outcrops or caves of any sort (as is present a little closer to Thabazimbi), the site does provide a number of habitats each at least some capacity to support an array of CIS. These include riparian habitat (which includes the Crocodile River), wetlands,

thornveld (primarily degraded riparian vegetation) and croplands. Overall the riparian habitat was found to be the most important for CI fauna (mainly for reptiles, but also mammals, birds and dragonfly) followed by wetlands (for frogs, dragonfly and reptiles). Thornveld still has value for mammals and frogs, and croplands little faunal habitat value.

Figure 48 | *Eichhornia crassipes* (Common water hyacinth)

Figure 49 | *Achyranthes aspera* (Burweed)

Figure 50 | *Physalis peruviana* (Cape Gooseberry)

Figure 51 | *Melia azedarach* (Syringa)

The importance of these varied habitats for fauna is evidenced by Table 23 which illustrates the sites' potential to support a high proportion of the regional diversity. Conservation Important Species (CIS) confirmed to occur on site during the survey included Lanner falcon (VU), Nile Crocodile (VU), Southern African Python (PS), Leopard (VU), Serval (NT), Rusty Pipistrelle (NT), Aardvark and Hippopotamus (VU). Yellowthroated Sandgrouse (NT) is reported to occur sporadically by local farmers. The locations of these species within the study area are shown in Figure 52.

Hippopotamus, Crocodile and Yellow-throated Sandgrouse should be considered keystone species for the study area. They are conservation important and charismatic species that are most likely to be sensitive to any disturbances associated with the mining operations in future and thus represent good indicators for biodiversity monitoring efforts.

Table 23 | Summary of faunal species richness on site as compared to a regional scale

Faunal Group	Species Richness					
	Potential			Observed		
	Region[1]	Atlas[2]	Site[3]	NSS[4]	Anecdotal[5]	Total
Mammals	117	39	84	23	1	23
Birds	408	328	356	115	1	116
Reptiles	67	27	59	5	1	6
Frogs	22	10	20	2	-	2
Butterflies	137	103	137	20	-	20
Dragonflies & Damselflies	65	1	62	13	-	13
Scorpions	9	-	7	-	-	-
Baboon Spiders	4	-	4	1	-	1
Key						
[1]Considered likely to occur within the QDS 2427CB based on distribution data						
[2]Recorded during atlas projects within the QDSs 2427CB (ADU, 2015)						

[3]Considered likely to occur on site based on distribution and habitat availability (LO of 2 or 3)
[4]Observed on site by NSS
[5]Reported anecdotally to occur on site

The various habitats on site were ranked in terms of their importance in representing the region's CI faunal species diversity. This was determined using the CIS Index (CISSI) below (Table 24) which incorporates both likelihood of occurrence and conservation status to rank a habitats potential to support CI species relative to a regional maximum. Overall the riparian habitat was found to be the most important for CI fauna (mainly for reptiles but also mammals, birds and odonata) followed by wetlands (for frogs, odonata and reptiles), thornveld (for mammals and frogs) and croplands (which was only really important in terms of Yellow-throated Sandgrouse and even then only under the ideal circumstances i.e. bare or fallow lands).

Table 24 | Conservation Important Species Sensitivity Index (CISSI) habitat comparison

GROUP	CISSI			
	RIPARIAN	WETLANDS	CROPLANDS	THORNVELD
Mammals	0.54	0.26	0.10	0.40
Birds	0.58	0.21	0.16	0.31
Reptiles	1.00	0.67	0.00	0.33
Frogs	0.33	0.53	0.20	0.53
Butterflies	-	-	-	-
Odonata	0.59	0.44	0.00	0.00
Score	0.61	0.42	0.09	0.32
Rating	Mod-High	Moderate	Very Low	Mod-Low

CISSI = Conservation Important Species Sensitivity Index (a measure of the site's importance in representing the region's conservation important species diversity)

Note: Numbers exclude species restricted to managed populations i.e. game. Butterflies are omitted as there are no regionally occurring CI butterfly species and arachnids due to their cryptic nature and artificial underrepresentation in the fieldwork data.

In conclusion, no species of Conservation Importance were recorded on the study area for flora. The most important faunal habitat is largely associated with the Crocodile and its riparian habitat. In summary, from these initial investigations, the Crocodile River, associated riparian vegetation and the active floodplain habitat have been assessed as having a High Conservation Value from a terrestrial biodiversity perspective (Crocodile River and associated riparian habitat) and from a wetland perspective.

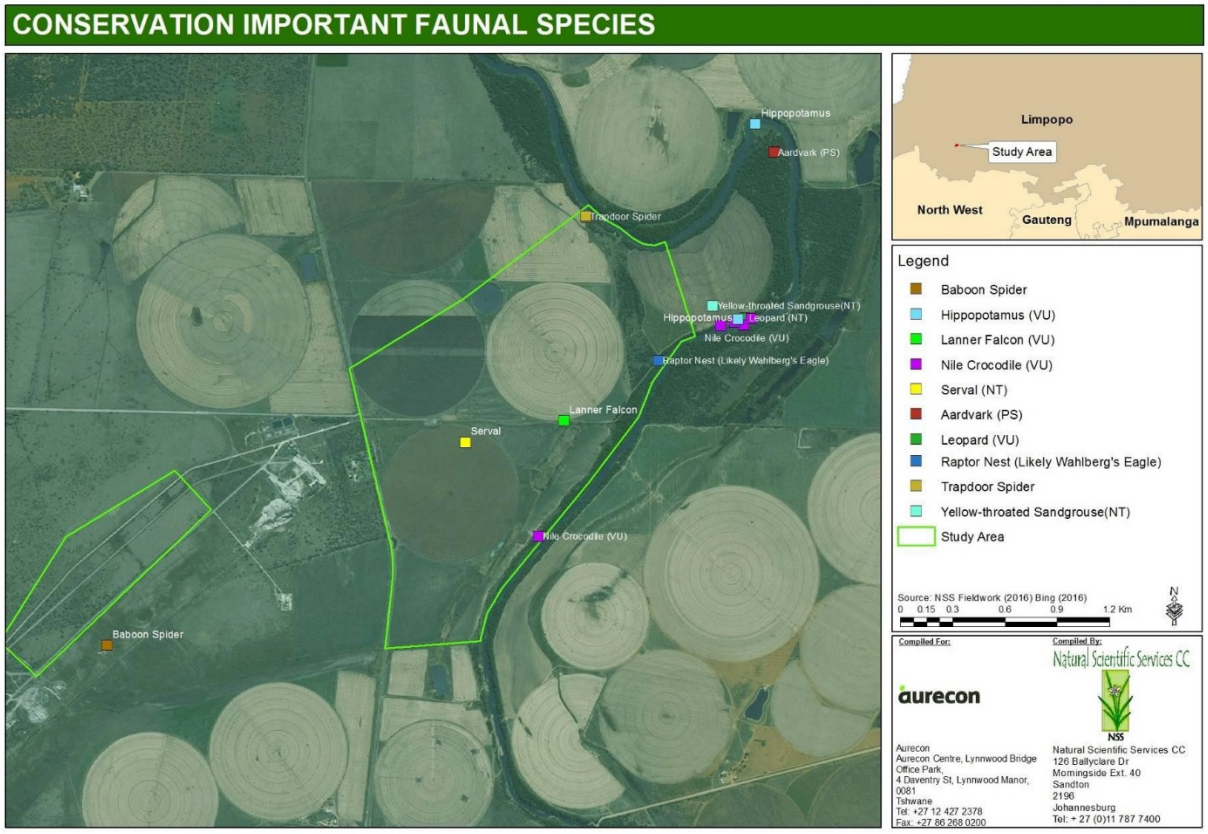


Figure 52 | Localities of Conservation Important Fauna (Natural Scientific Services, 2017).

Ambient air quality

The main findings from the baseline assessment, conducted by EHRCON, for the proposed Haakdoorndrift Opencast Project were as follows:

- The project falls within the Waterberg District Municipality and the Waterberg–Bojanala Priority Area (WBPA). Air Quality Management Plans (AQMPs) have been drafted and baseline characterisation has been completed for these areas. The status of ambient air quality indicates elevated fine particulate concentrations in the vicinity of the project.
- Dustfall rates were mostly below the residential limit of 600mg/m^2/day during the period December 2015 to April 2016.
- PM_{10} monitoring data for Thabazimbi show elevated annual and daily concentrations.

Climate

The WBPA experiences a temperate climate. Winters are generally mild and dry, but cold at night. Summers are hot, but mild at night. Rainfall occurs almost exclusively in summer in the form of convective showers or thundershowers because of low-pressure troughs over the central plateau. As the WBPA is a very large area, the climate varies across the region. The western and northern parts of the WBPA are generally warmer than the eastern and southern parts and receive less rainfall.

The annual average maximum temperature increase from 26.4ºC at Rustenburg in the south to 27.9ºC at Thabazimbi and 29.1ºC further north at Lephalale. The northern and western parts of the WBPA receive less rainfall than the southern and eastern parts. Annual average rainfall varies from 435 mm at Lephalale in the north to 574 mm at Thabazimbi, and 633 mm at Bela-Bela in the east and 680 mm at Rustenburg in the south of the WBPA.

The winds in the northern WBPA show a predominant easterly tendency and the winds are light and generally under 6 m/s. Over the central parts of the WBPA, at Thabazimbi and Mokopane, winds are predominantly northerly, with occasional north westerly winds. Again, all winds are light and rarely exceed 6 m/s. This predominant northerly wind is also evident at Bela-Bela, the eastern edge of the WBPA. There are a number of monitoring stations in the southern part of the WBPA, in the area between Brits and Rustenburg. In this part of the WBPA, the winds are more varied, but rarely blow from the west. Northerly to north westerly winds are common, as are winds from the south to southeast. Easterly winds also occur in the southern WBPA. Period (Figure 53),

daytime (Figure 54), evening (Figure 55), night-time (Figure 56), spring (Figure 57), summer (Figure 58), autumn (Figure 59), and winter (Figure 60) wind roses for the period 1 May 2011 to 30 April 2016 in the WBPA are shown below.

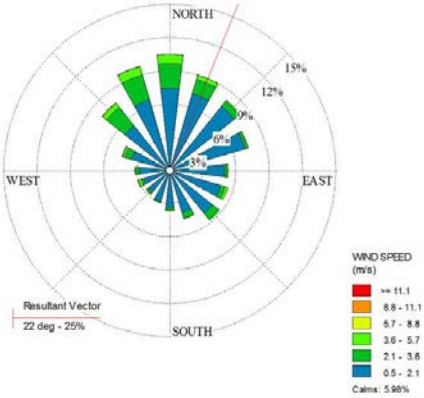


Figure 53 | Wind rose for 1 May 2011 to 30 April 2016 measured in Thabazimbi.

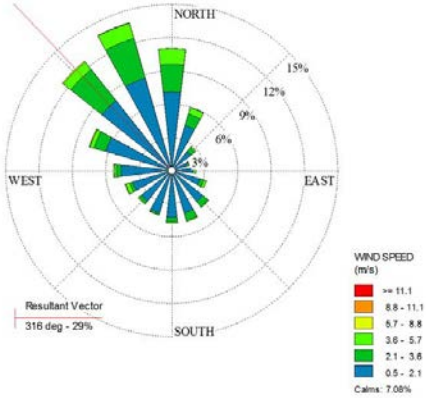


Figure 54 | Daytime wind rose for May 2011 to April 2016.

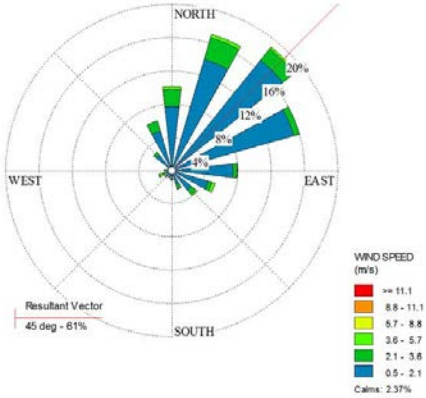


Figure 55 | Evening wind rose for May 2011 to April 2016.

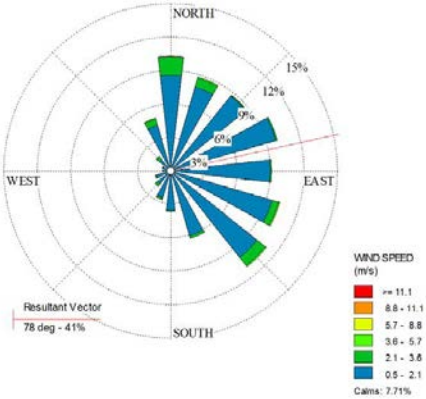


Figure 56 | Night time wind rose for May 2011 to April 2016.

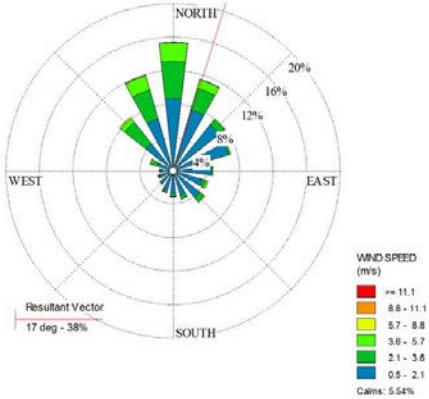


Figure 57 | Spring wind rose from 2011 to 2016.

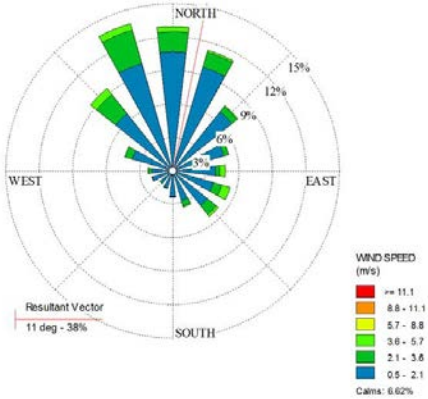


Figure 58 | Summer wind rose from 2011 to 2016.

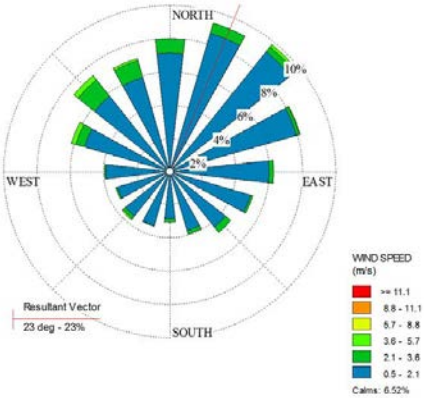


Figure 59 | Autumn wind rose for 2011 to 2016.

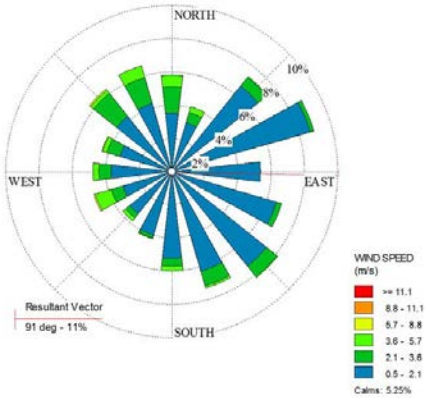


Figure 60 | Winter wind rose for 2011 to 2016.

Limpopo Province air quality

Air pollutant sources within Limpopo districts include: industry, domestic fuel burning and mining, with differences in contribution by each source across the districts. Other sources within the Province contributing to air pollution include domestic fuel burning, vehicle tailpipe emissions, and biomass burning.

The main sources of SO_2 and NO_x within the Province are the power generation sources within the WDM. Small boilers, followed by mining operations (both coal and metallurgical), are the main contributing sources to total suspended particulate matter (TSP) with boilers (assuming all TSP to be PM_{10}) the main source of PM_{10}. Wood processing is the second most significant source of PM_{10}. The main contributor within the Province to fine particulate matter ($PM_{2.5}$) and CO is biomass burning. Vehicle tailpipe emissions are the main source of hydrocarbons specifically within the Districts of Waterberg, Capricorn and Vhembe. VOCs show to be primarily from wood treatment works, mainly restricted to Mopani District Municipality. Small boilers, where quantified, also indicated to be potentially significant sources of CO_2. These air pollutants will be considered during the cumulative impact rating of the proposed project's air quality impact.

Waterberg-Bojanala National Priority Area air quality

The emission summary in Table 25 for the WBPA shows the dominant sectors with regard to the major pollutants considered in the baseline assessment. SO_2 is primarily sourced from industry in the area, with 99.9% of total emissions generated by this sector. Minimal SO_2 contributions are observed from motor vehicles and the residential sectors. Total SO_2 emissions for the priority area are estimated at almost 397 000 tons per annum. For NO_x, the industrial contribution to the overall pollutant load is 87%, and the contribution from motor vehicles is 13%. Total WBPA NO_x emissions are estimated at approximately 87 000 tons per annum. For PM_{10}, mining contributes the greatest proportion of emissions, approximately 60 000 tons per annum, and over 70% of total emissions. Industry contributions are lower but still significant at 27%. Total priority area PM_{10} emissions are estimated at approximately 83 000 tons per annum.

The WBPA area was declared in anticipation of the development of air quality problems associated with the development of the Waterberg coal fields. Initial analyses indicated that the area may already be facing air quality problems, prior to the initiation of the major planned developments in the area.

Table 25 | Total emissions from the WBPA

	SO_2 ton/annum	%	NO_x ton/annum	%	CO ton/annum	%	PM_{10} ton/annum	%
Industry	393,815	99.9	74,671	86.3	39,309	85.7	19,425	24.2
Mining	-	-	-	-	-	-	59,488	74.2
Residential	21	<0.1	59	<0.1	-	-	306	0.4
Motor vehicles	317	<0.1	11,608	13.4	-	-	435	0.5
Biomass	-	-	202	<0.1	6,560	14.3	545	0.7
Total	394,153		86,540		45,869		80,199	

Waterberg District Municipality air quality

An emissions inventory for the WDM was compiled for air pollution sources where information was available or where emission factors could be applied to quantify emissions. Potential air pollution sources in the WDM have been identified as:

- *Power generation:* Matimba Power Station is the main source of SO_2 emissions in Lephalale. The new Medupi Power Station will also be a significant source of SO_2 emissions.
- *Mining:* mainly fugitive dust emissions from mining activities.
- *Industrial emissions:* mainly emissions from small boiler sources and brickworks in the WDM. These sources contribute to PM_{10} and SO_2 concentrations.
- *Domestic fuel burning:* mainly coal and paraffin burning in informal settlements such as Mahwelereng (Mogalakwena), Marapong (Lephalale) and Regorogile and Ipeleng (Thabazimbi).

- *Vehicle emissions*: from petrol and diesel vehicles along major roads and the N1 highway in the WDM. However, vehicles are not considered to be a significant air pollution source in the WDM.
- *Agricultural activities:* although not quantified, agricultural activities are considered to be an important source of ambient particulate concentrations. Thabazimbi Local Municipality is the main contributor to agricultural activities in the District, contributing to almost 40% of the WDM's GDP.
- *Biomass burning:* also not quantified due to the irregular and seasonal nature of this source, but also considered to be an important contributor to ambient particulate concentrations, particularly during the fire-burning season.
- *Waste treatment and disposal:* there are seven licensed disposal facilities (landfills) in the WDM for the disposal of general waste. Incineration occurs on a small scale in the WDM with medical waste from hospitals and clinics outsourced to Tshumisano Waste Management.
- Vehicle entrainment of dust from paved and unpaved roads: was not quantified as part of the AQMP.
- Other fugitive dust sources such as wind erosion of exposed areas: was not quantified as part of the AQMP.

Based on the available ambient air quality monitoring data and the emissions inventory compiled for the WDM, air pollution 'hotspots' were identified in the District. Emphasis was placed on areas with high population densities and the spatial distribution of sources in relation to residential areas. Based on these criteria, two hotspots have been identified:

1) *Lephalale (Lephalale Local Municipality):* One of the largest industrial sources, Matimba Power Station, is located in this Municipality. Future developments such as Medupi Power Station and Sasol's Coal-To-Liquids Plant will make this an important industrial area in future years.
2) *Thabazimbi and Northam (TLM):* This Municipality includes many of the larger opencast mines such as Thabazimbi Mine, Amandelbult Platinum Mine and Northam Platinum.

Amandelbult Section air quality

Dust fall monitoring is conducted at the Tumela mine's existing opencast operations, with monitoring stations located approximately 7.7 km southwest of the proposed Haakdoorndrift pit. Dust fallout rates for the period December 2015 to April 2016 ranged from 65 mg/m^2/day to 1,669 mg/m^2/day (Figure 61). Dust fallout rates near the current operations remained mostly below 600mg/m^2/day. One monthly contravention of the non-residential standard was recorded at Station 10 Zizwe North East, in April (i.e. 1,669 mg/m^2/day).

No ambient fine particulate monitoring data is available for the Amandelbult operations.

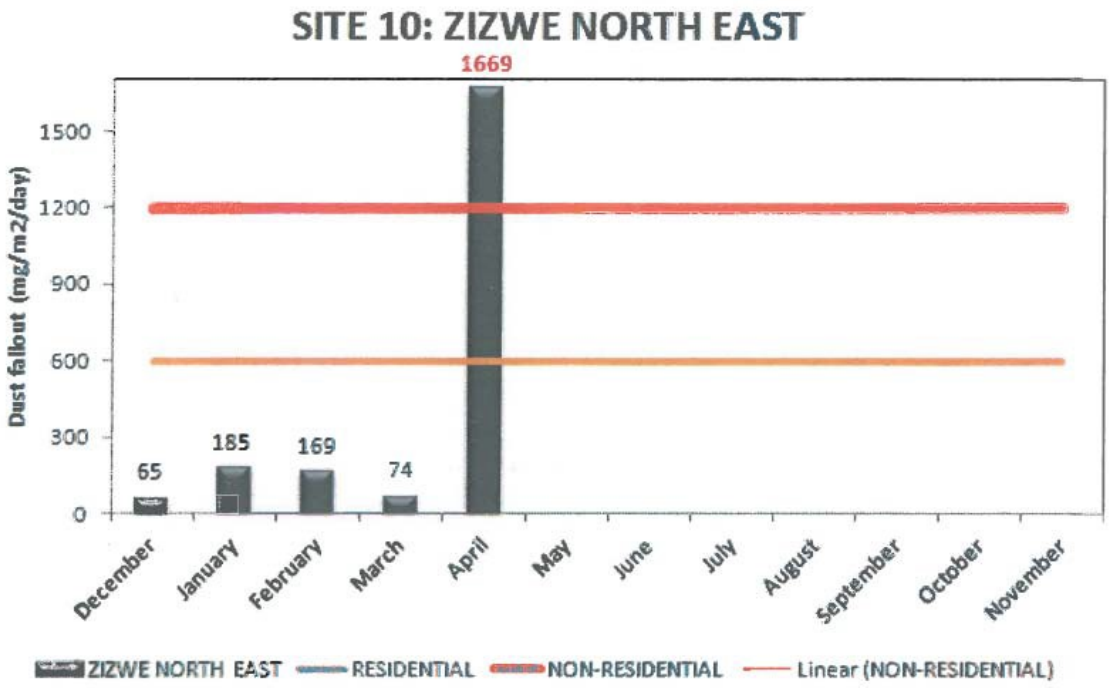


Figure 61 | Dust fall monitoring data for the period December 2015 to April 2016.

Ambient noise

Ambient sound levels were measured (as part of the baseline investigation by Enviro Acoustic Research), semi-continuously at one location over a period of approximately 20 hours (1 night), augmented with 10-minute measurements at 5 locations during May 2016. The potentially noise-sensitive receptors in the vicinity is shown in Figure 62.

A number of single measurements were collected to gauge the ambient sound character and levels in the area. The data collected and information about the measurement locations are presented in Table 26.

Note:

- $L_{Aeq,I}$: Equivalent (average) A-weighted impulse-time-weighted noise level
- $L_{Aeq,f}$: Equivalent (average) A-weighted fast-time-weighted noise level
- L_{A90}: Noise level that is exceeded 90% or more of the time, A-weighted fast-time-weighted noise level

All the 10-minute measurements indicated an area with a potential to be quiet, although traffic on the roads as well as natural sounds (birds, insects and wind-induced noise) increase the noise levels. Considering the measurements, and measurements conducted in the last few years at similar areas, rating levels at the potential noise-sensitive developments would be typical of a suburban to urban noise district.

Figure 62 | Potential noise-sensitive receptors (green points) and sound measurement locations (blue points) in the Haakdoorndrift Opencast project area.

Table 26 | Ambient noise measurements in the Haakdoorndrift Opencast project area.

Measurement location	$L_{Aeq,i}$ level (dBA)	$L_{Aeq,f}$ level (dBA)	L_{A90} Level (dBA90)	Comments
HDDSTASL01 Night-time	55	51	34	Crickets and other insect sounds dominate. Some wind induced noises. Frogs and cicada. Sounds of traffic almost constantly audible. Wind gusts. Aeolian sounds just audible with the wind. Dogs in far distance. Traffic at distance. Passing traffic the maximum noise. $L_{Aeq,i}$ around 34.5 and $L_{Aeq,f}$ around 33 for the 4 minutes before car passed. 1) 3 cars 2) 2. 5 cars
	62	59	34	

HDDSTASL02 Daytime	62	59	30	Birds completely dominate. Music from dwelling in area constant background. Insects clearly audible at times. Siren or alarm just audible, far from location. Ventilation fan audible. Traffic dominates during passing. 1) 2 cars 2) 7 cars
	65	62	29	
HDDSTASL02 Night-time	59	57	38	Crickets and insect sounds dominate. $L_{Aeq,i}$ around 43. Ventilation fan constant background noise, clearly audible. Sprinkling system spraying maize crop audible in distance. Passing traffic maximum noise. Traffic on R511 just audible. 1) 6 cars 2) 5 cars
	60	58	39	
HDDSTASL03 Daytime	31	28	26	Insects were a constant sound source. Birds in distance audible at times (no trees in vicinity). Sound of traffic clearly audible at times. Ventilation fan just audible. Wind induced noises at times. Tractor operating in distance but quite audible.
	36	30	25	
HDDSTASL03 Night-time	41	39	36	Crickets, insects and frogs dominating. Ventilation fan constant background noise. Traffic on tar road clearly audible during passing. Plane over flight in distance end first, start second measurement although it did not change the measured sound level.
	44	40	34	
HDDSTASL04 Daytime	30	27	24	Birds and insects dominant sound. Traffic on R511 clearly audible. Humming sound (ventilation fan) in distance. LDV passes microphone slowly at 6 minutes, second measurement.
	32	30	26	
HDDSTASL04 Night-time	35	31	27	Insects and frogs sounds dominating. Traffic on R511 clearly audible during passing. Traffic on D3707 audible when passing.
	36	34	27	
HDDSTASL05 Daytime	76	72	34	Traffic dominates during passing and a significant constant noise. Birds audible. Insects just audible at times. 1) 26 cars, 11 trucks 2) 22 cars, 4 trucks
	75	71	32	
HDDSTASL05 Night-time	70	66	33	Crickets dominating. Unidentifiable broadband noise like a fan audible in distance (from grain silo area). Traffic on R511 dominating. 1) 6 cars, 3 trucks 2) 7 cars, 4 trucks
	73	69	34	

Cultural, heritage and palaeontological resources

Survey results

The proposed mining area was investigated for cultural and heritage resources by G & A Heritage. It was found that the area has been highly modified by past and present agricultural activities. Most of the study area has been repeatedly ploughed and ripped. For this reason, no sites of heritage significance could have survived in these areas, it is also not possible to determine if subterranean sites were located here. One site with the remains of a small pump station was located on the banks of the Crocodile River, however it is not thought to be older than 30 years, therefore falling outside the protection parameters of the National Heritage Resources Act (NHRA).

Palaeontology

The relevant literature and geological maps for the study area in which the development is proposed to take place, have been investigated for a desktop study by an independent palaeontology specialist, J F. Durand.

Geomorphologically, the study area lies on a gentle slope adjacent to the Crocodile River which forms much of the eastern boundary of the study area. The study area and the adjacent farms are under cultivation or used for grazing. The area is characterised by deep red and black soils.

The rocks of the Bushveld Igneous Complex (BIC) are non-fossiliferous and are of no palaeontological concern.

The study site is largely situated on alluvium deposited on BIC rocks (Figure 63). The alluvium consists mainly of Aeolian sand which has been deposited from the Tertiary to Quaternary along the Crocodile River and may be correlated with the Kalahari beds. These soil types are listed in more detail in Table 27. No fossils have been reported from the study area and the probability of fossils occurring in the Tertiary to Quaternary Aeolian sand and soils in the study area is very low. These sediments are correlated with the Kalahari Group sediments. The fossils reported from Kalahari Group sediments are very sparse, occur sporadically and are low in diversity. Although no fossils have been reported for the study area, fossils such as root casts, burrows, termitaria, ostrich egg shells, mollusc shells and isolated bones have been discovered in the Kalahari Group elsewhere (Almond & Pether, 2008).

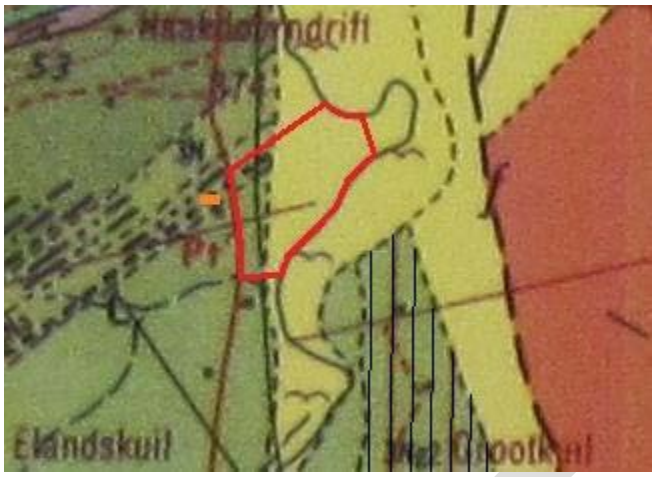


Figure 63 | Geological map of the proposed study area and surroundings (adapted from the 2426 THABAZIMBI 1:250 000 Geology Map, Council for Geoscience, 1978).

Table 27 | Geological legend to Figure 63

Legend	Lithology	Geological Units		Age
	Alluvium	-	-	Tertiary to Quaternary
	Black soil, red soil, ferricrete, calcrete	-	-	Tertiary to Quaternary
	"Main granite", granophyric, porphyritic, pegmatitic or aplitic in places	Lebowa Granite Suite	Bushveld Igneous Complex	Vaalian
	Ferrogabro with magnetite bands	Rustenburg layered Suite (mafic rocks)	Bushveld Igneous Complex	Vaalian
	Gabbro: Noritic at base and locally anorthositic	Rustenburg layered Suite (mafic rocks)	Bushveld Igneous Complex	Vaalian
	Pyroxenite	Rustenburg layered Suite (mafic rocks)	Bushveld Igneous Complex	Vaalian

Stone Age

During the Middle Stone Age, 200 000 years ago, modern man or *Homo sapiens* emerged, manufacturing a wide range of tools, with technologies more advanced than those from earlier periods. This enabled skilled hunter-gatherer bands to adapt to different environments. From this time onwards, rock shelters and caves were used for occupation and reoccupation over very long periods of time. Two Middle Stone Age sites at the Withoek Spruit (Brakpan) were researched 17 years ago, but no information on this discovery has been published.

The Late Stone Age, considered to have started some 20 000 years ago, is associated with the predecessors of the San and Khoi Khoi. San hunter-gatherer bands with their small (microlithic) stone tools may have lived in Eastern Gauteng, as a magnificent engraving site near Duncanville attests to their presence in Vereeniging, south of, but close to Ekurhuleni. Stone Age hunter-gatherers lived well into the 19th century in some places in SA, but may not have been present when the first European colonists crossed the Vaal River during the early part of the 19th century. Stone Age sites may occur all over the area where an unknown number may have been obliterated by mining activities, urbanisation, industrialisation, agriculture and other development activities during the past few decades.

Iron Age

This area is located in a region where both components of the Iron Age (both Early and Late) is found although the Late Iron Age (LIA) is far more common. During the later stages of the 18th and 19th century, the Bakwena were living in megalithic sites such as Boitsimogale and Kaditshwene in the Bankeveld. The 18th and 19th centuries constituted an era of momentous change in the South African interior. The era was characterised, among other things, by the emergence and decline of large African polities, colonial expansion, the forging of new identities and the disappearance of others, as well as significant population movements, such as witnessed during the Difaqane and the Great Trek. This period also saw the introduction of new cultigens, materials and technologies, including the gradual adoption of writing as a primary archive. It was during this formative period that the area beyond the Orange and Vaal Rivers became inextricably woven into the fabric of a broader South African society as the thrust of colonial advance

reached deep into the interior. The whole region south of the Limpopo River became part of an embryonic but irreversibly globalised world that had started to emerge a few centuries earlier in the wake of European colonisation and expansion.

Tlokwa oral traditions recall that a chiefly branch of this Tswana cluster had shifted their capital to a large plain close to the Pilwe Hills towards the end of the 18th century. Oral records associated the capital site, known as Marothodi, with the historical farm Bultfontein 204 JP, onto which a small section of the stone walling extends.

The Historic Era

The Historic Era is dominated by the conflict between Mzilikazi and the tribes living in the area. Mzilikazi established temporary settlements near present-day Rustenburg, then launched into action against the baKwena. After falling on the Kwena at Silkaatsnek the Matabele turned on the Po who were easily overwhelmed. Kgatla Chief Pilane fled to the hills that now bear his name. Mzilikazi ruthlessly massacred the remaining Tswana groups in the area. Using the Magaliesberg as his centre, Mzilikazi expanded his kingdom, which by then, stretched from the Vaal River in the south to the confluence of the Crocodile and Limpopo Rivers.

The first white farmers settled in this part of the country after 1841. The district of Waterberg was established in 1866. This indicates that there must have been enough people to make the establishment of a district a viable option.

Thabazimbi ("Mountain of Iron") was named for the exceptionally lucrative iron ore that is found in the vicinity. The iron ore was discovered in 1919 by J.H. Williams. The railway from Rustenburg reached the area in the 1930s and full-scale iron and steel production began. Thabazimbi was proclaimed in 1953.

In the last decade, Thabazimbi was developed into an ecotourism hub with its large variety of wildlife, birds and hiking trails. The Marakele National Park is situated 15km north of the town.

The Thabazimbi mine has been in operation since 1931. The mine uses conventional opencast methods.

In a 2004 article, the Mining Weekly stated that Amandelbult is Anglo Platinum's largest contributor and the second largest platinum mine in the world. A series of shafts has been sunk at the mine since 1973. The mine was temporarily closed from 1973 to 1976, but since has continued to increase production and in October 2002 produced 2 tons of platinum in a month.

The Amandelbult East Upper UG2 Project conventionally mines the UG2 reef, using existing mining infrastructure previously employed to extract the Merensky reef, at the vertical number 2 shaft and at three decline shafts at 44 East, 50 East and 62 East. The recently completed 75 000 tons per month UG2 concentrator was expanded to 210 000 tons per month and by 2012 the project contributed an additional 100 000 ounces of refined platinum per annum to Amandelbult's production.

Cultural landscape

The cultural landscape in the study area is mostly agricultural and associated mining activities and the specific sites are severely altered making it impossible to comment on the possible existence of sub-surface sites.

The built environment

Although some structures on the proposed property date back to the early 1990s, they will not be affected directly or indirectly or visually by the proposed development. Some structures associated with rural living were identified:

- Brick outbuildings (modern and historic);
- Barb-wire fences (modern);
- Mud-brick huts (modern);
- Dirt roads (modern);
- Footpaths;
- Surfaced roads (modern);
- Corrugated iron buildings and sheds (modern); and
- Mining structures.

None of the structures are of any heritage value.

Conclusion

Although unlikely, sub-surface remains of heritage sites could still be encountered during the construction activities associated with the project. Such sites would offer no surface indication of their presence due to the high state of alterations in some areas as well as heavy plant cover in other areas. The following indicators of unmarked sub-surface sites could be encountered:

- Ash deposits (unnaturally grey appearance of soil compared to the surrounding substrate);
- Bone concentrations, either animal or human;
- Ceramic fragments such as pottery shards either historic or pre-contact; and
- Stone concentrations of any formal nature.

The proposed project site has been severely altered by agricultural activities in the past. Some uncultivated areas between pivot irrigation lands and some of the riverine forest on the banks of the Crocodile River were encountered. These areas were highly overgrown and it is possible that small sites such as graves could have been overlooked, however no sites of heritage significance were identified. Accidental uncovering of any sites during the mining phase should be treated as laid out above. A Palaeontological Impact Assessment Report was also compiled for the study, which indicated that it is unlikely that any fossils could be encountered during the operation of the mine.

Traffic

A Traffic Impact Assessment (TIA) was conducted by Aurecon to establish the potential effects of the HOP on the local transportation network (Aurecon, 2016). A site visit was undertaken on the 20th of October 2016. The development site currently has access off the D1639 Road (Figure 64), through a gravel road, the Amandelbult Mine access road shown in Figure 65. The access is shared with the adjacent agricultural holding. There is also a staggered intersection about 30m north of the development access, which provides access to the Cronimet mine via a gravel road Figure 66.

D1639

The D1639 is a provincial road that connects to major regional and national routes such as R510, R511, R516, N1 and N4. The D1639, a paved single-carriageway with one lane in each direction is the only major public road that could be affected by the traffic generated by the HOP activities. It is situated on the eastern boundary of the proposed ore stockpile site and the western boundary of the proposed pit site. D1639 runs in a north-south direction from its intersection with the R510 in the north, towards Thabazimbi, to its intersection in the south with the R511, towards Setaria. D1639 functions as collector/distributor road serving mainly mining and farming activities. Based on observations during a site visit, the surfacing of the D1639 appeared to be in a good condition.

Amandelbult Mine access road

The currently existing Amandelbult access road is a gravel road with traffic moving in both directions. The road intersection is paved up to about 65m from the D1639 on the western leg, and the eastern leg is a gravel road entirely (Figure 67). The only traffic using the road currently are Amandelbult employees and maintenance vehicles.

Cronimet Mine access road

The Cronimet access road is a gravel road with one lane in each direction and is located approximately 30m from the Amandelbult Mine access road. The road is currently used by civilians and Cronimet mine employees about 10% of the time. Another access road to Cronimet mine exists outside the study area and is used more frequently than this one.

Traffic survey

To better understand the traffic situation on the local road network close to the site, a manual classified 12-hour traffic count survey was undertaken on Thursday 27th October 2016, from 05h00 to 17h00. The counts were classified into heavy goods vehicles, light vehicles, buses and minibus taxis. A full count survey was carried out at the D1639 / Amandelbult Mine access road intersection. Inbound and outbound traffic on the Cronimet Mine access road were also observed. The traffic count data were then used in SIDRA Intersection assessment software to analyse the intersection capacity and impact of the development at key intersections close to the site (these impacts are discussed in section 12.5).

Few vehicles were observed along D1639 during the site visit, and no vehicles were observed at the Amandelbult Mine access road and adjacent Cronimet Mine access road:

- The D1639 carries approximately 43 vehicles per hour (vph) northbound and 187 vph southbound during the AM peak, and carries approximately 187 vph northbound and 37 vph southbound in the PM peak.
- No vehicle volumes were observed using the Amandelbult Mine access road during peak hours, but approximately 4vph in both directions were seen using the road during off-peak hours.
- The Cronimet Mine access road carries approximately 2 vph westbound and 3 vph eastbound during the AM peak, and 6vph westbound and 2 vph eastbound during the PM peak

Road safety

No major road safety problems (in terms of sight distances, road surfacing, road marking and signage) were evident during the site visit. Road signs and markings were observed south of the development site. Sight distances at the D1639 / Amandelbult access intersection meet sight stopping distance requirements for the southbound approach of the D1639. Traffic volumes on the D1639 are very low and no pedestrian activity was observed. Therefore, there are no significant pedestrian safety issues that were evident on the immediate road network.

Figure 64 | The D1639 paved regional distributor road.

Figure 65 | Amandelbult Mine access road (western leg of intersection from the D1639).

Figure 66 | Cronimet mine access road.

Figure 67 | Gravel farm access road, located opposite the Amandelbult Mine access road, i.e. the eastern leg of the intersection from the D1639).

Existing public transport and non-motorised transport

Minibus taxis and buses were the only mode of public transport observed travelling along the D16369 from Thabazimbi towards Setaria / Koedoeskop, during the site visit. No public transport lay-bys or stopping facilities were observed along D1639 or in the vicinity of the site.

No pedestrians were observed walking in the vicinity of the site, or along the D1639. Additionally, no non-motorised transport infrastructure was observed along the D1639. No paved sidewalks or any form of pedestrian facilities were observed along D1369, in the immediate vicinity of the site.

Visual resource

To determine the value of a landscape as a visual resource, it is described and assessed in terms of various factors. This assessment is based on information obtained from an on-site photographic assessment, as well as available aerial photo imagery and topographical maps. The visual character of the site and surrounds is summarised below and in the photos presented in Table 28:

- *Topographic ruggedness and landforms*: The ridge system associated with Thabazimbi some kilometres north of the site does not impact on the local sense of place. Driving on the district road from north to south, the area becomes flatter towards the south, and almost completely flat on site.
- *Presence of water bodies:* The Crocodile River itself is not visible from the pit area, but its riparian vegetation provides a constant reminder of this key landscape feature in the area.
- *Vegetation cover:* Due to the close proximity of the site to the Crocodile River and the agricultural land uses, vegetation cover is limited to crops in the direct vicinity of the site, and dominated by the riparian zone of the Crocodile River directly east of the site.

- *Prevalence of natural landscapes and human-made elements:* Apart from the 62 East Decline shaft and powerline in close proximity to the site, the site is mainly rural, and dominated by elements such as farmsteads, pivot points and barns for storage.

Visual quality is assessed by considering the visual attributes (views, sense of place, visual absorption capacity and aesthetic appeal) together with the physical landscape character and gives the landscape a high, medium or low visual quality value. When considering attempts to classify or score the value of something that is inherently subjective and influenced by individual interpretation, results will not be absolute and can only be measured against the criteria and parameters that have been assigned for their assessment. The assessment criteria are based on principles commonly used in visual assessment and address concepts that are expected to be universally understood and experienced. The criteria used to assess the visual quality of the landscape are summarised in Table 29.

Table 28 | Visual resource quality photos of the site and surrounds

View towards the south *en-route* to site on the district road some 7 km from site.

View in close proximity to site with agricultural area and Crocodile river riparian zone.

View at site entrance towards east showing Crocodile River riparian vegetation and Eskom distribution line.

View at site entrance towards west showing transmission line infrastructure and 62 East Decline Shaft in the background.

View on site towards the east showing agricultural land and Crocodile riparian zone in the background.

View from the east of the Crocodile River towards the site.

Keeping the criteria of Table 29 and the above assessment of the study area visual character in mind, in summary, it can be stated that the visual quality of the study area is of medium value.

Table 29 | Visual quality assessment criteria (Golder Associates, 2009)

Level	Criteria
High	Pristine or near-pristine condition / little to no visible human intervention visible/ characterised by highly scenic or attractive features / areas that exhibit a strong positive character with valued features that combine to give the experience of unity, richness and harmony. These are landscapes that may be considered to be of particular importance to conserve and which may be sensitive to change (e.g. nature reserves).
Medium	Partially transformed or disturbed landscape / human intervention visible but does not dominate view / scenic appeal of landscape partially compromised / noticeable presence of incongruous elements / areas that exhibit positive character but which may have evidence of degradation / erosion of some features resulting in areas of more mixed character. These landscapes are less important to conserve, but may include certain areas or features worthy of conservation (e.g. rural landscapes).
Low	Extensively transformed or disturbed landscape / human intervention dominates available views / scenic appeal of landscape greatly compromised / visual prominence of widely disparate or incongruous land uses and activities / areas generally negative in character with few, if any, valued features. Scope for positive enhancement frequently occurs (e.g. urban areas).

Socio-economic character

Demographics

The project site is located 14 km south of Thabazimbi within the Thabazimbi Local Municipality (TLM) and within the Waterberg District's jurisdiction in the Limpopo Province, approximately 137 km northwest of Pretoria. The population of TLM consists of 85 234 people with an annual population growth rate of approximately 2.63% (StatsSA, 2011). As of January 2016, the project area falls within Ward 6, and is bordered by Ward 4 to the east and south, Ward 9 to the north, and Ward 3 and 11 to the west (Municipal Demarcation Board, 2016). The local context is shown in Figure 68.

The age profile of a population provides valuable insight into the composition of the market population and will help establish the Potential Economically Active population (PEA). The PEA refers to the population that falls within the working age group (aged between 15 and 64). It does not mean that this entire portion of the population is prepared, willing or able to be employed, i.e. some prefer to stay at home as housekeepers, others are disabled and some are fulltime students, or have stopped looking for work. They do, however, form part of the potential labour pool. In TLM, 76.4% of the population is classified as PEA.

Approximately 2.4% of the population is over the age of 65 and approximately 21.1% is under the age of 14. The dependency ratio indicates the number of individuals that is younger than 15 and older than 64, who are dependent on the PEA population. In TLM, 30.8% of the population is dependent on the PEA population (StatsSA, 2011).

The TLM is dominated by a black African population (84.3%), with a smaller representation of white people (14.4%) and other population groups (1.2%). Gender and age are important variables in terms of the labour-sending capacity of an area. As shown in Table 30, the male population per age category within the TLM predominantly exceeds that of the female population for the same age category. The predominance of males can partially be attributed to the historical in-migration of males as result of the local platinum mining industry and farm employment.

The language predominantly spoken in the TLM is Setswana (38%), followed by Afrikaans (14.5%) and IsiXhosa (11.4%). The remaining languages spoken in TLM and their distributions are provided in Table 31.

Table 30 | Gender and age distribution for Thabazimbi Local Municipality (StatsSA, 2011)

Age distribution	Gender	
	Males	Females
0-4	4,7%	4,8%
5-9	3,2%	3,1%
10-14	2,7%	2,7%
15-19	3%	2,9%
20-24	6,4%	4,5%
25-29	8,6%	5,2%
30-34	7,4%	4,2%
35-39	5,9%	3,5%

40-44	4,3%	3%
45-49	4,3%	4,3%
50-54	3,6%	1,9%
55-59	2,3%	1,2%
60-64	1%	0,7%
65-69	0,5%	0,5%
70-74	0,3%	0,3%
75-79	0,2%	0,2%
80-84	0,1%	0,1%
85+	0,1%	0,1%
Total	58.6%	43.2%

Table 31 | Languages spoken by the Thabazimbi Local Municipality population (StatsSA, 2011)

Language	Percentage of population
Afrikaans	14,5%
English	3,3%
IsiNdebele	0,9%
IsiXhosa	11,4%
IsiZulu	2%
Sepedi	7,3%
Sesotho	3,6%
Setswana	38%
Sign Language	0,3%
SiSwati	0,7%
Tshivenda	1,2%
Xitsonga	6,8%
Other	2.1%
Not Applicable	7,8%

Education

A critical factor affecting quality of life is the standard of education within a community. The level of education of a population is used as an indicator of human capital. It is measured by the percentage distribution of the population older than 20 years and the highest level of schooling attained. The 2011 Census data provided by StatsSA (2011) indicates that only approximately 14.2% of the population attained a matric level of education, with only 1.6% of the population having completed a higher education. Table 32 contains a summary of the education level of the all ages of the population within the TLM.

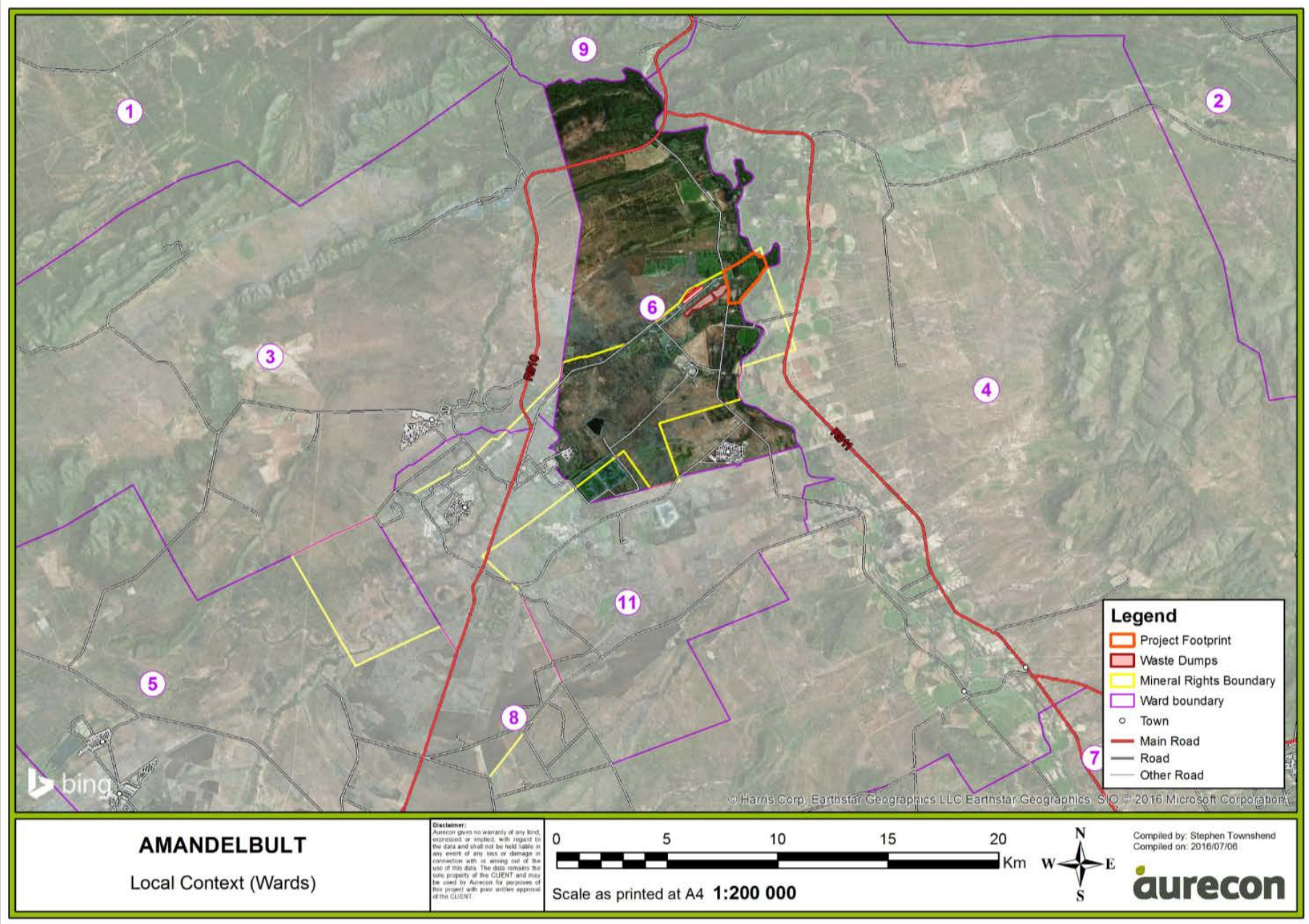


Figure 68 | Ward within which the proposed Haakdoorndrift Opencast Project falls.

Table 32 | Education level of the Thabazimbi Local Municipality (StatsSA, 2011)

Level of Education	Percentage of population in TLM (all ages)
No Schooling	5,6%
Some Primary	36,3%
Completed Primary	6,4%
Some Secondary	33,4%
Completed Secondary	14,2%
Higher Education	1,6%
Not Applicable	2,5%

Employment and earnings

Of the total working age population of approximately 76.4% in the TLM, 20.6% are unemployed. The unemployment and youth unemployment rates (26.9%) are the lowest in the district. Table 33 provides an overall summary of the employment status within the TLM for those aged 15 to 64.

Table 33 | Employment status of the working age population in the Thabazimbi Local Municipality (StatsSA, 2011)

Employment status	Number
Employed	32,918
Unemployed	8,562
Discouraged Work Seeker	1,236
Not Economically Active	22,438

The ability of people to afford basic services (such as water, sanitation and health care), is often indicated through income levels. As shown in Table 34, households with an income of between R 38 201 and R 76 400 form the largest single group (20%) in. The majority of the population (69.5%) earns an annual income of less than R 76 400. Note that the average household size is 2.8 people.

