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SISHEN IRON ORE COMPANY (PTY) LTD

KOLOMELA MINE

HEUNINGKRANZ PROJECT

(MINING AND PROCESSING AT HEUNINGRANZ)

POSTMASBURG, NORTHERN CAPE

ENVIRONMENTAL IMPACT ASSESSMENT

&

ENVIRONMENTAL MANAGEMENT PROGRAMME

PART A

FOR SUBMISSION TO DMR

DMR REFERENCE: NC30/5/1/2/3/2(069)MR

EXM Advisory Services

ENVIRONMENTAL • MINERAL RIGHTS • SOCIAL & SD

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PART A

FOR SUBMISSION TO THE DMR

NAME OF APPLICANT: Sishen Iron Ore Company (Pty) Ltd – Kolomela Mine

TEL NO: 053 313 9139

FAX NO: 078 560 5600

POSTAL ADDRESS: Private Bag X3003, Postmasburg, 8420

PHYSICAL ADDRESS: Kolomela Mine, Farm Strydfontein, Postmasburg

REF NUMBER: NC 30/5/1/2/3/2/(069)MR

TO BE SUBMITTED FOR AUTHORISATION IN TERMS OF:

SECTION 102 OF THE MINERALS AND PETROLEUM RESOURCES DEVELOPMENT ACT

LISTED ACTIVITIES UNDER THE NATIONAL ENVIRONMENTAL MANAGEMENT ACT AND NATIONAL ENVIRONMENTAL MANAGEMENT: WASTE ACT

AMENDMENT OF AN AUTHORISATION UNDER THE EIA REGULATIONS OF THE NATIONAL ENVIRONMENTAL MANAGEMENT ACT.

PREPARED BY: EXM Advisory Services (Pty) Ltd

DATE: 23 April 2018

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Name	**Designation**	**Signature**	**Date**
Kerry Fairley	EAP Director Pr.Sci.Nat		23 April 2018
Joshua O'Brien	Environmental Scientist		23 April 2018

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ACRONYMS AND ABBREVIATIONS

	Definition
AEL	Atmospheric Emissions Licence
BID	Background Information Document
CBA	Critical Biodiversity Area
DMR	Department of Mineral Resources
DWS	Department of Water and Sanitation
EAP	Environmental Assessment Practitioner
EIA	Environmental Impact Assessment
EIS	Ecological Importance and Sensitivity
EMC	Ecological Management Class
EMPr	Environmental Management Programme
ESA	Ecological Support Area
GHG	Greenhouse Gases
GNR	Government Notice
IAP	Interested and Affected Party
LOM	Life of Mine
Mtpa	Million tons per annum
LSA	Late Stone Age
mamsl	Metres above mean sea level
Mbs	Metres below surface
MPRDA	Mineral and Petroleum Resources Development Act
MSA	Middle Stone Age
NAAQS	South African National Ambient Air Quality Standards
NDCR	National Dust Control Regulations
NEMA	National Environmental Management Act
NEM: AQA	National Environmental Management Air Quality Act
NEM: BA	National Environmental Management Biodiversity Act
NEM: WA	National Environmental Management Waste Act
NFEPA	National Freshwater Ecosystem Priority Areas
NHRA	National Heritage Resources Act
PES	Present Ecological Status
PM10	Particulate matter less than 10 microns
PM2.5	Particulate matter less than 2.5 microns
ROM	Run of Mine
RWD	Return Water Dam
SACNASP	South African Council for Natural & Scientific Professionals
SAHRA	South African Heritage Resource Agency
SAMRAD	South African Mineral Resources Administration (System)
SDF	Spatial Development Framework
SIOC	Sishen Iron Ore Company (Pty) Ltd
SLP	Social Labour Plan
TOPS	Threatened or Protected Species
UHDMS	Ultra-High Dense Media Separation
WML	Waste Management Licence

1. EXECUTIVE SUMMARY

1.1 Introduction and Purpose