Table 34 | Annual income distribution of households within the Thabazimbi Local Municipality (StatsSA, 2011)

Average household income	Percentage
No income	14%
R1 - R4,800	2,7%
R4,801 - R9,600	4,1%
R9,601 - R19,600	12,6%
R19,601 - R38,200	16,1%
R38,201 - R76,400	20%
R76,401 - R153,800	14%
R153,801 - R307,600	9,9%
R307,601 - R614,400	4,6%
R614,001 - R1,228,800	1,2%
R1,228,801 - R2,457,600	0,4%
R2,457,601+	0,2%

Living conditions

Of the 25 080 households in the TLM, 47.3% have piped water inside the dwelling, 23.9% have piped water inside the yard, and 12.7% have access to piped water less than 200 m from their dwellings. Only 6.2% of households have no access to piped water. The various water sources in TLM is listed in Table 35. Most of the TLM-population live in urban settings, and the remainder on

farms, with 70.7% of the population residing in formal dwellings. Only 63.1% of households have access to toilets connected to a sewerage system, but 76.8% of households have access to electricity for lighting. Refuse is removed by a local authority or private company for 62.2% of households, and 31% of households dispose of refuse in dumps themselves. Further details on housing, water and sanitation facilities, energy sources, and refuse disposal are provided in Table 35.

Table 35 | Living conditions details for the Thabazimbi Local Municipality (StatsSA, 2011)

Facility		Percentage of households	
Housing			
Urban		82,2%	
Tribal/Traditional		0%	
Farm		17,8%	
Source of water			
Regional/Local water scheme (operated by municipality or other water services provider)		63,9%	
Borehole		17,4%	
Spring		0,2%	
Rain water tank		0,3%	
Dam / Pool / Stagnant water		0,3%	
River/Stream		0,2%	
Water vendor		1,2%	
Water tanker		14,8%	
Other		1,7%	
Toilet facility			
None		6,3%	
Flush toilet (connected to sewerage system)		63,1%	
Flush toilet (with septic tank)		4,9%	
Chemical toilet		0,7%	
Pit toilet with ventilation		2,6%	
Pit toilet without ventilation		18,4%	
Bucket toilet		0,8%	
Other		3,3%	
Energy source	Cooking	Heating	Lighting
Electricity	73,1%	68%	76,8%
Gas	1,7%	1,2%	0,2%
Paraffin	16,1%	8%	4,4%
Solar	0,1%	0,2%	0,3%
Candles	0%	0%	17,9%
Wood	8,7%	14%	0%
Coal	0,1%	0,1%	0%
Animal Dung	0%	0,1%	0%
Other	0%	0%	0%
None	0,2%	8,2%	0,4%
Refuse Disposal			
Removed by local authority / private company at least once a week		60,4%	
Removed by local authority / private company less often		1,8%	
Communal refuse dump		2,2%	
Own refuse dump		28,8%	
No rubbish disposal		5,5%	
Other		1,3%	

12.4.2. Description of current land uses

Land use in the Thabazimbi Local Municipality

The TLM is dominated by open bush vegetation, a few scattered patches of low shrubland vegetation, and large portions of degraded vegetation. Cultivated commercial croplands are also common, especially along the Crocodile River. Various mines are located in the vicinity of the proposed project together with associated communities, such as the Chromite mine settlement to the west of the Amandelbult Section. A land-cover map of the municipality shows the intensive agriculture close to the Crocodile River in Figure 69.

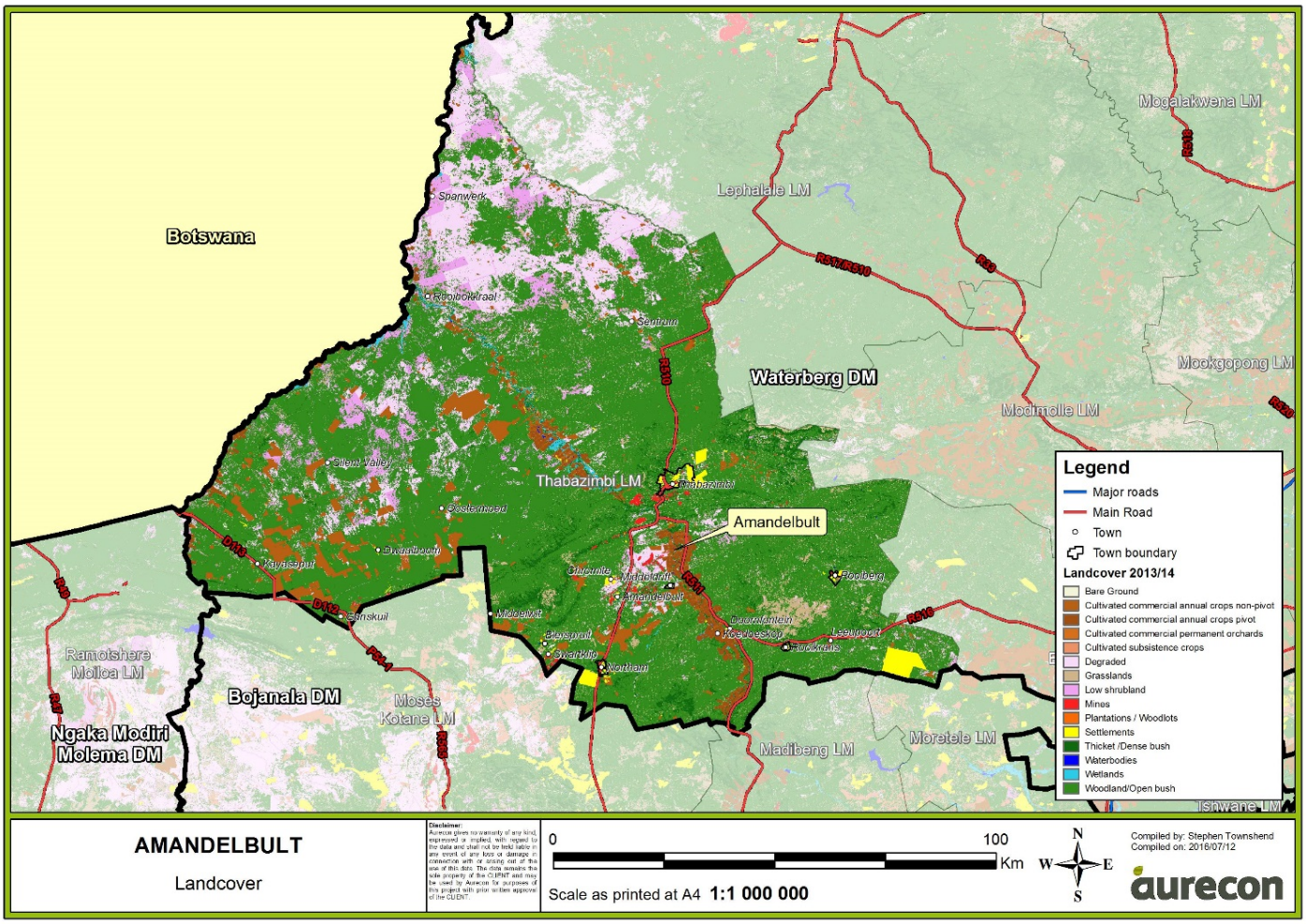


Figure 69 | Land cover and land use of the Thabazimbi municipal area.

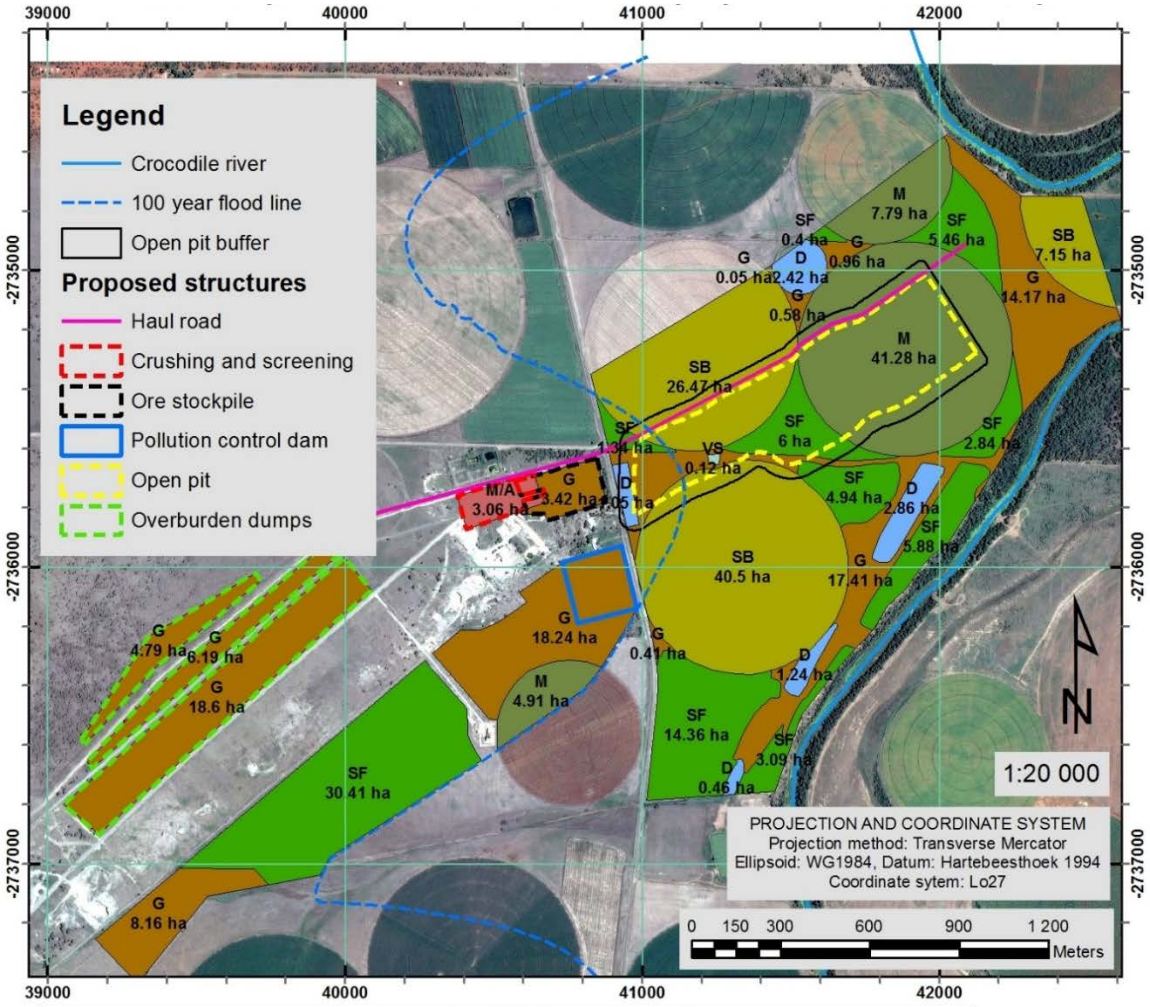
Land use within the project area

The land use of the proposed Haakdoorndrift Project area is dominated by "grazing and remainder areas between cultivating", followed by dryland agriculture (sunflowers, soybeans and maize), various dams used for farming activities, and mine infrastructure. Irrigated agriculture with irrigation pivot points is practised in along to the Crocodile River. Mining activities of Amandelbult are located further west. The localities and extents of current land uses within the project area are shown in Figure 70 and are summarised in Table 36.

Table 36 | Land use codes associated with Figure 70

Land Use Code	Pre-mining Land Use	Unit Count	Area (ha)	Area (%)
M	Maize	3	53.99	17.58
SB	Soybeans	3	74.13	24.14
SF	Sunflower	10	74.72	24.34
D	Dam	5	8.03	2.62
G	Grazing and remainder areas between cultivation	12	92.99	30.29

VS	Ventilation shaft	1	0.12	0.04
M/A	Abandoned mining structures	1	3.06	1.00
	TOTAL	35	307.04	100.01



LEGEND – PRE-MINING LAND USE				
Land Use Code	**Pre-mining Land Use**	**Unit Count**	**Area (ha)**	**Area (%)**
M	Maize	3	53.99	17.58
SB	Soybeans	3	74.13	24.14
SF	Sunflower	10	74.72	24.34
D	Dam	5	8.03	2.62
G	Grazing and remainder areas between cultivation	12	92.99	30.29
VS	Ventilation shaft	1	0.12	0.04
M/A	Mining infrastructure	1	3.06	1.00
	TOTAL	**35**	**307.04**	**100.0**

Figure 70 | Land uses within the proposed Haakdoorndrift project area (Rehab Green, 2017).

12.4.3. Description of specific environmental features and infrastructure on the site

Specific environmental features are described in section 12.4.1 and shown in Figure 71. There are no original farmstead buildings, graves, or archaeological artefacts on the project area. Farmhouses and living quarters of farm workers located within 5 km from the proposed area are located to the west, north and east. Main issues of concern include:

- blasting and crushing noise impacts on households;

- potential dust impacts on crops;
- the irrigation dam close to the project area may be impacted by blasting.

The D1639 district road will be used as an access road between the pit area and the stockpile areas. Details in infrastructure on site is described in section 9.2.

12.4.4. Environmental and current land use map

Current land use / cover are shown in Figure 69 and described in section 12.4.2. Various dryland cultivation and grazing activities in the area are indicated on these maps, as well as the locations of various dams used for agriculture in the area. To the west of the pit, the 62E Decline Shaft area is characterised by the presence of mining infrastructure.

Environmental features are mainly the Crocodile River and its riparian zones described in section 12.4.1. The current land uses identified within a 2 km radius around the HOP-area include:

- Irrigation farming with associated boreholes;
- Mining;
- Grazing for livestock and game; and
- The D1639 road to the west of the pit area.

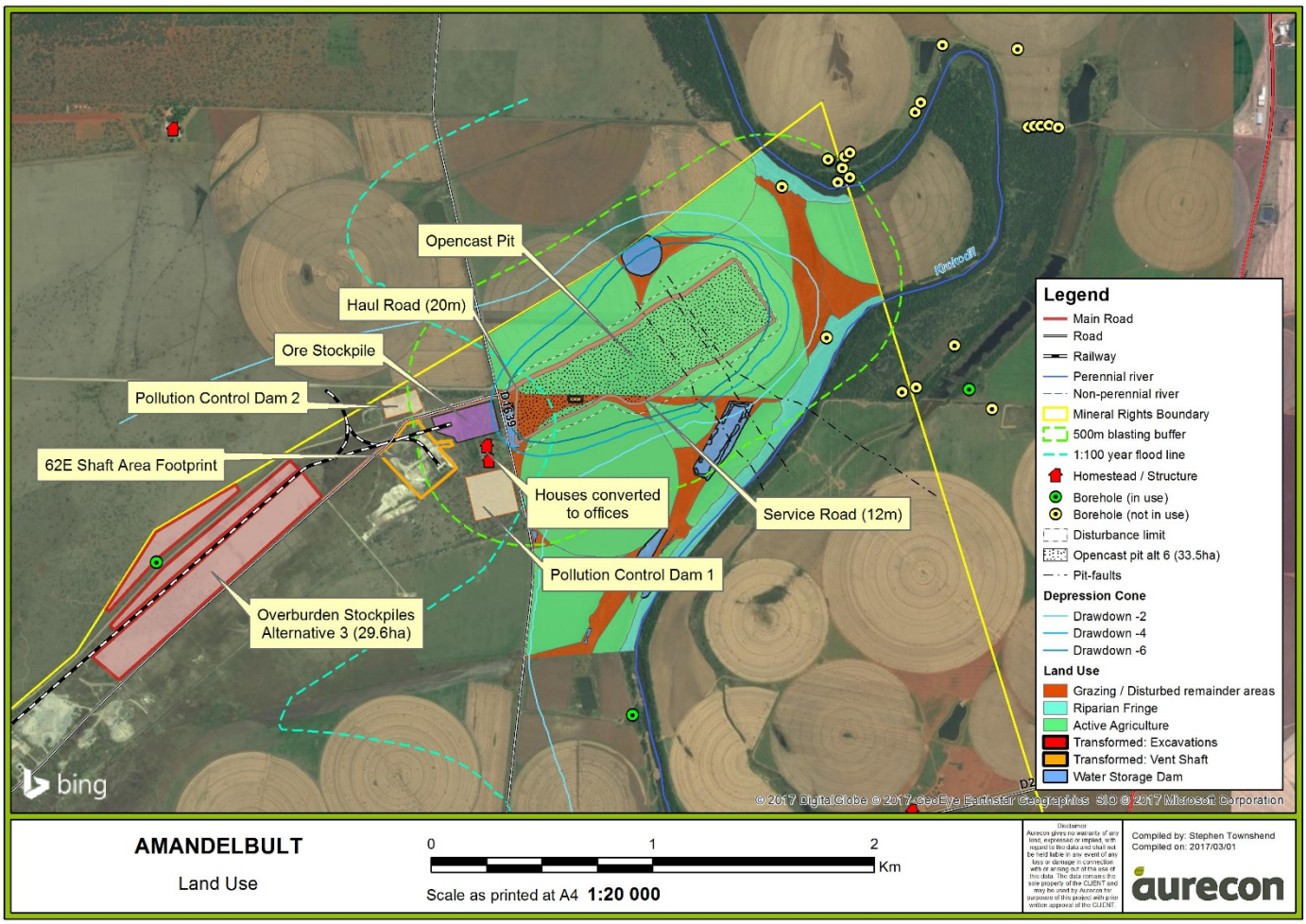


Figure 71 | Land use map of the proposed Haakdoorndrift Opencast project site, as well as sensitive receptors (farmsteads) and boreholes in the surrounding area.

12.5. Impacts and risks identified including the nature, significance, consequence, extent, duration and probability of the impacts, including the degree to which these impacts can be mitigated

This chapter forms the primary focus of the EIA process. It contains detailed assessments of potential social and biophysical impacts (positive and negative) associated with the proposed project and associated infrastructure during the lifecycle of the project. The methodology that was used for the impact assessment is described in Section 12.6. The nature, significance, consequence, extent, duration and probability of the impacts are provided in the tables below. Impacts identified were informed by consultations with specialists, I&APs, as well as typical known impacts of such activities.

The degree to which these impacts can be reversed, avoided, managed or mitigated is indicated as "post-mitigation" impact ratings for individual impacts. In addition, the tables include required mitigation or management measures for impacts. Recommended mitigation measures are based on specialist recommendations and concerns raised by interested and affected parties.

12.5.1. Soils, land use and land capability

The proposed pit will severely impact arable soils with a moderate dryland crop production potential that comprise mostly of deep soils of the Arcadian and Bonheim soil forms. Arable Arcadian soils will also be covered with overburden waste rock dumps. The impacts are summarised Table 38.

The nature of the impact of opencast mining on the soil environment includes the stripping and stockpiling of topsoil (consisting of A- and B-horizons) and the compaction of soils during the construction of facilities such as overburden stockpiles, pollution and run-off control dams and any other possible structures. Heavy machinery traffic on the soil surface and possible chemical pollution of soil through polluted water or certain geological materials could constitute further impacts on soil.

Stripping and stockpiling of topsoil will result in:

- Loss of the original spatial distribution of natural soil forms and horizon sequences which cannot be reconstructed similarly during rehabilitation.
- Loss of natural topography and drainage pattern.
- Loss of original soil depth and soil volume.
- Loss of original fertility and organic carbon content.
- Soil compaction from heavy machinery traffic during earthworks and rehabilitation will adversely affect effective soil depth, structure and density, thus influencing the pedohydrology of the area
- Exposure of soils to weathering, compaction, erosion, and chemical alteration of nutrients, particularly nitrogen.

Sag subsidence is a gradual settling of the soil service that could occur in open pit areas that have been rehabilitated. These areas can hold water if the post mining or post subsidence topography lends itself thereto. Water will seep into these areas if the subsidence intersects the water table or if surface runoff is high. Very little can be done to combat subsidence in the mining environment. It is therefore evident that open pit mining could severely impact the hydropedological functioning of the area.

Heavy machinery traffic on the soil surface during and after mining can lead to compaction and this could adversely affect the land capability of the area. Fine sand and silt are more prone to compaction. The soils in the pit area of the Arcadian and Bonheim forms are high in clay content (refer to Figure 36). Compaction and hard setting of the soils are therefore definite concerns as it hampers root growth and increases surface runoff.

Mitigation

The impact on soil, land capability and land use are mitigated by means of the rehabilitation process which commences with stripping and stockpiling of topsoil *before* mining takes place and is not a process that starts with replacing of topsoil after or during the mining operation. Rehabilitation and subsequent mitigation of soil, land capability and land use consists of the following phases, discussed below (Rehab Green, 2017):

- Stripping and stockpiling of topsoil;

- Backfill of open pits and levelling of overburden material to a free draining surface;
- Replacing and levelling of topsoil and preparation of the surface; and
- Soil amelioration and re-vegetation.

Stripping and stockpiling of topsoil

The term "topsoil" refers to the A- and B-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 B-horizon from 300 mm up to the stripping depth specified per soil type indicated in Figure 72, which shows the soil types that should be stripped and stockpiled together, based on soil type and soil quality.

Figure 72 should be read together with Table 37, which indicated the stripping depths, areas, percentages and the total soil volume per soil type, based on the stripping depth. It also shows the post-mining replacing depth (topsoil thickness) and land capability class. The replacing depth was determined by calculating the total soil volume per soil group divided by the original area stripped. This implies that topsoil which was stripped at different depths, and then stockpiled together, will be replaced at a single average depth.

If there is a stage where stripping and direct replacing takes place, the replacing depths should be similar to the stripping depth as indicated in Figure 72.

The following guidelines for stripping and stockpiling procedures need to be aimed for:

- Due to the similar soil properties of the soil types within the open pit footprint all soil types (Ar1 and Bo1) can be stored together on a single stockpile. The stockpile height should preferably not exceed 6 m in height.
- The boundaries of the soil types that should be stripped at different depths should be surveyed and staked by the mine surveyor before the commencement of soil stripping. The soil boundaries can be adapted to follow the nearest mining blocks as usually created for a mine plan.
- The most suitable stockpile positions should be determined by the mine planner based on the mining sequence plan and need to be surveyed and staked by the mine surveyor.

The post-mining land capability of the total open pit area (100%) should be arable by replacing 1.15 m of high quality topsoil.

Backfilling of open pit and levelling of overburden material

Before topsoil can be replaced, the open pit should be backfilled to an elevation similar to the pre-mining topography in order to ensure continuation of the pre-mining surface drainage pattern. The backfilled surface should be surveyed by a surveyor in order to ensure that it has the correct elevation and slopes to be free draining. A non-free-draining surface could lead to local depressions of periodically saturated zones and increased percolation. This could cause localised subsidence of the underlying spoil material. Therefore, the slopes of the spoil surface should be similar to that of the pre-mining surface with only gradual changes. Abrupt changes in slope gradient increase the susceptibility for erosion initiation.

Replacing and levelling of stored topsoil and preparation of the surface

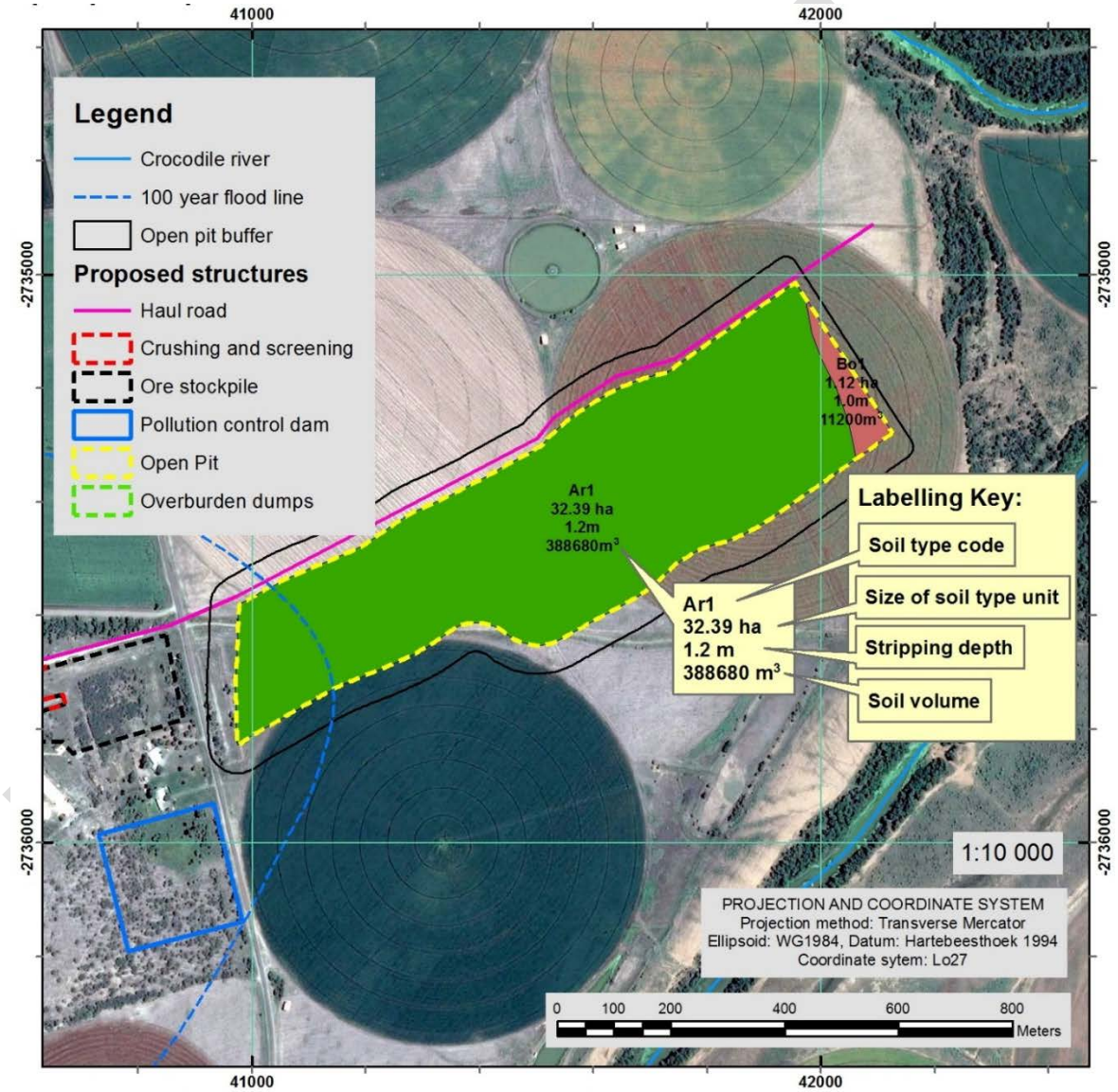
- The backfilled and levelled spoil surface should be covered with stockpiled topsoil. Care should be taken to tip enough soil per square unit to reinstate the total required post mining soil depth (1m) at once. Spreading of soil over large distances and repeated traversing of heavy mechanical equipment should be minimised in order to prevent compaction in the lower profile. The dumped soil heaps should thus only be levelled on top to reach the required soil thickness. Caterpillar-type tracked equipment is preferred for levelling topsoil, as these tracks cause less compaction. Bowl scrapers cause enormous compaction and should not be used.
- The replaced topsoil thickness should be progressively monitored during replacement to verify if it is similar to the replacing depth provided in Table 37 to prevent a topsoil shortage.

Soil amelioration and re-vegetation

- The soil fertility status should be determined by soil chemical analysis after levelling (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 for a few years during which the stability and erosion should be monitored.
- Crop farming can be re-introduced on those areas declared suitable for crop farming by a soil specialist after a post-mining soil and land capability assessment has been carried out.
- Re-vegetation should be done as soon as possible and preferably in spring and early summer to stabilise 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.

A final post-mining land capability map needs to be compiled and should be submitted for closure purposes.



Legend: Pre-mining stripping depths, soil volumes, post-mining replacing depths and land capability

Soil Type	Pre-mining					Post-mining			
	No of units	Strip depth (m)	Area (ha)	Area (%)	Soil volume (m^3)	Replacing			Land capability
						Depth (m)	Area (ha)	Area (%)	
Ar1	1	1.2	32.39	96.66	388680	1.15	33.51	100.0	Arable
Bo1	1	1.0	1.12	3.34	11200				
		Total	**33.51**	**100.0**	**399880**		**33.51**	**100.0**	

Figure 72 | Soil stripping and stockpiling guide map (Rehab Green, 2017).

Table 37 | Soil stripping, stockpiling and replacement guideline for the Haakdoorndrift pit area (Rehab Green, 2017)

Legend: Pre-mining stripping depths, soil volumes, post-mining replacing depths and land capability									
	Pre-mining					Post-mining			
Soil type	No. of units	Strip depth (m)	Area (ha)	Area (%)	Soil volume (m^3)	Replacing			Land capability
						Depth (m)	Area (ha)	Area (%)	
Ar1	1	1.2	32.39	96.66	388680	1.15	33.51	100.0	Arable
Bo1	1	1.0	1.12	3.34	11200				
Total			33.51	100.0	399880		33.51	100.0	

Table 38 | Soil, land use and land capability impacts and risks

Impacts	Pre-mitigation:						Recommended Mitigations	Post-mitigation:					
	Duration	Extent	Intensity	Consequence	Probability	Significance		Duration	Extent	Intensity	Consequence	Probability	Significance
Loss of topsoil due to negligent stripping and stockpiling procedures at open pit use of topsoil for construction purposes	Long-term	Site-specific	Moderate - negative	Moderately detrimental	Certain	Moderate - negative	• Soil types should be stripped at depth and stockpiled as indicated on the soil stripping plan Figure 72. • Stripped topsoil should be used for the sole purpose of rehabilitation of the open pits. • No topsoil should be used for landscaping or construction purposes such as roads or embankments.	Short-term	Site-specific	Low - negative	Negligible	Very likely	Very low
Deterioration of topsoil quality due to contamination with underlying subsoil layers or rock formations	Long-term	Site-specific	Moderate - negative	Moderately detrimental	Certain	Moderate - negative	• Soils to be stripped according to soil stripping and stockpiling plan Figure 72; • Soils to be stripped using delineated soil types as guide; • Prevent mixing of topsoil with underlying material to ensure sufficient volumes of high quality soil for rehabilitation; • Separate stockpiling of different soil type groups to obtain the highest post-mining land capability; • Stockpiles are to be clearly demarcated.	Short-term	Site-specific	Low - negative	Negligible	Very likely	Very low
Decline in topsoil fertility due to mixing of soil's A and B horizons (upper and lower horizons) and possible mixing of different soil types	Long-term	Site-specific	Moderate - negative	Moderately detrimental	Certain	Moderate - negative	• Soils to be stripped according to soil stripping and stockpiling plan, Figure 72; to separate different soil types; • Soil types should be replaced as continuous units or blocks; • Soil fertility should be established by representative sampling and laboratory analysis, analytical results evaluated by a qualified expert, and soil fertility ameliorated prior to establishing vegetation on rehabilitated soil; • Replaced soils are to be maintained in fertile and erosion-free state by sampling them at least every 4 years for macro nutrients and pH.	Short-term	Site-specific	Low - negative	Negligible	Certain	Low - negative
Compaction and decline in topsoil structure during stockpiling and topsoil re-placing	Medium-term	Site-specific	Low - negative	Slightly detrimental	Certain	Low - negative	• Stripping at correct depth to ensure removal and stockpiling of only high quality topsoil to combat hardsetting and compaction as far as possible; • Topsoil to be stripped when the soil is dry, to reduce compaction;	Short-term	Site-specific	Low - negative	Negligible	Very likely	Very low

							• Stockpiles are to be kept to a maximum height of 6m; • Handling of stripped topsoil should be minimised to ensure soil's structure does not deteriorate; • Traffic on stockpiles should be avoided to prevent compaction. • Care should be taken to tip enough soil per square unit to reinstate the total required post-mining soil depth. • Spreading of soil over long distances, and repeated traversing of heavy mechanical equipment should be minimised in order to prevent compaction in the lower profile. The dumped soil heaps should thus only be levelled on top to reach the required soil thickness. • Caterpillar-type tracked equipment is preferred for levelling of topsoil because these tracks cause less compaction. Bowl scrapers cause enormous compaction and should not be used.						
Compaction and sterilisation of undisturbed topsoil underneath stockpiles and dumps	Long-term	Site-specific	Moderate - negative	Moderately detrimental	Certain	Moderate - negative	• Keep stockpile and dumps footprint areas as small as possible; • Stockpiles and dumps should be removed as soon as possible; • After removal of the stockpiles and dumps, 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 by the stockpiles or dumps and related activities; • Ripping should be done when the soil is dry to maximise the loosening effect of ripping and to reduce re-compaction from bulldozer tracks; • The soil should 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
Topsoil contamination with hydrocarbons and chemical compounds	Medium-term	Site-specific	Moderate - negative	Slightly detrimental	Fairly likely	Low - negative	• Prevent any spills from occurring as far as possible;	Short-term	Site-specific	Low - negative	Negligible	Fairly likely	Very low

from mechanical equipment							• 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; and • Leaking vehicles will have drip trays place under them where until repaired.						
Loss of topsoil through erosion at stockpiles, pit edges and rehabilitated areas	Long-term	Site-specific	Moderate - negative	Moderately detrimental	Very likely	Moderate - negative	• Designed post mining landforms should be modelled to establish the post mining landscape stability by using a combination of GIS and erosion modelling techniques by a suitably qualified expert • Ensure proper storm water management designs and systems are in place; • Erosion berms are to be put in place where there is a high risk of erosion; • If erosion occurs, corrective actions must be taken to minimise any further erosion from taking place; and • Stockpiled soils must be re-vegetated as soon as possible to reduce the risk of erosion.	Short-term	Site-specific	Low - negative	Negligible	Fairly likely	Very low
Cease in land capability at pit, dumps, stockpiles and infrastructure footprints during mine construction and operation	Long-term	Site-specific	Very high - negative	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 opencast mine; • Mitigation of land capability loss during decommissioning/rehabilitation phase includes: o A closure plan specifying clear targets on medium to long term post-mining land capability influencing possible land uses; o Post mining landform and slopes to be modelled to establish post mining landscape stability (erosional); o Soil quality should 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; and o 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

Cease in current land use at pit, dumps, stockpiles and infrastructure footprints during mine construction and operation	Long-term	Site-specific	Very high - negative	Highly detrimental	Certain	High - negative	• 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 opencast mine. • Mitigation of loss in current land use during decommissioning/rehabilitation phase includes: o A closure plan specifying clear targets on medium to long term post mining land capability influencing land use.	Short-term	Site-specific	Moderate - negative	Slightly detrimental	Certain	Low - negative
Cease in agricultural production at pit, dumps, stockpiles and infrastructure footprints 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 opencast mine; • Mitigation of loss in agricultural production potential during decommissioning/rehabilitation phase includes: o Closure plan specifying clear targets on medium to long term post-mining land capability to re-instate broad pre-mining land capability class (arable, rangeland); o 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
Reconstructed topography	Long-term	Local	Low – negative	Moderately detrimental	Certain	Moderate - negative	• Conduct a first order volumetric assessment to define expected overburden, topsoil and ore volumes; • Develop a dedicated conceptual post-mining landform model for the proposed open pit based on the volumetric assessment (overburden volume bilked by 25%) to ensure the integration of rehabilitation and mining activities during the planning phase; • Slopes should be 1:10 or flatter to support the proposed post mining land use; - The landform should be free draining of surface water runoff, with a drainage framework aligned with the natural catchment; • Develop the concept to detailed design level, utilize the design elevations to ensure that concurrent backfilling is to the correct levels; • Measure actual volumes throughout the LoM and maintain a LoM materials balance for the HOP;	Medium-term	Local	Low – negative	Slightly detrimental	Very likely	Low - negative

							• Utilise the volumes to inform the FRDCP closure provision and ARP provision determination.						

12.5.2. Biodiversity

Several potential risks to the receiving environment by the proposed mining operation have been identified and are presented in the sections below. An impact assessment was undertaken and the significance of each impact determined. Following the assessment of impacts, mitigation measures were developed which will aim to reduce or eliminate the significance of the identified impacts. Impacts are listed in

Table 43.

Flora

- Loss of floral habitat
  - In terms of floral habitat, the potential loss of natural and semi natural vegetation is highlighted in Figure 36 below. For the Overburden Stockpile Area Alternative 1, over 17 hectares of natural to semi natural vegetation will be lost. Overburden Stockpile Area Alternative 3, 23 hectares will be lost. However, the significance of the Riparian vegetation is much greater than the loss of the more uniform Dwaalboom representative vegetation. This type of vegetation is considered to be of Least Concern Nationally as is more abundant going westward. The individuals in a riparian community have specific adaptations for living in repeatedly flooded environments. Riparian forests provide critical habitat for migratory bird species, waterfowl (breeding and nesting areas), secretive mammals such as Serval and Leopard (providing predator protection) and a host of other species. Riparian systems also improve water quality, reduce erosion, attract beneficial insects etc.
  - Riparian vegetation captures, stores and filters pollutants in overland flow from upland sources such as salt from road network and excess fertilisers from the agricultural fields. The width, density, and structure of the riparian vegetation community are important characteristics of the buffer that also impact the level of its functionality.

Table 39 | Areas of Potential Floral Habitat Loss

	Area (ha)			
	Overburden Stockpile Area Alternative 1	Pit Area Alternative 1	Pit Area Alternative 2	Overburden Stockpile Area Alternative 3
Semi- to Natural Habitat				
Bothriochloa Hydromorphic Grass Patch	0.01			
Acacia - Zizphus (Dwaalboom) Transition Thornveld	0.47	1.53		
Cynodon Disturbed Areas	0.76			
Acacia Patches	1.35			
Acacia-Combretum Riparian Fringe	3.60			
Bothriochloa - Hibiscus Disturbed Grassland	11.01	2.45	2.45	23.41
Acacia tortilis Woodland		10.43		
Previously Farmed: *Acacia* Thornveld in Recovery		0.02		
Transformed Habitat				
Water Storage Dam	4.35			
Zea Mays Fields	27.55	21.52	24.00	
Sunflower Fields	29.11	1.07	0.19	
Soya Fields	34.43	0.40	0.25	
Transformed: Mining		0.04	0.04	9.78

- Loss of key Conservation Important (CI) species
  - From the Plants of Southern Africa (POSA) website, two listed CI species have been recorded in the 2427CB QDS, one Vulnerable and one Rare species. However, habitat potentially exists for only the Rare species *Freylinia tropica* along the Riparian Fringe. From the field assessment, no Red listed species or Protected Species (including Protected Trees) were found

during the assessment. However, this does not preclude them from being on site. If found, these may not be cut, disturbed, damaged, destroyed without obtaining a permit from Limpopo Province or a delegated authority.

- Harvesting of natural resources
  - It is possible that fauna within the study area may be subject to increased levels of poaching following the increase in daily site visitation levels. This human influx may also have an impact on the surrounding wooded vegetation through the harvesting of wood. This impact is likely to occur both within the Overburden Stockpile Alternative 3 and the riparian zone along the Crocodile River. However, due to the size and age of the trees within the riparian zone the impact would be considered more severe.
- Alien and invasive species
  - The herbaceous layer within the Riparian and *Acacia* dominated wooded areas already contains a dense layer of the CARA Category 1 rated *Achyranthes aspera*. In addition, wooded species identified along the Riparian Zone such as *Melia azedarach* and *Nicotiana glauca* could further spread if not controlled. With an increase in pollutants/nutrient loading of the Crocodile River, species such as *Eichhornia crassipes* and *Arundo donax* will increase and potentially choke certain sections of the river system (Marginal and Lower Zones). Alien and invasive plant species establishment is expected to be less severe within the Arcadia soils found in the Overburden Alternative 3 area.

Fauna

- Loss of faunal habitat
  - Of greatest significance in this regard would be the loss or degradation of the Crocodile River and associated riparian zone and wetland habitats. These habitats serve as important refugia, foraging and movement corridors for a number of wide ranging fauna in a landscape otherwise heavily transformed by crop production and mining. Conservation important species currently reliant on these habitats include Leopard, Hippopotamus and Nile Crocodile. However, the quiet well wooded backwaters and overhanging vegetation additionally provide ideal habitat for African Finfoot, Whitebacked Night-heron and Half-collared Kingfisher, all of which are highly sensitive to the loss of opening of riparian habitat and the influx of alien plant species. These habitats would be most severely impacted by Overburden Stockpile Area Alternative 1 and Pit Area Alternative 1. Pit Area Alternative 2 is only likely to impact these habitats through edge effects acting to deteriorate habitat quality through soil disturbances and an increase in alien and invasive species. In contrast, the relatively flat, dry and largely homogenous vegetation within Overburden Stockpile Area Alternative 3 provides little in terms of faunal species richness, abundance or its capacity to support conservation important species (with the exception of perhaps Yellow-throated Sandgrouse). As such the loss of this habitat is considered to be of lower significance. Regardless of the position of the pit and overburden stockpile areas suitable habitat within the core of the remaining South African population of Yellow-throated Sandgrouse will be displaced.
- Sensory disturbances to fauna
  - The Haakdoorndrift mining operation will invariably result in sensory disturbances to fauna, increasing in significance towards the Crocodile River. These disturbances may manifest themselves in the form of increased light, noise, visual stressors (from moving people and machinery) and vibrations (from machinery and blasting). Such disturbances may affect behavioural patterns and interfere with important life history patterns such as breeding, lekking etc. Most sensitive to these effects are likely to be medium to large mammals (particularly carnivores) as well as large terrestrial birds. Of particular significance with regards to this project would be the adverse effects felt by Leopard, Nile Crocodile and Hippopotamus all of which are threatened species. It is likely that any activity within 200 m of the delineated riparian and floodplain wetland boundary will adversely affect these species through visual disturbances and ultimately displace them.
  - Excessive light pollution around the pit area may adversely affect nocturnal fauna (e.g. Serval, Civet, various potentially occurring CI bat species and various invertebrate species). In contrast, a certain spectrum of common and generally commensal species may be tolerant of or even attracted to such disturbances (e.g. Hadeda, House, Grey-headed and Cape Sparrows as well as Cape Serotine and Egyptian Free-tailed Bats). Light pollution poses a serious threat to flora and fauna whose growth, rest, behaviour and reproduction are influenced by night length, especially when introduced into area that currently contain limited light impact (such as the current project area). Light pollution can confuse animal navigation, alter competitive interactions, change predator-prey relations, and cause physiological harm.
- Direct faunal mortality
  - Loss or displacement of fossorial and less mobile species (e.g. snakes, burrowing lizards, frogs, terrapins, tortoises and rodents) is probable as a result of site clearing, blasting and / or continuous movement of vehicle traffic. Although not detected during the survey, both Giant and African Bullfrog occur in the greater region and therefore the possibility exists of unearthing aestivating individuals during construction/operation while dispersing frogs may enter site during the rainy season and be

subject to road kill. From the field investigations a number of faunal road kills were detected – examples are provided in Figure 73 and Figure 74 below.

Figure 73 | Water mongoose (*Atilax paludinosus*)

Figure 74 | Snouted Cobra (*Naja annulifera*)

- Alien and invasive species
  - The site is relatively devoid of feral dogs and cats, however, with an influx of people particularly with the intention to hunt, the levels of feral animals may increase with detrimental consequences for local wildlife.

Aquatic systems

- Direct loss of wetland, river and riparian habitat
  - The proposed project has the potential to result in the direct loss of wetland and riparian habitats. The extent to which it does so is largely dependent on the infrastructure alternative opted for. It is illustrated in Table 40 that the greatest potential for wetland loss would occur if Overburden Stockpile Area 1 at 31.04 ha. The findings of the wetland study in this report do, however, reveal that Overburden Stockpile Area 3 is devoid of wetlands and as such construction of the stockpile within this area, at least from a wetland perspective, is preferential. The original location for the pit area (Alternative 1) extends marginally into the wetland zone displacing 1.88 ha of wetland habitat. Following this as well as findings of the geohydrological report the eastern end of the pit was retracted behind the paleo-channel mark to give rise to Pit Alternative 2. This alternative only very marginally overlaps the floodplain depression HGM unit and its prescribed buffer zone.

Table 40 | Areas of Potential Wetland Loss

Name	Area (Ha)		
	Overburden Stockpile Area Alternative 1	Pit Area Alternative 1	Pit Area Alternative 2
Intact Riparian Vegetation	3.55	0.00	
Degraded Riparian Vegetation		0.11	
Seep	0.32		
Floodplain flat	9.20	0.05	
Floodplain depressions	17.97	1.71	0.02
Total	31.04	1.88	0.02

- Decline in surface water inputs into the Crocodile River and associated wetlands
  - The proposed project has the potential to decrease surface water inputs into a portion of the Crocodile River and associated wetland systems. However, given that base flow is the overriding factor driving these systems, surface water inputs from the site is considered to be of lower significance and has therefore not been rated in this report.
  - The Lower Crocodile is a highly water stressed sub catchment with high levels of water use and limited capacity to store water. Although a Stormwater Management Plan for the development will been compiled by redirecting clean surface water runoff back into the Crocodile River, this will inherently have implications for certain portions of the system.
- Pit dewatering consequences for the Crocodile River and associated wetlands

- Although the effects on the floodplain depression HGM unit are likely to be buffered by surface water recharge from the Crocodile, water loss from this system is direct and has significant implications for downstream biota. These loss estimates should be interpreted in light of the potential decreases in losses as a result of ceased centre-point pivot irrigation activities within the pit area.
- A decrease in water within the Crocodile River, depending on the severity could have an impact on the aquatic ecology of the Crocodile River. The expected fish and macro invertebrate species, and their level of sensitivity to changes in flow, are highlighted in Table 41 and Table 42. In terms of vegetation trees within the riparian zone utilise both surface and sub-surface water for use by the plant. An impact on the available water could therefore impact the riparian vegetation identified on site. Riparian vegetation within the ox-bow lakes of the floodplain have shown structural changes with *Acacia* species starting to dominate due to a decrease in the readily available groundwater. Should the de-watering of the pit impact the availability of water for these riparian species, it could result in a decline of the EC of the riparian vegetation and a change in vegetation structure. Most of the CIS species that use the Crocodile River and associated riparian habitat are sensitive to the loss of riparian vegetation either through the removal of indigenous vegetation, a change in vegetation structure or the encroachment of alien and invasive species.

- Deterioration in water quality of the Crocodile River and associated wetlands
  - The Crocodile River and associated riparian vegetation provides both an important habitat and movement corridor for a number CIS. Most of these species are sensitive to declines in water quality from sedimentation, erosion, pollution. Results of the water quality report estimate that the proposed activities will not contribute significantly to the overall Amandelbult mine ground water pollution plume. The main contaminants associated with this plume include nitrates and sulphates. A particular concern involves the use of contaminated groundwater from PCD1 in dust suppression activities. This introduces the potential for contamination of the river and associated wetlands particularly during high rainfall events. The other more long-term source of contamination may arise following pit decant more than a century post-closure.
  - Water discharged into the Crocodile River from the mine as a result of either surface water runoff or decant has the potential to result in a marked deterioration of water quality within the river with potentially diverse effects on the diversity of fish (Table 41) and aquatic macro-invertebrate assemblages (Table 42), and other dependent fauna (e.g. Hippopotamus and Nile Crocodile). The current monitoring undertaken by Clean Stream (2015) highlights how the current mining operations and the agricultural activities on the site are resulting in an increase in inorganic dissolved salts (salinity), a problem common to the greater sub catchment.

Table 41 | Expected fish species for the Crocodile River, Conservation Status of fish and fish species' velocity-depth and cover preference as well as sensitivity to flow and physico-chemical water quality changes

Family	Species	Common Name	Conservation Status	Velocity-depth Preference	Flow Intolerance	Cover Preference	Tolerance to physico-chemical
ANGUILLIDAE	*Anguilla mossambica*	Longfin eel	LC	FD, FS & SD	Moderately tolerant to no flow	Undercut banks Substrate	Moderately tolerant to modified WQ
CICHLIDAE	*Chetia brevis*	Orange-fringed river bream	EN	SD & SS	Tolerant to no flow	Overhanging vegetation	Moderately tolerant to modified WQ
CICHLIDAE	*Chetia flaviventris*	Canary kurper	LC	SD & SS	Tolerant to no flow	Overhanging vegetation	Tolerant to modified WQ
CICHLIDAE	*Pseudocrenilabrus philander*	Southern mouthbrooder	LC	SS	Tolerant to no flow	Overhanging vegetation Undercut banks	Tolerant to modified WQ
CICHLIDAE	*Tilapia sparrmanii*	Banded tilapia	LC	SS	Tolerant to no flow	Overhanging vegetation Aquatic macrophytes	Tolerant to modified WQ
CICHLIDAE	*Oreochromis mossambicus*	Mozambique tilapia	NT	SD & SS	Tolerant to no flow	Water column	Tolerant to modified WQ
CLARIIDAE	*Clarias gariepinus*	Sharptooth catfish	LC	SD & SS	Tolerant to no flow	None	Tolerant to modified WQ
CYPRINIDAE	*Barbus mattozi*	Bushveld papermouth	LC	SD & SS	Moderately tolerant to no flow	Substrate Aquatic macrophytes Water column	Moderately intolerant to modified WQ
CYPRINIDAE	*Barbus paludinosus*	Straightfin barb	LC	SD & SS	Moderately tolerant to no flow	Overhanging vegetation Aquatic macrophytes Water column	Tolerant to modified WQ
CYPRINIDAE	*Barbus trimaculatus*	Threespot barb	LC	SD & SS	Moderately tolerant to no flow	Overhanging vegetation	Tolerant to modified WQ
CYPRINIDAE	*Barbus unitaeniatus*	Longbeard barb	LC	SD & SS	Moderately tolerant to no flow	Overhanging vegetation	Moderately tolerant to modified WQ
CYPRINIDAE	*Labeobarbus marequensis*	Lowveld largescale yellowfish	LC	SD & SS	Moderately intolerant to no flow	Substrate Water column	Moderately tolerant to modified WQ
CYPRINIDAE	*Labeo cylindricus*	Redeye labeo	LC	FD & FS	Moderately intolerant to no flow	Substrate	Moderately intolerant to modified WQ
CYPRINIDAE	*Labeo molybdinus*	Leaden labeo	LC	FD, FS & SD	Moderately intolerant to no flow	Substrate	Moderately intolerant to modified WQ
CYPRINIDAE	*Mesobola brevianalis*	River sardine	LC	SD & SS	Tolerant to no flow	Water column	Moderately tolerant to modified WQ

Family	Species	Common Name	Conservation Status	Velocity-depth Preference	Flow Intolerance	Cover Preference	Tolerance to physico-chemical
MOCKOKIDAE	*Chiloglanis paratus*	Sawfin suckermouth	LC	FD & FS	Moderately intolerant to no flow	Substrate	Moderately intolerant to modified WQ
MOCKOKIDAE	*Chiloglanis pretoriae*	Shortspine suckermouth	LC	FD & FS	Intolerant to no flow	Substrate	Intolerant to modified WQ
MOCKOKIDAE	*Synodontis zambezensis*	Brown squeaker	LC	SD	Tolerant to no flow	Undercut banks	Moderately tolerant to modified WQ
POECILIIDAE	*Aplocheilichthys johnstoni*	Johnston's topminnow	LC	SD & SS	Tolerant to no flow	Overhanging vegetation	Moderately intolerant to modified WQ
SCHILBEIDAE	*Schilbe intermedius*	Silver butter catfish	LC	SD	Tolerant to no flow	Water column	Tolerant to modified WQ

LC = Least Concern; NT = Near Threatened (highlighted in orange); EN = Endangered (highlighted in red)
FD = Fast Deep; FS = Fast Shallow; SD = Slow Deep; SS = Slow Shallow
The families highlighted in green are sensitive to flow and WQ changes.

Table 42 | Aquatic macro-invertebrate families' sensitivity score, -class as well as sensitivity to flow and water quality changes

Family	Common Name	Sensitivity Score	Family Sensitivity Class	Flow Preference	Sensitivity to flow changes	Sensitivity to WQ changes
Aeshnidae	Hawkers & Emperors	8	Moderate	None	Low	Moderate
Atyidae	Shrimps	8	Moderate	<0.1-0.3	Low	Moderate
Calopterygidae	Dragonflies	10	Moderate	0.1-0.3	Low	Moderate
Ceratopogonidae	Biting midges	5	Low	>0.6	High	Low
Coenagrionidae	Sprites & blues	4	Low	0.3-0.6	Moderate	Low
Corduliidae	Cruisers	8	Moderate	0.1-0.3	Moderate	Moderate
Ecnomidae	Caddisflies	8	Moderate	0.1-0.3	Very high	Moderate
Elmidae	Riffle beetles	8	Moderate	0.3-0.6	High	Moderate
Gomphidae	Clubtails	6	Moderate	0.3-0.6	Moderate	Moderate
Gerridae	Pond skaters	5	Low	<0.1	High	Moderate
Gyrinidae	Whirligig beetles	5	Low	>0.6	Moderate	Low
Hydracarina	Water mites	8	Moderate	0.3-0.6	Low	Moderate
Hydrometridae	Water measures	6	Moderate	<0.1	High	Moderate
Hydropsychidae 1sp	Caddisflies	4	Low	>0.6	High	Low
Leptoceridae	Caddisflies	6	Moderate	0.3-0.6	Moderate	Low
Lestidae	Emerald damselflies	8	Moderate	<0.1	Very high	Moderate

Family	Common Name	Sensitivity Score	Family Sensitivity Class	Flow Preference	Sensitivity to flow changes	Sensitivity to WQ changes
Libellulidae	Darters	4	Low	0.3-0.6	Moderate	Low
Muscidae	House flies	1	Low	>0.6	High	None
Naucoridae	Creeping water bug	7	Moderate	0.3-0.6	Moderate	Low
Potamonautidae	Crabs	3	Low	0.3-0.6	Moderate	None
Polymitarcyidae	Pale burrowers	10	Moderate	>0.6	Moderate	Moderate
Simuliidae	Blackflies	5	Low	>0.6	High	Low
Turbellaria,	Flatworms	3	Low	0.3-0.6; >0.6	High	None
Unionidae	Perly mussels	6	Low	0.1-0.3	Moderate	Low
Veliidae	Ripple bugs	5	Low	<0.1	Very high	Moderate
The families highlighted in green are very sensitive to flow changes.						

Table 43 | Flora, fauna, and aquatic system-impacts and risks

Impacts	Pre-mitigation:						Recommended Mitigations	Post-mitigation:					
	Duration	Extent	Intensity	Consequence	Probability	Significance		Duration	Extent	Intensity	Consequence	Probability	Significance
Loss of floral habitat													
Overburden Stockpile Area Preferred (Alt 3)	Long-term	Local	Moderate - negative	Moderately detrimental	Certain	High - negative	The main mitigation for this Impact would be that the preferred options - Pit Area Alternative 2 and Overburden Stockpile Area Alternative 3, are selected for development. In addition: ■ Excavation of the pit and any other disturbances should avoid encroaching into the Riparian Zone and associated buffer. ■ The Crocodile floodplain and remaining natural Riparian and Acacia woodland should be properly managed and monitored to promote ecosystem functioning. ■ Concurrent rehabilitation of the pit must take place. ■ During mining it is recommended that the cropland within the oxbow be decommissioned and rehabilitated to as near as possible its reference riparian thicket state. A thorough rehabilitation programme, specifically for this area, involving post-closure monitoring should be implemented under the supervision of an appropriately qualified	Long-term	Site-specific	Low - negative	Slightly detrimental	Certain	Moderate - negative
Pit Area Preferred (Alt 2)	Long-term	Local	Low - negative	Moderately detrimental	Certain	Moderate - negative		Long-term	Site-specific	Low - negative	Slightly detrimental	Fairly likely	Low - negative

							ecologist, with the aim of improving the current baseline condition within the study area. Rehabilitation must involve extensive landscaping, topsoil re-introduction and seeding with indigenous, locally occurring species (including geophytic species) as well as planting of indigenous tree species. Long-term monitoring is essential to prevent establishment of alien species.						
Loss of faunal habitat													
Overburden Stockpile Area Preferred (Alt 3)	Long-term	Local	Low - negative	Moderately detrimental	Certain	Moderate - negative	Given the high number of present and potentially occurring CI species reliant on the Crocodile River and associated Riparian and wetland habitats any loss or degradation of these habitats is strongly ill-advised and should be avoided altogether. The final development footprint should exclude these habitats and a 100 m buffer off the *Acacia-Combretum* Riparian Fringe and a 50 m buffer off the floodplain depression and flats. The development footprint area should be clearly demarcated on the ground and all construction activities strictly limited to within this area. Given the relatively small scale of the proposed mining development there is considerable potential to increase the remainder of the sites' capacity to support CI species both during and post operation through appropriate land management practices. During mining it is recommended that the cropland within the oxbow be decommissioned and rehabilitated to as near as possible its reference riparian thicket state. Following decommissioning of the mine the pit and overburden areas should be appropriately rehabilitated and any future land use must remain outside the prescribed wetland buffer.	Long-term	Site-specific	Negligible	Negligible	Certain	Very low
Pit Area Preferred (Alt 2)	Long-term	Local	High - negative	Highly detrimental	Certain	High - negative		Medium-term	Site-specific	Moderate - negative	Slightly detrimental	Certain	Moderate - negative
Loss of key CI floral species													
Overburden Stockpile Area Preferred (Alt 3)	Long-term	Local	Low - negative	Moderately detrimental	Fairly likely	Low - negative	■ The main mitigation would be that the preferred options - Pit Area Alternative 2 and Overburden Stockpile Area Alternative 3, are selected for development. If this is the case the potential for CI species destruction would be greatly reduced and the project will remain outside of the sensitive riparian zone. ■ Any Protected floral and faunal species will require permits for destruction/translocation.	Long-term	Site-specific	Low - negative	Slightly detrimental	Unlikely	Very low
Pit Area Preferred (Alt 2)	Long-term	Local	Low - negative	Moderately detrimental	Fairly likely	Low - negative		Long-term	Site-specific	Low - negative	Slightly detrimental	Unlikely	Very low
Sensory Disturbances to Fauna													

Overburden Stockpile Area Preferred (Alt 3)	Medium-term	Local	Moderate - negative	Moderately detrimental	Certain	Moderate - negative	The main aim should be to minimise sensory disturbance to faunal communities. This may be achieved by limiting all activities to within the project footprint, minimising the effects of light pollution on nocturnal fauna and ensuring lighting is kept to an absolute minimum. The pit area should be fenced and access to the river strictly prohibited. All outdoor lights should be fitted with hoods and angled downwards (low beam angle not exceeding 90° above horizontal). Avoid lights with high UV content such as metal halide or mercury light sources (blue-white short wavelength lights). These are very attractive to insects and are known to have a significant negative effect on them (and consequently bats). Instead opt for bulbs emitting warm (long wavelength) yellow-red light. It is also possible to use UV filters or glass housings on lamps to filter out UV. Hippopotamus and Nile Crocodile represent good indicators for biodiversity monitoring efforts and therefore it is recommended that a monitoring programme using these indicator species be implemented throughout the life of the mine. The rehabilitation of the cropland within the oxbow will drastically aid in lessening the effects of sensory disturbance on these species.	Medium-term	Local	Low - negative	Slightly detrimental	Very likely	Low - negative
Pit Area Preferred (Alt 2)	Medium-term	Local	High - negative	Moderately detrimental	Certain	High - negative		Medium-term	Local	High - negative	Moderately detrimental	Very likely	Moderate - negative
Direct faunal mortality													
Overburden Stockpile Area Preferred (Alt 3)	Medium-term	Local	Low - negative	Slightly detrimental	Very likely	Low - negative	▪ Construction activities should be timed to start (and preferably end) during winter, when activity levels and the presence of breeding (particularly Sandgrouse) and migratory species are lowest. Bullfrogs are, however, a concern in this regard as overwintering individuals may be unearthed during construction activities in winter. ▪ To decrease road kill incidents on site, speed regulation measures (e.g. signs and speed humps) should be implemented and enforced. ▪ Relocation efforts are of limited value in the pit area as most of the available habitat has already been transformed for agricultural purposes.	Medium-term	Local	Negligible	Negligible	Fairly likely	Very low

Pit Area Preferred (Alt 2)	Medium-term	Local	Low - negative	Slightly detrimental	Very likely	Low - negative	■ The operations footprint should be fenced to reduce the chances of fauna either falling into the pit or making their way into the operational area. ■ It is also important to ensure that policies and procedures are in place regarding the handling and removal of fauna encountered on site. To this end ensure that staff are trained and properly equipped to safely handle fauna (particularly snakes and bullfrogs) or that the services of a trained professional are readily available on call. ■ The mine must make all staff and contractors aware of the importance of local biodiversity. ■ This should be orchestrated by the Environmental Officer (EO), and could be achieved during inductions, training courses and with posters, pamphlets and presentations which highlight: – the mine's environmental commitments; – local ecosystems and ecosystem services; – local flora and fauna including: – CI species, especially those that are vulnerable to collision with traffic, such as the Serval, Giant Bullfrog, etc.; – CI and non-CI taxa that are harvested, feared or persecuted for cultural or other reasons, such as medicinal plants, mammalian carnivores, owls, snakes, etc. – snakes, scorpions and spiders, and how to handle bites or stings from venomous species; and – faunal ecosystem services and keystone taxa, such as insect pest control by bats, rodent pest control by snakes, and plant pollination by bees.	Medium-term	Local	Negligible	Negligible	Fairly likely	Very low
Harvesting of natural resources													
Overburden Stockpile Area	Medium-term	Local	Moderate - negative	Moderately detrimental	Fairly likely	Low - negative	■ To limit the potential increase in poaching of fauna it is recommended that the mine prohibit access to areas	Medium-term	Local	Low - negative	Slightly detrimental	Unlikely	Very low

Preferred (Alt 3)							outside the operational area, particularly the Crocodile River.						
Pit Area Preferred (Alt 2)	Medium-term	Local	Moderate - negative	Moderately detrimental	Fairly likely	Low - negative	▪ Educate staff on prohibited actions involving the utilisation of wildlife (i.e. poaching / harvesting) through training and notices. ▪ All fence lines should be routinely walked to remove snares.	Medium-term	Local	Low - negative	Slightly detrimental	Unlikely	Very low
Alien and Invasive Species													
Overburden Stockpile Area Preferred (Alt 3)	Long-term	Local	Moderate - negative	Moderately detrimental	Very likely	Moderate - negative	An Alien and Invasive Management Plan should be developed for the project or if Amandelbult has an existing plan, it will need to be updated within this area and approved by the relevant government departments. If no assessment exists, a detailed assessment of alien species within the greater study area, their density and distributions should form the baseline. Preventing the introduction of alien invasive species is the cheapest, most effective and most preferred option and warrants the highest priority. Furthermore the following is recommended: ▪ Rehabilitation materials should be sourced from reliable suppliers that can certify the absence of weed specimens in their materials (although this is extremely difficult to manage it does have an effect on introductions into the area). ▪ The EO and staff in general should be made aware of existing and potentially occurring alien species on site. If any alien species are seen emerging, the EO on site must be able to identify and remove these. Of particular importance is the floodplain and riparian zones to which Category 1 infestations are present. ▪ The intentional introduction of an alien plant species should not be considered for any screening effects or for stabilising, rehabilitation etc. Indigenous alternatives should be considered suitable for the purposes for which the introduction is required.	Medium-term	Local	Low - negative	Slightly detrimental	Fairly likely	Low - negative
Pit Area Preferred (Alt 2)	Long-term	Local	High - negative	Highly detrimental	Very likely	High - negative		Medium-term	Local	Low - negative	Slightly detrimental	Very likely	Low - negative

							▪ Introductions of dogs and cats should be prohibited and steps should be taken to control any infestations of feral or alien animals which may arise. ▪ Develop and implement an incident reporting system and effective communication channels with I&APs.						
Direct loss of wetland, river and riparian habitat													
Pit Area Preferred (Alt 2)	Long-term	Local	Moderate - negative	Moderately detrimental	Very likely	Moderate - negative		Long-term	Site-specific	Moderate - negative	Moderately detrimental	Fairly likely	Low - negative
Pit dewatering; consequence for the Crocodile River and associated wetlands													
Pit Area Preferred (Alt 2)	Long-term	Regional	High - negative	Highly detrimental	Fairly likely	Moderate - negative	▪ Stormwater management should be developed and implemented. All clean surface water runoff must be redirected into the Crocodile River. All dirty surface water runoff must be treated and discharged back into the Crocodile River immediately downstream of the pit. ▪ Water abstracted for de-watering must be sent to a Water Treatment Facility and returned to the receiving environment under the requirements of the Resource Quality Objectives (RQOs) or if these have not been set then the Target Water Quality Range for the protection of the receiving environment. If a WULA is a requirement, the requirements of the Reserve Determination must also be taken into consideration in terms of volume and timing of releases. ▪ Annual monitoring of the PES (using VEGRAI) and Eco-system services of the Crocodile River is required. ▪ The flow within the Crocodile River should be monitored prior to construction and during the operational and closure phases of the mine. The minimum flow requirements, as per the reserve determination, must be met. ▪ No untreated water should enter the receiving environment. It is assumed that water that is pumped into the river will be treated and sterile and should therefore be	Long-term	Regional	Moderate - negative	Highly detrimental	Fairly likely	Moderate - negative

							released slowly (ideally through a natural filtering process, attenuation features) into the receiving river.						
Deterioration in water quality of the Crocodile River and associated wetlands													
Overburden Stockpile Area Preferred (Alt 3)	Short-term	Site-specific	Low - negative	Negligible	Fairly likely	Very low	▪ Any activity impacting on a watercourse, or associated buffer, should only occur after authorisation by the relevant authorities. ▪ Contain all dirty water within the pit during the operational phase and manage in accordance with the Amandelbult dirty water management plans. ▪ Regularly check vehicles, machinery and equipment operating on site to ensure that none have leaks or cause spills of oil, diesel, grease or hydraulic fluid. ▪ No untreated water should enter the receiving environment. ▪ It is highly recommended that water released into the receiving environment must comply with the RQO or if these have not been set then the TWQR (DWAF, 1996) for the protection of the receiving environment. ▪ It is assumed that water is treated before being pumped into the river and should be released slowly through attenuation structures into the receiving river. ▪ Prevent dirty water runoff from leaving the general mining area. ▪ The pit must be filled and rehabilitated using sound engineering principles to prevent ground and surface water contamination. ▪ Monthly surface water quality monitoring on the Crocodile River must be conducted and the results interpreted in light of previous water and biomonitoring studies of the system. ▪ If significant changes occur in WQ, the cause must be investigated and rectified immediately.	Short-term	Site-specific	Low - negative	Negligible	Unlikely	Very low
Pit Area Preferred (Alt 2)	Medium-term	Local	Very high - negative	Highly detrimental	Fairly likely	Moderate - negative		Long-term	Local	Moderate - negative	Moderately detrimental	Fairly likely	Low - negative

							■ Diatoms are also a good indicator of water quality conditions and could be used in addition to water quality. ■ It is highly recommended that the biomonitoring of the habitat, macro-invertebrates and fish communities should be determined bi-annually up and downstream of the study area. ■ Monitoring should also include vegetation monitoring along the floodplain. ■ Implement groundwater monitoring.						

12.5.3. Groundwater resources

Groundwater level impacts

Groundwater levels are expected to decrease within the immediate vicinity of the opencast pit as a result of pit dewatering. The degree of aquifer dewatering depends on the extent and depth of the opencast pits below the local groundwater level as well as the hydraulic properties of the aquifer host rock.

Pit dewatering (from in-pit sumps) will occur whenever necessary to ensure dry and safe mining conditions. Groundwater will flow radially inwards to the pit void created below the water table. Therefore, groundwater contamination of surrounding users is not expected to take place while the mine is still operational. Contamination is only expected to migrate in the downgradient groundwater flow directions after water levels have recovered from the impacts of pit dewatering, long after mining/dewatering has ceased (Groundwater Complete, 2017). Thus, the impact rating is focused on the impacts associated with the pit dewatering, thus on groundwater level impacts. The rating of potential impacts on groundwater levels is provided in Table 47.

Groundwater flow impacts

A numerical groundwater model (Processing Modflow 8) was employed to simulate the potential impacts of the HOP on the interacting aquifer systems underlying the site (Groundwater Complete, 2017). Detailed parameters and dimensions used in the construction of the model are described in the Groundwater Complete report, attached in Appendix 7. Simulated groundwater levels were exported from the flow model to construct simulated depression cones for the pre-mining, mining, and post-mining scenarios.

An increase in transmissivity will lead to an increase in the radius of influence (extent of depression cone), while the opposite holds true for aquifer storativity. Where the pit intersects transmissive geological structures (Figure 31), the groundwater level impacts (depression cone extent) will be extended. The pit void causes dewatering of the aquifer down to the deepest point in the pit floor. An increase in mining depth below the water table will consequently lead to an increase in groundwater level drawdown because of the increased flow gradient. However, the generally low transmissivity of the deeper fractured rock aquifer will restrict the formation of a drawdown cone, which will in turn limit water level impacts.

Simulations of historical impacts

Extensive underground mining of the MER and UG2 reefs has been ongoing for at least 40 years. Mine dewatering during this time period has caused water levels in the deep fractured rock aquifer to decrease to the elevation of the lowest mine level. Very little interaction occurs between the deep- and shallow aquifer as groundwater monitoring information collected during the past seven years has shown only minor decreasing water level trends in a few monitoring boreholes (refer to section 12.4.1 for details on the groundwater monitoring boreholes).

The model simulated depression cone in the shallow aquifer is indicated in Figure 75. The shape and extent of the depression cone is clearly influenced by the Crocodile River and Bierspruit, which feed (recharge) the shallow aquifer. This same phenomenon was simulated within the immediate vicinity of the tailings dam, which artificially recharges the underlying shallow aquifer.

Geological structures such as dykes were simulated to create aquifer compartments, effectively cutting off or isolating certain areas from the impacts of mine dewatering. Faults on the other hand, due to their high hydraulic conductivities, were simulated to act as pathways along which the impacts were extended. A maximum groundwater level drawdown of nearly 7 meters was simulated for the shallow aquifer. Groundwater monitoring information, where available, concurs with the results of the numerical flow model.

Simulations of the proposed Haakdoorndrift Opencast Project

The planned LoM of the proposed new Haakdoorndrift pit is three years, therefore, the depression cone presented in Figure 76 represents maximum groundwater level impacts after three years of active mining. During this three year period the underground mining operations remain active. The volumes of groundwater expected to discharge into the proposed new pit were also predicted with the numerical flow model and are provided in Table 44.

Please note that volumes were simulated for two possible scenarios due to aquifer heterogeneity and the possible occurrence of transmissive geological structures:

- Worst case scenario (maximum influx), i.e. pit cuts through two transmissive geological structures.

- Best case scenario (minimum influx), i.e. transmissive structures were removed from the model simulation.

Table 44 | Model simulated groundwater influx (Groundwater Complete, 2017)

Year	Best-case scenario		Worst-case scenario	
	m^3/d	l/s	m^3/d	l/s
1	200	2.2	280	3.2
2	220	2.5	310	3.6
3	330	3.8	450	5.2

The cone of depression (water level impacts) created by the dewatering of the proposed new Haakdoorndrift pit was simulated to extend along three prominent north-west by south-east trending faults that cut through the Crocodile River and proposed pit, indicated in Figure 76.

These structures form a hydraulic connection between the river and pit and are therefore expected to make a significant contribution to the influx of groundwater. This influx of water was simulated with the numerical flow model and is expected to increase from approximately 3.2 l/s by the end of the first year of mining to a maximum of ± 5.2 l/s at the end of year three (Table 43). This increase in groundwater influx coincides with the yearly pit progression, which ultimately leads to an increase in groundwater gradients towards the mine void.

The pre-mining surface water flow direction is from the higher elevation of the river head to the lower groundwater elevations in the adjacent aquifer/s, i.e. the river is a losing stream. During active opencast mining the river will continue to "lose" a portion of its water to the adjacent aquifer/s, consequently helping to alleviate the impacts of pit dewatering. However, the depression cone created by pit dewatering (Figure 76) will cause groundwater gradients to increase, while the head in the Crocodile River remains more or less unaffected. This general increase in gradients will ultimately lead to an increase in the *volume of water being lost/discharged by the Crocodile River*, as shown in Table 45:

Table 45 | Surface water discharge prior to and after the HOP (Groundwater Complete, 2017)

Surface water discharge from Crocodile River	
Pre-mining (m^3/d)	End of mine: Year 3 (m^3/d)
300	650

After mining has ceased, the discharge of surface water from the Crocodile River will gradually decrease to the pre-mining rate of approximately 300 m^3/d as groundwater levels return to pre-mining elevations. The rehabilitated pit will continue to act as a groundwater sink for as long as it takes groundwater levels to recover from the impacts of pit dewatering.

The perennial Crocodile River acts as a barrier (constant head or recharge boundary) between the proposed new Haakdoorndrift pit and groundwater users to the east of the river. Therefore, the groundwater levels in these user boreholes are expected to remain unaffected by the proposed new mining activities. The user borehole most likely to be affected by the proposed opencast mining activities is borehole LS01, which is located nearly 300 meters east of the Haakdoorndrift pit (Figure 76). This borehole was however not in use at the time of the hydrocensus. Surface water discharge from the Crocodile River into the adjacent aquifer/s helps to reduce water level impacts within the immediate vicinity of the river and the water level of user borehole LS01 is not expected to decrease by more than 2 meters (Figure 76).

One should however keep in mind that a secondary fractured rock aquifer (such as the one underlying the project area below the alluvial aquifer) is a highly complex system and is by no means homogeneous.

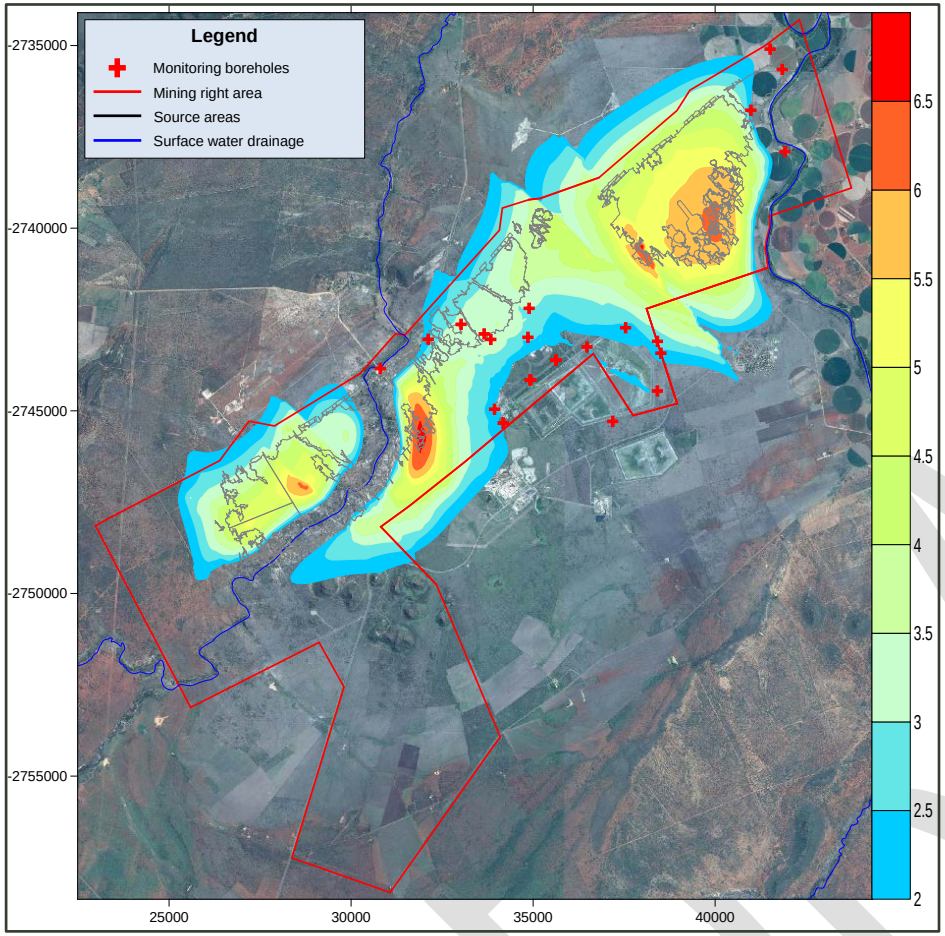


Figure 75 | Cone of depression in weathered zone/alluvial aquifer after approximately 40 years of active underground mining. The colour scale to the right of the figure represents water level drawdown in meters below surface. Red symbols on the figure indicate positions of groundwater monitoring boreholes (Groundwater Complete, 2017).

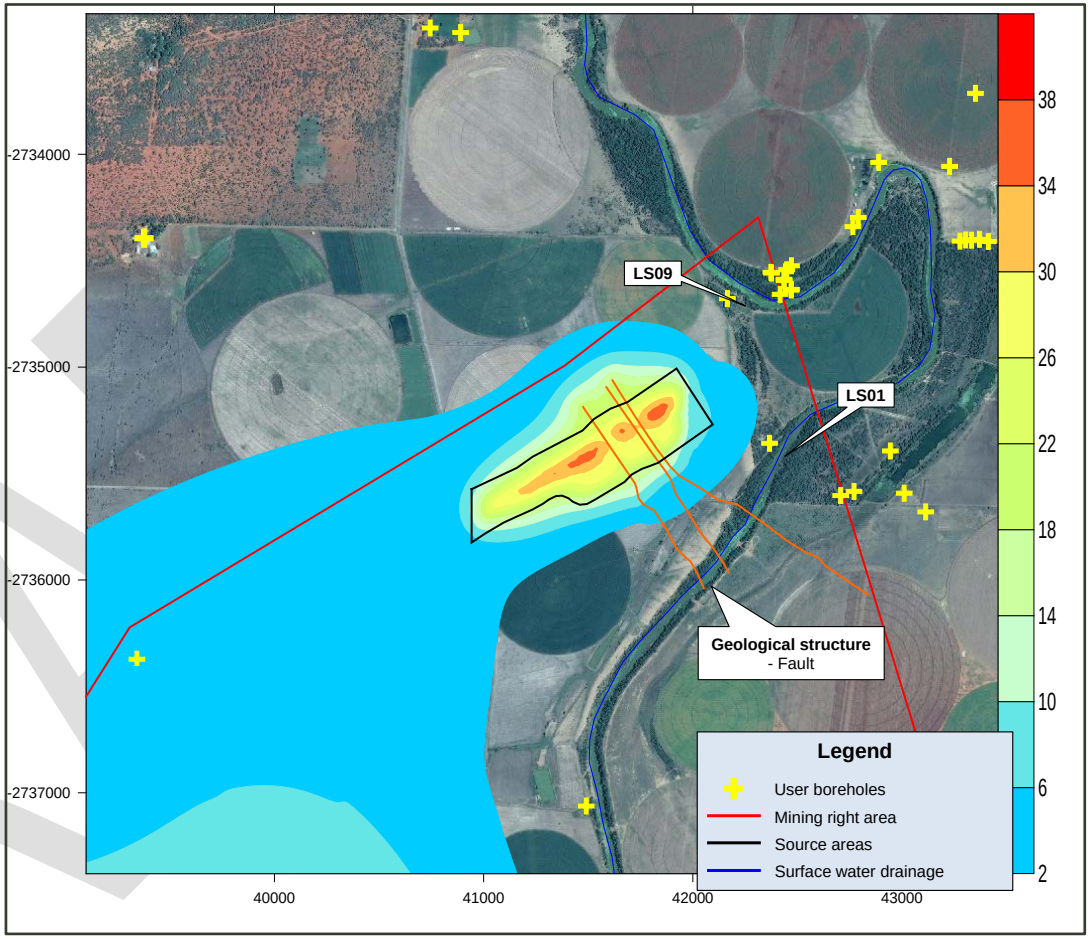


Figure 76 | Cone of depression in weathered zone/alluvial aquifer after three years of active opencast mining of the new Haakdoorndrift pit. The colour scale to the right of the figure represents water level drawdown in meters below surface. Yellow symbols on the figure indicate positions of groundwater monitoring boreholes (Groundwater Complete, 2017).

Groundwater level recovery, recharge rate and potential decant

During decommissioning, and for a certain time after closure, the geohydrological environment will dynamically attain a new equilibrium after the dewatering effects of the opencast workings. Decant predictions in an opencast mining environment is affected by the following:

- The mean annual precipitation (MAP);
- Recharge to the mine void, expressed as a percentage of the MAP. Recharge on the other hand is affected by:
  - The size of the surface area disturbed by mining activities;
  - The transmissivity of the backfill material;
  - Surface water runoff;
- The overall porosity of the rehabilitated pit area; and
- The groundwater contribution to water inflow, which is determined by the hydraulic properties of the surrounding undisturbed aquifer/s.

The groundwater gradient within a rehabilitated opencast pit is generally very close to being zero as a result of the high transmissivity of the backfill material. Decanting [5]of an opencast pit is therefore most likely to occur wherever the pit intersects the lowest surface elevation. This concept is further explained and schematically illustrated in Figure 77 by means of a conceptual cross section through a typical opencast pit. The most probable decant position is indicated in Figure 78.

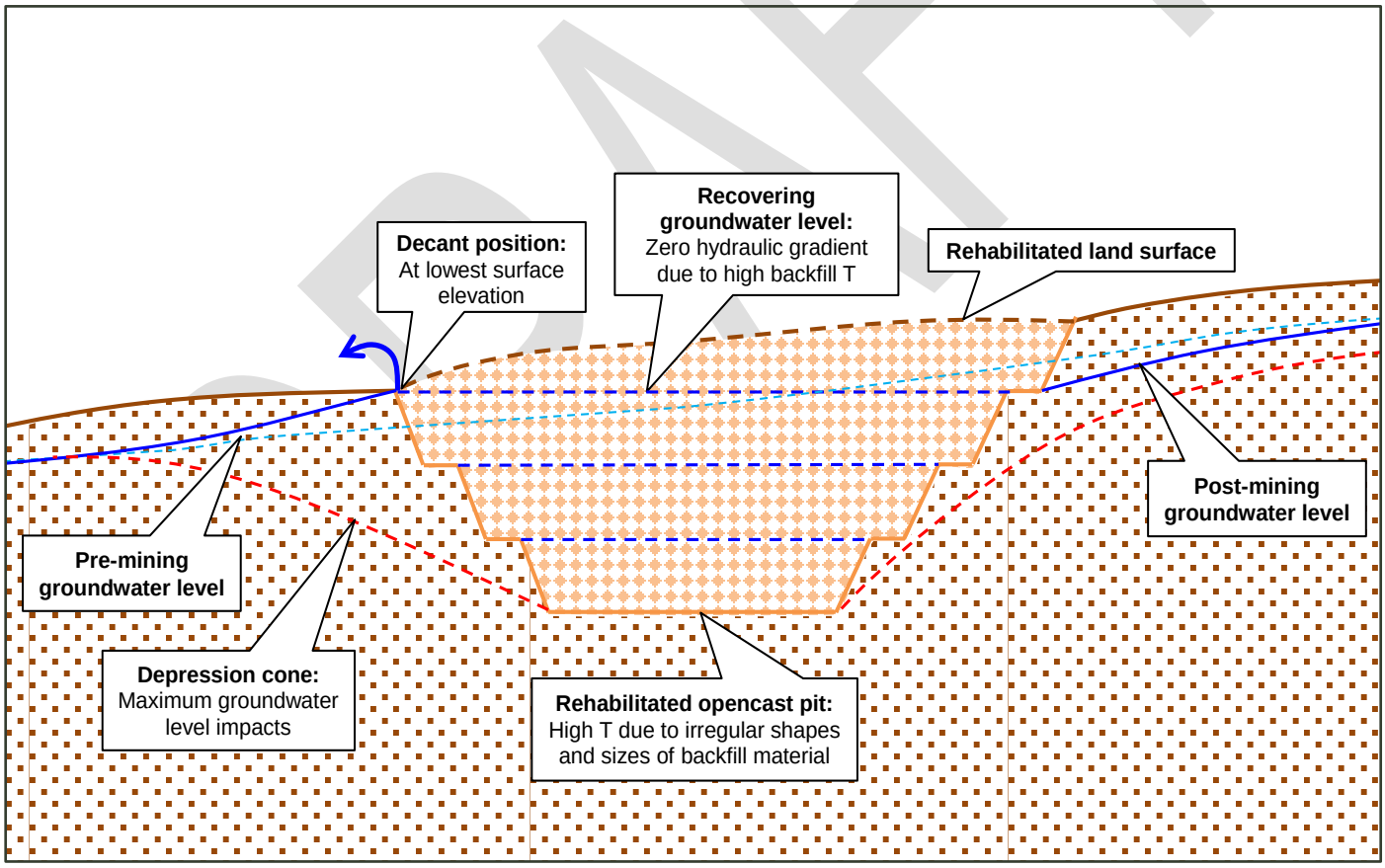


Figure 77 | Conceptual model for the decanting of an opencast mine void (Groundwater Complete, 2017).

[5] Decanting of a mine void generally occurs as a result of an excess volume of water that cannot be "absorbed" by the aquifer system (Groundwater Complete, 2017).

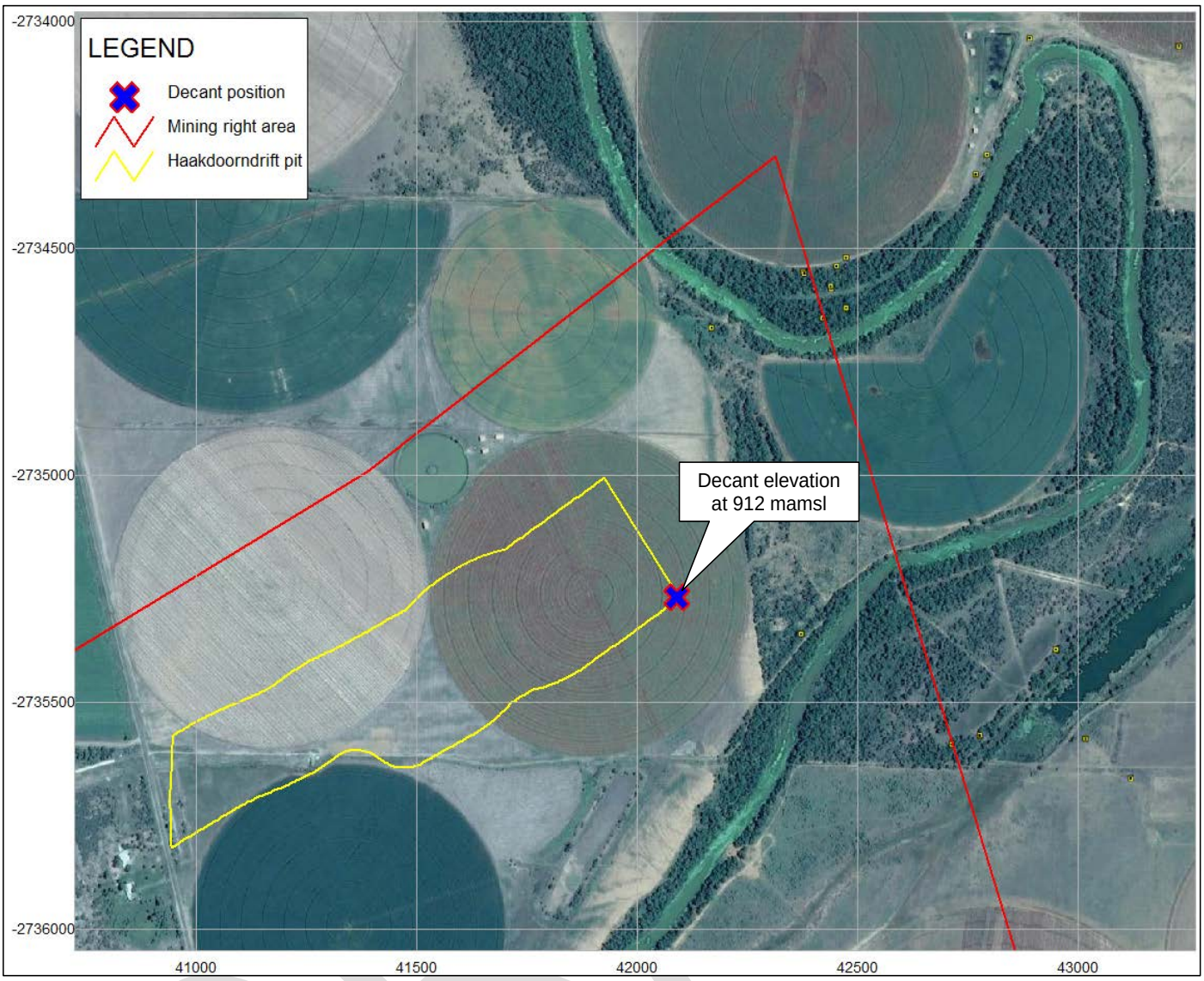


Figure 78 | Most probable decant position (Groundwater Complete, 2017).

The expected time it will take the proposed new Haakdoorndrift pit to fill with water after mine closure, was calculated with the use of volume/recharge calculations and the results are provided in Table 46.

After mining and rehabilitation (backfill, levelling of spoils, topsoil replacement and re-vegetation) the water level in the pit is expected to recover. Pools will form in the backfill material from the deepest parts of the pit. The water level is expected to exceed the pre-mining elevation due to the increase in recharge. As the water level in the backfill approaches the decant elevation, however, evapotranspiration effects will start to come into play. The evapotranspiration will increase until a new equilibrium is established where the water level in the backfill remains more or less consistent.

Decanting can however be prevented by simply controlling the water level in the rehabilitated pit. This is done by drilling a borehole into the deepest part of the rehabilitated pit, and when necessary, abstracting water from it to lower the water level and thus keeping it below the decant elevation. Another method involves leaving a void open at the decant position, which will allow evaporation to keep the water level below the decant elevation.

Table 46 | Time-to-fill calculations for the proposed Haakdoorndrift opencast pit (Groundwater Complete, 2017)

General information	Units	Haakdoorndrift Pit
Surface area	m^2	334 160
Decant elevation	mamsl	912

Total void volume	m^3	8 625 387
Mean annual rainfall	m/a	0.6
Backfilled void volume		
20% Porosity	m^3	1 725 077
25% Porosity	m^3	2 156 347
30% Porosity	m^3	2 587 616
Recharge/Decant rate		
6% Recharge	m^3/y	12 030
8% Recharge	m^3/y	16 040
10% Recharge	m^3/y	20 050
Most probable scenario (25% Ø and 8% RCH)	Years	134

Given the drive for reduced clean water consumption and water storage options, it follows from the above table that there is a real opportunity for bulk water storage in the rehabilitated Haakdoorndrift pit. After backfill there will remain void space in excess of 2.1 Mm^3 that can be used for bulk water storage.

The expected decant rate of 16 040 m^3/y (0.5 l/s) is in practice expected to be even lower due to water loss from evapotranspiration. Furthermore, the majority of pits are linked with the underground workings (by means of mining activities or transmissive geological structures), which must be flooded first before any decanting can occur.

Simulated pollution plumes

A mass transport model was run to simulate pollution migration in the aquifer system underlying the proposed new mining activities. During active opencast mining and until a new groundwater equilibrium has been reached, the mine void will act as a groundwater sink. This means that during this period potential pollution generated by the mining activities is expected to move towards the mine void and should not drain towards the immediate surroundings. Potential contaminant risk sources include:

- The rehabilitated pit is considered to be a potential source of groundwater contamination, especially nitrate contamination since backfill material is likely to be contaminated with nitrate. However, this contamination will however be restricted to the pit for as long as it acts as a groundwater sink;
- Post closure decant of poor quality water; and
- Down gradient movement of pollution plume in shallow weathered zone aquifer.

In order to better illustrate the impact of the abovementioned potential contaminant sources on the surrounding groundwater quality conditions, contamination contours were exported from the mass transport model and used to construct simulated contamination plumes. Pollution plumes provided are representative of the concentration and distribution of TDS in groundwater underlying the mining right area. Present-day pollution plumes are shown in Figure 79.

Pollution plumes during from the Haakdoorndrift Opencast Project

The planned LoM for the proposed new Haakdoorndrift pit is no more than three years. During this period no additional impacts on groundwater quality were simulated to occur as a result of the new mining activities (Groundwater Complete, 2017). The simulated pollution plumes close to the HOP-area are illustrated in Figure 80.

Pit dewatering causes local groundwater levels to decrease. Groundwater and any potential contamination occurring within this affected area will migrate towards the centre of the depression cone for as long as it takes groundwater levels to recover from the impacts of pit dewatering. It is for this reason that no plume migration was simulated for the Haakdoorndrift pit.

Plume migration is relatively slow throughout most of the mining right area (not including areas where faulting occurred). Combined with the short LoM of the proposed Haakdoorndrift pit, no significant advances in the plume footprint were simulated between stress period four and seven.

Post-closure pollution plumes

The mass transport model was run for a maximum time period of 50 years after closure of the Haakdoorndrift pit.

Contamination was simulated to continue migrating in the two down gradient groundwater flow directions. Plume migration is especially prominent along transmissive faults, which act as pathways through which flow occurs at higher rates. Contamination from the proposed new Haakdoorndrift pit, rather than migrating towards the east/south-east along two very prominent faults, was simulated to migrate towards the north-west. This plume migration pattern is in line with the conceptual model of the project area in that surface water from the Crocodile River discharges into the adjacent aquifer/s, therefore not allowing groundwater and contamination from the pit to migrate towards the east/south-east.

Pollution plumes are shown as simulated at 25 years (Figure 81) and 50 years (Figure 82) after the closure of the HOP. Yellow point marks displayed in these figures indicate the positions of groundwater user boreholes located during the hydrocensus/user survey. Note that the contamination plume simulated for the proposed Haakdoorndrift pit does not intersect any of these user boreholes, i.e. groundwater quality of user boreholes will remain unaffected by the planned new mining activities.

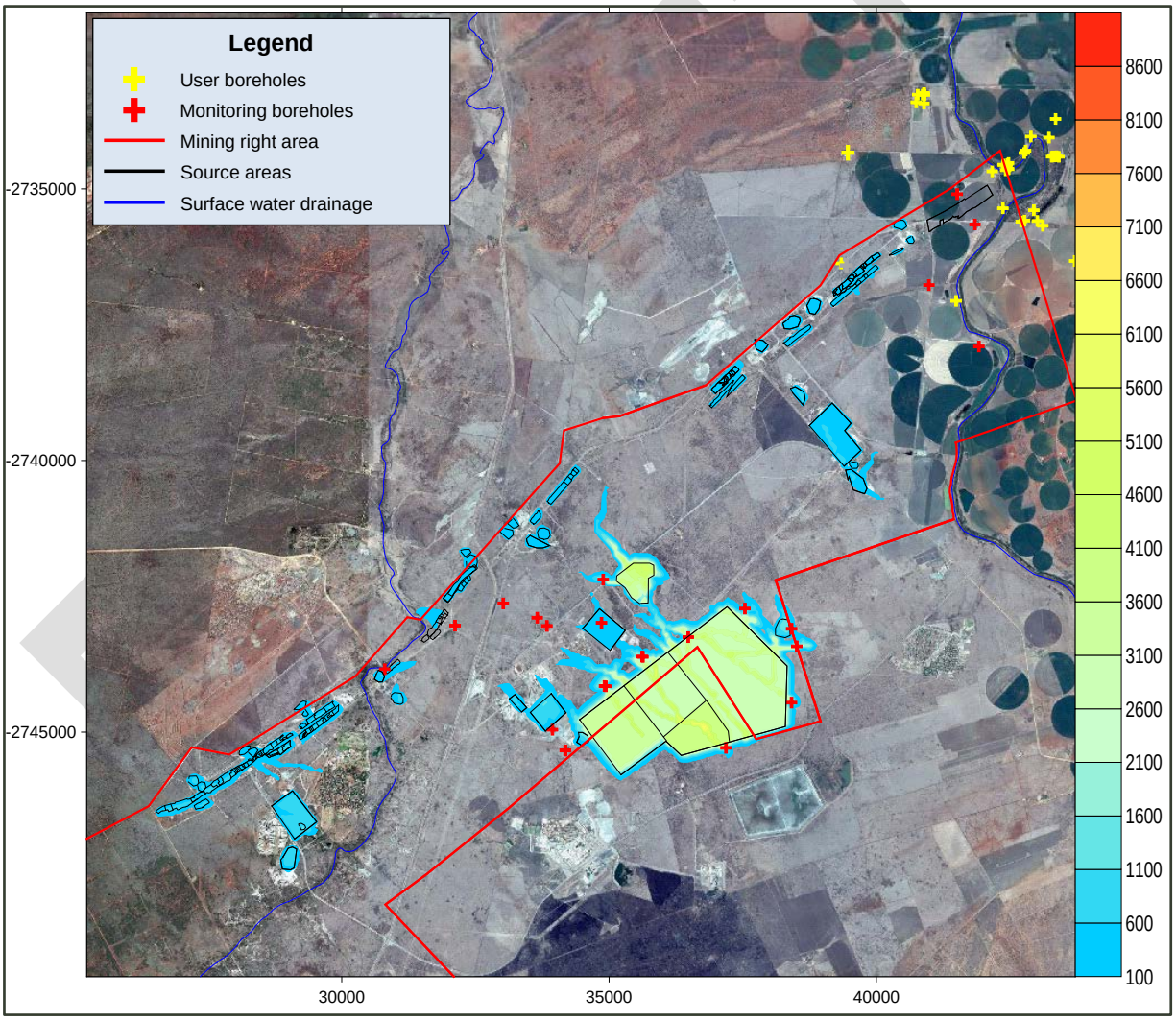


Figure 79 | Present-day simulated pollution plumes (Groundwater Complete, 2017).

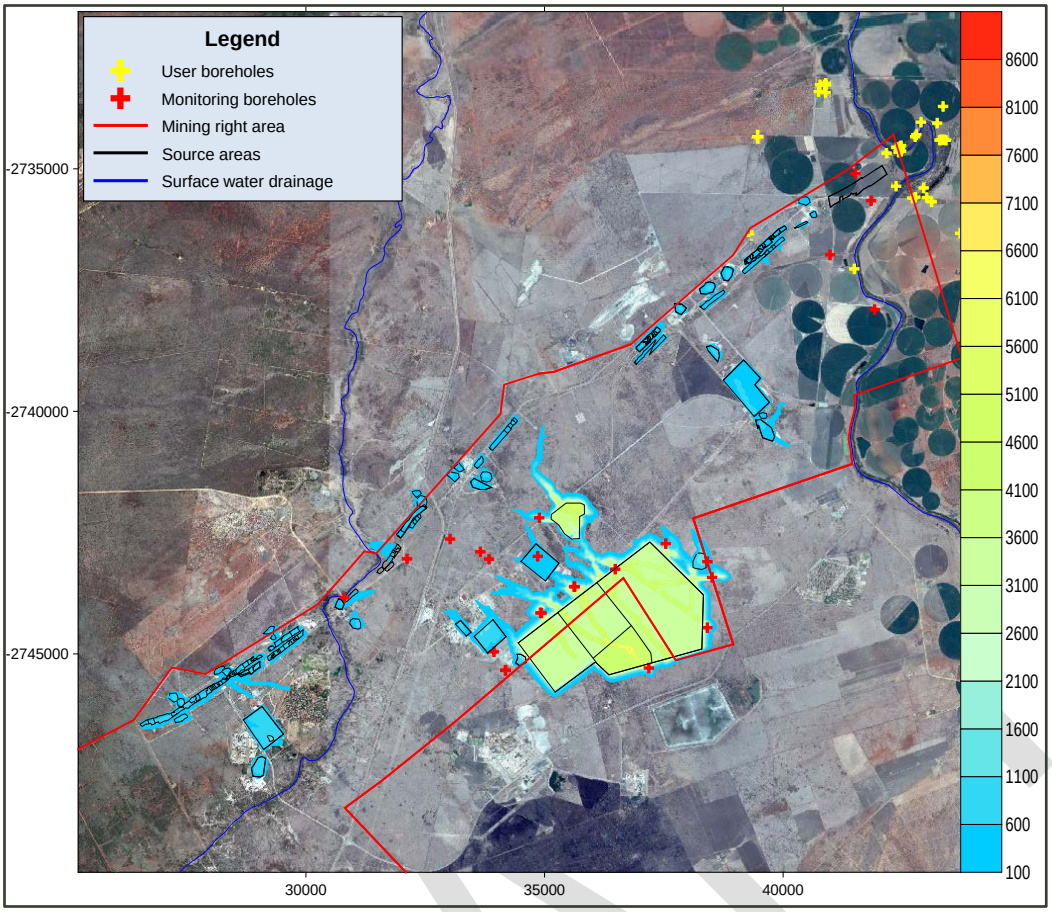


Figure 80 | Simulated pollution plumes as at closure of the Haakdoorndrift Opencast pit i.e. at the end of LoM (Groundwater Complete, 2017).

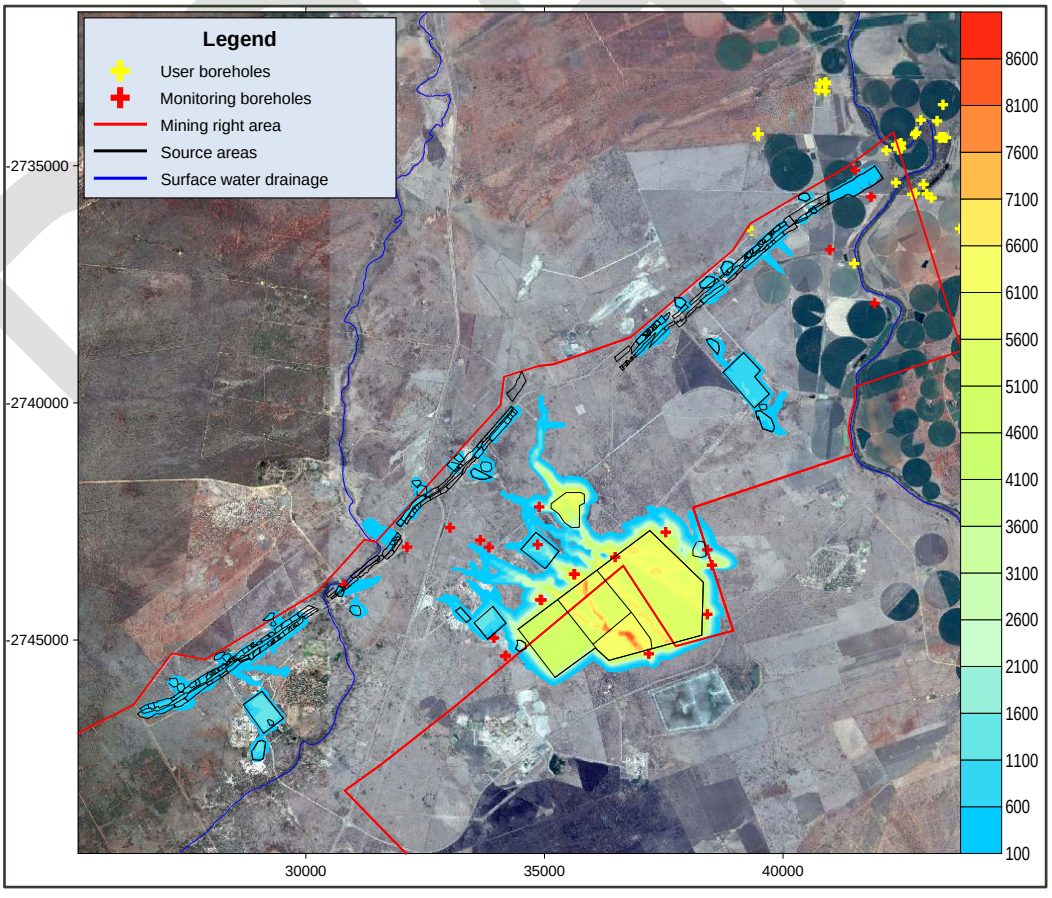


Figure 81 | Simulated pollution plumes, 25 years post-closure of the HOP (Groundwater Complete, 2017).

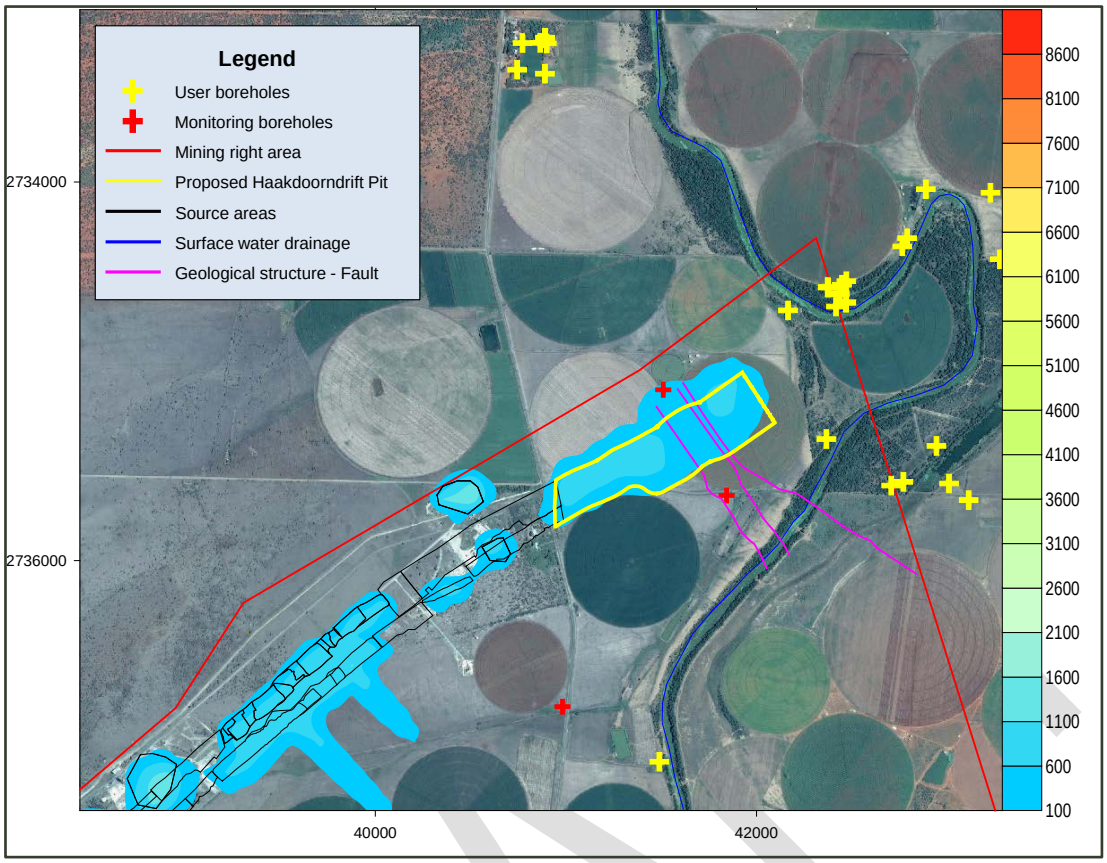


Figure 82 | Simulated pollution plumes, 50 years post-closure of the HOP (Groundwater Complete, 2017).

Conclusion

- As no water will be discharged into the Crocodile River as part of this project, water quality is not expected to be affected.
- The pit size has been reduced by approximately 250 m (or 16%) such that it no longer intersects the floodplain depression of the Crocodile River. This will reduce water flowing into the pit from the River. The amount of water flowing into the pit has been calculated as 280 m^3/day for the first year, 310 m^3/day for the second year, and 450 m^3/day for the third year under the "worst-case scenario" (Groundwater Complete, 2017).
- The perennial Crocodile River acts as a barrier (constant head or recharge boundary) between the proposed new Haakdoorndrift pit and groundwater users to the east of the river. Therefore, the groundwater levels in these user boreholes are expected to remain unaffected by the proposed new mining activities.
- The user borehole most likely to be affected by the proposed opencast mining activities is borehole LS01, which is located nearly 300 meters east of the Haakdoorndrift pit (the locations of all boreholes identified during the hydrocensus are shown in Figure 26). However, this borehole was not in use at the time of the hydrocensus (please refer to Table 12 for usage details of boreholes). Surface water discharge from the Crocodile River into the adjacent aquifer/s helps to reduce water level impacts within the immediate vicinity of the river, and the water level of user borehole LS01 is not expected to decrease by more than 2 meters.
- The worst case scenario for groundwater influx into the pit is 450 m^3/day in year three of mining, or 164,250 m^3 per annum.
- The likely abstraction in a 1.5 km radius from the pit for the purpose of irrigated agriculture (512 ha according to aerial photography) based on a conservative estimate of 5,000 m^3 per hectare per year, is 2,560,000 m^3 per year. Depending on the crop type, this figure could be up to 10,000 m^3.

If one compares the worst-case groundwater loss to the pit, it represents 6 % of the conservative irrigation usage in the vicinity of the project. Therefore, these quantities are low in comparison with water extracted from groundwater (allowed through the Crocodile River Valley Subterranean Water Control Area) River for irrigation purposes.

After mining has ceased the discharge of surface water from the Crocodile River will gradually decrease to pre-mining rates as groundwater levels return to pre-mining elevations. After rehabilitation, the pit will continue to act as a sink for both groundwater flow and mass transport for as long as it takes groundwater levels to recover from the impacts of pit dewatering.

12.5.4. Surface water impacts

The philosophy supporting the following section of the report is that if all constituents in the cumulative discharge from the Project site are within the applicable target water quality range, then the Project activities will not contribute significantly to an unacceptable cumulative impact.

The converse of this statement is not necessarily true, as different activities within the catchment may discharge different pollutants at different concentrations, and the dilution effect may mean that a constituent that is out of the target water quality range in the cumulative discharge from the Project site is within the target water quality range when the discharge is combined with the major rivers flow itself.

However, the Precautionary Principle requires that a conservative approach be taken, in this case to account for possible discharge of pollutants by future activities in the river catchment, and therefore the dilution effect of the major rivers cannot be relied upon.

Increased sediment load in the River

In the natural state of the project site, vegetation cover causes friction to rainfall runoff, reducing flow velocities and consequently shear forces between the water and the ground surface, resulting in the ground surface remaining intact and not being eroded away. If for any reason flow velocities are increased, there is potential for increased erosion to occur.

Increased erosion means that the runoff contains a higher silt or sediment load, which is discharged to the river. The sediment load contains particles fine enough to remain in suspension, 'clouding' or 'muddying' the water.

The extent of this effect can be quantified by measuring a water quality parameter, *viz*. suspended solids. If there are too many suspended solids in the water, biological life could be affected.

In addition, a changed sediment load could have similar morphological effects to the river as changing peak flow rates, such as changes in channel character or dimensions and changes to bed roughness. All of these changes could potentially affect biological life.

The following activities are likely to cause an increase in flow velocities, or directly increase erosion:

- Construction of hard-standing areas that increase run-off volumes, including roads, buildings and paved areas;
- Canalisation of runoff, particularly if canals do not discharge directly into the river; and
- Construction activities that loosen the ground surface.

Furthermore, if runoff from the overburden and ore stockpiles is uncontrolled, such runoff would likely contain a high sediment load due to the fine particles in the waste product resulting from the ore crushing process.

Impaired water quality due to pollutants discharged or dirty water runoff

- It is likely that runoff from the stockpiles will have a different chemical composition (due mainly to higher nitrate remnants from explosives) to natural runoff. In this event it is best practice to keep 'dirty' water from stockpile runoff separate from 'clean' water from natural runoff.
- Overflow of water (decant), whether surface or ground, from the pits could release water with poorer quality to the surface water environment if geochemical testing indicates water quality issues.
- Fuel or oil spills from vehicles could contaminate surface water resources. Leakages, spills or runoff from vehicle wash bays, workshop facilities, fuel depots or storage facilities of potentially polluting substances could contaminate surface water resources.

Unless proper measures are taken, dirty runoff water may enter the Crocodile River. The following areas are considered to be dirty water areas:

- Areas of materials mining and haulage including pits, haul roads, tips and loading areas;
- Areas of materials storage such as overburden and ore stockpiles; and

- Areas of potential hydrocarbon pollution, such as fuelling areas, workshops and fuel or lubricant storage areas.

Increase in the 1:100 year floodline of the Crocodile River

- Should the overburden from the pit be placed in its originally planned location below the 1:100 year floodline, this is likely to cause the floodline to enlarge in the area around and upstream of the project, thereby increasing risk of damage to property and other human activities close to the river.
- The preferred location (Alternative 3) for overburden stockpiles, located west of the district road and the 62E Decline Shaft, will not affect the floodline of the Crocodile River.
- The areas of the pit, haul road, fence and safety berm below the 1:100 year flood line of the Crocodile are not expected to affect the floodline.

Table 47 | Water resource-impacts and risks

Impact	Pre-mitigation:						Recommended Mitigation	Post-mitigation:					
	Duration	Extent	Intensity	Consequence	Probability	Significance		Duration	Extent	Intensity	Consequence	Probability	Significance
Decreased groundwater levels during pit dewatering	Long-term	Site-specific	High - negative	Moderately detrimental	Very likely	Moderate - negative	▪ A quarterly monitoring program should be implemented to monitor the extent of pit dewatering. ▪ However, the dewatering of the local aquifer system and destruction of its structure/s cannot be prevented or mitigated, hence the same significance rating pre- and post-mitigation. ▪ Implement concurrent rehabilitation to design elevations to construct a free draining post-mining landform with slopes flatter than 1:10, maximising clean surface water runoff and limiting erosion/	Long-term	Site-specific	High - negative	Moderately detrimental	Very likely	Moderate - negative
Increased sediment load in the River	Short-term	Site-specific	Moderate - negative	Slightly detrimental	Fairly likely	Low - negative	▪ Flow attenuation measures should be implemented around new hardstand areas where increased erosion is likely. ▪ Dissipating storm water measures should be constructed around areas likely to be affected by dirty runoff, such as ore- and overburden stockpiles. ▪ Clean water should be directly released into the River.	Short-term	Site-specific	Moderate - negative	Slightly detrimental	Unlikely	Very low - negative
Impaired water quality due to pollutants discharged or dirty water runoff	Short-term	Site-specific	Moderate - negative	Slightly detrimental	Fairly likely	Low - negative	▪ Contain all dirty water within the pit during the operational phase; ▪ Regularly check vehicles, machinery and equipment operating on site to ensure that none have leaks or cause spills of oil, diesel, grease or hydraulic fluid; and ▪ Prevent dirty water runoff from leaving the general mining area;	Short-term	Site-specific	Low - negative	Negligible	Unlikely	Very low - negative

Increase in the 1:100-year floodline of the Crocodile River	Short-term	Site-specific	Low - negative	Negligible	Unlikely	Very low - negative	Alternative 3 for overburden stockpile locations was selected as the preferred alternative, as it has zero risk of having an impact on the floodline. Therefore, no mitigation measures are recommended.	Short-term	Site-specific	Low - negative	Negligible	Unlikely	Very low - negative

12.5.5. Air quality

The main findings of the air quality impact study (EHRCON, 2016), aimed at describing emissions from the Haakdoorndrift opencast pit, concluded the following:

- Suspended particulates account for most emissions from the process with PM_{10} being the criteria pollutant of consequence.
- Dry deposition will most likely be a nuisance on-site and beyond the mining boundary, up to a distance of 600 m from operations.
- Dust deposition rates at the nearest sensitive receivers, will not exceed the residential action limit of 600 mg /m^2 / day.
- Deposition patterns will closely correlate opencast mining, material handling and transport activities. Fugitive emissions from exposed terrain and stockpiles will also be apparent sources of nuisance dust.
- PM_{10} concentrations above both the 24-hour and annual national standards are likely beyond the mining boundary.
- During peak pollution episodes, typically associated with hot, dry and windy conditions, excessive daily PM_{10} concentrations could be experienced up to a distance of 5 km downwind of mining operations. It is unlikely that these contraventions will top the prescribed number of four per annum at the nearest sensitive receivers.
- Cumulative annual PM_{10} concentrations will probably exceed the national standard of 40µg/m^3 up to a distance of 1.2 km from mining operations. Annual average PM_{10} concentrations are expected to be the highest near the ROM crushing operations.
- Mobile equipment, opencast mining and crushing are the most important sources of PM_{10} in this project.

Construction impacts

Construction is a source of dust emission which has a temporary impact on the local air quality. Infrastructure and road construction are the two construction activities with the highest emission potentials. The emissions associated during the construction of a building or road can be associated with land clearing, drilling and blasting, ground excavation and depending on the level of activity, the specific operation and the prevailing meteorological conditions. It has been noted that large quantities of the emissions are generated due to the traffic movement of equipment across temporary roads and around the construction site (USEPA, 1996).

The temporary nature of construction activities is what distinguishes it from other fugitive sources present within the locality. Emissions from construction activities are expected to have a definitive start and end period and will vary depending on the various construction phases. In contrast to other fugitive sources, here the emissions occur in a steady state or follow a discernible pattern. The quantity of dust emissions from construction activities is proportional to the area of land under construction (USEPA, 1996).

The impact on air quality and air pollution of fugitive dust is dependent on the quantity and drift potential of the dust particles (USEPA, 1996). Large particles settle out near the source causing a local nuisance problem. Fine particles can be dispersed over much greater distances. Fugitive dust may have significant adverse impacts such as reduced visibility, soiling of buildings and materials, reduced growth and production in vegetation and may affect sensitive areas and aesthetics. Fugitive dust can also adversely affect human health.

The following components of the environment may be impacted upon during the project construction phase:

- The ambient air quality;
- Local residents, farms and neighbouring communities; and
- The surrounding environment, including the Crocodile River, and possible the fauna and flora.

Because of the relatively short term nature of construction activities, some control measures are more cost effective than others. Wet suppression and wind speed reduction are two common methods used to control open dust sources at construction sites, because a source of water and material for wind barriers tend to be readily available at a construction site. However several other forms of dust control are available.

Operational impacts

A qualitative assessment of the operational impacts of the proposed project on the surrounding environment is discussed in this section.

In open pit mining, a massive overburden will have to be removed to reach the mineral deposits below. This may require excavators, transporters, loaders and conveyors belts which will result in a massive discharge of fine particulates from the overburden material. Similarly, normal operations will also require excavation, transportation, loading, unloading, size reduction, stock piling, etc. All of these activities will generate particulate matter (PM). Drilling and wind erosion over open and exposed surfaces are major sources of fugitive dust emissions. The source and characteristic of fugitive emissions from dust mining operations vary in each case, as do their impacts. Diesel trucks and equipment used in mining activities are also a source of PM.

Dust deposition

During mining operations, dry deposition will most likely be a nuisance on-site and beyond the mining boundary. Blasting and vehicle entrained emissions will be the most visible sources of fugitive dust. Fugitive emissions from exposed terrain, stockpiles as well as material handling operations will be other apparent sources of nuisance dust associated with the project.

Emission control tactics, such as the wetting of haul roads, must be employed to keep dust deposition within prescribed limits. Dust deposition rates in the area can be further reduced through the implementation of a combination of other control options in a focused approach.

PM_{10}

During peak pollution episodes, typically associated with hot, dry and windy conditions, excessive daily PM_{10} concentrations could be experienced downwind of mining operations. PM_{10} concentrations could also be high near the ROM crushing facility. Other important sources of PM_{10} in this project relate to material handling and fugitive emissions from exposed areas.

Relatively low PM_{10} concentrations have been associated with various health effects including increased respiratory hospital admissions, respiratory system exacerbation, coughing and, in some cases, mortality, and will therefore be investigated in detail in the EIA phase of the project.

Rehabilitation phase

The rehabilitation of the mining pits will commence when there are no further plans to mine at the site. If the rehabilitation option entailing backfilling the open pit area is selected, emissions could be generated through:

- Material handling (loading and unloading of hauling vehicles);
- Wheel generated dust from hauling vehicles (travelling from stockpile to open pit area); and
- Wind erosion.

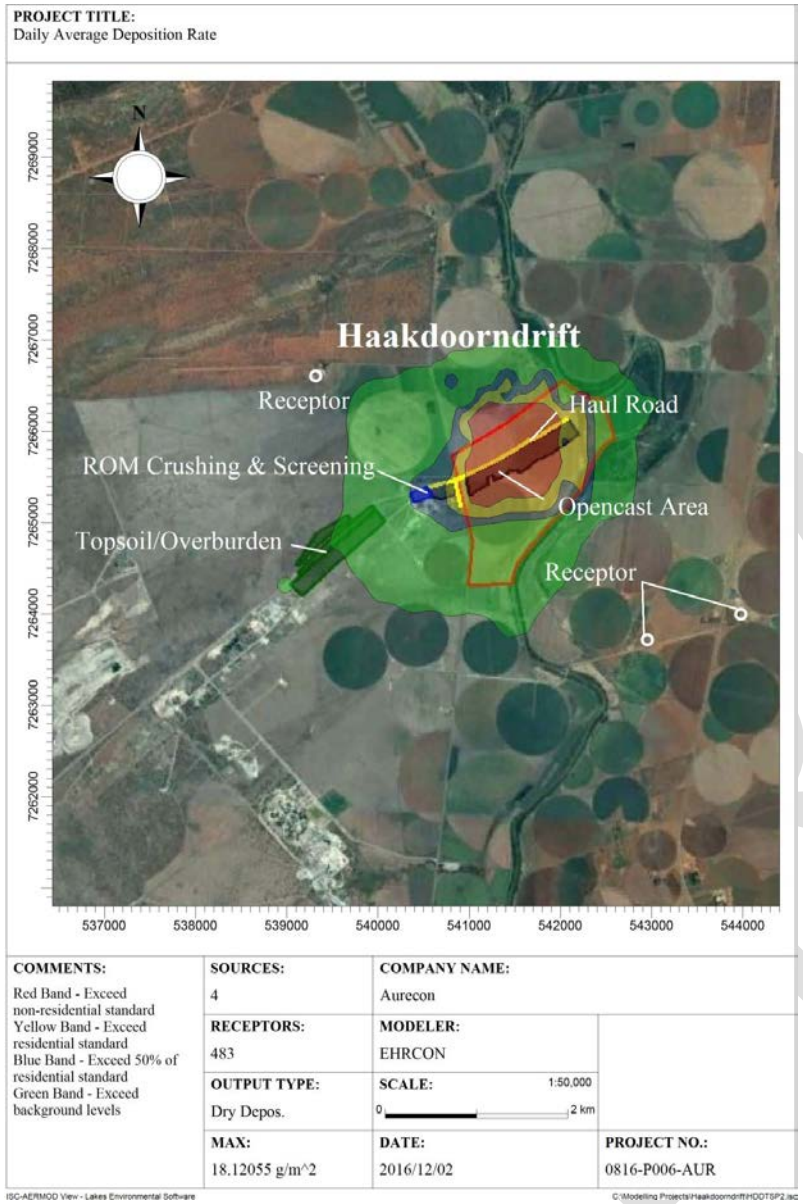


Figure 83 | Daily average dust deposition rate (EHRCON, 2016).

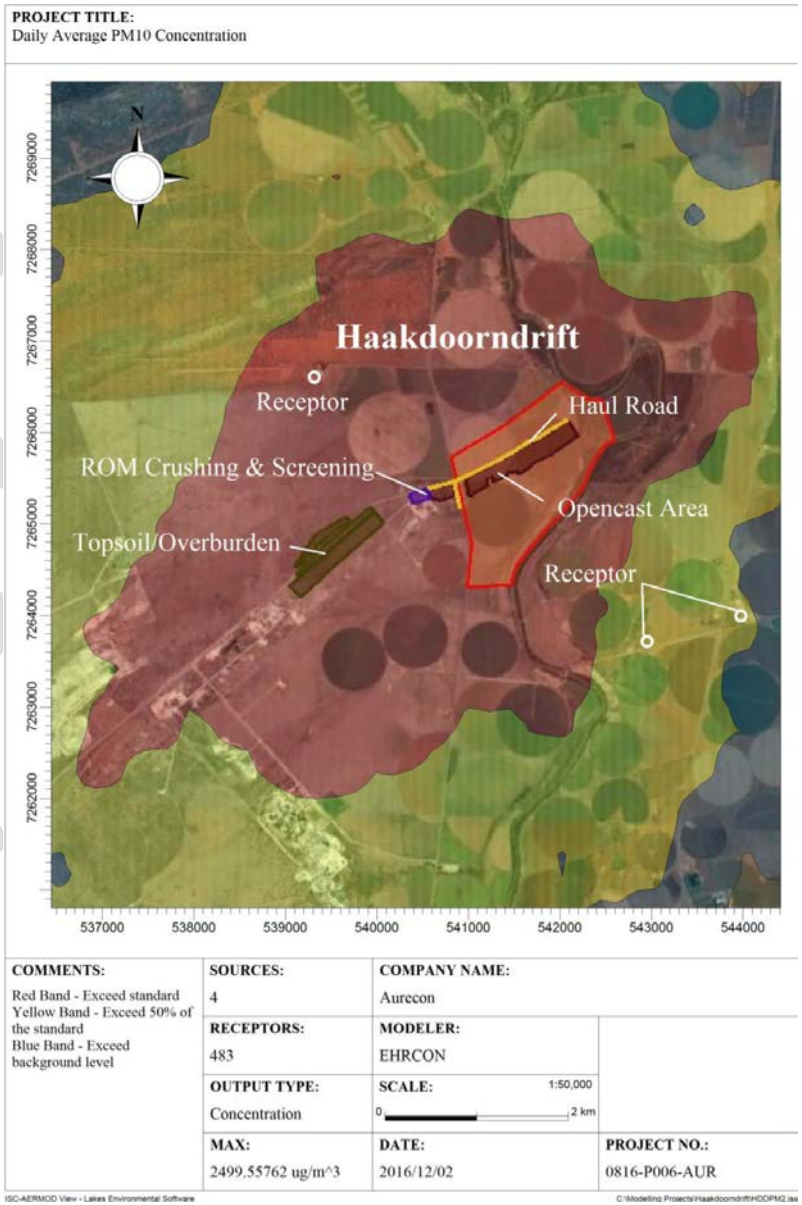


Figure 84 | Daily average PM_{10} concentration (EHRCON, 2016).

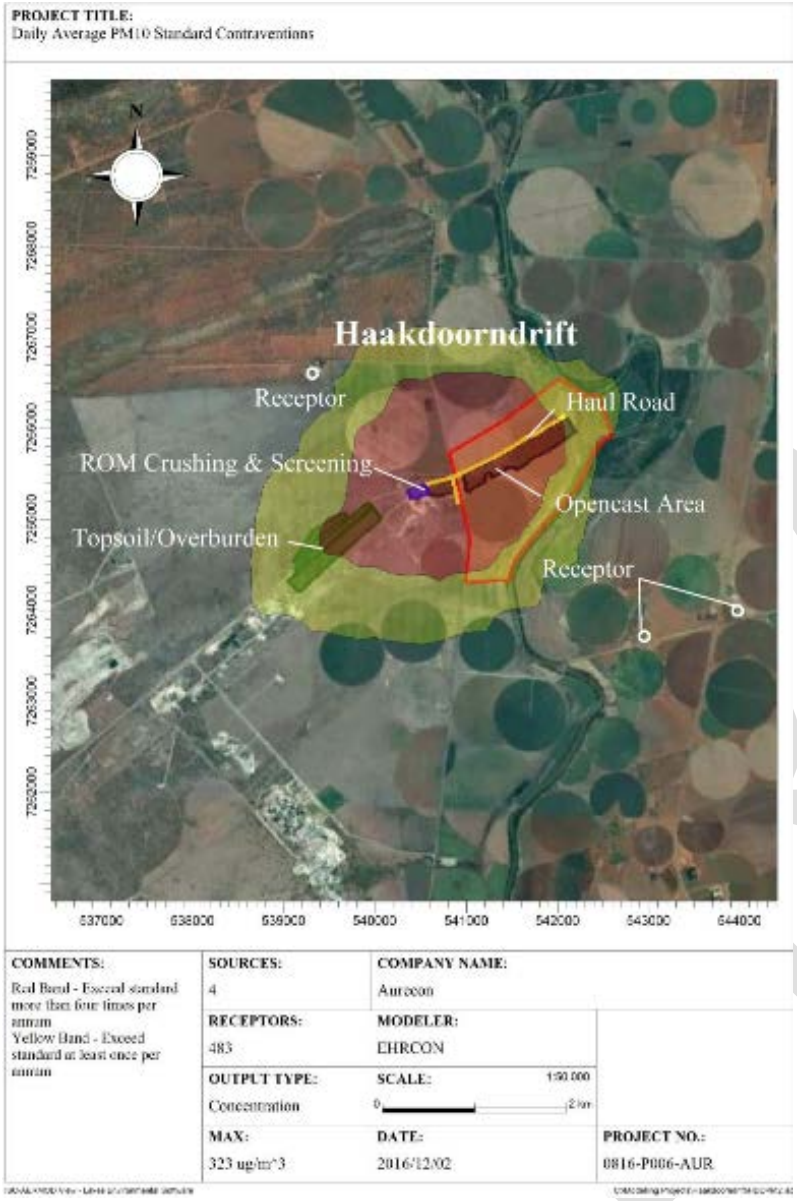


Figure 85 | Daily PM_{10} contraventions (EHRCON, 2016).

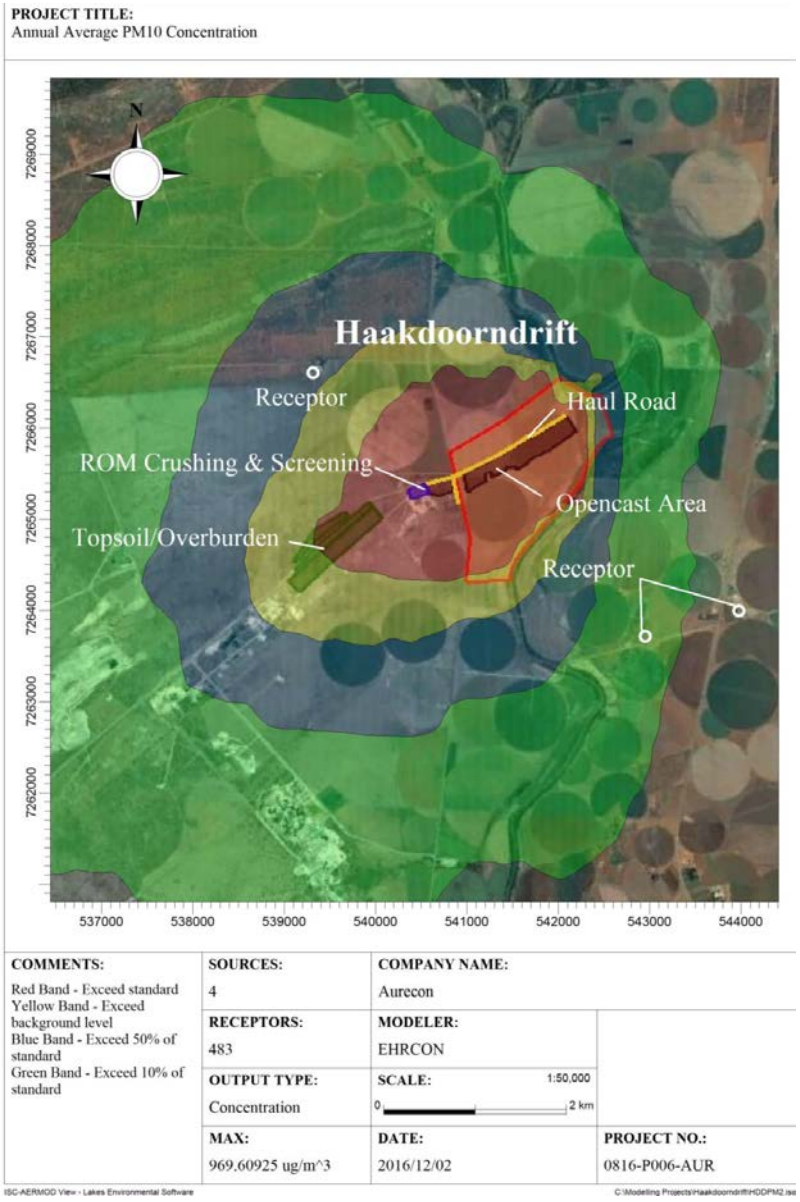


Figure 86 | Annual average PM_{10} concentration (EHRCON, 2016).

Table 48 | Air quality impacts and risks

Impact	Pre-mitigation:						Recommended Mitigation	Post mitigation:					
	Duration	Extent	Intensity	Consequence	Probability	Significance		Duration	Extent	Intensity	Consequence	Probability	Significance
Dust deposition emissions during normal operations (pre-mining, decommissioning and closure)	Short-term	Site-specific	Low - negative	Negligible	Unlikely	Very low	■ Develop and implement an incident reporting system and effective communication channels with I&APs; ■ Place dust generating activities where maximum protection can be obtained from natural features; ■ Locate dust generating activities where prevailing winds will blow dust away from the receiving community; ■ Minimise the need to transport and handle materials by placing adequate storage facilities close to processing areas; ■ Supplement natural vegetation establishment of stockpiles where required; ■ Dust control at processes and plant could be affected through installation of mechanical ventilation systems, wet suppression systems and vacuum sweeping; ■ Control techniques for fugitive dust sources, including stockpiles, generally involve watering, chemical stabilisation and the reduction of surface wind speed through the use of windbreaks and vegetation. Watering represents a commonly used, relative inexpensive option, but provides only temporary control; ■ Implement traffic control measures aimed at reducing the entrainment of material by restricting traffic volumes; ■ Reduce vehicle speeds and measures aimed at binding the surface material or enhancing moisture retention, such as wet suppression and chemical stabilisation; ■ On paved surfaces, measures aimed at reducing the extent of the source of fugitive dust include; the reduction	Short-term	Site-specific	Low - negative	Negligible	Very unlikely	Very low

Dust deposition emissions during normal operations (operation)	Short-term	Site-specific	Moderate - negative	Slightly detrimental	Unlikely	Very low	in the amount of material being handled and the elimination of track-on; ■ Where possible, pave all major haul routes. Paving is effective, but expensive and unsuitable for surfaces used by very heavy vehicles or subject to spillage of material in transport. In addition, dust control measures will usually still be required on paved surfaces. The use of gravel or slag can be moderately effective, but repeated additions are normally required; ■ Set speed limits of 40km/hr or less for site traffic on paved roads and 20km/hr on unpaved surfaces. Speed control has a linear effect on dust emissions. Thus by reducing speed from 30 to 15km/hr, emissions can be reduced by 50%; ■ Wet suppression of unpaved areas should be applied during dry windy periods, using a water car and/or sprinklers at a rate of more than 2.0l/m²/hour; ■ Chemical suppression can also be used in conjunction with wet suppression. This involves the use of chemical additives in the water, which aids the formation of a binding crust. Repeated treatment is normally required; ■ Inspect road integrity and repair frequently; ■ Provide firm marshalling areas; ■ Reduce track-on through the use of a wheel wash-bay; ■ Reduce unnecessary traffic; ■ Limit load size; ■ Minimise travelling distance through good layout and process design; ■ Limit the area of operation to what is absolutely necessary; ■ Rehabilitation should be performed on an ongoing basis;	Short-term	Site-specific	Low - negative	Negligible	Unlikely	Very low

							■ Limit the height and slope of stockpiles to reduce wind entrainment. The ideal stockpile is not higher than 3m, has a gentle slope (>45°) and has an irregular apex; ■ Ideally stockpiles should be fully enclosed; ■ Minimise drop heights onto stockpiles; and ■ Wind barriers can be effectively used to control pollution from stockpiles.						
PM_{10} emissions (pre-mining, decommissioning and closure)	Short-term	Local	Low - negative	Slightly detrimental	Unlikely	Very low	In view of the predicted ambient pollutant concentrations resulting from emissions from the Haakdoorndrift Mine the following is recommended: ■ A priority must be given to continuous monitoring of ambient dust deposition rates for the full duration of the project. Source monitoring stations should be positioned near the open cast mine, transport routes and the ROM area. Receptor monitoring stations should be positioned at representative receivers within a radius of 2 kilometres from mining operations. Dust deposition monitoring is essential to determine spatial and temporal trends, and to track progress made by control measures implemented. ■ It is imperative that a PM_{10} monitoring network be established for the Amandelbult operations. ■ An emissions inventory and annual modelling regime must be maintained throughout the life of the project.	Short-term	Site-specific	Low - negative	Negligible	Unlikely	Very low
PM_{10} emissions (operation)	Short-term	Local	Low - negative	Slightly detrimental	Fairly likely	Low - negative		Short-term	Site-specific	Low - negative	Negligible	Fairly likely	Very low

12.5.6. Ambient noise

Increased noise levels are directly linked with the various activities associated with the construction, as well as the operational phase of the activity (EAR, 2016). Noise caused by construction and operational phases is associated with various sources, including mechanical sources such as equipment operation, material impact noises (such as the noise made when materials are dropped at a height to ground level), and electrical noise (reverse hooters from equipment).

Construction of proposed open cast pits includes site clearance and overburden removal. The operational phase includes the removal of ore material.

Potential noise sources: construction phase

The potential extent of construction equipment noise depends on a number of factors, including the prevailing ambient sound levels during the instance the maximum noise event occurred, as well as the spectral character of the noise and the ambient surroundings. The potential noise sources during the construction phase are shown in Figure 87.

Development of opencast pit

The level and character of the construction noise will be highly variable as different activities with different equipment take place at different times, for different periods of time (operating cycles), in different combinations/sequences and on different parts of the construction site.

The following activities / equipment may have an impact on noise receptors close to the proposed project:

- a bulldozer, clearing vegetation with a grader and developing access roads;
- a large excavator operating in conjunction with articulated dump trucks (ADTs) loading topsoil;
- the dumping of the topsoil material at a location just outside the opencast footprint using an ADT;
- a large excavator operating in conjunction with two ADTs loading overburden;
- the dumping of the overburden material at a location just outside the opencast footprint using a ADT;
- a water dozer and drill operating close to the excavator and ADTs; and
- travelling of ADTs to and from the overburden stockpile area.

Potential noise sources: operational phase

Potential noise sources during the operational phase of the proposed mine are shown in Figure 89.

Opencast mining activities

During this phase construction activities (preparation activities in front of the opencast pit) will move ahead of the opencast area. These preparation activities will be similar to the construction phase.

Operational activities (and associated noise sources) taking place within the mining pit could include:

- Excavation of material;
- Drilling activities; and
- Hauling of ROM to the crushing plant.

Crushing activities

Noise from crushing activities can originate from:

- Trucking and stockpiling ROM.
- Crushing ROM with a mobile crusher, fed by a front-end loader.
- Loading the crushed ROM onto railway wagons every few weeks, then to the Amandelbult processing plant.

Potential noise sources: closure phase

Closure activities generally have a significantly lower noise impact than both the construction and operational phases. Closure activities are generally less intense than construction and operational activities. Noise levels are lower and frequently limited to daylight hours. Most rehabilitation takes place concurrently with mining. It is therefore just another activity generating noise that could be considered as part of the operational phase. The EMPr will advise, in detail, on noise impacts and associated mitigation measures during this phase.

Figure 87 | Potential noise sources during the construction phase (EAR, 2016).

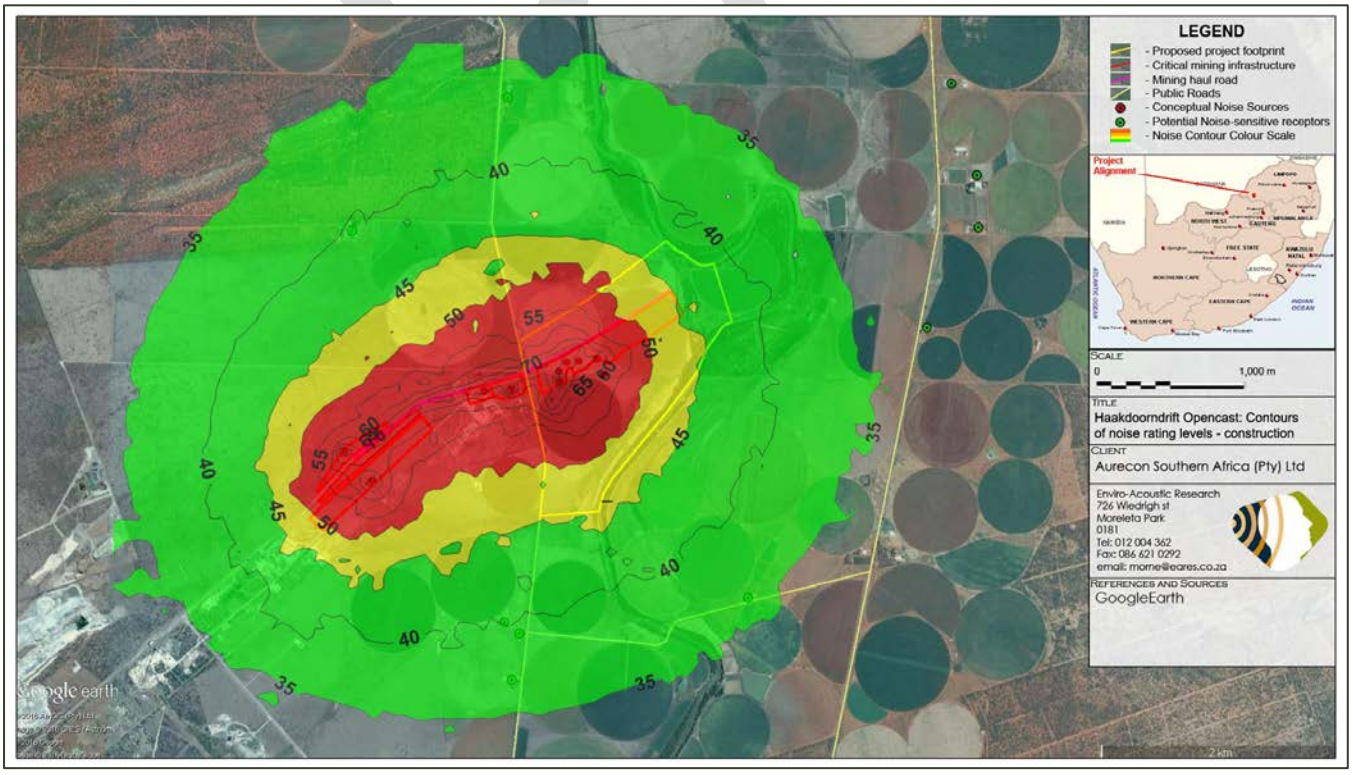


Figure 88 | Projected conceptual night-time noise rating levels during construction (EAR, 2016).

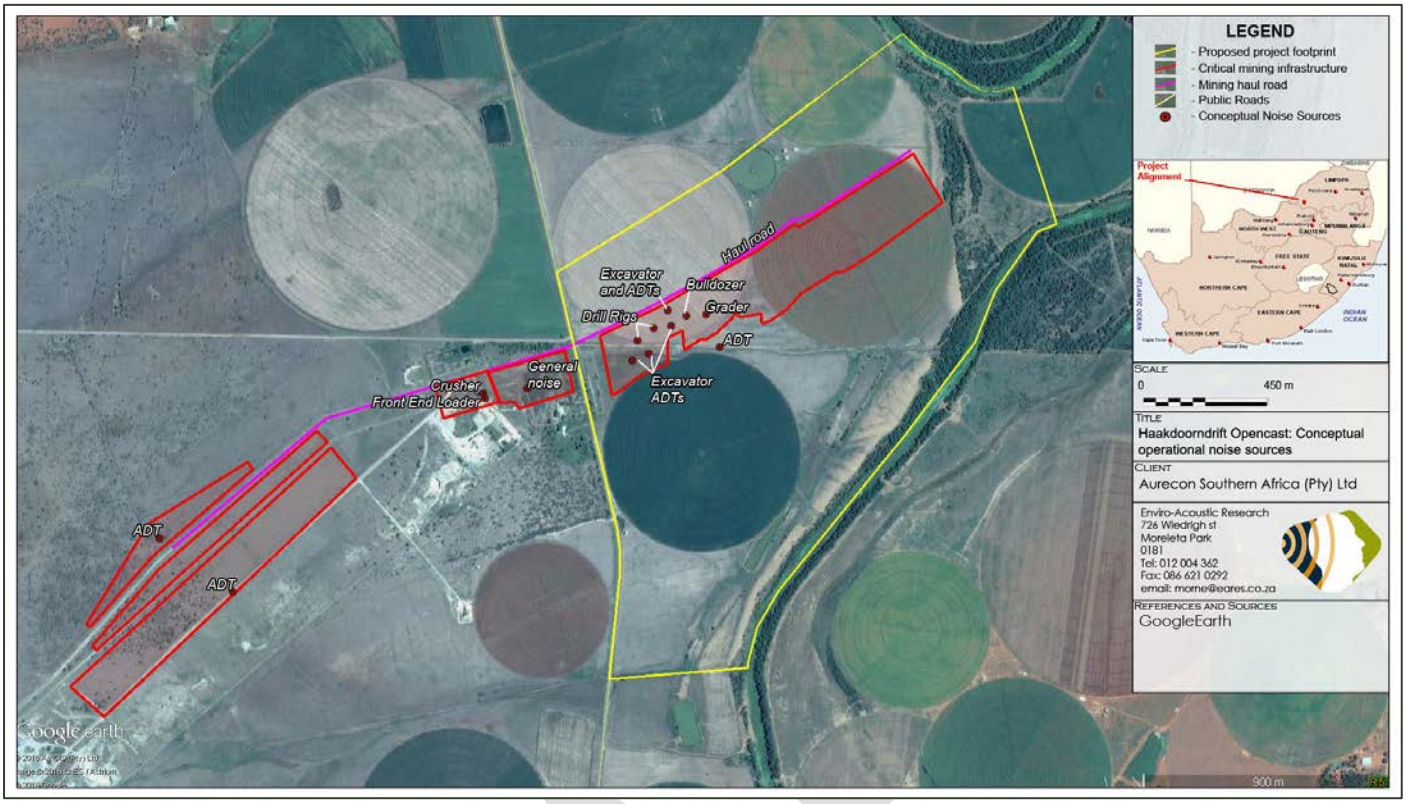


Figure 89 | Potential noise sources during the operational phase (EAR, 2016).

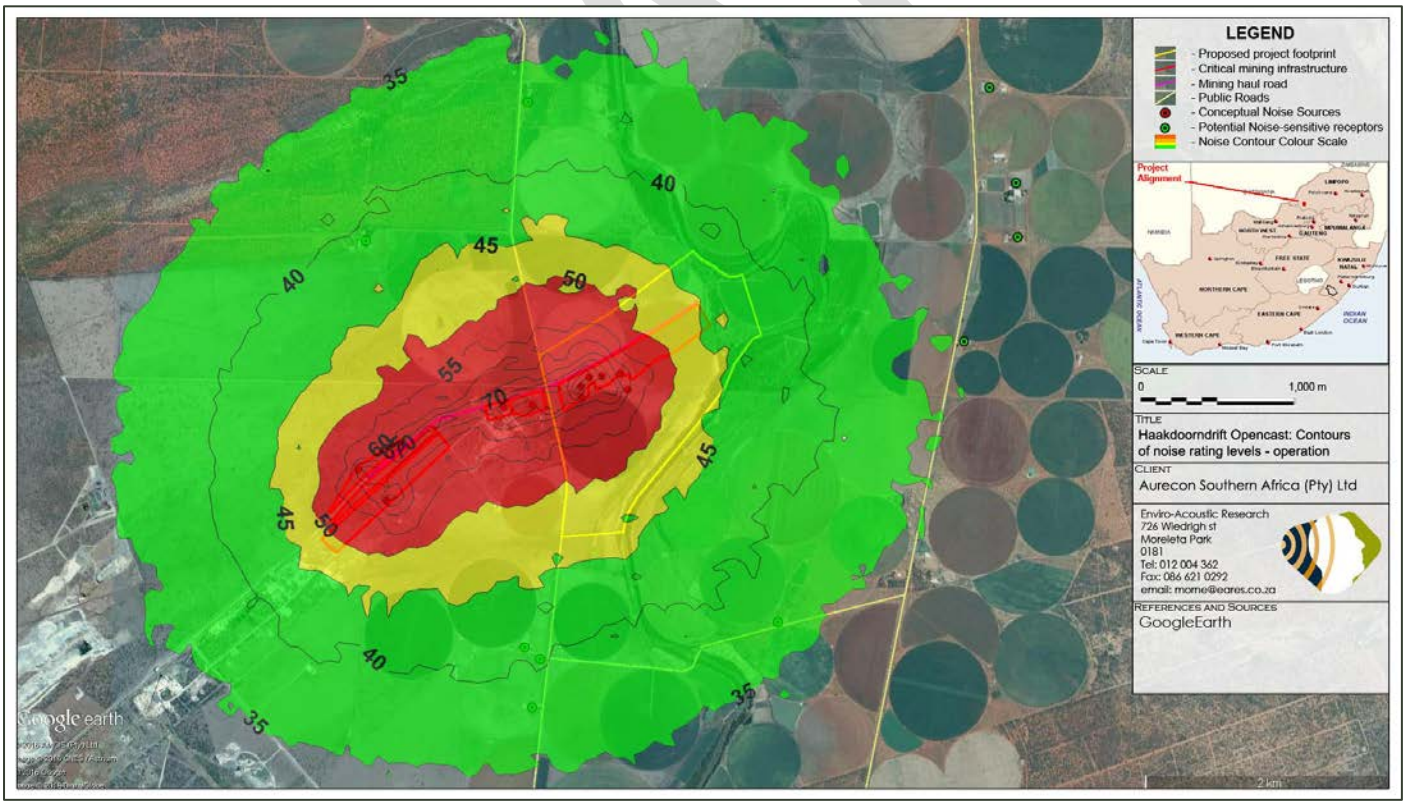


Figure 90 | Projected conceptual night-time noise rating levels during operation (EAR, 2016).

Table 49 | Noise impacts and risks

Impact	Pre-mitigation:						Recommended Mitigation	Post mitigation:					
	Duration	Extent	Intensity	Consequence	Probability	Significance		Duration	Extent	Intensity	Consequence	Probability	Significance
Daytime construction activities	Long-term	Local	Negligible	Negligible	Unlikely	Very low	■ The use the smaller/quieter equipment when operating near receptors; ■ Where possible only operate during the day. If night-time construction activities are required, do not operate closer than 900m (mobile equipment) from any receptors (prevent noise impact of medium or higher significance); Ensure that equipment is well maintained and fitted with the correct and appropriate noise abatement measures. ■ It is highly recommended that the mine include an Environmental Awareness component in their Safety and Health induction which should include a sound and noise facet (to allow employees and contractors to realize the potential noise risks that activities - especially night-time activities - pose to the surrounding environment). All employees and contractors should receive this training. ■ The development of an Environmental Awareness section in the Safety and Health Induction training programme is highly recommended. ■ At all stages surrounding receptors should be informed about the sound generated by proposed project. ■ Develop and implement an incident reporting system and effective communication channels with I&APs.	Long-term	Local	Negligible	Negligible	Unlikely	Very low
Night-time construction activities	Long-term	Local	Low - negative	Moderately detrimental	Fairly likely	Low - negative		Long-term	Local	Low - negative	Moderately detrimental	Unlikely	Low - negative
Daytime operational activities	Long-term	Local	Negligible	Negligible	Unlikely	Very low		Long-term	Local	Negligible	Negligible	Unlikely	Very low
Night-time operational activities	Long-term	Local	Low - negative	Moderately detrimental	Fairly likely	Low - negative		Long-term	Local	Low - negative	Moderately detrimental	Unlikely	Low - negative

12.5.7. Blasting and vibration

Possible area of influence

The project area was reviewed on scoping (desktop) level and some possible points of interest (POI) were identified for possible influence (Blast Management & Consulting, 2016).

The source area is expected to be the open pit area at the proposed Haakdoorndrift project. The receiving environment is considered to be of high sensitivity up to 500 m around the pit area, of medium sensitivity between 500 m and 1500 m around the pit area, and of low sensitivity above 1500 m around the pit area. The area of influence is not expected to exceed a distance range of 3500 m around the final open pit area, and the assessment of potential impacts is therefore limited to the buffer shown in Figure 91.

A review of the project area indicated that various POI exist within 3500 m of the pit area. These POI include farm houses or structures, low integrity / informal houses, numerous industrial installations (e.g. pivot irrigation, pump houses, dams, silos, power lines / pylons, a bridge, pipelines, ventilation shafts, mine buildings / structures) scattered in all but the western direction, animal related areas (game and cattle grazing areas and waterholes) to the northwest, the Crocodile River to the east, and roads (R511, D1639, D2357 and gravel roads).

The two houses within 500 m of the proposed pit, within the so-called high sensitivity area, will not be occupied at commencement of mine operations. There are domestic, agricultural and monitoring boreholes present around the site, however, blasting operations are unlikely to have any impacts on them.

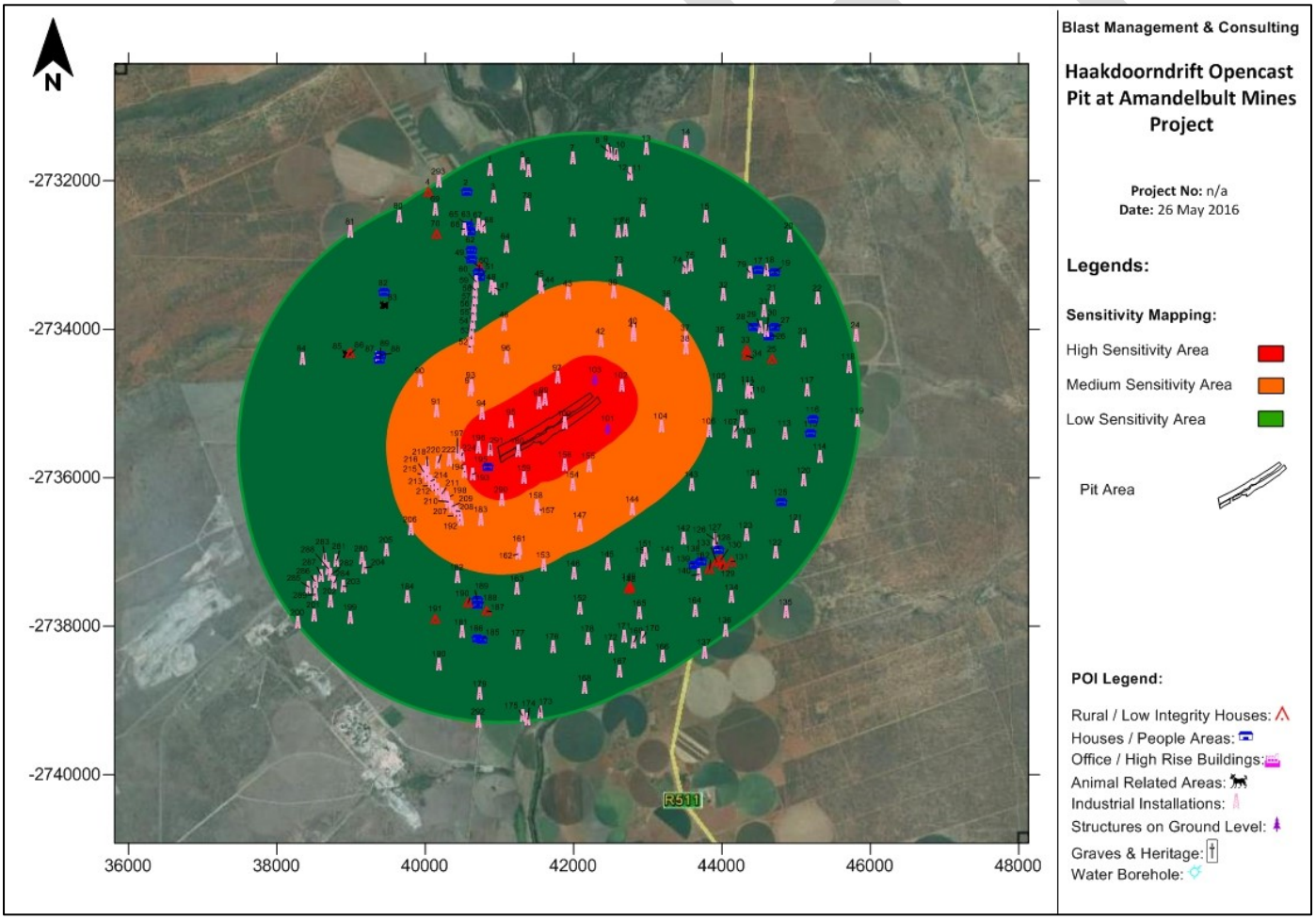


Figure 91 | Identified sensitive areas (Blast Management & Consulting, 2016).

Anticipated impacts

Blasting operations have the potential to yield secondary effects such as ground vibration, air blast, fly rock and fumes. These aspects could have a negative impact on the surrounding areas depending on the levels generated. The potential impacts considered can be described as follows:

- *Ground vibration:* levels greater than recommended limits may be damaging to structures. Different structures have different permitted levels. However, humans may experience ground vibration at levels far lower than those potentially damaging to structures. Well sloughing or collapse could also impact boreholes if wells are inherently weak.
- *Air blast:* in most cases the effect of air blast is underestimated. High levels of air blast could cause damage and normally windows are first to be damaged. Levels lower than required to induce damage may rattle windows and large roof surfaces. These effects are generally mistaken as ground vibration and may lead to complaints.
- *Fly rock:* fly rock can be mitigated but never eliminated. Controlling fly rock will also control the effects of air blast. Fly rock is of greatest concern within 268 m of the pit boundary.
- *Noxious fumes:* nitrous oxides and carbon monoxide fumes are potential products of explosives detonation during blasting operations. Low concentrations of these gases have an irritating effect on humans, while higher concentrations (or long exposure times) could cause severe respiratory illnesses. Oxygen balanced explosive chemicals should be used to limit impacts on health. Residual nitrates from explosives could also be transported to the groundwater system.

Table 50 | Blasting and vibration impacts and risks

Impact	Pre-mitigation:						Recommended Mitigation	Post mitigation:					
	Duration	Extent	Intensity	Consequence	Probability	Significance		Duration	Extent	Intensity	Consequence	Probability	Significance
Ground vibration Impact on houses	Medium-term	Local	High - negative	Moderately detrimental	Very likely	Moderate - negative	▪ Change Blast Design ▪ Smaller diameter blast holes, ▪ Reduce Charge Mass/Delay over decreasing distance, ▪ Increase stemming length and controls put in place for management of stemming lengths.	Medium-term	Local	Low - negative	Slightly detrimental	Very likely	Low - negative
Ground vibration Impact on boreholes	Medium-term	Local	Low - negative	Slightly detrimental	Unlikely	Very low	Maintain proper Blasting practices	Medium-term	Local	Negligible	Negligible	Unlikely	Very low
Ground vibration Impact on roads - gravel and tar	Medium-term	Local	Low - negative	Slightly detrimental	Unlikely	Very low	Maintain proper Blasting practices	Medium-term	Local	Negligible	Negligible	Unlikely	Very low
Ground vibration Impact on powerline	Medium-term	Local	Low - negative	Slightly detrimental	Unlikely	Very low	Maintain proper Blasting practices	Medium-term	Local	Negligible	Negligible	Unlikely	Very low
Air Blast Impact on houses	Medium-term	Local	High - negative	Moderately detrimental	Very likely	Moderate - negative	Manage Stemming material and stemming lengths to maintain best practice blasting	Medium-term	Local	Low - negative	Slightly detrimental	Very likely	Low - negative
Air Blast Impact on boreholes	Medium-term	Local	Low - negative	Slightly detrimental	Very unlikely	Very low	N/A	Medium-term	Local	Negligible	Negligible	Very unlikely	Very low
Air Blast Impact on roads	Medium-term	Local	Low - negative	Slightly detrimental	Very unlikely	Very low	N/A	Medium-term	Local	Negligible	Negligible	Very unlikely	Very low
Air Blast Impact on powerline	Medium-term	Local	Low - negative	Slightly detrimental	Unlikely	Very low	N/A	Medium-term	Local	Negligible	Negligible	Unlikely	Very low
Fly rock Impact on houses	Medium-term	Local	High - negative	Moderately detrimental	Fairly likely	Low - negative	Changed Blast Design, Smaller diameter blast holes, Increase stemming length, controls put in place for management of stemming lengths.	Medium-term	Local	Low - negative	Slightly detrimental	Fairly likely	Low - negative

Fly rock Impact on boreholes	Medium-term	Local	Low - negative	Slightly detrimental	Very unlikely	Very low	N/A	Medium-term	Local	Negligible	Negligible	Very unlikely	Very low
Fly rock Impact on roads	Medium-term	Local	Moderate - negative	Moderately detrimental	Very likely	Moderate - negative	Maintain proper Blasting practices	Medium-term	Local	Low - negative	Slightly detrimental	Very likely	Low - negative
Fly rock Impact on powerline	Medium-term	Local	Moderate - negative	Moderately detrimental	Fairly likely	Low - negative	Maintain proper Blasting practices	Medium-term	Local	Negligible	Negligible	Fairly likely	Very low

12.5.8. Traffic impacts

Trip generation calculations were undertaken for the construction, operational, and decommissioning phases to determine the impact of vehicular traffic in the project area (Aurecon, 2016). The complete TIA is attached in Appendix 7.

Construction phase

Workforce

The expected workforce required for the construction phase is approximately 25 workers. The workforce will be sourced from the neighbouring communities, which include Mantserre, Thabazimbi, Northam and Smashblock. All workers will be transported to and from the site using staff transport comprising of 22-seater buses and 15-seater minibus taxis. Construction will be conducted 6 days a week on a 10-hour shift starting from 07h00 to 17h00.

Construction vehicles

It is expected that the project will generate four truck trips per hour for construction work, for instance, to transport equipment and construction materials.

A summary of vehicle trips expected to be generated during the construction phase is provided in Table 51:

Table 51 | Vehicle trip generation during AM and PM peak hours of the construction phase

Scenario	Vehicle trips per hour AM and PM)					
	Heavy vehicles	Bus	Minibus Taxi	Car	Total (vph)	Total (Passenger Car Units [PCU])
2019	4	1	1	3	9	18

Operational phase

Workforce

Once fully operational the mine will employ about 230 workers. Similar to the construction phase the majority of the workforce will be sourced from the same communities listed in the construction phase.

Heavy vehicles

It is expected that ore will be transported for a period of 34 months from the proposed Haakdoorndrift Opencast site to the ore stockpile site by 40 tonne- and 200 tonne-ADTs. The mine is expected to generate about three (3) *reef* heavy vehicle trips per hour and four (4) *overburden* heavy vehicle trips per hour during the operational phase. The distribution of these reef and overburden heavy vehicles trips during two operational phases and the decommissioning phase are illustrated in Table 52.

Table 52 | Distribution of reef and overburden heavy vehicle trips during operation and decommission phase

Scenario	Time (months)	Timeline	Reef (loads per hour)	Waste and topsoil (loads per hour)	Total (loads per hour)
Operation Phase 1	13 – 23	Jan. '20 to Oct. '20	3	4	7
Operation Phase 2	24 – 37	Nov. '20 to Oct. '23	3	0	3
Decommissioning Phase	38 – 48	Nov. '23 to Aug '24	0	4	4

Considering the two operation phases in the table above, trip generation calculations and capacity analyses were only carried out for the worst case scenario, which is Operation Phase 1. The vehicular trips expected to be generated by operation phase 1 activities are summarised in Table 53.

Table 53 | Vehicle trip generation during AM and PM peak hour of the operational phase 1

Scenario	Vehicle trips per hour AM and PM)					
	Heavy vehicles	Bus	Minibus Taxi	Car	Total (vph)	Total (Passenger Car Units [PCU])
2020	14	7	7	23	51	86

Decommissioning phase

Workforce

The decommissioning phase, which entails rehabilitation of the proposed mining area when mining operations have ceased by backfilling the pit, will employ about 60 workers. Similar to the preceding phases, the employees will also be sourced from the same communities listed in the construction phase. This phase will consist of two shifts, with similar time periods to those of the operational phase.

Heavy vehicles

As shown in Table 52, the rehabilitation activities during the decommissioning phase will generate an additional four heavy vehicle trips per hour which will consist of void filling and transporting equipment and material. This will amount to 8 bi-directional heavy vehicle trips per hour.

The vehicle trips expected to be generated during the decommissioning phase are shown in Table 54:

Table 54 | Vehicle trip generation during AM and PM peak hours of the decommissioning phase

Scenario	Vehicle trips per hour AM and PM)					
	Heavy vehicles	Bus	Minibus Taxi	Car	Total (vph)	Total (Passenger Car Units [PCU])
2023	8	2	2	6	18	36

Development access

The access to the Haakdoorndrift opencast site will be taken off the existing D1639 / Amandelbult (farm) access roads, but with some upgrades. The intersection will remain a priority controlled intersection, with priority on the D1639 and the access (minor) road on give way (Stop). Dedicated 30m right-turning lanes are also proposed on both approaches of the D1639. The additional lanes are only required to improve traffic safety rather than for additional lane capacity. The lanes will allow unimpeded movement of the through traffic and provide safe stacking space for right turn vehicles as they wait for a gap in the traffic stream to turn. Refer to Figure 92 for the conceptual layout of the intersection.

The queuing analysis indicated that a single entry and exit lane would be adequate at the access control booms to facilitate access to the proposed development. However, for practicality reasons, it is recommended that two access lanes be provided at the booms. This will allow a separate processing of haulage traffic and the employee vehicles and buses at the access gate, resulting in more optimal access control.

Recommendations

The buses and minibus taxis transporting labour are expected to form part of the mine's staff transport fleet, and are expected to pick up and drop off the employees *from within the development precinct* (i.e. not from the public road network). It is recommended that public transport facilities, such as lay-bys, bus shelters and walkways, be provided at convenient locations *within the development site*.

Considering that the site is not located within reasonable walking distance from the potential labour sending communities (i.e. Mantserre, Thabazimbi, Northam and Smashblock), the site is not expected to generate primary non-motorised trips. Additionally due to likely use of staff buses, no drop-off or pickup of passengers is expected on the public road network. Therefore, there are no public transport recommendations for the public road network, in addition to the internal requirements described above.

It is recommended that the mine make a contribution to the rehabilitation of the section of D1639 that would be affected by the HOP activity. This gesture would illustrate to local road authorities the willingness of the client to support the local community and its contribution to the maintenance of roads in the area.

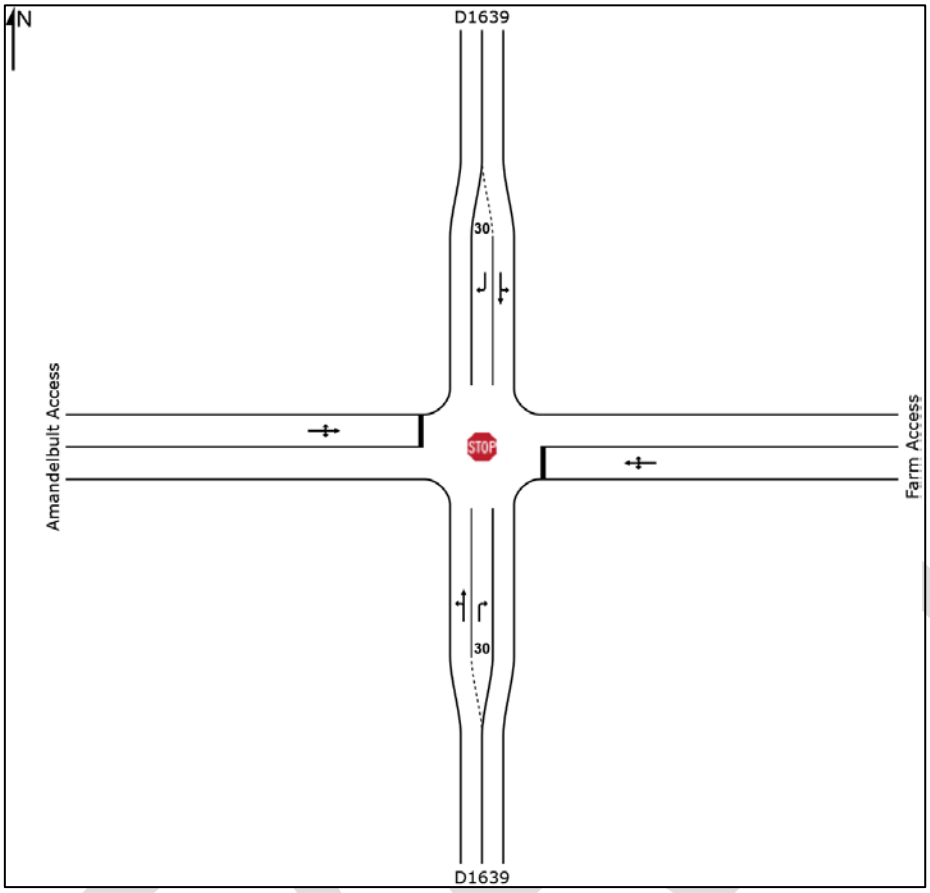


Figure 92 | Conceptual design of the new D1639/Amandelbult intersection (Aurecon, 2016).

12.5.9. Visual impact

Due to the limited scope of the project (only 30 months) a limited VIA (or visual impact statement) was conducted. The terms of reference for the VIA were to determine the potential visual impacts of the proposed project components on potential viewers or receptors, in terms of the visual context within which the activity will take place and to develop mitigation strategies to address these. The following steps were followed:

- Describing the landscape as visual resource by way of a baseline investigation, and characterising the nature and quality of the landscape and the visual sensitivity of the resource;
- Determining the change in the visual resource that would be brought about by elements of the proposed project, and how visible this change will be from the surrounding areas;
- Describing the expected visual impacts of key components of the proposed project; and
- Recommending mitigation measures to reduce the potential visual impacts of the project.

View shed analysis

A view shed analysis of the overburden dumps was created, and is shown in Figure 93. A 10m buffer (5 metres on both sides from the centre of the Crocodile River) was placed along the River, as the existing riparian vegetation creates a visual buffer to the east of the site. As a result of the riparian vegetation and the ridgeline lying west of the site, overall visibility is localised and does not theoretically extend much further than 2km. A complete visual impact statement is included in Appendix 7.

Visual impact from mining infrastructure is expected to be short term (less than 5 years), provided that effective rehabilitation of impacted areas takes place, and the overburden dumps utilised as backfill within the open pit.

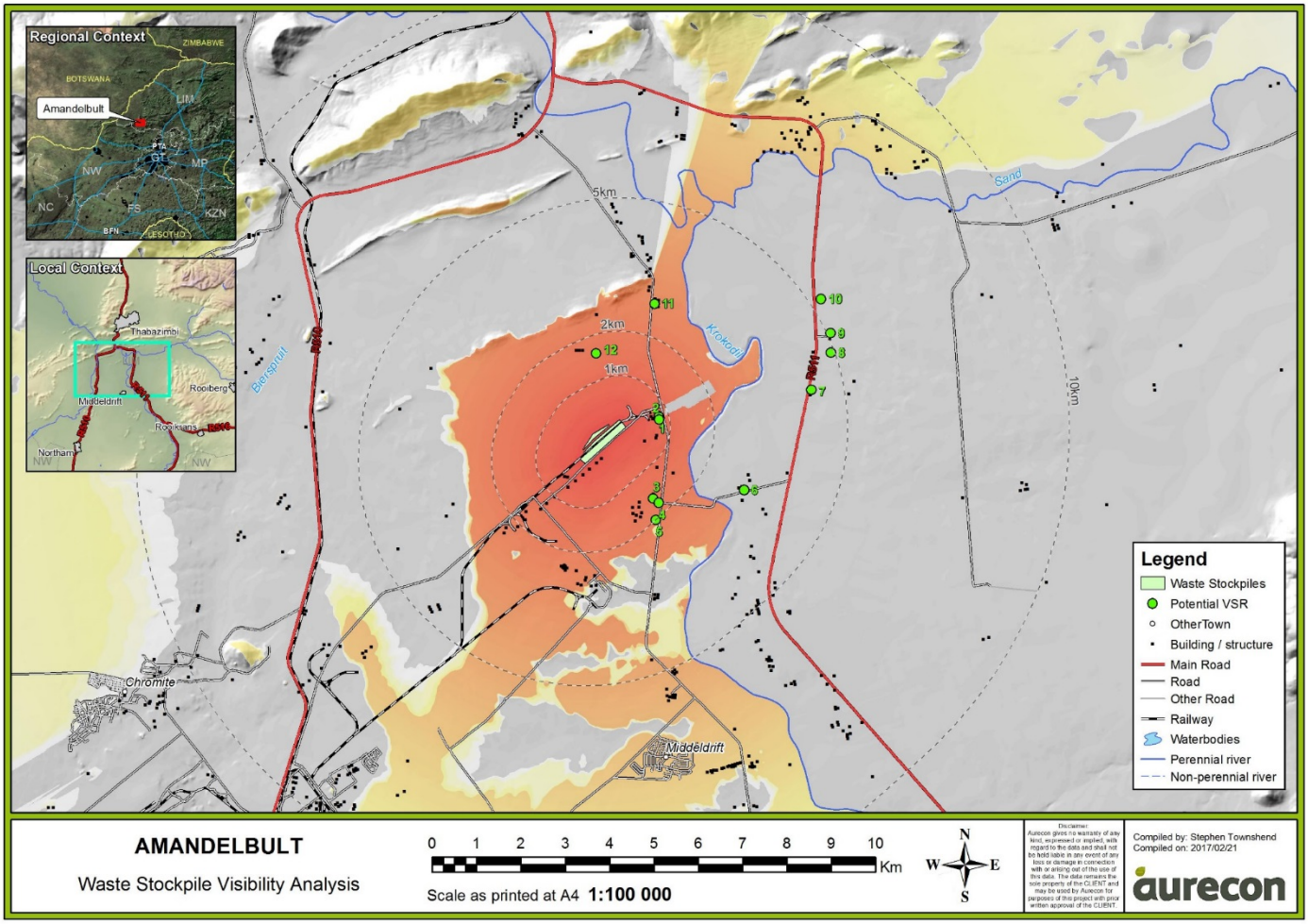


Figure 93 | Haakdoorndrift overburden stockpile view shed analysis (Aurecon, 2017).

Visual intrusion

The visual intrusion in relation to the existing mining activities and related infrastructure will be low, whereas compared to the Crocodile River and rural agricultural character it will be higher. The series of ridges, forming a backdrop north west of the site, also contribute to the visual intrusion as it increases the proposed project to be visually absorbed into the landscape. The overall visual intrusion is medium and the landscape in general have a fair ability to camouflage the proposed development (Aurecon, 2017).

Visual exposure

The visual exposure of the proposed project is based on the distance from the proposed source of impact. The visibility of an object decreases exponentially over distance. The majority of receptors will experience the proposed project between 1 and 2 km and as a result will experience *moderate* visual exposure.

Key receptors

The key receptors which will be affected by the proposed project are the following:

- People travelling by car on the local roads in close proximity of the site:
  - D1639 (situated on the eastern boundary of the proposed ore and overburden stockpiles and the western boundary pit site);
  - Current existing Amandelbult access road and;
  - Cronimet Mine Access Road
- People working at the existing Amandelbult mine and;
- People residing in dispersed homesteads around the site (receptors residing at point 1 and 2 as indicated on Figure 93 will be relocated during the proposed activity).

The abovementioned roads surrounding the site will be mostly used by the local farming community and mine employees. Tourists (or people not necessarily residing in the area) are expected to travel on the R511, and views from there will probably be visually screened by the riparian vegetation along the Crocodile River. The receptor sensitivity is expected to be *Low* to *Medium* for all of the above mentioned receptors, as the impact will be temporary, current viewers (receptors) have grown accustomed to the existing mining related infrastructure, and the majority of perceptions are driven by economic opportunities rather than aesthetics.

Night-time lighting

The majority of the study area is generally free from the effects of night lighting sources, with low-level light sources coming from the farming homesteads of the surrounding farms. Two types of lighting are associated with the proposed project, namely stationary lighting sources and vehicle mounted lighting sources.

The proposed project is expected to contribute to the effects of sky glow and artificial lighting in the region, particularly as a result of stationary lighting sources, including lighting from the crushing facilities. Generally, the impacts of vehicle mounted lighting sources will be confined to the local setting due to the effects of distance and intervening undulating topography, existing settlements and vegetation which restrict the potential impact on views from more distant regional points.

Dust

Dust from mining activities may be visible in close proximity of the mine, but will depend on weather conditions and the prevailing wind direction.

Several potential risks to the receiving aesthetic and visual environment as a result of the proposed mining operation have been identified, relating to impacts on visual character and sense of place, visual intrusion and visual exposure and visibility. These impacts will be assessed in detail in the impact assessment phase of the project and as far as possible mitigation recommendations will be presented.

Mitigation measures

Night time lighting

- Reduce the height from which floodlights are fixed and identify zones of high and low lighting requirements, with lights focussing inward, rather than outward.
- Avoid up-lighting of structures. Rather direct the light downwards and focused on the object to be illuminated.
- All security lights shall have covers to ensure light is directed downwards.

Dust

Dust should be kept to a minimum through using appropriate dust suppression measures.

Design of disposal dumps

The shape and sides of the dumps should mimic the surrounding landscape as far as possible to minimise the visual impact. In principle, this means the use of rounded, gradual slopes and shapes rather than geometric slopes and shapes.

Vegetation rehabilitation

Best practice methods should be applied regarding rehabilitation and the establishment of a vegetation layer on the final rehabilitated open pit and footprint area of the disposal dumps. Ongoing monitoring should be required in order to ensure that vegetation is successfully established and that erosion does not occur, both avoiding further visual impact.

Screening vegetation

If required, views from stationary receptors (such as remote homesteads) towards the site, can be screened by planting indigenous, evergreen trees in appropriate locations.

Table 55 | Visual impacts and risks

Impact	Pre-mitigation:						Recommended Mitigation	Post mitigation:					
	Duration	Extent	Intensity	Consequence	Probability	Significance		Duration	Extent	Intensity	Consequence	Probability	Significance
Night-time lighting	Short-term	Local	Low - negative	Slightly detrimental	Certain	Low - negative	▪ Reduce the height from which floodlights are fixed and identify zones of high and low lighting requirements, with lights focussing inward, rather than outward. ▪ Avoid up-lighting of structures. Rather direct the light downwards and focused on the object to be illuminated. ▪ All security lights shall have covers to ensure light is directed downwards.	Short-term	Local	Negligible	Negligible	Certain	Very low
Dust	Short-term	Local	Low - negative	Slightly detrimental	Fairly likely	Low - negative	Dust should be kept to a minimum through using appropriate dust suppression measures.	Short-term	Site-specific	Negligible	Negligible	Certain	Very low
Northern and southern views from the D1639	Short-term	Local	Low - negative	Slightly detrimental	Certain	Low - negative	▪ The shape and sides of the dumps should mimic the surrounding landscape as far as possible to minimise the visual impact. In principle, this means the use of rounded, gradual slopes and shapes rather than geometric slopes and shapes. ▪ Best practice methods should be applied regarding rehabilitation and the establishment of a vegetation layer on the final rehabilitated open pit and footprint area of the disposal dumps. Ongoing monitoring should take place post-rehabilitation in order to ensure that vegetation is successfully established and that erosion does not occur, both avoiding further visual impact.	Short-term	Local	Low - negative	Slightly detrimental	Certain	Low - negative

12.5.10. Social impact and benefits

The preliminary socio-economic and cultural impacts and benefits are listed below. These issues will be further investigated during the EIA Phase:

Demographic and population impacts

The proposed Haakdoorndrift Opencast project will secure jobs of existing mine workers who will be transferred to the new pit. However, "news" of the proposed new activities may attract job seekers under the impression that more jobs are available. The presence of job seekers or the lack of new jobs may lead to informal settlement establishment, increased crime, local conflict, and disease.

Air pollution impacts

Dust resulting from blasting and mining activities could impact crop health by inhibiting the photosynthetic ability of crops cultivated in the area. Resulting poor yields could affect neighbouring farmers' revenue generation, in turn affecting their ability to sustain local employment.

Pollutants such as dust and vehicle fumes could impact pulmonary health of mine workers and neighbouring farm inhabitants. Noxious fumes from blasting activities could lead to severe health impacts in case of prolonged exposure.

Structural impacts

Closing off district roads (D1639) will impact the ease of accessibility with which local farmers and workers travel around the area. Using different roads may lead to increased time and fuel expenditures on the part of local farmers.

Air blast and ground vibration may cause damage to houses and other structures close to the mining area. Although it has been established that the likelihood of blasting impacts to nearby structures is low, it may cause rattling or noise which could be *perceived* as causing structural damage.

Fly rock resulting from blasting could pose a safety and structural hazard if blasting operations are not carried out a per the recommendations made by the blasting specialist, if blasting operations are not carried out by qualified personnel, or if animals or humans are in the vicinity of the 500 m blasting boundary around the pit.

Agricultural impacts and sense of place

The affected land owner will not be able to farm on the proposed pit area during the LoM and rehabilitation phases, causing a potential livelihood impact on the farm business and its employees. If alternative land cannot be provided, some farm workers may need to be retrenched as a result of the contraction of farming operations during the mine's operation and rehabilitation.

The arable land may not be rehabilitated to the same land capability after mining and rehabilitation has taken place, consequently impacting on yields and local revenue from agriculture. After rehabilitation, land may only be useful for grazing.

Visual and nuisance impacts

Overburden stockpiles may cause a visual disturbance where there currently is none. The presence and constant activity of ADT's, reverse sirens and loading and hauling activities could cause irritation resulting from noise, especially in evenings when sound travels for further distances than during daytime.

Table 56 | Social impacts and risks

Impact	Pre-mitigation						Recommended Mitigation	Post-mitigation					
	Duration	Extent	Intensity	Consequence	Probability	Significance		Duration	Extent	Intensity	Consequence	Probability	Significance
Demographic and population impacts	Short-term	Local	Low - negative	Slightly detrimental	Unlikely	Very low	• The recruitment policy used to employ people on the project must be fair and transparent. • The intention of giving preferential employment to locals is clearly communicated, so as to discourage an influx of job-seekers from other areas. • Have clear rules and regulations for access to the site. • Mine workers should be clearly identifiable by wearing proper uniforms displaying the logo of the contractor/company. • Employees must also be provided with identification tags. • The mine should join and actively participate in local community / farm security and policing fora.	Short-term	Local	Low - negative	Slightly detrimental	Very unlikely	Very low
Agricultural impacts and sense of place	Long-term	Site-specific	Moderate - negative	Moderately detrimental	Very likely	Moderate - negative	• Unauthorised access to the site must be prevented through appropriate fencing and security. • When mining has ended, adequate rehabilitation measures should be implemented to return the landscape to as close as possible to its original state.	Long-term	Site-specific	Low - negative	Slightly detrimental	Very likely	Low - negative
Visual and nuisance impacts	Short-term	Local		Slightly detrimental	Fairly likely	Low - negative	• Adjacent households should be consulted and notified of any mining activities that could lead to excessive noise levels in advance.	Short-term	Site-specific	Low - negative	Negligible	Fairly likely	Very low
Continuation of employment at Amandelbult	Medium-term	Local	Moderate - positive	Moderately beneficial	Very likely	Moderate - positive	• Anglo to recruit local labour and business where possible.	Medium-term	Local	Moderate - positive	Moderately beneficial	Very likely	Moderate - positive
Continuation of mining activities at Amandelbult	Long-term	Local	Moderate - positive	Moderately beneficial	Very likely	Moderate - positive	-	Long-term	Local	Moderate - positive	Moderately beneficial	Very likely	Moderate - positive

12.5.11. Heritage and palaeontological resources

No resources with heritage or palaeontological value were discovered on the proposed project site, thus no impacts are anticipated. However, in the unlikely event that such discoveries are made during mining operations, a heritage specialist shall be contacted to assess the significance of the find and to propose a way forward in terms of required licences/permits required, documenting, excavation and / or destruction of the find.

Table 57 | Summary of heritage and palaeontological impacts

Impact	Pre-mitigation:						Recommended Mitigation	Post mitigation:					
	Duration	Extent	Intensity	Consequence	Probability	Significance		Duration	Extent	Intensity	Consequence	Probability	Significance
Locating potential heritage sites of significance	Medium-term	Site-specific	Low - negative	Slightly detrimental	Unlikely	Very low	The following recommendations are given should any sub-surface remains of heritage sites be identified: • All operators of excavation equipment should be made aware of the possibility of the occurrence of sub--surface heritage features and the following procedures should they be encountered. • All construction in the immediate vicinity (50m radius of the site) should cease. • The heritage practitioner should be informed as soon as possible. • In the event of obvious human remains the South African Police Services (SAPS) should be notified. • Mitigation measures (such as refilling etc.) should not be attempted. • The area in a 50m radius of the find should be cordoned off with hazard tape. • Public access should be limited. • The area should be placed under guard. • No media statements should be released until such time as the heritage practitioner has had sufficient time to analyse the finds.	Medium-term	Site-specific	Negligible	Negligible	Unlikely	Very low
Locating fossiliferous resources	Medium-term	Site-specific	Low - negative	Slightly detrimental	Very unlikely	Very low	• In the unlikely event of fossils being discovered in the sands and the soils in the study area, the ECO should document the fossils photographically, note the locality and contact a palaeontologist for advice. • No attempt should be made to remove such fossils. In this event a palaeontologist should be appointed to rescue the fossils with a permit from SAHRA and to take it to an acknowledged palaeontological repository such as the Ditsong Museum in Pretoria.	Medium-term	Site-specific	Negligible	Negligible	Very unlikely	Very low

12.5.12. Cumulative impact assessment

Cumulative impacts are those which will add to the effects that current land uses or activities are having on the environmental and social aspects of the affected area. Significant current impacts felt in the vicinity of the project are (discussed in detail in Section 12.4.1):

- Surface water contamination from mining activities, a wastewater treatment plant, and potentially agricultural activities;
- Groundwater contamination caused by tailings dam seepage;
- Noise caused by blasting operations at the Amandelbult mine;
- General noise cause by mining activities;
- Dust generated by material loading, hauling, vehicle movement and unloading;
- Degradation of intact floral and faunal habitat, especially through agriculture close to riverine vegetation adjacent to the Crocodile River;
- Groundwater extraction for irrigation; and
- Social capital and services.

The highest impacts anticipated as part of the HOP are associated with encroachment into the riverine habitat and the impacts that groundwater drawdown will have on the wetland habitat. The impacts on groundwater availability are discussed in detail in Section 12.5.3. It is reiterated that, in the context of current land uses, groundwater ingress into the proposed pit is lower than water extracted for irrigation.

As for contamination of groundwater (currently from tailings seepage), it is currently not affecting the HOP-area, as it occurs in a somewhat isolated aquifer (Groundwater Complete, 2017). Surface water contamination will be mitigated through the installation of clean and dirty water separation measures through the HOP-area.

12.6. Methodology used in determining and ranking the nature, significance, consequences, extent, duration and probability of potential environmental impacts and risks

This section briefly outlines the proposed method for assessing the significance of the potential environmental and socio-economic impacts identified above during the construction, operational and decommissioning phase. 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 (probability) and consequence, firstly in the case of no mitigation and then 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 ratings provided.

Intensity ratings are assigned based in the criteria stated in Table 58:

Table 58 | Definitions 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.

Duration ratings are assigned according to the criteria shown in Table 59:

Table 59 | 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.

Extent ratings are assigned according to the criteria shown in Table 60.

Table 60 | 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.

The consequence is then established using the formula:

Consequence = intensity x (duration + extent)

Depending on the numerical result of this calculation, the impact's consequence would be classified as one of the following:

- Extremely; highly; moderately; slightly detrimental;
- Negligible; or
- Slightly, moderately, highly or extremely beneficial.

Consequence ratings are applied according to score ranges shown in Table 61:

Table 61 | Application of Consequence ratings

Rating	Significance 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

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 must take into account the likelihood of occurrence and the degree of uncertainty and detectability of the impact.

Probability ratings are assigned according to the criteria shown in Table 62:

Table 62 | 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.

Significance is calculated according to the following formula:

Significance = consequence x probability

Depending on the numerical result of this calculation, the impact would fall into a significance category of one of the following:

- Very Low;
- Low (negative or positive);
- Moderate (negative or positive);
- High (negative or positive); or
- Very High (negative or positive).

Significance ratings are applied according to the scores shown in Table 63:

Table 63 | Application of Significance ratings

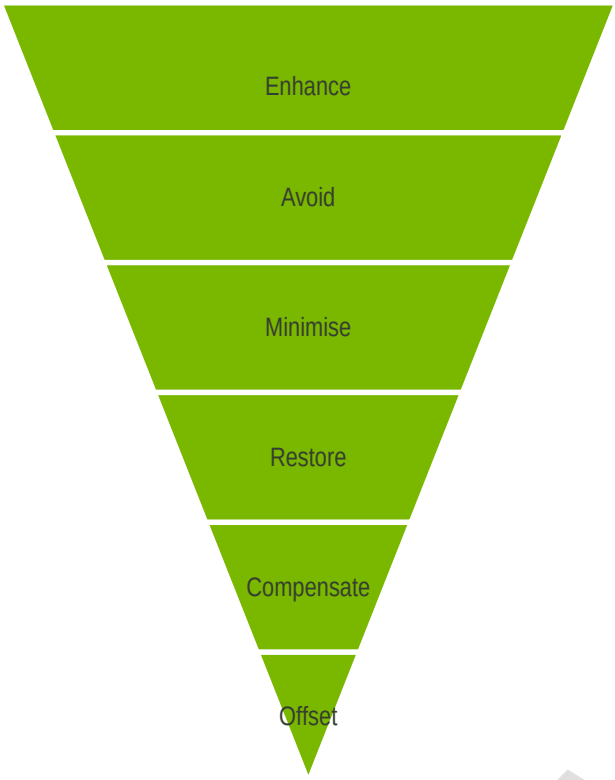
Rating	Significance rating
-4	Very high - negative
-3	High - negative
-2	Moderate - negative
-1	Low - negative
0	Very low
1	Low - positive
2	Moderate - positive
3	High - positive
4	Very high - positive

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.

12.6.1. Methodology for identification of mitigation measures

The mitigation hierarchy (Figure 94) illustrates the actions which can be undertaken to respond to negative impacts and the preference give to mitigation measures. The topmost measures are preferred, and the preference for mitigation measures decreases the further one moves down the hierarchy.

For each impact assessed, mitigation measures will be proposed to reduce and/ or avoid negative impacts and enhance positive impacts. The mitigation measures identified by the specialists will be reviewed for feasibility with the proponent and then incorporated into the EMPr during the EIA Phase to ensure that they are implemented throughout the lifecycle of the proposed project. The EMPr would become a legally binding document should this project receive an EA.



Impact avoidance: This step is most effective when applied at an early stage of project planning. It can be achieved by:

- Not undertaking certain projects or elements that could result in adverse impacts;
- Avoiding areas that are environmentally sensitive; and
- Putting in place preventative measures to stop adverse impacts from occurring.

Impact minimisation: This step is usually taken during impact identification and prediction to limit or reduce the degree, extent, magnitude, or duration of adverse impacts. It can be achieved by:

- Scaling down or relocating the proposal;
- Redesigning elements of the project; and
- Taking supplementary measures to manage the impacts.

Impact compensation: This step is usually applied to remedy unavoidable residual adverse impacts. It can be achieved by:

- Example, by habitat enhancement;
- Restoration of the affected site or environment to its previous state or better; and
- Replacement of the same resource values at another location (off-set), for

Figure 94 | Mitigation hierarchy.

12.7. The positive and negative impacts that the proposed activity (in terms of the initial site layout) and alternatives will have on the environment and the community that may be affected

The relative positive and negative impacts of each of the alternatives proposed for the activity are considered in Table 64.

Table 64 | Consideration of positive and negative impacts of the proposed activity and alternatives

Positive	Negative
Pit alternative 1	
Larger ore body extracted.	High likelihood of intersecting and affecting the subterranean flow of the Crocodile River.
Higher eventual income generation.	High volumes of ingress into the pit from the Crocodile River system.
Pit alternative 2	
Subterranean flow of the Crocodile River is less likely to be affected.	Approximately 10% reduction in volume of ore.
Lower volumes of groundwater ingress into the pit from the Crocodile River is expected.	Reduction in income to be generated.
Pit alternative 3	
Subterranean flow of the Crocodile River is less likely to be affected.	Groundwater ingress that will have to be pumped out.
Mining to take place to maximum depth of 60 m.	
Lower volumes of groundwater ingress into the pit from the Crocodile River is expected.	
Overburden stockpile location alternative 1	
Reduced operational time and costs associated with the stockpiling of overburden material.	Increased flood risk.

Low impact on traffic across the surfaced district road, as haul trucks only cross the road only for ore transport, and not for overburden transport.	The riparian zone of the Crocodile River will also likely be impacted upon.
	Up to 220 ha of agricultural land temporarily removed.
Overburden stockpile location alternative 2	
Reduced impacts on the water resource and arable land	Higher impact on traffic across the surfaced district road, as haul trucks have to cross the road for ore transport, as well as overburden transport.
Reduced potential for damage resulting from flooding	Safety risk associated with placing overburden material on undermined areas
The riparian zone of the Crocodile River will likely not be impacted upon	High operational time and costs associated with transportation of material to and from the pit.
Overburden stockpile location alternative 3	
Reduced impacts on the water resource and arable land	Higher impact on traffic across the surfaced district road, as haul trucks have to cross the road for ore transport, as well as overburden transport.
Reduced potential for damage resulting from flooding	High operational time and costs associated with transportation of material to and from the pit.
The riparian zone of the Crocodile River will likely not be impacted upon	
Smallest disturbance footprint of the three overburden stockpile location alternatives	
Mining method alternative 1	
Extraction of large ore body resource from Haakdoorndrift pit.	High cost of replacing all overburden material at end of HOP.
Mining method alternative 2	
Concurrent rehabilitation facilitated by placing overburden material into preceding box cuts.	Reduced PGE-resource extraction.
No-go alternative	
Present agricultural activities can continue.	No PGE-resource extraction.
No loss of freshwater resource to pit.	Potential closure of Amandelbult Complex.
No risk of nuisance caused by noise and blasting.	

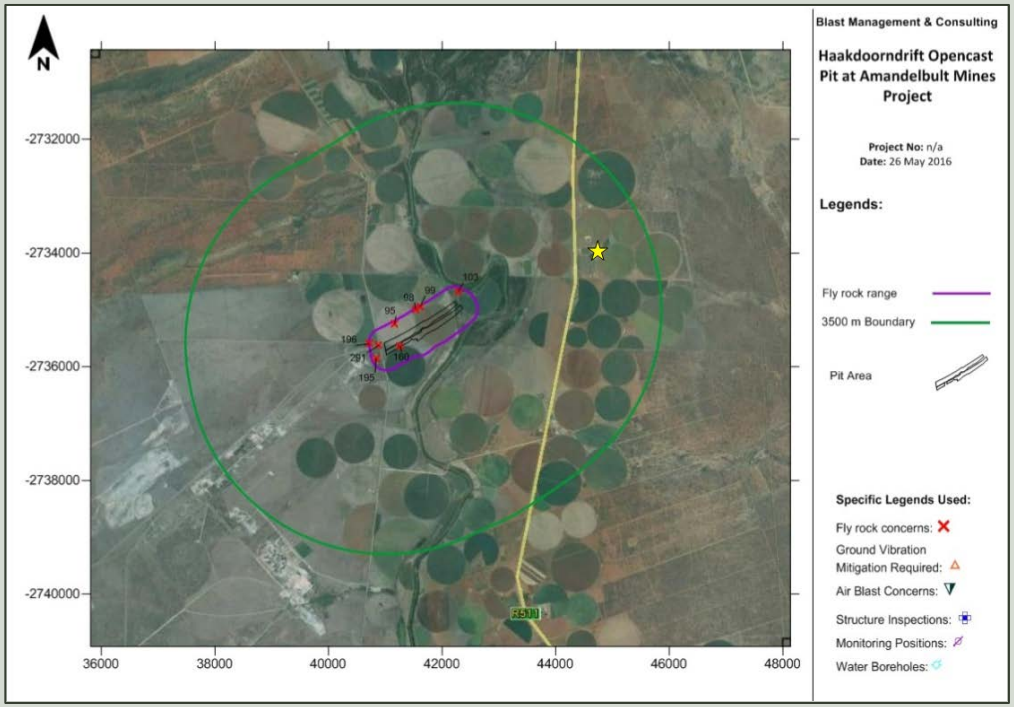
12.8. The possible mitigation measures that could be applied and the level of risk

Issues and concerns raised by affected parties are listed, along with an assessment and discussion of mitigations and/or site layout alternatives available to accommodate and/or address their concerns. The impacts and risks associated with the mitigation or alternatives are discussed or, where appropriate, reference is made to Sections in this report where it is addressed.

Table 65 | Possible mitigation measures to accommodate or address I&AP concerns

Issues and concerns raised by I&APs	Mitigations / site layout alternatives	Impacts / risks associated with mitigations / site layout alternatives
Pit voids left as is or used as dams after mining, could pose a drowning hazard.	■ The pit will be rehabilitated by replacing box cuts with overburden material as mining continues. The pit will not be used as a dam. ■ Fencing and strict access control around the mining area will be enforced.	Using the pit void as a dam could provide a water resource for mining activities after completion of this project, potentially reducing water requirements from external resources for use in mining operations. However, due to the safety risk highlighted by I&APs, and the fact that the land could be reused for agricultural purposes, this option was abandoned.
Local, affected communities; small companies; and subcontractors should benefit from this project.	• The project site is on a privately owned farm and no communities will be directly affected. • When and if labour is needed, communities will be informed through the Leadership Development Forum (LDF – a registered I&AP to this project, and a group often consulted with by Anglo) and they will have the opportunity to apply for available positions. Local recruitment will be done. There will be a formal process to select appropriate local Small, Medium and Micro-sized Enterprises (SMMEs) for the project. Local procurement processes are ongoing and joint ventures (JVs) will be established with small local businesses.	Due to the relatively short timeframe in which the proposed project will be completed, no additional job opportunities will be created. In addition, the use of SMMEs and JVs with local businesses will be short-lived. Therefore, the risk exists that local SMMEs, businesses, or job-seekers anticipates more opportunities than can be provided.
Farm workers' jobs and livelihood could be lost, along with valuable agricultural land. Concerns were raised that residents would have to be relocated. The landowner's access route to the River would be destroyed.	• The footprint surrounding the pit has been reduced from the initial 220 ha-area to approximately 50 ha after consideration of this concern by various I&APs, including the landowners, DAFF, and LEDET. For an indication of the reduced project footprint, please refer to Figure 2. • A compensation discussion between the land owner and Anglo will take place prior to the commencement of the proposed mining operations. • Topsoil should be stripped and stored according to Anglo Rehabilitation Guidelines, as well as those provided in the soil specialist report (Rehab Green, 2017). Concurrent backfilling of overburden material will take place as mining progresses, which will expedite the rehabilitation process after mining. • No relocation will be required as part of the proposed project. • The landowner will still have access to the River through existing roads.	• Some overburden material and topsoil (from the first box cuts) would still have to be temporarily stored on a designated area. • By reducing the footprint area around the pit, overburden material will now have to be transported further than if it were dumped to the north and south of the pit. This will require the construction of a new district road crossing at D1639.
Rehabilitation must ensure that land is returned to its pre-mining state.	• The mining method has been modified since Scoping Phase. Instead of moving all overburden material out of the pit area and returning it only after mining has been concluded, overburden material will only be moved to the designated area (on mine-owned property, not used for agriculture) for the first six months of the project. After mining at Haakdoorndrift is concluded, all overburden material will be returned to the pit. Thus, no overburden / waste dumps will remain after rehabilitation.	• The soils in the pit area might no longer be arable after rehabilitation, but rather only of grazing quality.

Issues and concerns raised by I&APs	Mitigations / site layout alternatives	Impacts / risks associated with mitigations / site layout alternatives
Rehabilitation is seldom successful. The visual impact of mining operations and overburden dumps should be removed after mining.	• Topsoil will be stripped and stockpiled as per Anglo Rehabilitation Guidelines, as well as recommendations provided in the Soil, Land Use, and Land Capability specialist report conducted by Rehab Green. The soil could then be returned to a state appropriate to grazing. • The project footprint has been reduced from a 220 ha area to 50 ha, therefore reducing the amount of arable land lost by 80 ha.	
The irrigation dam could be impacted by blasting.	• As the irrigation dam directly north of the pit is located within the legislated 500 m No-Go zone around the pit, it should be cleared of all human activity. Any damage to the dam should be assessed at an appropriate time after rehabilitation of the mining area, and should be addressed as part of the compensation discussion between the landowner and Anglo. Damage to the dam, as described in the Blast Impact Assessment (BIA) by Blast Management and Consulting, could occur as a result of ground vibration caused by blasting. • Affected landowners will be notified of blasting activities.	The dam might have to be repaired if post-blasting or post-mining investigations show that significant structural damage was caused to the dam.
Water quality or availability might be reduced by mining operations.	• As no water will be discharged into the Crocodile River as part of this project, water quality is not expected to be affected. • The pit size has been reduced by approximately 250 m (or 16%) such that it no longer intersects the floodplain depression of the Crocodile River. This will reduce water flowing into the pit from the River. The amount of water flowing into the pit has been calculated as 280 m^3/day for the first year, 310 m^3/day for the second year, and 450 m^3/day for the third year under the "worst-case scenario" (Groundwater Complete, 2017). • The perennial Crocodile River acts as a barrier (constant head or recharge boundary) between the proposed new Haakdoorndrift pit and groundwater users to the east of the river. Therefore, the groundwater levels in these user boreholes are expected to remain unaffected by the proposed new mining activities. • The user borehole most likely to be affected by the proposed opencast mining activities is borehole LS01, which is located nearly 300 meters east of the Haakdoorndrift pit (the locations of all boreholes identified during the hydrocensus are shown in Figure 26). However, this borehole was not in use at the time of the hydrocensus (please refer to Table 12 for usage details of boreholes). Surface water discharge from the Crocodile River into the adjacent aquifer/s helps to reduce water level impacts within the immediate vicinity of the river, and the water level of user borehole LS01 is not expected to decrease by more than 2 meters. • The worst case scenario for groundwater influx into the pit is 450 m^3/day in year three of mining, or 164,250 m^3 per annum. • The likely abstraction in a 1.5 km radius from the pit for the purpose of irrigated agriculture (512 ha according to aerial photography) based on a conservative estimate of 5,000 m^3 per hectare per year, is 2,560,000 m^3 per year. Depending on the crop type, this figure could be up to 10,000 m^3. • If one compares the worst-case groundwater loss to the pit, it represents 6 % of the conservative irrigation usage in the vicinity of the project. Therefore, these quantities are low in comparison with water extracted from groundwater (allowed through the Crocodile River Valley Subterranean Water Control Area) River for irrigation purposes.	No risk of water contamination or loss is expected from this project.
Fly rock could affect True North Aviation Hub operations	• As indicated in the BIA, the range of fly rock is projected to occur within a 268 m-area around the pit. The True North Aviation School is located approximately 2.5 km from this boundary. The fly rock boundary is indicated in Figure 95 along with the location of True North Aviation Hub.	Very little impact is expected to affect the area of concern, especially in terms of fly rock.

Issues and concerns raised by I&APs	Mitigations / site layout alternatives	Impacts / risks associated with mitigations / site layout alternatives
	• Before any blasting operations can occur, the Civil Aviation Authority is to provide consent to Anglo. Thus the landowner will receive warnings well in advance of blasting activities, as well as information on zones of high risk that are to be avoided by aircraft (usually a 1 km zone). These authorisations are given for six (6) month periods.  Figure 95 | Fly rock boundary of 268 m around the general pit area, relative to True North Aviation Hub, indicated as a star to the northeast of the pit (Blast Management & Consulting, 2016).	
A concern was expressed about the new mining operations adding to the noise nuisance caused by current mining operations.	• Projected *construction* noise ratings are not expected to exceed the acceptable daytime noise level of 50 dB at any of the households around the HOP-area. However, noise ratings during construction are expected to exceed the acceptable 40 dB night time-level at two of the twelve households identified as potentially sensitive to the project. Please refer to Figure 88 for an indication of noise contour levels during the construction phase during the night. • *Operational* noise ratings are not expected to exceed the acceptable 50 dB-level at any households. However, three households are expected to experience noise levels above the 40 dB night-time limit. Please refer to Figure 90 for an indication of noise contour levels during the operational phase during the night. • The affected landowners have been directly consulted with on the project, in particular around their concerns on noise. Those landowners that are projected to fall within the unacceptable noise range had no issue with potential noise. The single landowner who was concerned about noise (Mr	The landowner's residence (Mr Louis Scheepers, located to the northwest of the pit), and a household to the south of the pit (on the property of Mr Marius Coetzee) will be affected during the night time during both construction and operational phases of the project.

Issues and concerns raised by I&APs	Mitigations / site layout alternatives	Impacts / risks associated with mitigations / site layout alternatives
	Frans Lourens) caused by the proposed project, is not projected to be impacted by the proposed operations, as his residence is located approximately 2.4 km from the closest activities.	
Dust could impact the health of crops	• Dust deposition mitigation is proposed through: dust suppression on haul roads surrounding the pit area; placing topsoil berms around the pit area; minimising material handling; and placing overburden dumps and topsoil stockpiles to the west of the pit. The prevailing northerly winds would blow dust mostly in this direction, where mostly game farming takes place, and no crop agriculture.	Material handling activities is expected to cause dust deposition up to 600m from its source, according to the Air Quality Impact Assessment conducted by EHRCON.
An influx of job seekers may increase local crime.	• Job opportunities will be available for this project, but the same number of jobs that are provided as part of current opencast operations, will be provided as part of this project. Therefore, the *number* of jobs currently provided at the Complex as a whole is proposed to remain as is. An influx of job seekers is not expected as local people are aimed to be employed as part of this project.	Job seekers might still travel to the area to secure employment.
New impacts on the Ecological Support Area (ESA) in which certain project components are located should be avoided.	• The project footprint around the pit has been reduced to 50 ha, from 220 ha rendering a substantial reduction in the affected ESA. Overburden material will no longer be placed in this area, but rather to the west thereof, in an area that is not regarded as important for biodiversity in the Limpopo C-plan. • The pit area that falls within the ESA, mainly supports agriculture, and is no longer in its natural state.	An area of approximately 50 ha within an ESA will affected by the proposed project. Approximately 30 ha thereof will consist the mined out pit, and the remaining 20 ha will be used for haul road, berm, and fence establishment.
Appropriate offset measures must be submitted to the DMR to compensate for the loss of biodiversity.	• Mitigation measures in terms of biodiversity impacts are included in the Environmental Management Programme (EMPr, Part B of this report). • The project area will be rehabilitated for use after mining in the pit area, but a significant loss of biodiversity is not expected to result from the project, considering that the intact riparian zone fringing the Crocodile River will not be affected by the majority of the proposed project.	Some activity might take place close to the riparian fringe, such as topsoil berm placement.
The applicant must comply to local by-laws	• Local by-laws have been reviewed to determine oversights on the project. A condition for authorisation has been included that such laws have to be adhered to during the project, and must be assessed as such by the Environmental Control Officer (ECO) during monthly inspections of the implementation of the EMPr.	Adherence to the EMPr should be monitored continually by on-site Environmental Officers, but the implementation thereof should not be their sole responsibility.

12.9. Motivation where no alternative sites were considered

Site *layout* alternatives were considered to determine the least impactful overburden dumping and topsoil stockpiling area; pit *size* alternatives were considered, and mining *method* alternatives were considered.

As indicated in Section 12.1 of this report, no alternatives to *pit locations* have been considered as mining can only be undertaken in areas where economically mineable resources occur. The relatively small size of the property further limits the potential for alternative sites.

The only real alternative to mining activities is the No-Go Option. The farm has been developed for irrigation farming. The land belongs to a private company, producing soy beans, maize, sunflowers and wheat, which can continue if the No-Go Option is pursued. The main consequence of the No-Go Option is the potential closure of the entire Amandelbult Mine Section. Other losses include the opportunity to develop a high quality mineral resource with an estimated LoM of 30 months which has the potential for economic benefits on a local level in terms of employment and a contribution to processed PGE resources.

12.10. Statement motivating the alternative development location within the overall site

The preferred location of overburden stockpiles is outside of the 1:100 year flood line of the Crocodile River, to the west of the pit. The pit size was selected as 34 ha at a 60 m depth, using a strip mining method with concurrent overburden material replacement. These preferred site conditions were selected due to the presence of the subterranean government control area for groundwater and the close proximity of the pit to the riparian habitat surrounding the Crocodile River. The mine will be able to continue operations through this and other opencast activities while commodity prices are low. In addition, an intersection at the D1639 district road will be developed to mitigate impacts on road users.

The execution of the No-Go alternative may lead to Dishaba mine being closed down due to low commodity prices, with the potential loss of numerous jobs.

13. Full description of the process undertaken to identify, assess, and rank the impacts and risks the activity will impose on the preferred site (in respect of the final site layout plan) through life of the activity

This section provides a description of all the environmental issues and risks that were identified during the environmental impact assessment process and an assessment of the significance of each issue and risk and an indication of the extent to which the issue or risk could be avoided or addressed by the adoption of mitigation measures.

The environmental issues and risks identified throughout the EIA-process are listed in Table 64 and Table 65, along with an assessment of the significance of each issue / risk. An indication of the extent to which the issues / risks could be avoided by adopting mitigation measures provided in Section 12.5, is also provided in Table 66.

To identify, assess, and rank impacts and risks of the proposed activity, the EAP perused:

- specialist reports;
- I&AP issues and concerns;
- typical impacts and risks associated with similar projects; and
- communication with authorities, such as DWS, DAFF, and LEDET.

14. Assessment of each Identified Potentially Significant Impact and Risk

The known typical impacts of each of the activities (including those identified by specialists and I&APs) are considered in Table 66:

Table 66 | Impacts and risks associated with opencast mining activities

ACTIVITY whether listed or not (e.g. excavations, blasting, stockpiles, discard dumps or dams, loading, hauling and transport, water supply dams and boreholes, accommodation, offices, ablution, stores, workshops, processing plant, storm water control, berms, roads, pipelines, powerlines, conveyors, etc.)	POTENTIAL IMPACT (e.g. dust, noise, drainage surface disturbance, fly rock, surface water contamination, air pollution, etc.)	ASPECTS AFFECTED	PHASE in which impact is anticipated (e.g. construction, commissioning, operational, decommissioning, closure, post-closure)	SIGNIFICANCE if not mitigated	MITIGATION TYPE (modify, remedy, control, or stop through e.g. noise control measures, storm-water control, dust control, rehabilitation, design measures, blasting controls, avoidance, relocation, alternative activity, etc.)	SIGNIFICANCE if mitigated
Project design	Loss of SCC Loss of land capability Complaints from affected and neighbouring land owners	Ecological structure Agricultural potential (soil)	Planning and design; Pre-construction	Low (-)	Please refer to Table 43.	Very Low (-)
				High to Moderate (-)	Please refer to Table 38.	Very Low (-)
				Moderate (-)	Please refer to Table 56.	Low (-)
Fencing of the pit area	Surface disturbance	Floral habitat	Construction	High to Moderate (-)	Please refer to Table 43.	Moderate to Very Low (-)
Entering and mining on private properties	Loss of land capability Noise Temporary loss of land and assets Impacts on sense of place	Agricultural potential (soil) Ambient noise levels Sense of place	Pre-construction; Construction	High to Moderate (-)	Please refer to Table 38	Very Low (-)
				Low to Very Low (-)	Please refer to Table 49.	Low to Very Low (-)
				Moderate (-)	Please refer to Table 56.	Low (-)
Establishment of laydown area, storm water management measures and haul roads	Loss of land capability Soil contamination Surface- and groundwater contamination Noise	Agricultural potential (soil) Surface- and groundwater Ambient noise levels	Pre-construction; Construction	High to Moderate (-)	Please refer to Table 38.	Very Low (-)
				Low (-)	Please refer to Table 47.	Very Low (-)
				Low to Very Low (-)	Please refer to Table 49.	Low to Very Low (-)
Personnel conduct	Noise Population influx Socio-cultural pathologies	Ambient noise levels Local socio-cultural environment Local economy	Pre-construction	Low to Very Low (-)	Please refer to Table 49.	Low to Very Low (-)
				Very Low (-)	Please refer to Table 56.	Very Low (-)

ACTIVITY whether listed or not (e.g. excavations, blasting, stockpiles, discard dumps or dams, loading, hauling and transport, water supply dams and boreholes, accommodation, offices, ablution, stores, workshops, processing plant, storm water control, berms, roads, pipelines, powerlines, conveyors, etc.)	POTENTIAL IMPACT (e.g. dust, noise, drainage surface disturbance, fly rock, surface water contamination, air pollution, etc.)	ASPECTS AFFECTED	PHASE in which impact is anticipated (e.g. construction, commissioning, operational, decommissioning, closure, post-closure)	SIGNIFICANCE if not mitigated	MITIGATION TYPE (modify, remedy, control, or stop through e.g. noise control measures, storm-water control, dust control, rehabilitation, design measures, blasting controls, avoidance, relocation, alternative activity, etc.)	SIGNIFICANCE if mitigated
Operation of sanitation system(s)	Surface- and groundwater contamination Soil contamination	Surface- and groundwater Agricultural potential (soil)	Operational	Low (-) Low (-)	Please refer to Table 47. Please refer to Table 38.	Very Low (-) Very Low (-)
Laydown area, storm water management measures, haul roads and equipment storage areas	Loss of land capability Soil contamination Surface- and groundwater contamination Noise Dust generation Air emissions	Agricultural potential (soil) Soil Surface- and groundwater Ambient noise levels Ambient air quality	Operational	High to Moderate (-) Low (-) Low to Very Low (-) Low (-)	Please refer to Table 38. Please refer to Table 47. Please refer to Table 49.	Very Low (-) Very Low (-) Low to Very Low (-) Low to Very Low (-)
Transportation of material	Dust emissions Noise District road damage	Ambient air quality Ambient noise levels District road integrity	Operational	Low (-) Low to Very Low (-) Moderate (-)	 Please refer to Table 49. Please refer to Table 56.	Low to Very Low (-) Low to Very Low (-) Low (-)
Trenching and transport of soils	Dust emissions Noise Loss of agricultural potential Loss of floral SCC	Ambient air quality Ambient noise levels Agricultural potential (soil)	Operational	Low (-) Low to Very Low (-) High to Moderate (-)	 Please refer to Table 49. Please refer to Table 38.	Low to Very Low (-) Low to Very Low (-) Very Low (-)
Mining activities within the Crocodile River floodplain	Risk of property damage Risk of flooding in project area within floodplain	Loss of habitat and ecological structure Flood risk Safety Property integrity	Operational	High to Moderate (-) Moderate to Low (-)	Please refer to Table 43. Please refer to Table 56.	Moderate to Low (-) Low to Very Low (-)
Protection of heritage sites and palaeontological finds	Damage to heritage sites Sealing in or destruction of fossils	Heritage resources Palaeontological resources	Construction and operational	Very low (-)	Please refer to Table 57.	Very low (-)

ACTIVITY whether listed or not (e.g. excavations, blasting, stockpiles, discard dumps or dams, loading, hauling and transport, water supply dams and boreholes, accommodation, offices, ablution, stores, workshops, processing plant, storm water control, berms, roads, pipelines, powerlines, conveyors, etc.)	POTENTIAL IMPACT (e.g. dust, noise, drainage surface disturbance, fly rock, surface water contamination, air pollution, etc.)	ASPECTS AFFECTED	PHASE in which impact is anticipated (e.g. construction, commissioning, operational, decommissioning, closure, post-closure)	SIGNIFICANCE if not mitigated	MITIGATION TYPE (modify, remedy, control, or stop through e.g. noise control measures, storm-water control, dust control, rehabilitation, design measures, blasting controls, avoidance, relocation, alternative activity, etc.)	SIGNIFICANCE if mitigated
Stripping and storage of topsoil	Loss of land capability Soil contamination Dust emissions Soil compaction	Agricultural potential Ambient air quality	Construction and operational	High to Moderate (-)	Please refer to Table 38.	Very Low (-)
				Low (-)		Low to Very Low (-)
Storage and use of hazardous material, including hydrocarbons	Soil contamination Surface- and groundwater contamination	Soil Surface- and groundwater	Operational	High to Moderate (-)	Please refer to Table 38.	Very Low (-)
				Low (-)	Please refer to Table 47	Very Low (-)
Storage, removal and disposal of domestic and hazardous waste	Soil contamination Surface- and groundwater contamination	Soil Surface- and groundwater	Operational	High to Moderate (-)	Please refer to Table 38.	Very Low (-)
				Low (-)	Please refer to Table 47	Very Low (-)
General mining activities	Fly rock Air blast Ground vibration Noise Dust generation Air emissions Loss of floral and faunal SCC Loss of floral and faunal habitat Loss of floral and faunal diversity Soil compaction	Safety Property integrity Ambient noise levels Ambient air quality Ecological structure Soil	Operational	Moderate to Very Low (-)	Please refer to Table 50.	Low to Very Low (-)
				Moderate to Very Low (-)		Low to Very Low (-)
				Moderate to Very Low (-)		Low to Very Low (-)
				Low to Very Low (-)	Please refer to Table 49.	Low to Very Low (-)
				Low (-)		Low to Very Low (-)
				High to Moderate (-)	Please refer to Table 43.	Moderate to Very Low (-)
				Moderate to Low (-)	Please refer to Table 38.	Low to Very Low (-)
Pit dewatering	Loss of aquifer water content	Groundwater quantity	Operational	Moderate (+)	Please refer to Table 47.	Moderate (+)
Continuation of employment opportunities and social benefits	Local employment continuation Continuation of mining activities at Amandelbult	Local socio-cultural environment Local economy	Operational	Moderate (+)	Please refer to Table 56.	Moderate (+)
Rehabilitation of roads impacted Waste removal Rehabilitation of pit void	Adequate use of infrastructure after rehabilitation Adequate removal of waste after rehabilitation Aquifer recharge	Local infrastructure Aesthetics Surface- and groundwater	Rehabilitation and Post-closure	Low (+)	-	Low (+)
				Low (+)	Please refer to Table 38.	Low (+)

ACTIVITY whether listed or not (e.g. excavations, blasting, stockpiles, discard dumps or dams, loading, hauling and transport, water supply dams and boreholes, accommodation, offices, ablution, stores, workshops, processing plant, storm water control, berms, roads, pipelines, powerlines, conveyors, etc.)	POTENTIAL IMPACT (e.g. dust, noise, drainage surface disturbance, fly rock, surface water contamination, air pollution, etc.)	ASPECTS AFFECTED	PHASE in which impact is anticipated (e.g. construction, commissioning, operational, decommissioning, closure, post-closure)	SIGNIFICANCE if not mitigated	MITIGATION TYPE (modify, remedy, control, or stop through e.g. noise control measures, storm-water control, dust control, rehabilitation, design measures, blasting controls, avoidance, relocation, alternative activity, etc.)	SIGNIFICANCE if mitigated
				Low (+)	Please refer to Table 47.	Low (+)
Topsoil replacement	Return of land to agricultural use	Agricultural potential (soil)	Rehabilitation	Low (+)	-	Low (+)
Aquifer recharge	Decant Downstream groundwater contamination	Surface- and groundwater	Rehabilitation	Low (-)	Please refer to Table 47.	Low (-)
		Agricultural potential (water availability)		Low (-)	Please refer to Table 47.	Low (-)

The supporting impact assessment conducted by the EAP is attached as Appendix 8.

15. Summary of Specialist Reports

The summary provided in Table 67 provides details of specialist reports undertaken for the proposed project, recommendations provided in reports, and how (and if) they were incorporated into this EIR.

Table 67 | Specialist reports undertaken and recommendations made for the proposed Haakdoorndrift Opencast Project

LIST OF STUDIES UNDERTAKEN	RECOMMENDATIONS OF SPECIALIST REPORTS	SPECIALIST RECOMMENDATIONS THAT HAVE BEEN INCLUDED IN THE EIA REPORT (Mark with an X where applicable)	REFERENCE TO APPLICABLE SECTION OF REPORT WHERE SPECIALIST RECOMMENDATIONS HAVE BEEN INCLUDED
Soil, land use, and land capability	1. In order to do successful rehabilitation, the procedures described in section 7 of the specialist report conducted by Rehab Green need to be executed as well as possible (Rehab Green, 2017). These procedures include *Principles for stripping and stockpiling of topsoil, Procedures to follow for structures with a flat basis such as ore stockpiles, haul roads, sidings and plants; Procedures to follow for structures such as hard and soft overburden stockpiles, waste stockpiles (rock dumps) and topsoil stockpiles; Procedures to follow for structures with a deeper concave basis such as pollution control dams;* a *Stripping, stockpiling, and replacement of topsoil at the open pit area* guide map and table; *Backfilling of open pit and leveling of spoil/rock material; Replacing and leveling of stored topsoil and preparation of the surface;* and *Soil amelioration and revegetation.* 2. A post-mining soil depth and land capability evaluation should be conducted by a soil specialist registered at the Council for Natural Scientific Professions (SACNASP) in order to map the final post-mining land capability which will be used for final post-mining land uses and closure purposes. Auger observations at a grid spacing of 100 x 100 m should be conducted to compile a final post-mining land capability map needs to be compiled and should be submitted for closure purposes. 3. The post-mining land capability of the total open pit area (100%) should be arable by replacing 0.98 m (roughly 1 m) of high quality topsoil.	All specialist mitigation measures have been incorporated into Part B of this report.	Table 69
Fauna, flora, and wetland ecology	As specified in Table 43.	All specialist mitigation measures have been incorporated into Part B of this report.	Table 69
Geohydrology	1. The dewatering of the local aquifer system and destruction of its structure/s cannot be prevented or mitigated. However, a quarterly monitoring program should be implemented to monitor the extent of the dewatering.	All specialist mitigation measures have been incorporated into Part B of this report.	Table 69

Air quality	1. According to SANS 1929:2005 the concentrations of specific pollutants within an area shall be evaluated against the specified upper and lower thresholds to determine applicable assessment methods (as detailed in the Air Quality Impact Assessment conducted by EHRCON). 2. Provision should be made for three air pollutant concentration assessment methods, based on the classification pollutant concentrations relative to the upper and lower assessment thresholds. These methods are: o mandatory monitoring, which may be supplemented by modelling techniques to provide an adequate level of information on ambient air quality. This method should be implemented where the upper assessment threshold for a specific pollutant is exceeded; o a combination of measurement and modelling techniques should be implemented in areas and for pollutants for which concentrations are between the upper and lower assessment thresholds; and o the sole use of modelling or objective estimation techniques is permissible for pollutant concentrations below the lower assessment threshold. o The classification to determine applicable assessment methods should be based on air pollutant concentrations recorded during the previous five years where data is available. Classification should be reviewed earlier than every five years in the event of significant changes in activities relevant to ambient air pollutant concentrations. 3. A priority must be given to continuous monitoring of ambient dust deposition rates for the full duration of the project. Source monitoring stations should be positioned near the opencast pit, transport routes and the ROM area. Receptor monitoring stations should be positioned at representative receivers within a radius of 2 km from mining operations. Dust deposition monitoring is essential to determine spatial and temporal trends, and to track progress made by control measures implemented. 4. It is imperative that a PM_{10} monitoring network be established for the Amandelbult operations. 5. An emissions inventory and annual modelling regime must be maintained throughout the life of the project. *Dust control measures – Processes and Plant* Consideration must be given to the relationship of activities on-site to sensitive areas beyond the property boundary, such as: 6. placing dust generating activities where maximum protection can be obtained from natural features; 7. locating dust generating activities where prevailing winds will blow dust away from the receiving community; 8. minimising the need to transport and handle materials by placing adequate storage facilities close to processing areas. *Dust control measures – Vehicle entrained emissions and fugitive sources* 9. Control techniques for fugitive dust sources, including stockpiles, generally involve watering, chemical stabilisation and the reduction of surface wind speed through the use of windbreaks and vegetation. 10. Permanent improvements in road surfaces, such as paving, results in continuous control efficiencies. Where possible, pave all major haul routes. Paving is effective, but expensive and unsuitable for surfaces used by very heavy vehicles or subject to spillage of material in transport. In addition, dust	All specialist mitigation measures, except no. 10, have been incorporated into Part B of this report. The exclusion of no. 10 is based on the risk of soil compaction associated with road pavement. Paving a road that would only be used for approximately three years will have a more sever environmental impact on the agricultural land affected than simply using a gravel haul road and using suppression measures to control dust.	Table 69

	control measures will usually still be required on the paved surfaces. The use of gravel or slag can be moderately effective, but repeated additions are normally required. 11. Set speed limits of 40km/hr or less for site traffic on paved roads and 20km/hr on unpaved surfaces. 12. Wet suppression of unpaved areas should be applied during dry windy periods, using a water car and/or sprinklers at a rate of more than 2.0l/m^2/hour. 13. Inspect road integrity and repair frequently. 14. Provide firm marshalling areas. 15. Reduce track-on through the use of a wheel wash-bay. 16. Reduce unnecessary traffic. 17. Limit load size. 18. Minimise travelling distance through good layout and process design. 19. Limit the height and slope of stockpiles to reduce wind entrainment. The ideal stockpile is not higher than 3m, has a gentle slope (>45°) and has an irregular apex. 20. Ideally stockpiles should be fully enclosed. 21. Minimise drop heights onto stockpiles. 22. Wind barriers can be effectively used to control pollution from stockpiles.		
Noise	1. An acoustical Measurement & Audit Programme is recommended to be conducted during the construction and operational phase. Measurements should be collected in 10-minute bins over at least a 24 hour measurement period. Variables and measurement recommended settings to be analysed include L_{AMin}, L_{Aeq}, L_{AMax}, L_{Amin}, L_{A10}, L_{A90} and spectral analysis. Noise measurements must be continued as long as there are potential receptors living within 2 km from the closest mining activities, or as long as reasonable and valid noise complaints are registered. More details on the proposed Programme and monitoring specifications are provided in the specialist report. 2. Use quieter equipment or berms (acoustical screens) between noise sources and receptors. 3. Operate at different times, operate equipment at different locations and limit the simultaneous use of equipment. 4. Monitoring may be required to measure the success of mitigation measures. 5. Surrounding receptors should be informed about sounds generated by the proposed project. Information presented to stakeholders should be factual and should not set unrealistic expectations. A positive community attitude throughout the greater area should be fostered, particularly with those residents near the mining operations. The applicant must implement a line of communication where complaints could be lodged.	All specialist mitigation measures have been incorporated into Part B of this report.	Table 69

	6. It is highly recommended that the mine includes an Environmental Awareness component in their Safety and Health induction which should include a sound and noise facet (to allow employees and contractors to realise the potential noise risks that activities – especially night-time activities – pose to the surrounding environment). All employees and contractors should receive this training. *Recommended mitigation measures during construction phase:* 7. Use smaller/quieter equipment when operating near receptors. 8. Investigate the use of white-noise generators instead of tonal reverse alarms on heavy vehicles operating on roads, in mine pits and at stockpile areas[6]. This option is highly recommended although it must be noted that reverse alarms is exempt from an acoustical assessment due to Government Notice R154 of 1992 (Noise Control Regulations) – Clause 7(1) – *"the emission of sound is for the purposes of warning people of a dangerous situation"*. 9. Where possible only operate during the day. If night-time activities are required, do not operate closer than 900 m (mobile equipment) from any receptors (prevent noise impact of medium or higher significance). 10. Ensure that equipment is well maintained and fitted with the correct and appropriate noise abatement measures. *Recommended mitigation measures during operational phase:* 11. Mitigation options are not required and recommended during the operation of the mine although the mine developer is recommended to consider the measures defined in the previous section. 12. The development of an Environmental Awareness section in the Safety and Health Induction training programme is highly recommended.		
Blasting and vibration	1. The level of ground vibration can be mitigated by: o Reducing the charge mass per delay by planning blasting operations while considering different initiation and charging options; o Increasing the distance between the blast and the structure of concern. 2. A monitoring programme for recording blasting operations is recommended, including: o Ground vibration and air blast results; o Blast Information summary; o Meteorological information at time of the blast; o Video Recording of the blast;	All specialist mitigation measures, except no. 9, have been incorporated into Part B of this report. The exclusion of no. 9 is based on confirmation from the applicant that the line is redundant and will be removed by Eskom prior to the commencement of the project.	Table 69

[6] White Noise Reverse Alarms: http://www.brigade-electronics.com/products.

	o Fly rock observations. 3. The legislated 500 m buffer should be regarded as a no-go zone during blasting operations. 4. Specific blast designs will need to be considered when blasting operations approaches the ventilation shaft and structures on western side. 5. A first test blast could be conducted to confirm levels of ground vibration and air blast. Detailed monitoring thereof could be used to help define blasting operations going forward. This test blast can be based on the existing design and only after this blast it may be necessary to define if changes are required or not. 6. The current proposed stemming lengths must be maintained at least to ensure control on fly rock. Specific designs where distances and blast is known should be considered with this. 7. Calculated minimum safe distance is 268 m. The final blast designs that may be used will determine the final decision on safe distance to evacuate people and animals. This distance may be greater pending the final code of practice of the mine and responsible blaster's decision on safe distance. The blaster has a legal obligation concerning the safe distance and he needs to determine this distance. 8. The D1639 and other gravel roads are in close proximity of the pit areas. Road closures will need to be arranged when blasting is done within 500 m from these roads. This must be negotiated prior to operation start with the necessary neighbours and authorities. 9. Powerlines close to the put area will need to be considered. Either a relocation process should be negotiated or if blasting is going to happen, in situ permissions will have to be acquired for this. If blasting operations are going to be done in situ, a new blast design process is recommended. The current design will not be sufficient to control fly rock and effects from blasting operations on the short distances then applicable. 10. A photographic survey of all structures up to 1500 m from the pit areas is recommended. This will give advantage on any negotiations with regards to complaints from neighbours on structural issues due to blasting. However, this process can only succeed if done in conjunction with a proper monitoring program. 11. Recommended ground vibration and air blast limits provided for different structures should not be exceeded. 12. A further consideration of blasting times is when weather conditions could influence the effects yielded by blasting operations. It is recommended not to blast too early in the morning when it is still cool or when there is a possibility of atmospheric inversion or too late in the afternoon in winter. Do not blast in fog. Do not blast in the dark. Refrain from blasting when wind is blowing strongly in the direction of an outside receptor. Do not blast with low overcast clouds. These 'do nots' stem from the influence that weather has on air blast. The energy of air blast cannot be increased but it is distributed differently and therefore is difficult to mitigate.		

	13. It is recommended that a standard blasting time is fixed and blasting notice boards set up at various routes around the project area that will inform the community of blasting dates and times. 14. Third-party consultation and monitoring should be considered to obtain unbiased evaluation of levels and influence from an independent group. Monitoring could be done using permanent stations. Audit functions may also be conducted to assist the mine in maintaining a high level of performance with regards to blast results and the effects related to blasting operations. 15. Based on the maximum charge per delay it is calculated that any boreholes closer than 350 m to pit boundary should be monitored. 16. The occurrence of NOx fumes should be closely monitored.		
Heritage	The following recommendations are given should any sub-surface remains of heritage sites be identified: 1. All operators of excavation equipment should be made aware of the possibility of the occurrence of sub--surface heritage features and the following procedures should they be encountered. 2. All construction in the immediate vicinity (50m radius of the site) should cease. 3. A heritage practitioner should be informed as soon as possible. 4. In the event of obvious human remains the South African Police Services (SAPS) should be notified. 5. Mitigation measures (such as refilling etc.) should not be attempted. 6. The area in a 50 m radius of the find should be cordoned off with hazard tape. 7. Public access should be limited. 8. The area should be placed under guard. 9. No media statements should be released until such time as the heritage practitioner has had sufficient time to analyse the finds.	All specialist mitigation measures have been incorporated into Part B of this report.	Table 69
Palaeontology	In the unlikely event of fossils being discovered in the sands and the soils in the study area, the ECO should document the fossils photographically, note the locality and contact a palaeontologist for advice. No attempt should be made to remove such fossils. In this event a palaeontologist should be appointed to rescue the fossils with a permit from SAHRA and to take it to an acknowledged palaeontological repository such as the Ditsong Museum in Pretoria.	All specialist mitigation measures have been incorporated into Part B of this report.	Table 69
Rehabilitation	1. The soils should be stockpiled on the parent soils and as close to the originally stripped and final rehabilitation areas as possible. 2. The *topsoil* stockpile area within the 31 ha designated stockpiling area must be clearly delineated. 3. Due to very similar soil properties of soil types within the open pit footprint all soil types (Ar1 and Bo1) can be stored together on one stockpile. 4. The stockpile height should preferably not exceed 6 m in height. 5. Soils should be stockpiled loosely. Where possible, soils should be dumped in a single lift if truck and shovel methods are used. If the dumps are too low, then the height could be increased by using a dozer blade or backacter bucket to raise the materials. 6. To mitigate compaction, soils should be stripped in thick cuts and dumped as thickly as possible.	All specialist mitigation measures have been incorporated into Part B of this report.	Table 69

	7. Vegetation should be allowed to establish itself in situ on the topsoil stockpiles to avoid soil loss due to erosion and weed colonisation as well as fertility loss. Should vegetation not establish itself, then fertilisers will need to be applied into the stockpile to vegetate. A similar seed mixture to the final one recommended for rehabilitation should be used. 8. The topsoil stockpiles must be clearly demarcated as "No Go" zones and monitored frequently. Employee awareness programmes are to be carried out to reduce the risk of stockpile "robbery" / unauthorised use or contamination. 9. During stripping and stockpiling the following principles should be aimed for: a. Prevent mixing of high quality topsoil (A and B-horizons) with low quality underlying material to ensure sufficient volumes of high quality soil for rehabilitation. b. Separate stockpiling of different soil type groups. Contrary to the general perception, separate stockpiling of different soil types does not have significant cost implications for the mine and only requires planning and continuing management. c. Separate stripping, stockpiling and replacing of soil horizons (A and B-horizon) in the original natural sequence to combat hard setting and compaction, maintain soil fertility and conserve the natural seed source. This approach will only be implemented for the topsoil stripping, stockpiling and placement to be done in the haul roads areas. The A and B-horizons should be stripped and stockpiled separately and replaced with the A-horizon overlying the B-horizon. 10. Design criteria should include: a. Post mining landform to be free draining of surface water runoff; b. Slopes to be 1:10 or flatter; c. Apply a bulking factor of 25% to the in-pit volumes removed during mining; d. Utilise as much of the waste volume as possible as backfill material; e. Waste material not utilized as backfill will remain on the designated waste rock footprints for rehabilitation; and f. Incorporate the waste rock volume utilised for haul road construction in the pit backfill. 11. The constructed post-mining landform should be covered with stockpiled topsoil. 12. A traffic management plan should be developed and implemented to ensure that trucks do not traverse topsoil at the stockpiles or the placement site. 13. Care should be taken to tip enough soil per square unit to reinstate the total required post mining soil depth (1m) at once. 14. Spreading of soil over far distances and repeated traversing of heavy mechanical equipment should be minimised. 15. The dumped soil heaps should only be levelled on top to reach the required soil thickness. Track mounted equipment is preferred for levelling of topsoil as they cause less compaction. 16. The replaced topsoil thickness should be progressively monitored during replacement to verify if it is similar to the replacing depth provided in the specialist report completed by Rehab Green (in particular, the *Stripping, stockpiling, and replacement of topsoil at the open pit area* guide map and table), and to prevent encountering shortages of topsoil.		

	17. Vegetation establishment should be carried out from the end of October to the beginning of April. 18. The vegetation establishment and rehabilitation is to be carried out in compliance with Section 5800 of the COLTO specifications. 19. In terms of chemical amelioration, lime shall be incorporated into the mixture to adjust the pH and Calcium sulphate incorporated to wash out excessive soluble salts. 20. Rip the entire area to a depth of 400 mm. Further specific details on the rehabilitation process is detailed in the Rehabilitation and Closure Liability Assessment completed by WRINK.		
Traffic	1. Public transport facilities, such as lay-bys, bus shelters and walkways, should be provided at convenient locations within the development site. 2. It is recommended that the mine make a contribution to the rehabilitation of the section of D1639 that is affected by the mine activity. This gesture would illustrate to road authorities the willingness of the client to support the local community and its contribution to the maintenance of roads in the area.	All specialist mitigation measures have been incorporated into Part B of this report.	Table 69

16. Environmental Impact Statement

16.1. Summary of key findings of environmental impact assessment

The key findings of the report (based on the implementation of the preferred alternatives) are:

- The worst-case figure for groundwater influx into the pit through geological faults, and to a lesser extent the surface water of the Crocodile River, is 450 m^3/day in year three, with gradual recovery thereafter.
- The closest borehole to the pit is about 300 m east of the pit. This borehole, LS01 (not currently in use) is outside the cone of depression that will be caused by the pit, but may, according to the groundwater report, experience a maximum drawdown of 2 m lower than the current water level. The closest borehole (in use) to the pit, MC04, is on the eastern side of the Crocodile River, and will because of the hydraulic head of the river, be unaffected by the project activities.
- The expected decant rate of 16 040 m^3/y (0.5 l/s) is based on an isolated groundwater model, not taking into account evapotranspiration or linkages between the pit and other underground workings. The decant was modelled to only occur after 134 years after mining activities have ceased. In practice, considering external factors to the isolated model below, it is expected to be even lower due to water loss from evapotranspiration through the vegetated soil capping after rehabilitation. The majority of current and old opencast pits are linked with the underground workings (by means of mining activities or transmissive geological structures), which must be flooded first before any decanting can occur. Based on current experience of these additional factors, the decant is expected not to occur.
- The contamination plume simulated for the proposed Haakdoorndrift pit (with elevated nitrate levels) does not intersect any of the user boreholes, i.e. groundwater quality of user boreholes will remain unaffected by the planned new mining activities.
- The south-eastern corner of the pit and its buffer zone (50 m activity area) is outside the floodplain depression. The pit operations will however, encroach on the 100 m buffer zone of the riparian vegetation, which has been classified as highly sensitive. Therefore, the potential exists that the groundwater drawdown may impact on the sensitive floodplain/riparian wetland vegetation. Plant moisture stress monitoring will be implemented to determine any impacts.
- The closest permanent farm homestead (or farm worker housing) is about 2 km from the pit edge, outside the blasting zone, high noise impact zone. Regarding noise, the 900 m non-operating zone during night-time will not be encroached upon.
- In terms of air quality, dry deposition will most likely be a nuisance on-site and beyond the mining boundary, up to a distance of 600 m from operations.
- The 65 ventilation shaft, buildings to the west of the pit (planned to be refurbished as offices), D1639 road, dams and pump houses to the north and south of the pit could possibly be influenced by ground vibration. Ground vibrations predicted ranged between 1.1 mm/s and 3199.6 mm/s for these points of interest. Ground vibration at structures and installations other than the identified problematic structures is well below any specific concern for inducing damage.
- Air blast levels expected ranged between low and high for the range from nearest to furthest points of interest. Air blast levels predicted showed less concern than ground vibration. The levels at the buildings to the west of the pit are expected to be higher than the proposed limits and might be damaging.
- The exclusion zone for blasting was established to be at least 268 m. Structures that occur within this zone include the D1639 road, the 65 ventilation shaft, farm buildings, pivot irrigation, the Crocodile River and the powerlines closest to the pit area. These installations are within the unsafe zone and will require specific attention regarding permissions, schedules and road closures that will have to be negotiated with the necessary authorities. However, the use of the typical minimum 500 m exclusion zone is recommended.
- Based on the maximum charge per delay it is calculated that any boreholes closer than 350 m to pit boundary could be affected by ground vibration.
- The haul road crosses the D1639 district road. A dedicated safe crossing is planned at this point, which will cause public road users to stop should a haul truck be crossing the road. The road has a low traffic volume.

After mitigation, only one “high” negative impact remains. The rest of the impacts are moderate and lower. The necessary monitoring programme has been developed for the HOP, and will be implemented. In addition, regular compliance assessments will be performed which will include the determination of efficiency of mitigation measures.

16.2. Final site map

The final site map is shown in Figure 96, and is attached as Appendix 3. The proposed overall activity and its associated structures and infrastructure are superimposed on the environmental sensitivities of the preferred site, areas that should be avoided, and buffers.

16.3. Summary of positive and negative implications and risks of proposed activity and identified alternatives

Please refer to Section 12.7 for a summary of the positive and negative implications and risks associated with each proposed alternative and the associated activities.

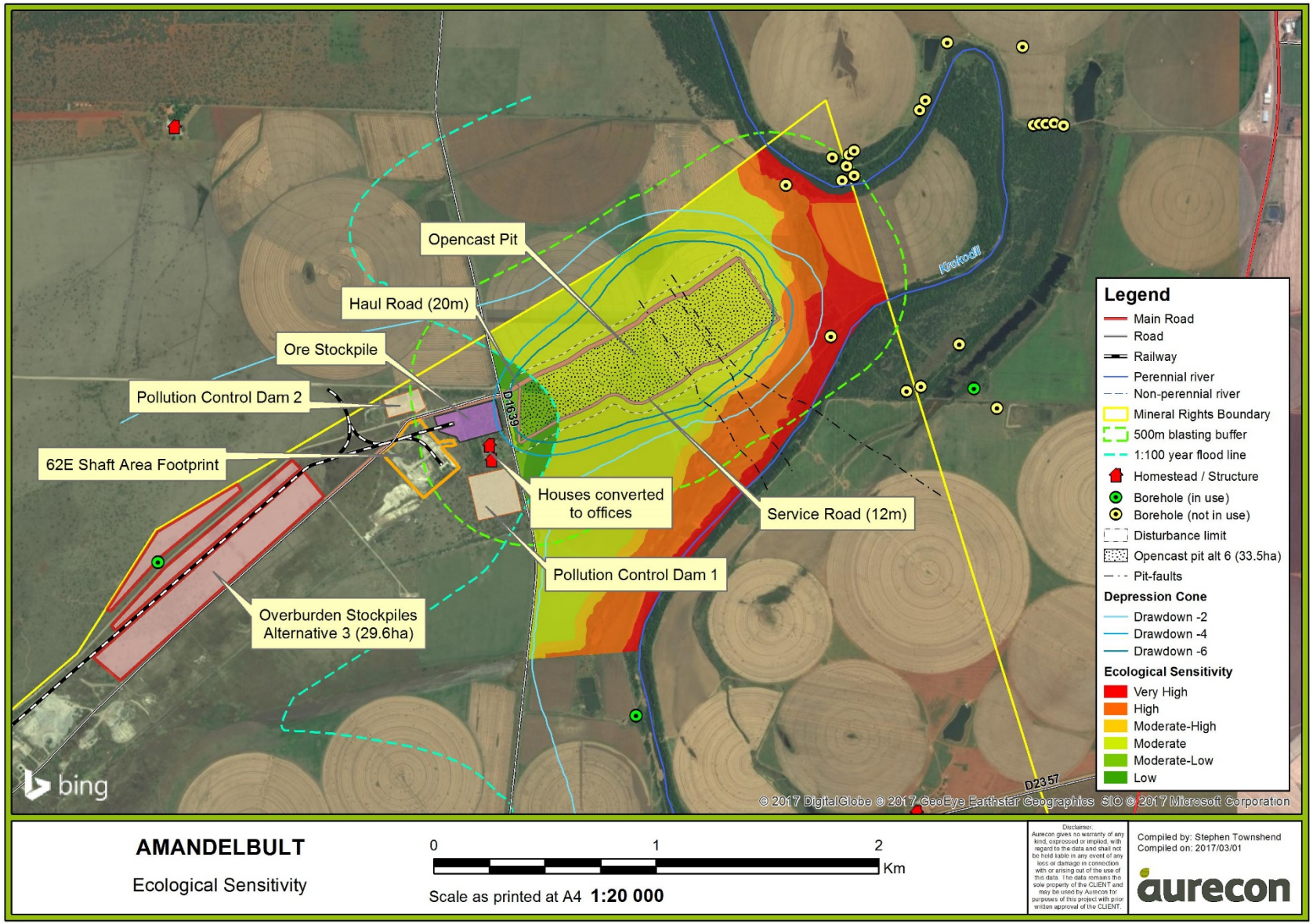


Figure 96 | Final site map showing the overall activities overlain onto the environmental sensitivities and buffer zones

17. Proposed Impact Management Objectives and Impact Management Outcomes for Inclusion in EMPr

Impact management objectives and outcomes are proposed in this chapter, based on the overall impact assessment and specialist report recommendations. These objectives and outcomes could also be included in the conditions of authorisation:

The EMPr seeks to achieve a required end state and describes how activities that have, or could have, an adverse impact on the environment must be mitigated, controlled and monitored.

This project's EMPr addresses the environmental impacts during the Construction, Operational, and Rehabilitation Phases of the Haakdoorndrift Opencast Project. Due regard must be given to environmental protection during the entire project. A number of mitigation measures have been recommended to achieve environmental protection during the project and thereafter, to ensure that the affected environment is reinstated to a similar or better state than its current condition. These objectives include, but are not limited to:

- Protect the biophysical environment from any impacts that cannot be mitigated and that will result in unacceptable negative impacts on biodiversity;
- Ensure that activities are carried out so as to aid rehabilitation;
- Ensure that all legislative requirements, in terms of NEMA and its Regulations, as well as the EMPr, are adhered to during all project phases.

Social objectives were set to allow the Haakdoorndrift Opencast Project to take place in a socially responsible manner:

- Adhere to an open and transparent communication procedure with stakeholders at all times.
- Enhance project benefits and minimise negative impacts through consultation with stakeholders.
- Ensure that recruitment strategies for the project, prioritise the sourcing of local labour and share in gender equality.
- Ensure an atmosphere of equality and non-discrimination among the workforce.

In addition, specialist reports include the following discipline-specific objectives and outcomes:

Air quality management objectives include:

The relationship between data collected and the information to be derived from it is essential in compiling an effective air quality management programme. The air quality management programme for the Amandelbult mining operation should ideally focus on the following key objectives:

- Determining population exposure and health impact assessment.
- Informing the public about air quality and raising awareness.
- Identifying threats to natural ecosystems.
- Determining compliance with national and international standards.
- Providing objective inputs to management.
- Source apportionment and identification.
- Policy development and prioritisation of management actions.
- Development/validation of management tools such as models and inventories.
- Assessing point or area source impacts.
- Trend qualification, to identify future problems or progress against management actions.

Rehabilitation objectives include:

- Ensuring long term physical and chemical stability;

- Establishment of a post-mining land use which can be sustained in the long term;
- Adherence to legislation relevant to mine closure; and
- Closure should be aligned with regional planning, company policies and agreements with stakeholders.
- Rehabilitation: to rehabilitate haul roads, stockpile areas and the open pit to the desired end land use (Arable);
- Demolition and reclamation: to demolish infrastructure, rehabilitated the related footprints and reclaim mine related infrastructure that can be redeployed;
- Monitor all aspects identified to demonstrate rehabilitation and closure success.
- All rehabilitated areas are free draining of surface water and integrated with the surrounding drainage network;
- The post mining land form is stable, erosion resistant and can be utilised gainfully as part of the areas agricultural mix; and
- Ground water stored within the rehabilitated pit forms part of the local extractable resource for agricultural purposes

18. Final Proposed Alternatives

This section provides and explanation of the final layout and activities of the proposed Haakdoorndrift Project.

The final layout of the infrastructure and activities of the overall project site, (as shown in Figure 2) are based on the impacts and risks assessed in Section 12.5 and 12.7. The final alternatives include:

1. The ***location of overburden material*** and topsoil stockpiles on a designated 31 ha area within the mining right area. The area has been disturbed by historic mining activities and is of little environmental importance. This area is not located within the 1:100 year floodplain of the Crocodile River (overburden location Alternative 3).
2. ***Adjusting the pit's eastern border*** such that it does not interfere with the sensitive riparian habitat surrounding the Crocodile River (pit Alternative 3).
3. Extracting PGE resources through a ***strip mining method*** and concurrently backfilling overburden material to limit risks within the floodplain and to facilitate the rehabilitation process (mining method Alternative 2).

19. Aspects for Inclusion as Conditions of Authorisation

The authorisation should be subject to the following conditions:

- The Project should, at all times, comply with the requirements of the EMPr and with all regulatory requirements;
- The EMPr should be implemented by one or more qualified Environmental Control Officers who are competent to interpret the requirements of the EIA and the EMPr, and who must be issued with a written mandate by Anglo to provide guidance and instructions to its contractors;
- Stakeholder engagement must be maintained during the construction, operational and rehabilitation phases of the project, with the emphasis on on-going provision of information pertaining to the project, and with the goal of maintaining constructive and mutually respectful stakeholder relations;
- A detailed record of all activities related to environmental and social management, as well as stakeholder engagement, should be retained for review and audit by independent parties for all phases of the project. The audit findings should be made available to the relevant environmental and local authorities upon such requests; and
- Any substantive changes to the project should be the subject of environmental assessments and should result in amendments to the EMPr. Information related to any such changes should be made available to the competent authority as well as for public review.

Conditions pertaining to noise impacts that should be included in the Environmental Authorisation include:

- An Acoustical Measurement & Audit Programme must be developed and implemented before the construction of the opencast pit. Noise measurements should continue as long as mining activities take place within 2 km from the closest potential noise-sensitive receptors;
- Anglo must investigate any reasonable and valid noise complaint if registered by a receptor staying within 2 km from any mining activities; and
- If blasting is required to take place near a receptor's dwelling (within 1,000 m), the developer must consult with a Vibration & Blasting Specialist.

Conditions pertaining to blasting impacts that should be included in the Environmental Authorisation include:

- A minimum 500 m exclusion zone for safe blasting should be enforced.
- A concern of the project is the location of the D1639 road, ventilation shaft, farm buildings, pivot irrigation, Crocodile River and the powerlines closest to the pit area. These installations are within the unsafe zone and will require specific attention regarding permissions, schedules and road closures that will have to be negotiated with the necessary authorities.

20. Description of Any Assumptions, Uncertainties and Gaps in Knowledge

This consultation EIA Report (CEIR) is based on the following assumptions:

- The information provided by Anglo is accurate, sufficient and unbiased, and no information that could change the outcome of the EIA process has been withheld.
- The information obtained from the specialist impact studies undertaken for this project is accurate and unbiased.
- The proposed mining methods, ore stockpile, overburden dump-, and crushing areas will not deviate significantly from the methods and areas assessed by the EAP and the specialists.
- In addition to this EA process, the impacts of the project on the surrounding water resources and related mitigation will be assessed and described in the IWULA and accompanying Integrated Water and Waste Management Plan (IWWMP).
- The lifespan of the project is approximately five years, including the rehabilitation and closure phase.
- Various environmental aspects have been covered for the overburden dump area as part of the Anglo RPM: AS's existing EAs which fall within the surface freehold of Anglo. However, the soil, land capability and terrestrial ecology aspects of the overburden dump area were investigated during the EIA phase of the project to determine the *impacts of placing overburden material and topsoil* on the designated site, as this was not previously assessed. Furthermore, relevant specialist studies to older approvals are more than five years old in some cases.
- Anglo will follow the conditions of the EA and applicable legislation for the duration of the project.

The CEIR is based on the following limitations:

- The scope of this investigation is limited to identifying the environmental impacts associated with the proposed HOP.

It is important to note that the scope of impacts presented in this report could change, should new information become available.

21. Reasoned Opinion as To Whether Proposed Activity Should or Should Not Be Authorised

21.1. Reasons why the activity should be authorised or not

The authorisation of this project will allow the Amandelbult Complex to continue to produce and supply PGE resources to a wide spectrum of industrial and commercial establishments and will benefit the Gross Domestic Product (GDP) of not only the municipality, but also the province as a whole. In addition, numerous persons will continue to be employed as a result of the opencast pit's operation. The environmental impact of this project is relatively small in the context of the entire mine, as no new additional processing facilities, railways, tailings facilities etc. are required to be constructed or monitored.

Furthermore, after mitigation, no "very-high" negative impacts remain, and only one "m" negative impact remains. The rest of the impacts are moderate and lower significance, through the implementation of the EMPr. The disturbed areas can be rehabilitated successfully by implementing the recommendations from various specialists, Anglo's Rehabilitation Guidelines, and monitoring rehabilitation success after project cessation.

21.2. Conditions to include in authorisation

21.2.1. Specific conditions to be included into compilation and approval of EMPr

- No machinery or heavy vehicles should be allowed outside the footprint applied for, as this may lead to damage of the riverine ecosystem of the Crocodile River.
- Mining operations should be monitored by an ECO.
- The mining area should be rehabilitated for agricultural use with the assistance of an appropriately qualified and competent soil and rehabilitation specialist(s)

The aspects that could be included in the EMP to ensure compliance with the Noise Control Regulations include the following:

- An Acoustical Measurement & Audit Programme must be developed and implemented before the construction of the opencast pit. Noise measurements should continue as long as mining activities take place within 2,000 m from the closest potential noise-sensitive receptors;
- The developer must investigate any reasonable and valid noise complaint if registered by a receptor staying within 2,000 m from any mining activities;
- If blasting is required to take place near a receptors dwelling (within 1,000 m), the developer must consult with a Vibration & Blasting Specialist; and
- The mine should minimise night-time mining activities (construction and operation) if closer than 1,000 m if there is no barrier between the mining activities and the closest receptors.

21.2.2. Rehabilitation requirements

The rehabilitation activities described in the specialist report according to GN1147 of NEMA (WRINK, 2017) must be implemented.

22. Period for Which Environmental Authorisation Is Required

Environmental Authorisation is required for 10 years, as the mine planning of the open cast activities may change depending on external factors, which may delay the implementation of the Haakdoorndrift Opencast Project.

23. Undertaking

The appointed EAP hereby declare the correctness of the information provided in this report as part of the EA application on behalf of Anglo.

23.1. Undertaking regarding the correctness of information

I, Johan Goosen, herewith undertake that the information provided in the foregoing report is correct and that the comments and inputs from stakeholders and I&APs have been correctly recorded in the report.

Signature of EAP

DATE: 7 March 2017

23.2. Undertaking regarding level of agreement

I, Johan Goosen, herewith undertake that the information provided in the foregoing report is correct and that the level of agreement with I&APs and stakeholders has been correctly recorded and reported herein.

Signature of EAP

DATE: 7 March 2017

24. Financial Provision

The amount required to manage and rehabilitate the affected project site is: R 211 605 106

24.1. Amount derivation

In accordance with legislation, financial provision must be made for the rehabilitation, closure, remediation of residual environmental impacts, and sudden cessation of mining operations.

Due to the nature anticipated for the Haakdoorndrift Opencast Project, the financial provision will include:

- Quantifying the annual concurrent rehabilitation provision based on a dedicated post-mining landform model and associated volumetric assessment;
- Determining the closure surface rehabilitation provision once mining has ceased, and the filled pit that must be dealt with; and
- Defining an initial quantification of specific provisions to deal with latent or residual impacts once the proposed Haakdoorndrift opencast mining area has entered a post-closure state.

Scope of work

Rehabilitation costs will be determined according to:

1. *Annual and closure rehabilitation provision*

Based on survey and planning data provided by the Applicant, and discussions with relevant mine personnel, annual concurrent rehabilitation and closure provisions will be determined by:

- Developing a dedicated post mining landform model utilising the available overburden and topsoil volumes;
- Compiling an annual rehabilitation plan for rehabilitation aligned with the proposed mining plan to delineate areas available for concurrent rehabilitation activities. The closure provision will be limited to the final void, remaining stockpile footprints and possible surface water management structures required once mining has ceased;
- Conducting an initial volumetric assessment of backfill and topsoil requirements for each area to be rehabilitated on an annual basis and at closure for the planned life of mine;
- Undertaking a first order hydrological assessment of the post-mining landform drainage structures to quantify drainage volumes and expected densities. The outcomes of this assessment will indicate if any additional storm water management measures will be required; and
- Compiling an itemised planning drawing indicating the relevant rehabilitation and closure components applicable to the proposed project.

2. *Specific post-closure provisions*

The new regulations for determining closure financial provisions specifically requires the quantification of potential latent or residual impacts. The purpose is mainly to ensure that financial provision is made for the management of the quality and quantity of groundwater after closure of the mine. This component will be implemented as follows:

- Reviewing the outcomes of the geohydrological assessment (and other relevant specialist studies) conducted for the proposed Haakdoorndrift opencast areas as part of the EIA process;
- Populating a risk assessment to identify possible latent or residual impacts for the post-closure state;
- Defining and quantifying measures to manage, mitigate or remove the identified risks.

24.2. Confirm that this amount can be provided for from operating expenditure

The amount stated is anticipated as an operating cost and is provided as such in the Mining Work Programme.

25. Deviations from Approved Scoping Report and Plan of Study

25.1. Deviations from methodology used in determining significance of potential environmental impacts and risks

- The mining method initially envisaged, mainly entailing the removal and stockpiling of overburden material and replacing it once-off after all mining at the pit is concluded.
- The initially proposed 30 ha pit was expanded to 40 ha, but the maximum depth up to which extraction will take place has been reduced from 115 m to 60 m.
- A 50 m disturbance zone around the pit area has been identified for the placement of haul roads, topsoil berms, and fencing. This addition amounts to an approximately 50 ha area (including the abovementioned pit and 50 m buffer) that would be disturbed by the proposed mining operations, instead of the initially proposed 220 ha area including and around the pit.
- A new Pollution Control Dam (no.1) had to be added to the project. This requires an additional listed activity (for the storage of water > 50,000 m^3 to also be added to the application.

25.2. Motivation for the deviation

Changes to the mining method were made after the mine plan was finalised more since the Scoping phase. During consultations with I&APs, authorities and specialists, various comments and issues were raised around the fate of the pit void, the temporary loss and potential damage to agricultural land, risks associated with the location of overburden dumps, the impacts of regularly crossing the D1639 road for the transportation of topsoil and overburden material, and the loss of groundwater caused by the partial removal of the aquifer. To avoid, manage, or mitigate these impacts and concerns, various aspects of the proposed project were rethought and investigated during the EIA phase of the project.

As part of the storm water management design and water balance for the HOP, it became apparent that the existing turf dams to the north of 62E shaft would not have sufficient capacity for the dirty water of the project, which was originally thought to have sufficient capacity.

26. Other Information Required By the Competent Authority

This section presents other information required by DMR in accordance with Section 24(4)(a) and (b) read with Section 24(3)(a) and (7) of the NEMA (Act 107 of 1998).

26.1. Compliance with provisions of sections 24(4) (a) and (b) read with section 24(3) and (7) of the National Environmental Management Act (Act 107 of 1998). The EIA report must include the:

26.1.1. Impact on the socio-economic conditions of any directly affected party

The following initial socio-economic issues that may influence project decisions were identified, investigated and rated in the impact assessment included in Section 12.5.

Potential negative socio-economic impacts

- A loss of land and assets to the pit and surrounding infrastructure area;
- A population influx (due to the influx of job-seekers into the area), with a possible concomitant increase in social pathologies;
- Disruption of access routes and daily movement patterns as a result of mining through two district roads;
- Impacts on sense of place. Such impacts may arise as a result of the visual intrusion of project-related infrastructure, as well as noise impacts during mining.
- Dust caused by the mining works and from movement of heavy equipment. During the mining activities, the local community and construction workers would be inconvenienced by the dust generated by the mining works.
- Noise and vibration due to the mining works and blasting.
- Socio-cultural differences and conflicts between migrant workers and the local community.
- The presence of migrant mine workers could create social conflicts, usually as a result of cultural differences, alcohol abuse or being away from their wives or partners for extended periods of time. A possible reason for conflict would be the perception among locals that the outsiders are taking up jobs that could have gone to unemployed members of the local community.
- Various social pathologies, such as drug / alcohol abuse, abuse of women and children and incidences of sexually transmitted infections (STIs) may increase with the influx of job-seekers into the area.
- An inflow of construction workers and job seekers may also be accompanied by an increase in crime. Even if specific instances of crime are not as a result of the newcomers, they may still be ascribed to them by local communities.

Potential positive socio-economic impacts

- A positive impact on continued permanent employment of mine workers and sub-contractors will be probable due to the proposed project as the long-term economic viability of the mine will be possible.
- Continued contribution of the Amandelbult Complex to available PGE-resources.

26.1.2. Impact on any national estate referred to in section 3(2) of the National Heritage Resources Act

No heritage resources were found in the study area (section 0).

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

As indicated in section 0 of this report, site layout alternatives and mining method alternatives have been considered as mining can only be undertaken in areas where economically mineable resources occur.

Three overburden stockpile layout alternatives have been considered:

1. Locating overburden stockpiles within the 100-year flood line in a 223 ha area to reduce operational time and costs associated with the stockpiling of overburden material;
2. Locating overburden stockpiles to the southwest of the pit in a 61 ha area, outside the flood line, to reduce impacts on the water resource and arable land, potential damage resulting from flooding. A safety risk exists in terms of shallow underground workings beneath this area; and
3. Locating overburden stockpiles to the west of the pit in a 31 ha area, to reduce the safety risk of locating overburden stockpiles on an area with shallow underground workings, and to reduce impacts on the water resource and arable land, and potential damage resulting from flooding.

Alternative (3) is preferred.

Three pit size alternatives have been considered:

1. Original 31 ha opencast pit (with significant potential impact on the Crocodile River);
2. Reduced 27 ha opencast pit (with reduced size and potential impact on the Crocodile River; and
3. Reduced 34 ha strip mining pit (with reduced size and potential impact on the Crocodile River).

It should be noted that Alternative 3 is a refinement of Alternative 2, which was approved by the DMR during the Scoping stage. The option is required as result of the shallower pits and strip mining method. It remains outside the riparian zone of the Crocodile River, as was the case with the 27 ha pit (Alternative 2).

Alternative (3) is preferred.

No-go alternative

The option of not implementing the activity was investigated. The main consequence of the "No-go" alternative is the potential closure of the Amandelbult mine altogether. In addition, a sizeable contribution to processed PGE resources will be lost, along with the opportunity for Anglo to provide of employment opportunities for mine workers.

28. Part B: Environmental Management Programme Report

Content as required by NEMA EIA Regulations GN No. 982, Appendix 4	Chapter / Section number
a) Details of– (i) The EAP who prepared the EMPr; and (ii) The expertise of that EAP to prepare an EMPr, including a curriculum vitae;	28.1
b) A detailed description of the aspects of the activity that are covered by the EMPr as identified by the project description;	28.2
c) A map at an appropriate scale which superimposes the proposed activity, its associated structures, and infrastructure on the environmental sensitivities of the preferred site, indicating any areas that should be avoided, including buffers;	28.3
d) A description of the impact management objectives, including management statements, identifying the impacts and risks that need to be avoided, managed and mitigated as identified through the environmental impact assessment process for all phases of the development including (i) Planning and design; (ii) Pre-construction activities; (iii) Construction activities; (iv) Rehabilitation of the environment after construction and where applicable post closure; and (v) Where relevant, operation activities;	28.4
e) A description and identification of impact management outcomes required for the aspects contemplated in paragraph (d);	28.5
f) A description of proposed impact management actions, identifying the manner in which the impact management objectives and outcomes contemplated in paragraphs (d) and (e) will be achieved, and must, where applicable, include actions to– (i) Avoid, modify, remedy, control or stop any action, activity or process which causes pollution or environmental degradation; (ii) Comply with any prescribed environmental management standards or practices; (iii) Comply with any applicable provisions of the Act regarding closure, where applicable; and (iv) Comply with any provisions of the Act regarding financial provisions for rehabilitation, where applicable;	28.6
g) The method of monitoring the implementation of the impact management actions contemplated in paragraph (f);	28.8
h) The frequency of monitoring the implementation of the impact management actions contemplated in paragraph (f);	28.8
i) An indication of the persons who will be responsible for the implementation of the impact management actions;	28.8
j) The time periods within which the impact management actions contemplated in paragraph (f) must be implemented;	28.6
k) The mechanism for monitoring compliance with the impact management actions contemplated in paragraph (f);	28.8
l) A program for reporting on compliance, taking into account the requirements as prescribed by the Regulations;	28.9
m) An environmental awareness plan describing the manner in which– (i) The applicant intends to inform his or her employees of any environmental risk which may result from their work; and (ii) Risks must be dealt with in order to avoid pollution or the degradation of the environment; and	28.10
n) Any specific information that may be required by the competent authority.	28.11

28.1. Details of the EAP

Details of EAP have been provided in Part A, Section 6.1, 6.2, of this document.

28.2. Description of the aspects of the activity

A description of the activities to be undertaken as part of the proposed Haakdoorndrift Opencast Project has been provided in Part A, Section 9.2 of this document

28.3. Composite Map

Please refer to Appendix 3.3.

28.4. Description of impact management objectives including management statements

28.4.1. Determination of closure objectives

Closure objectives are as described in Part A, Section 9.2.6 of this report.

EMPr objectives

The impact management measures described in this section have been informed by independent environmental assessment of the proposed mining activities, input from the project team as well as the existing 2013 EMPr for the Amandelbult Complex. These measures have been proposed to mitigate negative impacts and enhance the positive benefits of the project and to, ultimately, achieve the impact management objectives.

The EMPr has a long-term objective to ensure that:

1. Environmental Management considerations are implemented from the start of the project;
2. The completion date of the mining project is not delayed due to environmental problems arising during the LoM;
3. Anglo and its contractors are provided with practical guidance for environmentally and socially responsible construction, operation and closure of the proposed mining area;
4. Measures are prescribed for the mitigation of impacts identified during the EIA-phase;
5. Roles and responsibilities for the environmental management and monitoring of the proposed activities are defined;
6. All Anglo employees and contractors are aware of the environmental impacts of the proposed activity, thus enabling them to take timeous precautions against environmental damage;
7. Pollution or similar events are mitigated effectively; and
8. Regulatory requirements are complied with.

Anglo has a legal obligation to comply with the EMPr and to ensure compliance by its contractors and agents, where applicable.

This EMPr describes mitigation measures designed to minimise or eliminate the significant adverse impacts that may be caused as a result of the proposed Haakdoorndrift Opencast project It shall form the basis for environmental management at the proposed site. This EMPr should be considered dynamic, as it will be amended if conditions change or more information becomes available.

Penalties

The Contractor will comply with the environmental management requirements of this EMPr on an ongoing basis, any failure on their part to do so will entitle the Project Manager (PM), in consultation with the ECO to certify the imposition of a fine. The value of the fine will be agreed between the PM and the ECO based on the nature, extent and duration of the offence and subsequent environmental damage. Such penalties shall be payable in addition to any remediation costs for correction of environmental damage as a result of non-compliance to this EMPr, which will be for the Contractor's account. Time penalties may also be awarded by the Contracts Manager where Contractors do not comply. These details are to be included into the contracts.

Note that the following is applicable:

- In terms of the Conventional Penalties Act (1962) a creditor is not entitled to recover both the penalty and damages,

- Accordingly, where a Contractor causes damage, Anglo can either enforce a penalty or make the Contractor make good the damage, but not both.

The Contractor is considered NOT to have complied with this specification if:

- Within the boundaries of the mining site, site extensions and access roads, there is evidence of contravention of the requirements of the EMPr;
- Environmental damage ensues due to negligence;
- The Contractor fails to comply with corrective or other instructions issued within a specific time;
- The Contractor fails to comply with a site instruction given by the Engineer based on the ECO report;
- The Contractor fails to respond adequately to complaints from the public; and
- Legal action is instituted against the developer in terms of Environmental laws.

Payment of any fines in terms of the contract will not absolve the offender from being liable from prosecution in terms of any law.

28.4.2. The process for managing any environmental damage, pollution, pumping and treatment of extraneous water or ecological degradation as a result of undertaking a listed activity

Section 28.4.9 of the EMPr for the proposed Haakdoorndrift Opencast Project provides recommendations as informed by specialists and generally accepted management measures for the management of environmental damage, potential pollution, and ecological degradation caused during construction and operation activities. As for pumping and treatment of extraneous water, pit dewatering will take place during mining to ensure the continuation of mining activities. The water pumped from the pit area will be used for dust suppression on haul roads. Thus no water treatment would be required, as no water is proposed to be placed back into the Crocodile River as part of the project. The extraction of platinum does not pose a significant risk of contamination, as described below in Section 28.4.3, due to its low pyrite content (Groundwater Complete, 2016).

An environmental monitoring programme has been compiled for the IWULA of the HOP. This programme is provided in Section XX, and is to be implemented to ensure the timeous implementation of management solutions when necessary.

28.4.3. Potential risk of acid mine drainage

This project does not include the *processing* of Platinum Group Elements (PGE) and the resultant production of tailings.

Acid mine drainage reactions cause elevated groundwater sulphate concentrations in the *coal* mining industry. However, in the *platinum* mining industry, high sulphate concentrations are usually associated with the *processing* of platinum ore. Therefore, elevated sulphate concentrations are expected to occur within the processing plant areas, tailings dams and return water dams of the Amandelbult Complex, which do not form part of this application.

It should be noted that platinum mineral deposits in South Africa rarely produce acids (McCarthy, 2011). In particular, Merensky and UG2 tailings, exhibited low acid mine drainage (AMD) potential in studies conducted by Anglo Platinum (Mudd, 2010). Acid base accounting tests of mined and processed materials showed that low sulphur concentrations contribute to the low AMD generation potential of these materials. In addition, the host rock (Bushveld Igneous Complex [BIC]) and tailings contain gabbro-norite minerals which act as pH-buffers (Anglo Platinum, 2010). The BIC also does not contain pyrite, therefore the formation of AMD is highly unlikely.

28.4.4. Steps taken to investigate, assess and evaluate the impact of acid mine drainage

Any potential impacts resulting from AMD is dealt with under the Amandelbult Complex's approved EMPr (2013) and is monitored by Anglo's surface and groundwater monitoring programme at all its operations.

28.4.5. Engineering or mine design solutions to be implemented to avoid or remedy acid mine drainage

Engineering or mine design solutions to avoid or remedy surface and groundwater pollution are dealt with under the Amandelbult Complex's approved EMPr (2013) and method statements.

Acidifying sulphates are removed from waste materials in the PGE-recovery process to produce by-products to reduce its potential environmental impact:

- Sulphides are concentrated at the Concentrator Plant, burnt off at the Smelter to produce sulphur dioxide, and captured to produce sulphuric acid at the Acid Plant.
- Residual sulphate (as sodium sulphate) is sold to the pharmaceutical pharmacy after being crystallised at the Base Metal Refinery (Anglo Platinum, 2010).

28.4.6. Measures that will be put in place to remedy any residual or cumulative impact that may result from acid mine drainage

Any mitigation measures resulting from residual or cumulative impacts of AMD will be dealt with under the Amandelbult Complex's approved EMPr (2013). For the Haakdoorndrift Opencast Project, no AMD is expected, as platinum ore does not readily oxidise to create acidic conditions.

28.4.7. Volumes and rate of water use required for the mining, trenching or bulk sampling operation

Note that almost no water will be required for in-pit operations. Potable water will be provided to employees, and dust will be suppressed with water flowing into the pit (groundwater influx) as well as dirty surface water runoff water. The volumes of groundwater expected to discharge into the proposed put were simulated as presented in Table 68 as best-case and worst-case scenarios. The model assumed mining operations to continue for three years. The influx of water is expected to increase from approximately 3.2 l/s by the end of the first year of mining to 5.2 l/s at the end of year three in the worst-case scenario (Groundwater Complete, 2017).

Table 68 | Model simulated groundwater influx (Groundwater Complete, 2017)

Year	Best-case scenario		Worst-case scenario	
	m^3/d	l/s	m^3/d	l/s
1	200	2.3	280	3.2
2	220	2.5	310	3.6
3	330	3.8	450	5.2

28.4.8. Has a water use licence been applied for?

Yes, an Integrated Water Use Licence Application (IWULA) has been submitted to the Limpopo-Northwest Proto Catchment Management Area (CMA) Department of Water and Sanitation as part of this project.

28.4.9. Impacts to be mitigated in their respective phases

Measures to rehabilitate the environment affected by the undertaking of any listed activity are described in Table 69.

Table 69 | Mitigation measures required activities associated with respective project phases

ACTIVITIES (as listed in 2.11.1.)	PHASE of operation in which activity will take place (State, Planning and Design, Pre-construction, Construction, Operational, Rehabilitation, Closure, Post-closure).	SIZE AND SCALE of disturbance (volumes, tonnages and hectares or m^2).	MITIGATION MEASURES (describe how each of the recommendations herein will remedy the cause if pollution or degradation and migration of pollutants).	COMPLIANCE WITH STANDARDS (a description of how each of the recommendations herein will comply with any prescribed environmental management standards or practices that have been identified by Competent Authorities).	TIME PERIOD FOR IMPLEMENTATION (describe the time period when the measures in the environmental management programme must be implemented. Measures must be implemented when required. With regards to rehabilitation specifically, this must take place at the earliest opportunity. Therefore, state either "upon cessation of [the individual activity]" or "upon the cessation of [mining, bulk sampling, or alluvial diamond prospecting]").
PLANNING AND DESIGN					
Project design	Planning and design; Pre-construction	Approximately 91 ha (total affected area)	Objective: To ensure the finalisation of the mine plan takes the environment into account. Targets: • Assimilate requirements of the EMPr into the mine and rehabilitation plan. • The D1639 crossing and intersection construction shall be designed and approved to the appropriate standards. • Water uses shall take into account all specialist recommendations as agreed upon, as well as conditions stipulated in the Water Use Licence. • During the pre-construction walk down of the approved footprint, Anglo shall ensure that the project footprint is physically pegged out so as to avoid encroachment of sensitive areas (exclusion zones) identified within and around the approved footprint in correlation to such identified during the EIA. Any area beyond the footprint must be avoided and the associated infrastructure mining activities must be kept inside the fenced area (unless otherwise permitted / licensed through the EIR and / or EMPr). • A rehabilitation plan must be approved prior to the operational phase.	Conditions of Environmental Authorisation (EA) Water Use Licence (WUL) conditions	Prior to mining activities
PRE-CONSTRUCTION ACTIVITIES					
Fencing of the pit area	Construction	50 ha pit area	Objective: • Whilst establishing the site, the footprint of disturbance must be minimised and the extent of soil erosion, loss of vegetation, the potential for the pollution of soils, and the loss of agricultural land must be limited.	EMPr requirements Conditions of EA	Prior to mining activities

ACTIVITIES (as listed in 2.11.1.)	PHASE of operation in which activity will take place (State, Planning and Design, Pre-construction, Construction, Operational, Rehabilitation, Closure, Post-closure).	SIZE AND SCALE of disturbance (volumes, tonnages and hectares or m^2).	MITIGATION MEASURES (describe how each of the recommendations herein will remedy the cause if pollution or degradation and migration of pollutants).	COMPLIANCE WITH STANDARDS (a description of how each of the recommendations herein will comply with any prescribed environmental management standards or practices that have been identified by Competent Authorities).	TIME PERIOD FOR IMPLEMENTATION (describe the time period when the measures in the environmental management programme must be implemented. Measures must be implemented when required. With regards to rehabilitation specifically, this must take place at the earliest opportunity. Therefore, state either "upon cessation of [the individual activity]" or "upon the cessation of [mining, bulk sampling, or alluvial diamond prospecting]").
			Targets: • The buffer zone around the pit must be measured and demarcated by a surveyor. The correct footprint must then be adequately demarcated and fenced in. • The size of the pit footprint must be kept to a minimum. The maximum width of the area surrounding the pit will not exceed 50 m. The *final* pit footprint must be determined beforehand and indicated on plans. • Once the final footprint has been determined, a walk down of the site may occur in order to rescue and relocate any floral species of conservation concern (SCC) that are encountered along the riparian zone.		
Entering and mining on private properties	Pre-construction; Construction	50 ha pit area	Objectives: • To minimise damage to existing access roads. • To minimise loss of topsoil and erosion. • To minimise financial impact due to mining operations. • To maintain good relationships with landowners. Targets: • Existing maintenance and access roads within the mining footprint shall be used as far as possible. • Planning and construction of any additional access routes must be done in conjunction between the contractor, ECO, engineer and applicable landowners and authorities. • Should a landowner's access be disturbed, blocked or changed, an agreement must be reached between Anglo and the landowner in this regard. • All agreements reached should be legally documented and no verbal agreements should be made.	EMPr requirements Conditions of EA	Prior to and during mining activities

ACTIVITIES (as listed in 2.11.1.)	PHASE of operation in which activity will take place (State, Planning and Design, Pre-construction, Construction, Operational, Rehabilitation, Closure, Post-closure).	SIZE AND SCALE of disturbance (volumes, tonnages and hectares or m^2).	MITIGATION MEASURES (describe how each of the recommendations herein will remedy the cause if pollution or degradation and migration of pollutants).	COMPLIANCE WITH STANDARDS (a description of how each of the recommendations herein will comply with any prescribed environmental management standards or practices that have been identified by Competent Authorities).	TIME PERIOD FOR IMPLEMENTATION (describe the time period when the measures in the environmental management programme must be implemented. Measures must be implemented when required. With regards to rehabilitation specifically, this must take place at the earliest opportunity. Therefore, state either "upon cessation of [the individual activity]" or "upon the cessation of [mining, bulk sampling, or alluvial diamond prospecting]").
			• The contractor shall properly mark all access roads. Markers shall show the direction of travel. Roads not to be used shall be marked with a "NO ENTRY" sign. • Erosion to surrounding properties (including property access roads) must be prevented. • Any dangerous crossings shall be marked as such and where necessary, speed limits shall be enforced. • The contractor shall identify all existing private infrastructure in agreement with the landowner prior to mining commencing. Such infrastructure must be tested and its working condition so ascertained before and after mining to assist in assessing if any damage has been caused by mining activities. • Should private infrastructure (e.g. boreholes) be damaged (intentionally or unintentionally) or removed by Anglo or its contractor(s) during the mining activities, Anglo shall compensate the owner as agreed between the two parties. This applies to infrastructure identified during an aerial survey undertaken prior to commencement of the HOP. • Disruption of activities (such as farming) must be given adequate consideration by the contractor. Anglo is to ensure the contractor is aware of such activities to ensure minimum disruption. Anglo should consult with landowners regarding the mine-work schedule on the affected properties. • A complaints register must be established and kept up to date and available on site. This register must include detail on when and how the issues raised have been dealt with and closed out. • A photographic site- and aerial survey should be conducted prior to and after construction has been completed. This will then be available should any claims be instituted by any landowners.		

ACTIVITIES (as listed in 2.11.1.)	PHASE of operation in which activity will take place (State, Planning and Design, Pre-construction, Construction, Operational, Rehabilitation, Closure, Post-closure).	SIZE AND SCALE of disturbance (volumes, tonnages and hectares or m^2).	MITIGATION MEASURES (describe how each of the recommendations herein will remedy the cause if pollution or degradation and migration of pollutants).	COMPLIANCE WITH STANDARDS (a description of how each of the recommendations herein will comply with any prescribed environmental management standards or practices that have been identified by Competent Authorities).	TIME PERIOD FOR IMPLEMENTATION (describe the time period when the measures in the environmental management programme must be implemented. Measures must be implemented when required. With regards to rehabilitation specifically, this must take place at the earliest opportunity. Therefore, state either "upon cessation of [the individual activity]" or "upon the cessation of [mining, bulk sampling, or alluvial diamond prospecting]").
			• The rights of the landowners shall be respected at all times and all staff shall be sensitised to this.		
Establishment of laydown area, storm water management measures and haul roads	Pre-construction; Construction	23 ha (14 ha disturbance area around pit; 9 ha laydown, crushing, and ore stockpile laydown area)	Objective: • To prevent soil contamination. • To prevent groundwater contamination. • To minimise erosion, loss of topsoil and unnecessary vegetation clearing. Target: • Site establishment shall take place in an orderly manner and all amenities shall be installed before the main workforce move onto site. • A method statement is required from the contractor after appointment, for the management of ablution facilities, workshop areas, and any other components of the laydown area. • Site plans of the construction laydown area must be provided indicating waste-, storage-, and workshop- and ablution areas. • A minimum of one toilet must be provided per 15 persons within 100 m from worker activity. • The contractor shall ensure the necessary ablution facilities are provided as chemical toilets. • The contractor shall inform all site staff to use the supplied ablution facilities and under no circumstances shall indiscriminate excretion and urinating be allowed other than in supplied facilities. • The contractor shall supply waste collection bins and all solid waste shall be collected and sorted at the appropriate waste recycling facility on the mine or disposed of at a registered landfill site. • A certificate/record of safe disposal shall be obtained by the contractor and kept on file.	EMPr requirements Conditions of EA OHSAS	Prior to mining activities

ACTIVITIES (as listed in 2.11.1.)	PHASE of operation in which activity will take place (State, Planning and Design, Pre-construction, Construction, Operational, Rehabilitation, Closure, Post-closure).	SIZE AND SCALE of disturbance (volumes, tonnages and hectares or m^2).	MITIGATION MEASURES (describe how each of the recommendations herein will remedy the cause if pollution or degradation and migration of pollutants).	COMPLIANCE WITH STANDARDS (a description of how each of the recommendations herein will comply with any prescribed environmental management standards or practices that have been identified by Competent Authorities).	TIME PERIOD FOR IMPLEMENTATION (describe the time period when the measures in the environmental management programme must be implemented. Measures must be implemented when required. With regards to rehabilitation specifically, this must take place at the earliest opportunity. Therefore, state either "upon cessation of [the individual activity]" or "upon the cessation of [mining, bulk sampling, or alluvial diamond prospecting]").
			• All temporary structures must be soundly built and not pose a danger to workers. • Containers are to be used for the storage of materials which have the potential to release pollutants into the environment.		
Personnel conduct	Pre-construction	-	Objective: To ensure that personnel adhere to EMPr requirements. Target: • Anglo induction and/or environmental awareness training must be attended by all parties involved in project activities. • Such training must include the requirements of the EMPr as well as the location of sensitive areas of which the workers must be aware. A signed register of attendance must be kept as proof. • Toolbox talks should include aspects of the EMPr. • Labourers associated with the contractor must be easily recognisable (i.e. company issued overalls with company name/logo etc.) • The contractor shall take all necessary precautions against trespassing on private properties. • Basic firefighting equipment must be available on site. • All environmental incidents should be reported to the ECO, investigated, documented and kept on file.	EMPr requirements Conditions of EA	Prior to mining activities
MINING ACTIVITIES					
Operation of sanitation system(s)	Operational	9 ha laydown area	Objective: To ensure good sanitation system management throughout mining activities in respect of the entire affected site. Targets: • Chemical toilets must be emptied / serviced on a regular basis to prevent overflowing. Proof of this service must be provided to the ECO.	EMPr requirements Conditions of EA OHSAS	Throughout mining activities

ACTIVITIES (as listed in 2.11.1.)	PHASE of operation in which activity will take place (State, Planning and Design, Pre-construction, Construction, Operational, Rehabilitation, Closure, Post-closure).	SIZE AND SCALE of disturbance (volumes, tonnages and hectares or m^2).	MITIGATION MEASURES (describe how each of the recommendations herein will remedy the cause if pollution or degradation and migration of pollutants).	COMPLIANCE WITH STANDARDS (a description of how each of the recommendations herein will comply with any prescribed environmental management standards or practices that have been identified by Competent Authorities).	TIME PERIOD FOR IMPLEMENTATION (describe the time period when the measures in the environmental management programme must be implemented. Measures must be implemented when required. With regards to rehabilitation specifically, this must take place at the earliest opportunity. Therefore, state either "upon cessation of [the individual activity]" or "upon the cessation of [mining, bulk sampling, or alluvial diamond prospecting]").
Laydown area, storm water management measures, haul roads and equipment storage areas	Operational	23 ha (14 ha disturbance area around pit; 9 ha laydown, crushing, and ore stockpile laydown area)	Objective(s): • To prevent soil and water contamination. • To prevent damage from flooding. • To prevent traffic impacts from crossing the D1639. • To ensure vehicles are parked according to the specifications in the EMPr and that equipment is handled appropriately. Target: • Where possible and practical, all maintenance of vehicles and equipment shall take place in an approved and designated laydown area. • Leaking equipment shall be repaired immediately or removed from site to facilitate repair. • A suitable drip tray shall be used where leakages are observed to prevent spills onto the soil, especially where emergency repairs are conducted outside workshop areas. • A suitable area for emergency repairs must be approved by the ECO. • All hazardous and non-degradable waste shall be collected and sorted at the appropriate waste recycling facility on the mine or disposed of at a registered landfill site. • Workshop areas shall be monitored for oil and fuel spills and such spills shall be cleaned and remediated to the satisfaction of the ECO. • A method statement is required from the contractor for dealing with possible emergencies that can occur, such as fire, accidental leaks and spillage. • The contractor shall be in possession of emergency spill kits that must be complete and available at all times on site.	EMPr requirements Conditions of EA	Throughout mining activities

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			• The contractor must ensure that plant operators are informed of all relevant procedures and restrictions required ensuring compliance with this document. • All vehicles and equipment must be well maintained to ensure that there are no oil or fuel leakages. • The following shall apply: o All contaminated soil shall be removed and be placed in containers for further disposal; o Hazardous waste may only be stored on site for a maximum period of 90 days before it must be disposed of at a registered hazardous waste site; o Contaminated material can be taken to one central point where bio-remediation can be carried out; o Smaller spills can be treated on site; o A specialist contractor shall be used for the bio-remediation of contaminated soil where the required remediation material and expertise is not available on site. • All major spills of hazardous substances constituting a Section 30 Environmental Incident (according to the NEMA) must be reported to the ECO and relevant authorities within 14 days of the incident occurring. • No storage of vehicles or equipment should be allowed outside of the designated area. • Drip trays or any form of oil absorbent material must be placed underneath vehicles and equipment when not in use for periods longer than 3 days and/or for those vehicles and plant showing evidence of leaking hydrocarbons. • Public transport facilities, such as lay-bys, bus shelters and walkways, be provided at convenient locations within the development site.		

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Transportation of material	Operational	40 ha (30 ha overburden and topsoil stockpile area; 10 ha topsoil berm area)	Objectives: • To limit the spread of contaminated soil. • To limit traffic congestion. • To limit dust during transportation. • To limit excessive noise. Target: • Existing access roads must be utilised as far as possible, with only the minimum new access roads being constructed where absolutely necessary. This must be done in agreement with the affected landowner if applicable. • Access to privately owned land shall be arranged with landowners by the contractor, in conjunction with the PM and Anglo. • Adequate and appropriate traffic warning signage must be erected where applicable, along transport routes and access roads. • The contractor shall take preventative measures e.g. screening, muffling, timing, and pre-notification of affected parties, to minimise complaints regarding noise and blasting nuisance. • Vehicle speeds shall be restricted to 40 km/h on all roads for construction and motor vehicles. • A speed limit of 20 km/h shall be adhered to in "transitions", i.e. areas where vehicles move from dedicated roads to open areas such as open stockpile areas.	EMPr requirements Conditions of EA	Throughout mining activities
Trenching and transport of soils	Operational	91 ha (pit, haul roads, and stockpiling areas)	Objective(s): To reduce the generation of dust on or close to the pit, haul roads, and stockpiling areas. Target: • The contractor is to take appropriate measures to minimise the generation of dust as a result of soil stripping and overburden removal	EMPr requirements Conditions of EA	Throughout mining activities

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			works. Such measures include frequent spraying of water during low rainfall. • Paved or surfaced roads should be used where possible. • Speed limits must be enforced in all areas to reduce the generation of dust. • Keep soil loads below the freeboard of the truck to minimise fugitive dust. • Revegetate disturbed areas as soon as possible after disturbance. • When feasible, shut down idling construction machinery. • Tighten gate seals on dump trucks.		
Mining activities within the Crocodile River floodplain	Operational	50 ha pit area	Objective(s): Minimal negative impact on affected and surrounding watercourses and riverine habitat. Target: • Storm water management systems, such as berms, should include energy dissipation structures to minimise the potential erosion and/or sedimentation of the affected watercourses. • Surface water management features (V-drains) should be maintained in a manner to ensure flows remain unaltered and laminar in terms of direction, velocity and volume. This entails keeping drains clear of obstructions, sedimentation, etc. • Clearing of vegetation should be kept to a minimum. • No vehicular traffic or equipment shall be allowed outside of the fenced area unless authorised by means of a water use license or authorisation. • No mining activities (e.g. vehicle movement, waste disposal) are to take place outside the fenced footprint-area, so as to avoid impacts on sensitive areas surrounding the Crocodile River. • The conditions contained in the water use license must be adhered to.	EMPr requirements Conditions of EA and WUL	Throughout mining activities

ACTIVITIES (as listed in 2.11.1.)	PHASE of operation in which activity will take place (State, Planning and Design, Pre-construction, Construction, Operational, Rehabilitation, Closure, Post-closure).	SIZE AND SCALE of disturbance (volumes, tonnages and hectares or m^2).	MITIGATION MEASURES (describe how each of the recommendations herein will remedy the cause if pollution or degradation and migration of pollutants).	COMPLIANCE WITH STANDARDS (a description of how each of the recommendations herein will comply with any prescribed environmental management standards or practices that have been identified by Competent Authorities).	TIME PERIOD FOR IMPLEMENTATION (describe the time period when the measures in the environmental management programme must be implemented. Measures must be implemented when required. With regards to rehabilitation specifically, this must take place at the earliest opportunity. Therefore, state either "upon cessation of [the individual activity]" or "upon the cessation of [mining, bulk sampling, or alluvial diamond prospecting]").
			• No water may be abstracted from the Crocodile River unless such abstraction is approved by the Department of Water and Sanitation. • Dust suppression on affected areas should not be over-sprayed to prevent water run-off and subsequent sediment loss in the vicinity of the study area. • Soil erosion should be monitored monthly at clean water channels and/or discharge points to identify soil erosion. Refer to Table 73 ("Biodiversity / Land use management" aspect) for details on variables to be measured and suggested sampling methods.		
Protection of heritage sites and palaeontological finds (i.e. fossils)	Construction and operational	91 ha	Objective(s): • To ensure that heritage sites are preserved. • To prevent the undue and unlawful damage to or loss of paleontological assets within the project footprint. Target: Should any graves, heritage resources, archaeological sites or palaeontological finds (fossils) be uncovered during construction, construction within the immediate vicinity must be stopped, and reported to Anglo immediately, after which a heritage specialist should investigate the find.	EMPr requirements Conditions of EA NHA	Throughout mining activities
Stripping and storage of topsoil	Construction and operational	30 ha	Objective: • To ensure that topsoil is conserved, maintained and reused. • To ensure the preservation of soil fertility. • To limit soil compaction, erosion and contamination. Target: A procedure shall be developed to incorporate the following: • Topsoil should be removed (dependent on the soil profile) and temporarily stockpiled on the designated stockpiling areas for re-use during rehabilitation, as this layer is naturally the most fertile.	EMPr requirements Conditions of EA	Prior to and throughout mining activities

ACTIVITIES (as listed in 2.11.1.)	PHASE of operation in which activity will take place (State, Planning and Design, Pre-construction, Construction, Operational, Rehabilitation, Closure, Post-closure).	SIZE AND SCALE of disturbance (volumes, tonnages and hectares or m^2).	MITIGATION MEASURES (describe how each of the recommendations herein will remedy the cause if pollution or degradation and migration of pollutants).	COMPLIANCE WITH STANDARDS (a description of how each of the recommendations herein will comply with any prescribed environmental management standards or practices that have been identified by Competent Authorities).	TIME PERIOD FOR IMPLEMENTATION (describe the time period when the measures in the environmental management programme must be implemented. Measures must be implemented when required. With regards to rehabilitation specifically, this must take place at the earliest opportunity. Therefore, state either "upon cessation of [the individual activity]" or "upon the cessation of [mining, bulk sampling, or alluvial diamond prospecting]").
			• Separate stripping, stockpiling and replacing of soil horizons (A and B-horizon) in the original natural sequence should take place to combat hard setting, compaction and to maintain soil fertility. • The A-horizon should be removed to a depth of 200-300 mm and stored as a berm along haul roads. This can be achieved by using graders or dozers. The aim (on the long term) is to leave the B-horizon undisturbed and later replace the A-horizon in its original position, which implies a reconstruction of the original soil horizon sequences and subsequent less deterioration from pre-mining to post-mining land capability. • The structure footprint should then be covered with a base material layer suitable for the specific structure which will probably be specified by the engineering design (roads, foundations, sidings, stockpiles etc.) • Avoid any further stripping/excavation and stockpiling of in-situ soils, as far as possible, to ensure that the soils remain in their natural horizon sequence. • Topsoil stripping should occur during the dry season, to avoid compaction. • Stockpiles shall not be allowed to become contaminated with oil, diesel, petrol, garbage or any other material, which may inhibit the later growth of vegetation. • The contractor shall apply soil conservation measures to the stockpiles to prevent erosion. This could include the use of erosion control fabric or grass seeding. The use of berms should also be considered to prevent the topsoil from washing away during rainy periods. • All non-invasive vegetation should be left on the topsoil stockpiles so that they colonise the area after topsoil replacement. • A photographic record must be kept of the topsoil stockpiles.		

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			• Topsoil stockpiles must be placed on disturbed soil. Should no such area be available, the ECO is to advise on the laydown area for the stockpiles. • The contractor shall devise a soil conservation and stockpiling plan, to be approved by the ECO and engineer, which shall detail: o Stockpile sizes, laydown areas and form; o Means of erosion (wind and water) prevention for stockpiles; o The rehabilitation measures to be taken for the area occupied by the temporary stockpile; o Soil replacement should preferably run in parallel (where feasible) with the mining process; • Alien vegetation growing on stockpiles must be eradicated. • Herbicides shall not be used to remove alien vegetation unless approved by the ECO and the PM and in accordance with legal prescriptions. • Vehicles and equipment shall not be permitted to traverse stockpile areas, and no stockpiles may be used as loading ramps. • It must be ensured that topsoil stockpiles are located outside of any drainage lines and areas susceptible to erosion. Stockpiles should be placed away from areas known to contain hazardous substances, such as fuel storage areas. If any soils are contaminated, it should be stripped and disposed of at a registered hazardous waste dumping site. • The location of topsoil stockpiles should be selected strategically such that minimal re-handling is required during rehabilitation. • Stockpiles shall be formed such that no ponding of surface water forms on the surface of the stockpile, and shall be so placed to occupy the minimum area compatible with the natural angle of repose of the material. • Measures should be taken to prevent the stockpiled soil material from being spread over too wide a surface.		

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			• Topsoil shall not be buried or rendered in any other way unsuitable for further use, and precautions shall be taken to prevent unnecessary handling and compaction.		
Storage and use of hazardous material, including hydrocarbons	Operational	9 ha	Objective(s): To ensure adequate protection of soil and soil remediation measures in case of spills. Target: • Hazardous materials – such as paint, cement, fuels, bitumen, fuel, oil, herbicides, battery acid or detergents – must be stored in a hazardous store which is bunded to contain 110% of the store's capacity, lockable and well ventilated when not in use. • A register shall be kept on all hazardous substances and must be available for inspection at all times. Areas shall be monitored for spills and any spills shall be contained, cleaned and rehabilitated immediately. • No decantation into unmarked containers or containers with obsolete or incorrect labelling. • When handling hazardous materials, manufacturer's specifications must be complied with. Material Safety Data Sheets for all hazardous materials must be available where these materials are stored. • All reasonable care must be taken to prevent spills of any hazardous material when in use. • Emergency spill response and clean-up procedures must be in place with capable people listed as responsible parties. These parties must have the necessary training to adequately handle major accidents and/or spillages, including where such spillages might occur close to a watercourse.	EMPr requirements Conditions of EA OHSAS	Throughout mining activities

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			• All spills (minor and major) must be cleaned and remediated to the satisfaction of the ECO within 24 hours of occurrence, or the shortest time possible. • Appropriate remedial measures must be designed and implemented at the site. • The contractor must ensure that there is a supply of absorbent material (e.g. Drizit) and clean-up materials readily available to absorb, break down and, where possible, encapsulate minor hazardous material spillages. • All products are to be stored with compatibility in mind. • Storage areas shall display the required safety signs reading "No smoking", "No open flames" and "Danger". Containers shall be clearly marked to indicate contents as well as safety requirements. • The contractor shall supply a method statement to the engineer for approval for the storage of hazardous materials prior to site preparation works. • No drainage from fuel storage areas shall be permitted.		
Storage, removal and disposal of domestic and hazardous waste	Operational	91 ha	Objectives: • To minimise landowner complaints. • To ensure that waste is correctly stored and disposed of, decreasing the visual and possible environmental impact. • To ensure that soil and the rest of the surrounding environment is protected from hazardous waste. Targets: • Bins and containers must be made available by the contractor at strategic points on site for the storage of construction, domestic and hazardous waste.	EMPr requirements Conditions of EA NEM: WA	Throughout mining activities During rehabilitation

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			• Personnel must be informed about the necessity of using the waste containers. • No burning of waste will be permitted on site. • No material shall be left on site that could be of harm to humans and animals. • The contractor is required to the National Environmental Management: Waste Act (Act No. 59 of 2008) to determine whether any substance (new or waste) stored on site is subject to controls contained within the Act. • All hazardous waste (including contaminated water) must be stored in sealed and suitably marked containers for removal to a registered hazardous waste disposal facility. • Any oil spillage should be excavated to a depth determined between the ECO and disposed of for removal to a registered hazardous waste disposal site. Excavated areas are to be refilled with suitable replacement material. Alternative *in-situ* remediation techniques could be used, if approved by the ECO. • Volumes of waste generated and disposed should be monitored weekly on site according to waste types. These data should be available in contractor reports. Refer to Table 73 ("Waste" aspect) for details in variables to be measured and suggested sampling methods.		
General mining activities	Operational	50 ha	Objectives: • Minimise scarring of the soil surface and land features. • Minimise disturbance and loss of topsoil. • Minimise damage to vegetation. • Minimise possibility of erosion due to removal of vegetation. • Minimise removal/ clearing of plant material.	EMPr requirements Conditions of EA Conditions of permits	Throughout mining activities

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			• Rehabilitate all areas disturbed by project activities. • To prevent alien plants/ seeds from being introduced and spreading. • To ensure that fauna found on site are protected and not interfered with. • To prevent unintentional killing of fauna on site. • To minimise faunal habitat loss. • To minimise faunal pests. Targets: • Edge effects of mining activities need to be actively managed so as to minimise further impacts to the receiving environment. • Alien and invasive vegetation control should take place throughout all development phases (monthly) to prevent loss of floral habitat. • No uncontrolled fires whatsoever should be allowed. • If Species of Conservation Concern are identified during project activities, it must be relocated to suitable, similar habitat in close proximity outside the disturbance footprint, after obtaining the relevant permits from LEDET. • The contractor must ensure that the site is kept clean and free of litter that could potentially attract animal pests, and that refuse bins are scavenger proof. • The contractor must report problem-animals or vermin to the ECO. The possibility exists that domestic animals from neighbouring communities could scavenge the site. • Ensure that domesticated animals and livestock belonging to the local community are kept away from project area. • The contractor may only make use of pesticide or poison to control unwanted animals through the appointment of a registered pest control operator. • Workers should be educated so as not to kill any fauna found on site.		

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			• Hunting or trapping is strictly prohibited. Anyone found guilty of such an act shall be penalised. • Access roads should be planned so that only minimum linear distances are developed. • If night-time construction activities are required, do not operate closer than 900m (mobile equipment) from any receptors (prevent noise impact of medium or higher significance). • Ensure that equipment is well maintained and fitted with the correct and appropriate noise abatement measures. • Deterioration of water quality as a result of mining related activities should be monitored up- and downstream of the mining operation on a monthly basis. Refer to Table 73 ("Surface water" aspect) for details on variables to be measured and suggested sampling methods. • The condition of water management infrastructure should be monitored along clean and dirty water canals and dirty water dams on a monthly basis, or after a big rain event. Refer to Table 73 ("Surface water" aspect) for details on variables to be measured and suggested sampling methods. • The water quality and long-term chemical changes in dirty water systems should monitored on a monthly basis. Refer to Table 73 ("Surface water" aspect) for details on variables to be measured and suggested sampling methods. • Concurrent rehabilitation should be monitored on a monthly basis to determine if levelling, top soiling, and revegetation is done according to Anglo and specialist requirements (Rehab Green, 2017). • Dust deposition and PM_{10} emissions should be monitored through the monitoring network of the Complex to ensure compliance to regulated air		

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			quality standards. Refer to Table 73 ("Air" aspect) for details on variables to be measured and suggested sampling methods. • Noise levels should be measured at locations where reasonable and valid noise complaints are registered. Refer to Table 73 ("At" aspect) for details on variables to be measured and suggested sampling methods. • Ground vibration and air blast should be monitored whenever blasting takes place to ensure conformance to the recommended levels. Refer to Table 73 ("Blasting" aspect) for details on variables to be measured and suggested sampling methods.		
Pit dewatering	Operational	280 m^3/d in year 1; 310 m^3/d in year 2; 450 m^3/d in year 3.	Objectives: To ensure that no groundwater users are affected by pit dewatering in terms of quality and quantity. Targets: • A quarterly monitoring program should be implemented to monitor the extent of the dewatering from the pit. • If any legitimate groundwater users are impacted upon in terms of quantity or quality of borehole water, a groundwater specialist should investigate the matter. Legitimate groundwater users include those identified during the hydrocensus (Groundwater Complete, 2017). • Groundwater quality and levels should be monitored quarterly and monthly, respectively, through monitoring boreholes identified in the hydrocencus. Refer to Table 73 ("Groundwater" aspect) for details in variables to be measured and suggested sampling methods. • The mine's water balance, volume of water stored, volume of groundwater influx, and dewatering, should be monitored in the PCDs, monthly, to verify the water balance and volumes of water used. Refer	EMPr requirements Conditions of EA	Throughout mining activities

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			to Table 73 ("Mine water balance" aspect) for details in variables to be measured and suggested sampling methods.		
Continuation of employment opportunities and social benefits	Operational	-	Objectives: • To ensure that temporary employment opportunities and social benefits are maximised. • To ensure that the potential population influx is adequately mitigated to limit adverse effects on the social environment. Targets: • The recruitment policy used to employ people on the project must be fair and transparent. • The intention of giving preferential employment to locals should be clearly communicated, so as to discourage an influx of job-seekers from other areas. • Unskilled job opportunities should be afforded to the local communities. Equal opportunities for employment should be created to ensure that the local female population also has access to these opportunities. • Payment should comply with applicable labour legislation in terms of minimum wages. • Where local labourers are employed on a permanent basis, these labourers should be registered with the Unemployment Insurance Fund (UIF), Pay as You Earn or any other official bodies as required by law. This would enable the workers to claim UIF as a means of continuous financial support when the workers' positions have become redundant or once the project comes to an end. • Anglo Platinum is to deliver on its SLP commitments. • The project site should be fenced and access controlled.	Anglo Social Labour Plan	Throughout project.
REHABILITATION					

ACTIVITIES (as listed in 2.11.1.)	PHASE of operation in which activity will take place (State, Planning and Design, Pre-construction, Construction, Operational, Rehabilitation, Closure, Post-closure).	SIZE AND SCALE of disturbance (volumes, tonnages and hectares or m^2).	MITIGATION MEASURES (describe how each of the recommendations herein will remedy the cause if pollution or degradation and migration of pollutants).	COMPLIANCE WITH STANDARDS (a description of how each of the recommendations herein will comply with any prescribed environmental management standards or practices that have been identified by Competent Authorities).	TIME PERIOD FOR IMPLEMENTATION (describe the time period when the measures in the environmental management programme must be implemented. Measures must be implemented when required. With regards to rehabilitation specifically, this must take place at the earliest opportunity. Therefore, state either "upon cessation of [the individual activity]" or "upon the cessation of [mining, bulk sampling, or alluvial diamond prospecting]").
Rehabilitation of roads impacted Waste removal Rehabilitation of pit void	Rehabilitation and Post-closure	91 ha	Objective: • To reduce residual impacts to the environment as a result of project activities. • To successfully rehabilitate all damaged areas. • To prevent erosion. • To prevent topsoil loss. • To prevent alien and invasive vegetation establishment post-decommissioning. • To ensure minimal loss of land capability. • Adherence to the rehabilitation guidelines provided in the Soil specialist study (Rehab Green, 2017) and the Anglo American Platinum Rehabilitation guidelines. Targets: • Disturbed and cleared areas need to be revegetated with indigenous grass species in order to help stabilise the soil surface. • Alien and invasive vegetation control should take place for a period of two years after rehabilitation; • All soils compacted as a result of construction and operational activities should be ripped and profiled. • Soil compaction must be alleviated by ripping the soils to approximately 60 cm below ground surface to physically loosen the soil, using appropriate tillage implements. • Ripping of soils should occur prior to spreading of topsoil and reseeding, as per Anglo American Rehabilitation Guidelines. • Soils should be tilled to at least 1350 kg/m^3 to improve infiltration and crop water and nutrient uptake following rehabilitation;	Anglo Rehabilitation Guidelines EMPr requirements Conditions of EA	After operational phase: approximately 8 months

ACTIVITIES (as listed in 2.11.1.)	PHASE of operation in which activity will take place (State, Planning and Design, Pre-construction, Construction, Operational, Rehabilitation, Closure, Post-closure).	SIZE AND SCALE of disturbance (volumes, tonnages and hectares or m^2).	MITIGATION MEASURES (describe how each of the recommendations herein will remedy the cause if pollution or degradation and migration of pollutants).	COMPLIANCE WITH STANDARDS (a description of how each of the recommendations herein will comply with any prescribed environmental management standards or practices that have been identified by Competent Authorities).	TIME PERIOD FOR IMPLEMENTATION (describe the time period when the measures in the environmental management programme must be implemented. Measures must be implemented when required. With regards to rehabilitation specifically, this must take place at the earliest opportunity. Therefore, state either "upon cessation of [the individual activity]" or "upon the cessation of [mining, bulk sampling, or alluvial diamond prospecting]").
			• Soil compaction monitoring should preferably be correlated with annual crop yield monitoring for at least five years, in order to assess the residual effects of the proposed pit on agricultural crop productivity. • After rehabilitation, and when soils are returned to agricultural use, annual replenishment of essential plant macronutrients, particularly nitrogen (N), phosphorus (P), and potassium (K), is recommended until normalised crop yields are attained. • Maintenance of re-seeded areas shall be conducted until an acceptable cover has been established, meaning 75% ground cover with no gaps exceeding 500 mm. Maintenance includes watering, mowing and weeding as well as preventing the development of erosion channels. • The removal of all construction facilities, materials, and waste will be required, and rehabilitation thereof carried out. This includes the removal of fuel storage tanks and chemical toilets. • All access roads constructed for the project which are no longer required shall be rehabilitated. • Any contaminated material or soil must be removed to a registered hazardous waste disposal facility. • Rehabilitation must be carried out as soon as possible after mining of the pit is completed. All rehabilitation is to be done with approval of Anglo environmental management department. • The D1639 should be rehabilitated or repaired after mining activities have ended, where the road has been affected by mining activities. • The final rehabilitation and free-draining standards advised upon in the rehabilitation specialist's recommendations (WRINK, 2017) should be monitored on a monthly basis. Refer to Table 73 ("Biodiversity / Land		

ACTIVITIES (as listed in 2.11.1.)	PHASE of operation in which activity will take place (State, Planning and Design, Pre-construction, Construction, Operational, Rehabilitation, Closure, Post-closure).	SIZE AND SCALE of disturbance (volumes, tonnages and hectares or m^2).	MITIGATION MEASURES (describe how each of the recommendations herein will remedy the cause if pollution or degradation and migration of pollutants).	COMPLIANCE WITH STANDARDS (a description of how each of the recommendations herein will comply with any prescribed environmental management standards or practices that have been identified by Competent Authorities).	TIME PERIOD FOR IMPLEMENTATION (describe the time period when the measures in the environmental management programme must be implemented. Measures must be implemented when required. With regards to rehabilitation specifically, this must take place at the earliest opportunity. Therefore, state either "upon cessation of [the individual activity]" or "upon the cessation of [mining, bulk sampling, or alluvial diamond prospecting]").
			use management" aspect) for details on variables to be measured and suggested sampling methods.		
Topsoil replacement	Rehabilitation	30 ha	Objectives: • To ensure successful replacement of topsoil. • To ensure successful rehabilitation of topsoil stockpiling areas. Targets: • Prior to topsoil placement and reseeding, any deficiencies in topsoil fertility should be determined. Refer to Table 73 ("Biodiversity / Land use management" aspect) for details on variables to be measured and suggested sampling methods. • During the decommissioning phase the footprint should be thoroughly cleaned and all base material should be removed to a suitable disposal facility.	Anglo Rehabilitation Guidelines EMPr requirements Conditions of EA	After LoM
CLOSURE					
General closure activities	Closure and post-closure	91 ha	Objectives: • Adherence to the FRDCP (WRINK, 2017) for HOP. • Adherence to monitoring measures stipulated in section 28.8 of this report. Targets: • Adhere to closure and post-closure requirements stipulated in the FRDCP. • Implement monitoring recommendations provided by specialists in section 28.8 of this report.	FRDCP for HOP (WRINK, 2017)	After LoM, then annually
Aquifer recharge	Post-closure	34 ha	Objectives: • To ensure that water of poor quality does not affect the aquifer system. • To ensure that aquifer water level recharge to required levels.	EMPr requirements Conditions of EA South African National Standards for drinking water (SANS 241:2015).	Quarterly

ACTIVITIES (as listed in 2.11.1.)	PHASE of operation in which activity will take place (State, Planning and Design, Pre-construction, Construction, Operational, Rehabilitation, Closure, Post-closure).	SIZE AND SCALE of disturbance (volumes, tonnages and hectares or m^2).	MITIGATION MEASURES (describe how each of the recommendations herein will remedy the cause if pollution or degradation and migration of pollutants).	COMPLIANCE WITH STANDARDS (a description of how each of the recommendations herein will comply with any prescribed environmental management standards or practices that have been identified by Competent Authorities).	TIME PERIOD FOR IMPLEMENTATION (describe the time period when the measures in the environmental management programme must be implemented. Measures must be implemented when required. With regards to rehabilitation specifically, this must take place at the earliest opportunity. Therefore, state either "upon cessation of [the individual activity]" or "upon the cessation of [mining, bulk sampling, or alluvial diamond prospecting]").
			Targets: • Monitor post-closure water quality. • Monitor post-closure aquifer recharge.		

28.5. Impact Management Outcomes

A description of impact management outcomes, identifying the standard of impact management contemplated in Table 69 required is provided in Table 70.

Table 70 | Outcomes to the management of impacts on various aspects associated with project activities

ACTIVITY whether listed or not listed (e.g. excavations, blasting, discard dumps or dams, loading, hauling and transport, water supply dams and boreholes, accommodation, offices, ablution, stores, workshops, processing plant, storm water control, berms, roads, pipelines, powerlines, conveyors.)	POTENTIAL IMPACT (e.g. dust, noise, drainage, surface disturbance, fly rock, surface water contamination, groundwater contamination, air pollution.)	ASPECTS AFFECTED	PHASE in which impacts is anticipated (e.g. Construction, Commissioning, Operational, Decommissioning, Closure, Post-closure.)	MITIGATION TYPE (modify, remedy, control, or stop through e.g. noise control measures, storm water control, dust control, rehabilitation, design measures, blasting controls, avoidance, relocation, alternative activity). E.g.: • Modify through alternative method; • Control through noise control; • Control through management and monitoring; • Remedy through rehabilitation.	STANDARD TO BE ACHIEVED (Impact avoided, noise levels, dust levels, rehabilitation standards, end-use objectives etc.)
PLANNING AND DESIGN					
Project design	Loss of SCC Loss of land capability Complaints from affected and neighbouring land owners	Ecological structure Agricultural potential (soil)	Planning and design; Pre-construction	Please refer to Table 69.	Conditions of Environmental Authorisation (EA) Water Use Licence (WUL) conditions
PRE-CONSTRUCTION ACTIVITIES					
Fencing of the pit area	Surface disturbance	Floral habitat	Construction	Please refer to Table 69.	Prior to mining activities
Entering and mining on private properties	Loss of land capability Noise Temporary loss of land and assets Impacts on sense of place	Agricultural potential (soil) Ambient noise levels Sense of place	Pre-construction; Construction	Please refer to Table 69.	Prior to and during mining activities
Establishment of laydown area, storm water management measures and haul roads	Loss of land capability Soil contamination	Agricultural potential (soil)	Pre-construction; Construction	Please refer to Table 69.	Prior to mining activities

	Surface- and groundwater contamination Noise	Surface- and groundwater Ambient noise levels			
Personnel conduct	Noise Population influx Socio-cultural pathologies	Ambient noise levels Local socio-cultural environment Local economy	Pre-construction	Please refer to Table 69.	Prior to mining activities
MINING ACTIVITIES					
Operation of sanitation system(s)	Surface- and groundwater contamination Soil contamination	Surface- and groundwater Agricultural potential (soil)	Operational	Please refer to Table 69.	EMPr requirements Conditions of EA OHSAS
Laydown area, storm water management measures, haul roads and equipment storage areas	Loss of land capability Soil contamination Surface- and groundwater contamination Noise Dust generation Air emissions	Agricultural potential (soil) Soil Surface- and groundwater Ambient noise levels Ambient air quality	Operational	Please refer to Table 69.	EMPr requirements Conditions of EA
Transportation of material	Dust emissions Noise District road damage	Ambient air quality Ambient noise levels District road integrity	Operational	Please refer to Table 69.	EMPr requirements Conditions of EA
Trenching and transport of soils	Dust emissions Noise Loss of agricultural potential Loss of floral SCC	Ambient air quality Ambient noise levels Agricultural potential (soil)	Operational	Please refer to Table 69.	EMPr requirements Conditions of EA
Mining activities within the Crocodile River floodplain	Risk of property damage Risk of flooding in project area within floodplain	Loss of habitat and ecological structure Flood risk Safety Property integrity	Operational	Please refer to Table 69.	EMPr requirements Conditions of EA and WUL
Protection of heritage sites and palaeontological finds	Damage to heritage sites	Heritage resources	Construction and operational	Please refer to Table 69.	EMPr requirements

	Sealing in or destruction of fossils	Palaeontological resources			Conditions of EA NHA
Stripping and storage of topsoil	Loss of land capability Soil contamination Dust emissions Soil compaction	Agricultural potential Ambient air quality	Construction and operational	Please refer to Table 69.	EMPr requirements Conditions of EA
Storage and use of hazardous material, including hydrocarbons	Soil contamination Surface- and groundwater contamination	Soil Surface- and groundwater	Operational	Please refer to Table 69.	EMPr requirements Conditions of EA OHSAS
Storage, removal and disposal of domestic and hazardous waste	Soil contamination Surface- and groundwater contamination	Soil Surface- and groundwater	Operational	Please refer to Table 69.	EMPr requirements Conditions of EA NEM: WA
General mining activities	Fly rock Air blast Ground vibration Noise Dust generation Air emissions Loss of floral and faunal SCC Loss of floral and faunal habitat Loss of floral and faunal diversity Soil compaction	Safety Property integrity Ambient noise levels Ambient air quality Ecological structure Soil	Operational	Please refer to Table 69.	EMPr requirements Conditions of EA Conditions of permits
Pit dewatering	Loss of aquifer water content	Groundwater quantity	Operational	Please refer to Table 69.	EMPr requirements Conditions of EA
Continuation of employment opportunities and social benefits	Local employment continuation Continuation of mining activities at Amandelbult	Local socio-cultural environment Local economy	Operational	Please refer to Table 69.	Anglo Social Labour Plan
REHABILITATION					
Rehabilitation of roads impacted Waste removal Rehabilitation of pit void	Adequate use of infrastructure after rehabilitation Adequate removal of waste after rehabilitation Aquifer recharge	Local infrastructure Local socio-cultural environment Aesthetics Soil	Rehabilitation and Post-closure	Please refer to Table 69.	Anglo Rehabilitation Guidelines EMPr requirements Conditions of EA

		Surface- and groundwater			
Topsoil replacement	Return of land to agricultural use	Agricultural potential (soil)	Rehabilitation	Please refer to Table 69.	Anglo Rehabilitation Guidelines EMPr requirements Conditions of EA
Aquifer recharge	Decant Downstream groundwater contamination	Surface- and groundwater Agricultural potential (water availability)	Rehabilitation	Please refer to Table 69.	EMPr requirements Conditions of EA South African National Standards for drinking water (SANS 241:2015)

28.6. Impact Management Actions

A description of impact management actions, identifying the manner in which the impact management objectives and outcomes will be achieved, is provided in Table 71 below.

Table 71 | Impact management actions to be carried out to achieve impact management objectives and outcomes.

ACTIVITY whether listed or not listed (e.g. excavations, blasting, discard dumps or dams, loading, hauling and transport, water supply dams and boreholes, accommodation, offices, ablution, stores, workshops, processing plant, storm water control, berms, roads, pipelines, powerlines, conveyors.)	POTENTIAL IMPACT (e.g. dust, noise, drainage, surface disturbance, fly rock, surface water contamination, groundwater contamination, air pollution.)	MITIGATION TYPE (modify, remedy, control, or stop through e.g. noise control measures, storm water control, dust control, rehabilitation, design measures, blasting controls, avoidance, relocation, alternative activity). E.g.: • Modify through alternative method; • Control through noise control; • Control through management and monitoring; • Remedy through rehabilitation.	TIME PERIOD FOR IMPLEMENTATION (describe the time period when the measures in the environmental management programme must be implemented. Measures must be implemented when required. With regards to rehabilitation specifically, this must take place at the earliest opportunity. Therefore, state either "upon cessation of [the individual activity]" or "upon the cessation of [mining, bulk sampling, or alluvial diamond prospecting]").	COMPLIANCE WITH STANDARDS (a description of how each of the recommendations in 2.11.6 read with 2.12 and 2.15.2 herein will comply with any prescribed environmental management standards or practices that have been identified by Competent Authorities).
PLANNING AND DESIGN				
Project design	Loss of SCC Loss of land capability Complaints from affected and neighbouring land owners	Please refer to Table 69.	Planning and design; Pre-construction	Conditions of Environmental Authorisation (EA) Water Use Licence (WUL) conditions
PRE-CONSTRUCTION ACTIVITIES				
Fencing of the pit area	Surface disturbance	Please refer to Table 69.	Construction	Prior to mining activities
Entering and mining on private properties	Loss of land capability Noise Temporary loss of land and assets	Please refer to Table 69.	Pre-construction; Construction	Prior to and during mining activities

	Impacts on sense of place			
Establishment of laydown area, storm water management measures and haul roads	Loss of land capability Soil contamination Surface- and groundwater contamination Noise	Please refer to Table 69.	Pre-construction; Construction	Prior to mining activities
Personnel conduct	Noise Population influx Socio-cultural pathologies	Please refer to Table 69.	Pre-construction	Prior to mining activities
MINING ACTIVITIES				
Operation of sanitation system(s)	Surface- and groundwater contamination Soil contamination	Please refer to Table 69.	Operational	EMPr requirements Conditions of EA OHSAS
Laydown area, storm water management measures, haul roads and equipment storage areas	Loss of land capability Soil contamination Surface- and groundwater contamination Noise Dust generation Air emissions	Please refer to Table 69.	Operational	EMPr requirements Conditions of EA
Transportation of material	Dust emissions Noise Road damage	Please refer to Table 69.	Operational	EMPr requirements Conditions of EA
Trenching and transport of soils	Dust emissions Noise Loss of agricultural potential Loss of floral SCC	Please refer to Table 69.	Operational	EMPr requirements Conditions of EA
Mining activities within the Crocodile River floodplain	Risk of property damage Risk of flooding in project area within floodplain	Please refer to Table 69.	Operational	EMPr requirements Conditions of EA and WUL
Protection of heritage sites and palaeontological finds	Damage to cemeteries Sealing in or destruction of fossils	Please refer to Table 69.	Construction and operational	EMPr requirements Conditions of EA NHA
Stripping and storage of topsoil	Loss of land capability	Please refer to Table 69.	Construction and operational	EMPr requirements Conditions of EA

	Soil contamination Dust emissions Soil compaction			
Storage and use of hazardous material, including hydrocarbons	Soil contamination Surface- and groundwater contamination	Please refer to Table 69.	Operational	EMPr requirements Conditions of EA OHSAS
Storage, removal and disposal of domestic and hazardous waste	Soil contamination Surface- and groundwater contamination	Please refer to Table 69.	Operational	EMPr requirements Conditions of EA NEM: WA
General mining activities	Fly rock Air blast Ground vibration Noise Dust generation Air emissions Loss of floral and faunal SCC Loss of floral and faunal habitat Loss of floral and faunal diversity Soil compaction	Please refer to Table 69.	Operational	EMPr requirements Conditions of EA Conditions of permits
Pit dewatering	Loss of aquifer water content	Please refer to Table 69.	Operational	EMPr requirements Conditions of EA
Continuation of employment opportunities and social benefits	Local employment continuation Continuation of mining activities at Amandelbult	Please refer to Table 69.	Operational	Anglo Social Labour Plan
REHABILITATION				
Rehabilitation of roads impacted Waste removal Rehabilitation of pit void	Adequate use of infrastructure after rehabilitation Adequate removal of waste after rehabilitation Aquifer recharge	Please refer to Table 69.	Rehabilitation and Post-closure	Anglo Rehabilitation Guidelines EMPr requirements Conditions of EA
Topsoil replacement	Return of land to agricultural use	Please refer to Table 69.	Rehabilitation	Anglo Rehabilitation Guidelines EMPr requirements Conditions of EA

Aquifer recharge	Decant Downstream groundwater contamination	Please refer to Table 69.	Rehabilitation	EMPr requirements Conditions of EA South African National Standards for drinking water (SANS 241:2015)

28.7. Financial Provision

28.7.1. Determination of the amount of Financial Provision

Describe the closure objectives and the extent to which they have been aligned to the baseline environment described under Regulation 22 (2) (d) as described in 2.4 herein.

Existing closure plan of the Amandelbult Complex

The rehabilitation of the proposed facility will be subject to conditions in the existing closure plan of the Amandelbult Complex, in which provision is made for the decommissioning of facilities such as the proposed one. The current closure liability assessment for the Amandelbult Complex has the following closure objectives:

- The rehabilitation of land to the satisfaction of the Regional Director and to leave the area in the best possible state for continuous use of land by future generations;
- Revegetated areas will be monitored and maintained until such time as a vegetation cover has been established and can be shown to be self-sustaining;
- Measures to control erosion of soil, such as contour drains and other erosion control structures, will be installed and maintained during the decommissioning phase and up to closure; and
- Grass will be monitored and maintained until such time as a suitable cover has been achieved and a closure certificate can be issued.

The following rehabilitation specifications have been designed to meet the closure objectives in (2):

- Surface infrastructure will be demolished;
- Foundations will be removed;
- Building rubble will be disposed of at a nearby suitable site;
- All areas cleared of surface infrastructure will be rehabilitated by placement of topsoil and revegetated;
- All roads that will not be used by the local population in the post-mining scenario will be ripped and vegetated; and
- Any soil contamination will be removed during demolition activities prior to topsoil replacement and revegetation.

The remainder of this section will, however, focus on rehabilitation phase (1), as it has been investigated for the first time during this EIA-process due to the proposed Haakdoorndrift pit area's location on non-mine-owned land.

Final rehabilitation, decommissioning and mine closure plan for Haakdoorndrift project

A specialist closure & rehabilitation report in terms of regulation GN1147 of NEMA, was conducted by WRINK Environmental Engineers. This is summarised in detail in section 9.2.6 of this report and Appendix 7.9).

Alignment with baseline conditions

According to parts 3. (b) ii (aa) and (bb) of Appendix 4 of GNR1147, The final rehabilitation, decommissioning and mine closure plan (FRDCP) contains and considered the social and environmental baseline environment, which was based on the same specialist studies as chapter 2.4 of this report. The closure objectives are therefore aligned with the baseline environment.

Closure Vision

The proposed closure vision for the HOP is to develop a post mining landscape that is chemically and physically stable, that can be gainfully utilised for agriculture in the long run. The vision is the driver of all rehabilitation and closure activities.

Closure objectives

Rehabilitation objectives to underpin successful closure broadly include the following aspects:

- Design and construct a post mining landform that;

  - Is free draining of surface water runoff
  - has a drainage frame work aligned with the natural catchment
  - has slopes consistent with the post mining land use;
  - is designed based on geomorphic principles to ensure stability, combat erosion and limits the need for further storm water management measures;
- Rehabilitate all haul roads and operational storm water management measures to the required post mining land use;
- Remove all overburden and topsoil stockpiles and rehabilitate the footprints to the required post mining land use;
- Implement concurrent rehabilitation of the open pit and backfill to designed levels;
- Continually develop the "social licence' to operate through building pro-active relationships and involvement with local communities and forums;
- Monitor all aspects identified to demonstrate rehabilitation and closure success, mitigate as required and build towards a closure application once success criteria are met.

Confirm specifically that the environmental objectives in relation to closure have been consulted with landowner and interested and affected parties.

The first and primary objective of rehabilitation in this project is:

"*to rehabilitate haul roads, stockpile areas and the open pit to the desired end land use (arable agriculture),"* stated as such due to the current land use, i.e. agriculture. Therefore, the objective is not to rehabilitate the pit area to its pristine state, but rather to a state in which the landowner may continue to utilise it, for commercial agricultural purposes, post-mining.

The landowners have been consulted throughout the EIA-process in this regard. They were:

- personally informed of the proposed project during pre-application phase;
- consulted with again during the pre-application phase in a one-on-one meeting to provide them with an opportunity to raise issues or concerns with the project (captured and responded to in the comments and response report attached in Appendix 5 of the Scoping Report);
- provided with written notification of the availability of the consultation Scoping Report and simultaneously invited to comment thereon; and
- invited to a public meeting during the Scoping phase of the project, which they attended (records of this meeting is attached as Appendix 5).

During these meetings, project details were provided to the landowner, including rehabilitation objectives.

Registered Interested and Affected Parties (I&APs) were also informed of the project, rehabilitation objectives, the availability of the consultation Scoping Report, and invited to the open house and public meeting held during Scoping phase.

Consultation still to be undertaken

During the remainder of the EIA-process (EIA-phase), all specialist reports, including those on soil, land use, and land capability, and rehabilitation and closure, will be made available to the landowners for comment.

The I&APs as per the latest database will also be informed of the availability of the consultation Environmental Impact Report (cEIR) and Environmental Management Programme (EMPr) report for comment. All specialist reports will be available as part of the cEIR and EMPr.

Both the land owner and the I&Aps will further be invited to the EIA Phase open house / public meeting. Their comments and inputs from these interactions will be recorded and responded to as part of the Comments & Response Report.

Provide a rehabilitation plan that describes and shows the scale and aerial extent of the main mining activities, including the anticipated mining area at the time of closure.

The main mining activities during steady state production towards the end of LoM is illustrated in Figure 97 and Appendix 4.1.

The final arrangement at mine closure with overburden material returned to mined-out pits, calculated with a 6% doming factor is illustrated in Figure 98 and attached as Appendix 4.2.

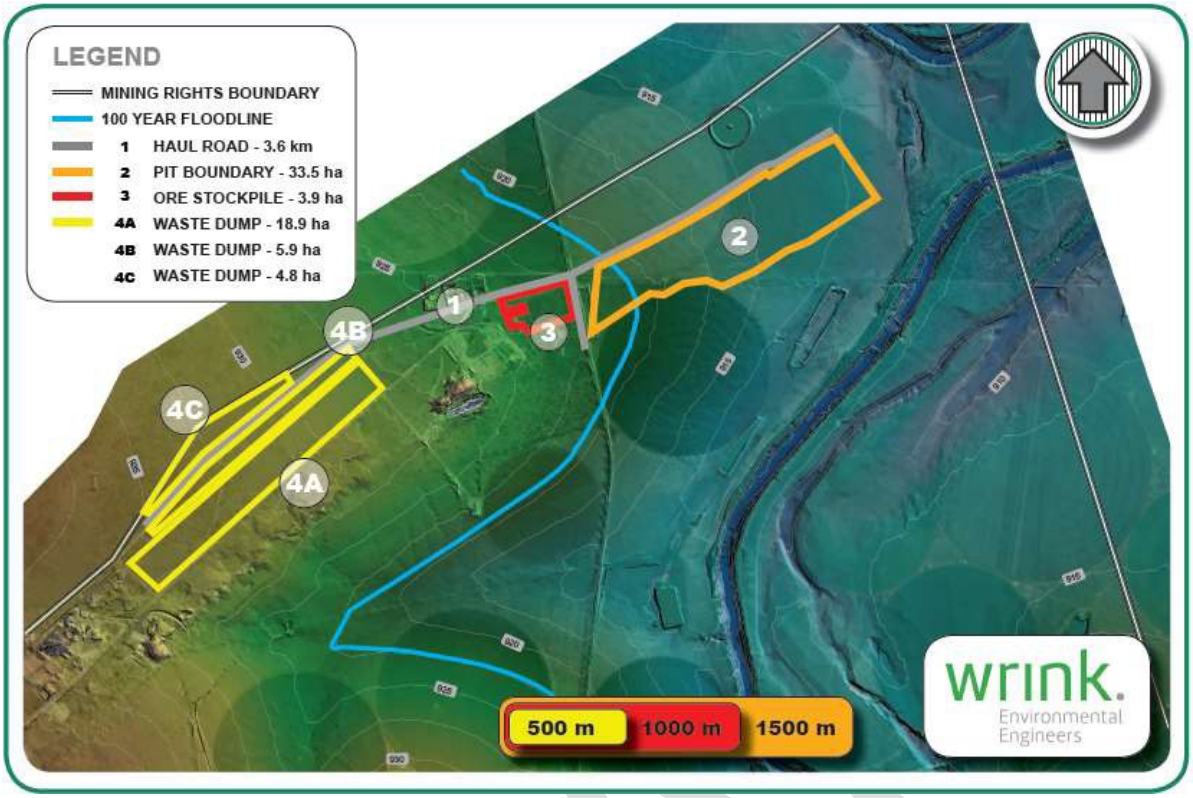

Figure 97 | Itemised layout plan for Haakdoorndrift at the time of closure (WRINK, 2017).

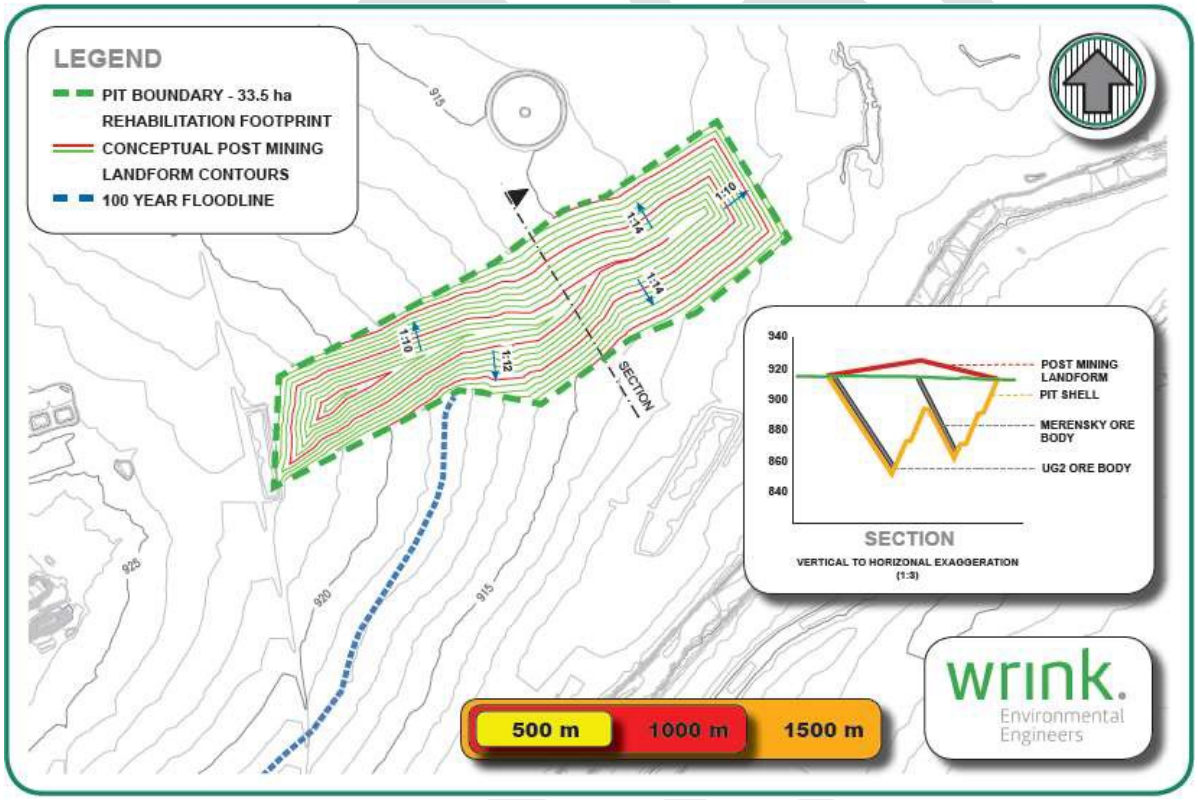

Figure 98 | Final pit arrangement with overburden material returned to the pit (WRINK, 2017).

Closure actions

Specific rehabilitation and closure actions have been determined for each Area itemized in Figure 97. The actions are aligned with the mitigations defined in the comparative risk assessment, form the basis of the closure cost assessment, and stated closure objectives. The actions will commence at the end of mining activities once cut 5 has been mined out. These main actions include:

Area 1 – Haul Roads

Haul roads will remain intact and utilised during the final void backfilling operation, rehabilitation will commence after topsoil has been replaced on the opencast post mining landform. The following actions will be implemented:

- Remove all signage;
- Rip the compacted haul road surface;
- Load and haul road building material to be used as infill for the open pit and clean to the B-horizon;
- Rip the in-situ B-horizon;
- Replace the A-horizon from stockpile 4;
- Conduct fertility sampling, have the soils analysed at an accredited laboratory and define amelioration measures based on the results; and
- Establish vegetation (includes agricultural ripping, land preparation, specified amelioration and seed mix application).

Area 2 – Open pit

Due to concurrent rehabilitation during the operations, only cut 5 (final void) will require backfilling. A dedicated conceptual post mining landform model was developed to inform this FRDCP and ARP. The model will require calibration throughout the life of mine to ensure an accurate materials balance. Final rehabilitation and closure measures, once mining has ceased, include:

- Backfill the open pit final void with Load and haul material from waste stockpiles (area 4) to the elevations specified in the post mining landform design;
- Load, haul topsoil from stockpile area 4, tip at the correct spacing and level to the specified depths;
- Conduct fertility sampling, have the soils analysed at an accredited laboratory and define amelioration measures based on the results; and
- Establish vegetation (includes agricultural ripping, land preparation, specified amelioration and seed mix application).

Item 3 – Infrastructure, screening and ore stockpile

No closure allowances will be made for offices or crushing and screening areas. Infrastructure will be shared with the 62 East decline shaft complex; the closure and rehabilitation liability is included under the Amandelbult authorisations and EMPr. Storage tanks and water filling points are included in this area while all vehicle servicing and maintenance will occur off site. The new PCD 1 is included in the FRDCP as part of the rehabilitation and decommissioning additions resulting from the HOP.

Area 4A, 4B and 4C – waste/topsoil stockpiles

The box cut overburden and topsoil stockpiles will be removed and used to rehabilitate the opencast pit final void (cut 5) at the end of the LOM. The actions include:

- Load and haul the overburden material from stockpiles in area 4 to be used as fill for the open pit (costs included in Item 2 – Open pit), and clean to A-horizon;
- Load and haul topsoil stockpiles from stockpile in area 4 and place on prepared haul road and open pit areas (costs included in Item 2 – Open pit and Item 1 – Haul roads) and clean to the A-horizon;
- Ensure that the footprint is cleared of rocks that could damage agricultural equipment;
- Cross rip in-situ A-Horizon with agricultural ripper to alleviate compaction;
- Conduct fertility sampling, have the soils analysed at an accredited laboratory and define amelioration measures based on the results; and

- Establish vegetation (includes land preparation, specified amelioration and seed mix application).

Storm water management measures

The storm water measures will be re-evaluated in the lead up to closure. The assessment should be conducted in consultation with the post mining land user to determine if certain structures should remain. The closure assumption currently is that all storm water measures will decommissioned and rehabilitated to reinstate the pre- mining surface water drainage framework. The following actions will be implemented:

- Grass lined V-Drains will be infilled with initial excavation material placed adjacent to the structures;
- Remove and dispose of the liners from the HDPE lined V-Drain, infill with initial excavation material placed adjacent to the structures;
- Demolish, remove and dispose of Concrete from HDPE lined V-drains and trapezoidal channels;
- Rip all compacted surfaces;
- Infill with initial excavation material placed adjacent to the structures;
- Conduct fertility sampling, have the soils analysed at an accredited laboratory and define amelioration measures based on the results; and
- Establish vegetation (includes land preparation, specified amelioration and seed mix application).

General items

General items include the following actions:

- removal of all signage;
- dismantling and removal of fencing;
- Installation of a monitoring/extraction borehole into the rehabilitated open cast pit (area 2); and
- Rehabilitation of access tracks to the fences, this will require ripping to alleviate compaction, land preparation, amelioration and seed-mix application.

Maintenance and Aftercare

Maintenance and aftercare for a three-year period after final rehabilitation is completed. The activity is closely linked to the monitoring phase and actions will largely be driven by the monitoring outcomes. Allowances include the following:

- Soil amelioration and vegetation establishment contracts routinely includes monitoring and reseeding of areas as required to ensure vegetation establishment in the first year;
- Reseeding a total of 2ha across the rehabilitated areas to establish vegetation on areas where erosion has been addressed (should it be required);
- Site inspections during the rainy season to identify erosion and determine the cause;
- General maintenance of possible surface depressions, subsidence and erosion gullies; and
- Addressing areas of continuous erosion.

Explain why it can be confirmed that the rehabilitation plan is compatible with the closure objectives.

The closure vision for the HOP is to develop a post-mining landscape that is chemically and physically stable, that can be gainfully utilised for agriculture in the long run. The closure and rehabilitation actions are each related to this vision and the various objectives set. These actions were further used to determine the quantum of the financial provision required.

Calculate and state the quantum of the financial provision required to manage and rehabilitate the environment in accordance with the applicable guideline.

Methodology

A summary of the costing methodology is provided below:

- Developing an itemised plan indicating an inventory of closure aspects based on the proposed life of mine plan and discussions with the mine planner;
- Defining specific rehabilitation actions for each through reviewing specialist studies, impact assessment outcomes, industry guidelines, conceptual modelling and rehabilitation experience;
- Quantifying the rehabilitation actions by conducting a first order volumetric assessment based on the electronic mining plan and pit shell provided, post mining landform modelling and specialist study inputs;
- Obtaining rates through consultation with rehabilitation and civil construction companies based on the volumes and distances for mass earthworks, soil types and areas requiring amelioration and vegetation and experience of similar closure and rehabilitation cost components;
- Calculating monitoring and maintenance costs through defining the required monitoring and maintenance, obtaining rates for laboratory analysis, specialists, travelling, accommodation and equipment rates;
- Compiling a dedicated closure spreadsheet to determine the closure costs of the quantified actions through applicable rates.

Assumptions and qualifications

The costing is based on the following general assumptions:

- No infrastructure will be developed for the HOP, the ore stockpile (Area 3), contractor's yard and offices will be shared with the 62 East decline complex. No allowances have been made for decommissioning and rehabilitating this area;
- This report addresses rehabilitation costs required at closure and the post closure monitoring and maintenance;
- The costs equate to outside (third party) contractors establishing on-site and conducting the specified mass earthworks, soil amelioration, vegetation establishment and maintenance;
- Rates have been determined through experience and consultation with contracting companies active in the mining industry, establishment costs are included in the various rates;
- Specialist involvement in monitoring, laboratory analysis, devising further amelioration measures, updating models and report writing have been allowed for;
- The costing provided does not include the following:
  - Post closure staffing and related infrastructure required by the mine; and
  - Labour force retraining, relocation, redeployment or severance package negotiations.

Closure costs

The summary of the closure costs for the proposed Haakdoorndrift open pit operation is set out in Table 72. Item 1 to 4 are indicated for specific areas, item 5 covers the decommissioning and rehabilitation of the operational storm water management measures, item 6 includes general items and post closure monitoring is detailed in item 7. The rates used in the determination are included in Appendix 7.9.

Confirm that the financial provision will be provided as determined.

Anglo will arrange to provide the financial guarantee for the rehabilitation costs to DMR as part of the mine's closure liability assessment.

Table 72 | Summary of Haakdoorndrift closure costs (WRINK, 2017)

Item	Description	unit	quantity	rate	amount
1	Haul roads				
1.1	Rip haul roads	ha	4,3	R20 000	R86 400
1.2	Load & haul all road building material and clean to B horizon	m^3	21 600	R30	R648 000
1.3	Rip B Horizon	ha	4,3	R20 000	R86 400
1.4	Load, haul & place topsoil from 4A	m^3	21 600	R30	R648 000
1.5	revegetate	ha	4,3	R16 578	R71 616
1	Haul roads Subtotal				R1 540 416
2	Open pit				

2.1	Load & haul fill material from stockpile area 4	m^3	4 421 748	R30	R132 652 436
2.3	Load & haul fill material from haul roads	m^3	25 920	R30	R777 600
2.4	Load, haul & place topsoil from stockpile area 4	m^3	274 400	R30	R8 232 000
2.5	Revegetation	ha	34	R16 578	R555 591
2	Open pit Sub-total				R142 217 627
3	Ore stockpile/offices				
3.1	Infrastructure shared with-/ included in Amandelbult liability estimate				
4	Overburden/topsoil stockpiles				
4.1	Load & haul waste dumps to open pit and clean to A-horizon	Included in 2 Open pit			
4.2	Load & haul topsoil stockpiles to place over filled open pit and haul roads, clean to A-Horizon	Included in 2 Open pit			
4.3	Cross rip *insitu* A-Horizon (agricultural ripping)	ha	30,1	R2 300	R69 152
4.4	Revegetate	ha	30,1	R16 578	R498 991
4	Waste dump/topsoil stockpile Sub-total				R568 144
5	Storm water management				
5.1	Remove liners	weekly	3	R59 602	R178 806
5.2	Demolish concrete	m^3	3 313	R461	R1 527 385
5.3	Rubble/liner transport - 50km	m^3	3 429	R350	R1 200 276
5.4	Disposal of inert rubble	m^3	3 429	R109	R373 800
5.5	Rip all compacted surfaces	ha	5	R20 000	R103 680
5.6	Fill all drains	sum	1	R16 113	R16 113
5.7	General levelling and shaping dam	ha	4,08	R105 710	R431 339
5.8	Replace topsoil over dam	m^3	20402	R27	R550 854
5.9	Revegetate	ha	17,52	R16 578	R290 449
5	Storm water management Sub-total				R4 672 703
6	General items				
6.1	Fence and signage removal	m	7 000	R115	R805 000
6.2	Drilling, equipping and testing borehole	no	1	R683 841	R683 841
6	General Items Sub-total				R1 488 841
	Rehabilitation Sub-total 1				R148 998 890
7	Monitoring & maintenance				
7.1	soils year 1-3, annually - analysis and reporting annually	sum	3	R62 064	R1 327 440
7.2	Vegetation Year 1-3, annually 3 years	sum	3	R119 400	R384 880
7.3	Land capability Year 1 & 3	sum	2	R129 450	R886 840
7.4	Surface water Year 1-5, monthly - reporting quarterly	sum	5	R115 200	R393 790
7.5	Groundwater Year 1-5, quarterly - reporting quarterly	sum	5	R115 200	R186 192
7.6	Surface water Year 6-10, bi-annually - reporting bi-annually	sum	5	R57 600	R358 200
7.7	Ground water Year 6-10, bi-annually - reporting bi-annually	sum	5	R57 600	R258 900
7.8	Vegetation maintenance	ha	2	R49 769	R99 538
7.9	Erosion and general maintenance (year 1 - 3)	week	9	R33 176	R298 584
7	Monitoring & maintenance Sub-total				R4 194 364
	Sub-Total 2 at closure				R154 682 095
8	Additional allowances				
8.1	Preliminary and general 10%				R15 468 209
8.2	Contingencies 10%				R15 468 209
8	Additional allowances Sub-total 3				R30 936 419
	Closure cost 1+2+3				R185 618 514
	VAT @ 14%				R25 986 592
	Total				R211 605 106

28.8. Mechanisms for monitoring compliance with and performance assessment against the environmental management programme and reporting thereon, including

a. Monitoring of Impact Management Actions
b. Monitoring and reporting frequency
c. Responsible persons
d. Time period for implementing impact management actions
e. Mechanism for monitoring compliance

28.8.1. Monitoring of change in baseline

The change in *baseline conditions* is to be monitored during the HOP. A comprehensive monitoring system is in place for the Amandelbult Section. The objective of the environmental monitoring system is to:

- Prevent and/or minimise the environmental impact associated with the mining activities;
- Ensure that the environmental management system performs according to specifications;
- Ensure conformance with the environmental objectives;
- Ensure timeous implementation of the environmental strategies and implementation programme;
- Act as a pollution early-warning system;
- Obtain the necessary data required to address knowledge gaps;
- Check compliance with license requirements; and
- Ensure consistent auditing and reporting protocols.

It is recommended that the current monitoring programme be expanded to include additional monitoring points and actions for the HOP, as presented in Table 73:

Table 73 | Environmental Monitoring Programme for the HOP

Aspect	Issue	Purpose	Monitoring points	Frequency	Sampling Method	Variables
Surface water	Surface water quality	Determine any deterioration in water quality as a result of the mining related activities	Up- and downstream of mining operation – refer to Table 74	Monthly	Grab sampling	EC, pH, TDS, SS, Cl, SO_4, NO_3, Na, F, Fe, Al, Mn, Zn, Total Alkalinity, Ca, Mg, K, Total Hardness
				Annually	Grab sampling	Analyses to 95% charge balance, including all metals and hydrocarbons
	Water management infrastructure	Monitoring of condition, identifying areas that require maintenance	Along clean and dirty water canals, clean and dirty water dams	Monthly	Visual	Evidence of erosion, cracks, subsidence, overgrowth, etc.

Aspect	Issue	Purpose	Monitoring points	Frequency	Sampling Method	Variables
				After a big rain event		
	Dirty water systems	Determine the water quality and long-term chemical changes in the dirty water systems	PCDs	Monthly	Grab sampling	EC, pH, TDS, SS, Cl, SO_4, NO_3, Na, F, Fe, Al, Mn, Zn, Total Alkalinity, Ca, Mg, K, Total Hardness
Groundwater	Groundwater quality	To determine any impact on the groundwater quality as a result of mining	Hydro-census / baseline boreholes – refer to Table 74	Quarterly	High integrity grab sampler (double valve), preferably made from PVC/Teflon	EC, pH, TDS, SS, Cl, SO_4, NO_3, Na, F, Fe, Al, Mn, Zn, Total Alkalinity, Ca, Mg, K, Total Hardness Annually: Analyses to 95% charge balance, including all metals and hydrocarbons
	Groundwater levels	To determine any impact on the groundwater levels as a result of mining	As above	Monthly	Pump samples	Water level
Mine water balance	Water levels in dams	To verify water balance and volume of water stored	PCDs	Monthly	Survey	Height (m)
	Pit dewatering	To determine volume of groundwater influx and dewatering	Mine dewatering at the dewatering pumps	Monthly reading	Water meters	Volume (m^3)
Biodiversity / Land use management	Soil erosion	To pro-actively identify soil erosion in order to rectify prior to serious degradation	Clean water channels / discharge point	Routinely (monthly)	Field survey	-
	Soil analysis	To determine any deficiencies in soil fertility prior to seeding	Topsoiled areas	Ongoing (prior to topsoil placement)	Soil samples	As per specialist advice
	Vegetation audit	To determine effectiveness of land use management plan and long-term sustainability of vegetated areas	Vegetated areas	Annually	Field survey	Vegetation growth status As per specialist advice
	Species diversity	To determine species diversity (fauna and flora)	Up- and downstream of mining operation – refer to Table 74	Annually	Field survey	As per specialist advice – refer Appendix 7.2
	Aquatic monitoring	Ongoing monitoring of the aquatic resources in the vicinity of the mining development	Up- and downstream of mining operation – refer to Table 74	Six-monthly (spring and autumn)	Field survey	As per specialist advice – refer Appendix 7.2
	Wetland monitoring	To determine the impact on the wetland systems as a result of mining	Up- and downstream of mining operation – refer to Table 74	Six-monthly (spring and autumn)	Field survey	As per specialist advice – refer Appendix 7.2
	Riverine forest	To determine the impact on the riverine forest as a result of mining	Selected points along Crocodile River	Six-monthly	Field survey Plant Moisture Stress	As per specialist advice
	Alien vegetation	To monitor conformance with alien vegetation programme	Up- and downstream of mining operation – refer to Table 74	Monthly (during eradication programme)	Survey	Area (hectares)
	Concurrent rehabilitation	To determine conformance with environmental objective for concurrent rehabilitation	Mining area	Monthly	Survey	Hectares disturbed, levelled, topsoiled and vegetated

Aspect	Issue	Purpose	Monitoring points	Frequency	Sampling Method	Variables
	Rehabilitation plan	To ensure conformance to final rehabilitation plan and free draining standard	Rehabilitated areas	Monthly	Survey	Final level of rehabilitation
Waste	Waste generation and management	To determine volume of waste generated and disposed	Site	Weekly	Contractor report	Waste types
Blasting	Noise and vibration	To ensure conformance to recommended levels	Three monitoring points as shown in Table 74.	Whenever blasting takes place	Instrumentation	Vibration (mm/s); air blast (dB)
Air	Dust deposition and PM_{10} emissions	To ensure compliance to regulated air quality standards	As per the Amandelbult dust fall monitoring network, or at representative receivers within 2 km from mining operations.	Monthly	Dust bucket measurements, emissions inventory, annual modelling	Dust fall (mg/m^2/day), PM_{10}
Ambient Sound	Noise	To ensure compliance to National Noise Control Regulations (GN R 154 of 1992).	Receivers 3 or 4 and 12 (indicated in Table 74). Locations of person registering valid and reasonable noise complaint	Quarterly		

The positions of the proposed additional monitoring points are listed in Table 74 and presented in Figure 99.

Table 74 | Position of proposed additional monitoring points

Monitoring points	No.	Coordinates *(WGS 84)*	
		South	East
Surface water and biomonitoring points	BM 3	-24.716713	27.41842
	BM 2	-24.726411	27.41681
	BM 1	-24.73375	27.41033
	BM 4	-24.70251	27.40945
Groundwater monitoring points (shown in Figure 99)	TBH01	-24.71728	27.41765
	TBH02	-24.72089	27.41766
	TBH05	-24.71868	27.41729
Hydrocensus boreholes (blocked boreholes excluded)	LS01	-24.72230	27.41874
	LS03	-24.71539	27.41941
	LS04	-24.71508	27.41881
	LS06	-24.71580	27.41974
	LS07	-24.71577	27.41975
	LS08	-24.73154	27.38888
	LS09	-24.71617	27.41673
	MC01	-24.72433	27.42274

	MC02	-24.72261	27.42445
	MC03	-24.72451	27.42211
	MC04	-24.72440	27.42511
	MC05	-24.72519	27.42613
	MC06	-24.73226	27.43241
	MC07	-24.73102	27.43203
	MC08	-24.73168	27.43328
	MC09	-24.73771	27.41013
	JDT01	-24.71505	27.41878
	JDT02	-24.71494	27.41953
	JDT03	-24.71477	27.41975
	JDT04	-24.71310	27.42265
	JDT05	-24.71271	27.42290
	JDT06	-24.71037	27.42386
	JDT07	-24.71053	27.42721
	JDT08	-24.70743	27.42842
	JDT09	-24.71370	27.42771
	JDT10	-24.71365	27.42798
	JDT12	-24.71362	27.42863
	JDT13	-24.71371	27.42905
	FL01	-24.70348	27.40418
	FL02	-24.70345	27.40384
	FL04	-24.70322	27.40410
	FL05	-24.70320	27.40409
Blasting and vibration monitoring points (Blast Management & Consulting, 2016)	93	24°43'1.08"S	27°24'5.24"E
	160	24°43'29.62"S	27°24'27.76"E
	161	24°44'15.09"S	27°24'27.65"E
	195	24°43'36.63"S	27°24'12.84"E
	291	24°43'29.10"S	27°24'14.56"E

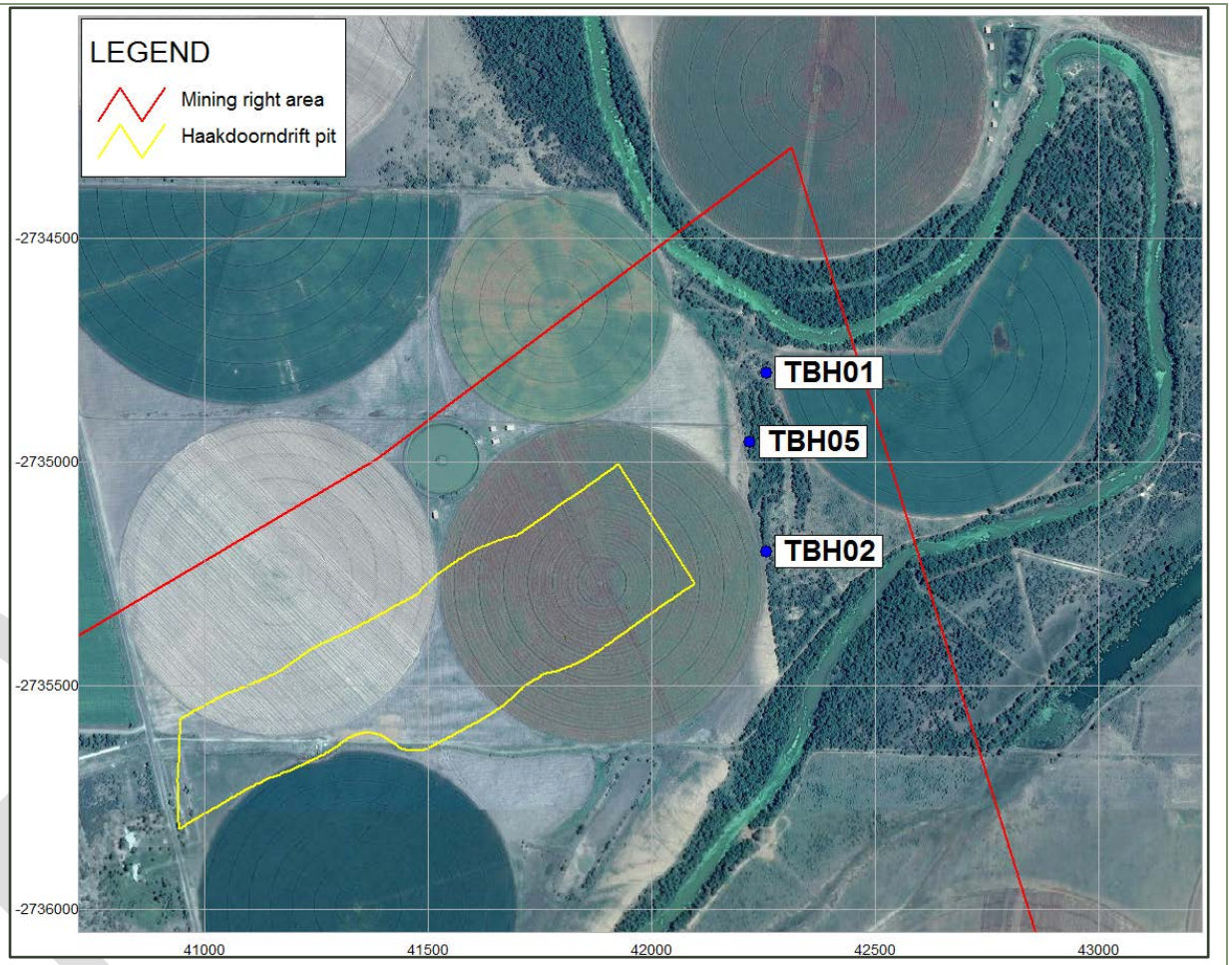

Figure 99 | Positions of new Haakdoorndrift source monitoring boreholes (Groundwater Complete, 2017).

Noise monitoring points (EAR, 2016)	3	24°44'36.28"S	27°24'8.54"E	
	4	24°44'39.31"S	27°24'12.99"	
	12	24°42'49.95"S	27°23'22.41"E	

28.8.2. Performance auditing and reporting

In order to ensure compliance with the EMPr and WUL for the HOP, the following is committed:

- Conduct the performance assessment and monitoring of the EMPr / WUL on an ongoing basis.
- Compile and submit to the DMR a report on the performance assessment of the EMPr.
- Compile and submit to the DWS a report on the performance assessment of the WUL.
- The performance assessments of the EMP / WUL and the compilation and submission of the reports will occur biennially (every 2 years) from the date of approval.
- Anglo will appoint a responsible person(s), in writing, who will monitor all environmental aspects of the site on a regular basis.

Mechanisms and responsibilities for implementation of the Impact Management Actions to ensure compliance with the EMPr / WUL are shown in Table 75.

Table 75 | Mechanisms and responsibilities for implementation of Impact Management Actions

SOURCE ACTIVITY	IMPACTS REQUIRING MONITORING PROGRAMMES	FUNCTIONAL REQUIREMENTS FOR MONITORING	ROLES AND RESPONSIBILITIES (for the execution of the monitoring programmes)	MONITORING AND REPORTING FREQUENCY AND TIME PERIODS FOR IMPLMENTING IMPACT MANAGEMENT ACTIONS	TIME PERIOD FOR IMPLEMENTATION
Impact on biophysical environment as a result of the HOP	Biophysical environment	Implementation of environmental monitoring programme	Environmental Department in line with the recommendations by the specialists	Annual review of monitoring programme or if major change in scheduling	Prior to mining
Impact on biophysical and social environment as a result of the HOP	Biophysical and social environment	Implement internal environmental awareness programme	Environmental Officer Human Resources	Ongoing review Include in annual induction programme	Construction Phase
Impact on biophysical environment as a result of the HOP	Biophysical monitoring	Review and analyses of monitoring data for: • Surface water • Groundwater • Mine water balance	Environmental Officer HSEC Committee	Monthly	Commencement of mining

SOURCE ACTIVITY	IMPACTS REQUIRING MONITORING PROGRAMMES	FUNCTIONAL REQUIREMENTS FOR MONITORING	ROLES AND RESPONSIBILITIES (for the execution of the monitoring programmes)	MONITORING AND REPORTING FREQUENCY AND TIME PERIODS FOR IMPLMENTING IMPACT MANAGEMENT ACTIONS	TIME PERIOD FOR IMPLEMENTATION
		• Land use management • Air quality • Environmental noise • Blasting • Natural resources, including riverine forest • Waste management			
Impact on SCC/protected faunal and floral species	SCC/protected faunal and floral species	Develop and implement Rescue and Relocation Plan and Reclamation Plan	Specialist to be appointed	Annual rescue operation for areas to be disturbed in the next 12 months	Prior to mining
Mining and vegetation clearance	Biodiversity impact	Develop and implement Biodiversity Action Plan (BAP), including avifaunal plan	Specialist to be appointed	Annual review	Within one year of mining
Mining and infrastructure development	Soils and land use	Develop Rehabilitation Plan / Land Use Management Plan	Mining Department	Annual review or if major change in scheduling	Construction Phase
Impact on soils, land use and biodiversity as a result of the HOP	Soils, land use and biodiversity	Reporting of rehabilitation plan • Areas disturbed • Areas levelled • Areas topsoiled • Areas vegetated	Rehabilitation Officer	Monthly	Construction Phase
Impact on soils, land use and biodiversity as a result of the HOP	Soils, land use and biodiversity	Vegetation audit to determine effectiveness of land use management plan and long-term sustainability of vegetated areas	External appointment	Annually	Within first 2 years of mining
Impact on soils, land use and biodiversity as a result of the HOP	Soils, land use and biodiversity	Implement aftercare and maintenance programme for rehabilitated areas	Rehabilitation Officer	Ongoing implementation as per specialist recommendations	Within 2 years of mining
Vegetation clearing and rehabilitation	Encroaching / spreading of alien vegetation	Initiate alien vegetation programme	Environmental Officer	Annual review	Construction Phase
Dewatering	Impact on surrounding	Establish baseline groundwater levels of all boreholes within the impact zone	Environmental Officer Groundwater specialist	Annually	Prior to any activities

SOURCE ACTIVITY	IMPACTS REQUIRING MONITORING PROGRAMMES	FUNCTIONAL REQUIREMENTS FOR MONITORING	ROLES AND RESPONSIBILITIES (for the execution of the monitoring programmes)	MONITORING AND REPORTING FREQUENCY AND TIME PERIODS FOR IMPLMENTING IMPACT MANAGEMENT ACTIONS	TIME PERIOD FOR IMPLEMENTATION
	boreholes and groundwater levels				
Dewatering	Impact on surrounding boreholes and groundwater levels	Enter into negotiations with surrounding land owners and communities impacted regarding compensation or alternative water supply	Environmental Officer Mine Management	Ongoing review, based on monthly monitoring results	Once monitoring indicates a lowering in water levels of boreholes
Impact on groundwater quality and levels	Groundwater quality and levels	Revision of groundwater flow and geochemical model	Specialist to be appointed	Revise every 5 years	Within 2 years of mining
Impact on aquatic systems and drainage lines as a result of the HOP	Aquatic systems and drainage lines	Maintenance of clean and dirty water system	Engineering Department	Monthly or after a large rain event	Operational Phase
Overburden / Product transport	Soil contamination	Identify and clean-up of any spillages along access and product transport roads	Engineering Department	Weekly	Construction Phase
Overburden / Product transport	Road damage	Identify and report any road maintenance issues	Engineering Department Roads Agency Limpopo	Ongoing discussions and auditing of road conditions	Construction Phase
Consultation	Social impacts	Develop Communication and Consultation Plan and Grievance Procedure	Human Resource Department Environmental Department	Ongoing review through the EMC	Prior to construction
Consultation	Social impacts	HSEC stakeholder meeting	Mine Management	Annually	Commencement of mining
EMPr / WUL compliance review		• Internal review of compliance, conformance to environmental objectives and strategies and the implementation thereof	Environmental Officer HSEC Committee / EMC	Annually	Commencement of mining
EMPr / WUL compliance review		• EMP performance assessment to determine conformance with the EMPr, including effectiveness and appropriateness of EMP	External appointment	Biennially (every 2 years)	Within first 2 years of mining
EMPr / WUL compliance review		• Environmental legal compliance audit	External appointment	Annually	Commencement of mining
EMPr / WUL compliance review		• Revision of closure cost assessment	Engineering Department	Annually	Commencement of mining

SOURCE ACTIVITY	IMPACTS REQUIRING MONITORING PROGRAMMES	FUNCTIONAL REQUIREMENTS FOR MONITORING	ROLES AND RESPONSIBILITIES (for the execution of the monitoring programmes)	MONITORING AND REPORTING FREQUENCY AND TIME PERIODS FOR IMPLMENTING IMPACT MANAGEMENT ACTIONS	TIME PERIOD FOR IMPLEMENTATION
Pit dewatering	Dewatering.	• Groundwater samples are to be taken from the three purpose-drilled monitoring boreholes downgradient from the Haakdoorndrift pit. • Monitoring boreholes should be capped and locked at all times. • Borehole depths should be measured quarterly and blown out with compressed air if blocked. • Vegetation around the boreholes should be removed on a regular basis and the borehole casings painted, when necessary, to prevent excessive rust and degradation.	Anglo American Platinum	Quarterly throughout mining activities (LoM).	Commencement of mining
General mining activities	All impacts described in Section 12.5, Part A.	The purpose of the monitoring programme is to ensure that mitigation measures identified and described in the EMPr are implemented. Construction, operation and decommissioning activities of the opencast activities shall be monitored and recorded by the ECO and audited against the EMPr on a monthly basis. A report must be submitted at the end of each month prior to progress meetings, where they will form part of the agenda. The ultimate target is to achieve 100% compliance with the EMPr.	*Environmental Control Officer* The Environmental Control Officer (ECO) is the person responsible for monitoring of the implementation of the EMPr. The ECO may be appointed by Anglo. The ECO has the authority to stop any works if, in his/her opinion, there is or may be a serious threat to or impact on the environment; caused directly by Anglo or the Contractor's actions or activities during all phases of the proposed project. In all such work stoppage situations, the ECO is to inform Anglo or the Contractor of the reasons for the stoppage within 24 hours. All ECO reports will be sent on a monthly basis to Anglo to keep abreast of compliance on site. Upon failure by Anglo or the Contractor, or their employees, to show adequate consideration to the EMPr, the ECO may recommend to Anglo or the Contractor to have their representative(s) or any employee(s) removed from the site, or work suspended until the matter is resolved. *Engineer* The Engineer responsible for the design of the Haakdoorndrift Opencast activities will be an Anglo appointment. It will be the responsibility of the Engineer to oversee the overall implementation of the project, compliance to the EMPr and incorporation of any potential environmental aspects mentioned, into the design.	Monthly from project commencement to end of LoM.	Commencement of mining

SOURCE ACTIVITY	IMPACTS REQUIRING MONITORING PROGRAMMES	FUNCTIONAL REQUIREMENTS FOR MONITORING	ROLES AND RESPONSIBILITIES (for the execution of the monitoring programmes)	MONITORING AND REPORTING FREQUENCY AND TIME PERIODS FOR IMPLMENTING IMPACT MANAGEMENT ACTIONS	TIME PERIOD FOR IMPLEMENTATION
			Anglo and the Contractor As part of being responsible for the construction, operation, and decommissioning of the proposed mining activities, Anglo or the Contractor will be responsible for the overall implementation of the EMPr. The Contractor will nominate a representative on site as his environmental representative, known as the Contractor's Environmental Control Officer (CECO). The Contractor must issue site instructions to rectify any environmental noncompliance, based on the CECO's findings. The Anglo Site Manager can also issue site instructions. *Contractor's Environmental Control Officer* The CECO will be responsible, on behalf of the Contractor, to ensure that the EMPr is implemented and complied with on site on a daily basis. The CECO will liaise with the ECO (see above) in all matters relating to the implementation of the EMP. The CECO needs a certain amount of environmental management experience in the field and preferably experience on opencast or platinum mining projects.		

28.9. Indicate the frequency of the submission of the performance assessment report

Performance Assessment Reports, as required by the NEMA EIA Regulations 2014, will be prepared and submitted every two years to DMR or as often as requested by DMR. In addition, the appointed ECO will undertake regular site audits. Copies of the site audits reports could be submitted to DMR if requested.

28.10. Environmental awareness plan

28.10.1. Manner in which the applicant intends to inform his or her employees of any environmental risk which may result from their work

Environmental awareness on site

Prior to mining activities, all employees of the applicant, as well as contractor teams involved in work on the proposed project, are to be briefed on their obligations towards environmental controls and methodologies in terms of this EMPr. It is recommended that the briefings take the form of an on-site talk and demonstration by the Contractor's (or Anglo's) Environmental Control Officer (CECO). The education/awareness programme should be aimed at all levels of management and workers within the contractor team. All new employees arriving on site shall undergo this training. Environmental induction must be done according to the Contractor's Environmental Management System, and must include all aspects of the site specific EMPr.

Toolbox talks are to be used as a tool for continuous training of employees and must be conducted on a weekly basis. Toolbox talks must be conducted in an interactive way to ensure that employees understand the content and purpose of the specific EMPr requirements. Relevant environmental site matters, incidents and issues shall form part of the Contractor's toolbox talks. The Contractor shall record the environmental subjects discussed.

As mining activities continue, an effort must be made by the Contractor to assess the training needs of workers on site. Cognisance must be taken of the specific work to be undertaken at the time and, if necessary, additional training on environmental requirements must be conducted to ensure all workers understand the risks involved as well as how to adequately implement mitigation measures.

A signed register documenting all employees' environmental training and awareness programmes must be kept on record for verification purposes.

Recordkeeping

The CECO is responsible for maintaining all records in relation to the EMPr requirements on site. Such records must be made available to the ECO on request during monthly audits, as well as at any time as requested by the ECO, auditor or project managers. Recordkeeping must be done in an orderly fashion with the intent of ensuring easy reference.

28.10.2. Manner in which risks will be dealt with in order to avoid pollution or the degradation of the environment

The following documents will be used as reference for identifying and managing impacts:

- Approved EMPrs;
- Approved EAs;
- Method statements or guidelines of Anglo American Platinum; and
- EMS.

The applicant and contractors will be responsible for the implementation of the required mitigation measures in order to avoid pollution or degradation of the environment. Appropriate implementation of the recommended mitigation measures specified in the EMPr will be monitored through regular site audits by an ECO.

28.11. Specific information required by the Competent Authority

(Among others, confirm that the financial provision will be reviewed annually).

The financial provision will be reviewed on an annual basis or as requested by DMR.

29. 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 ☒

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

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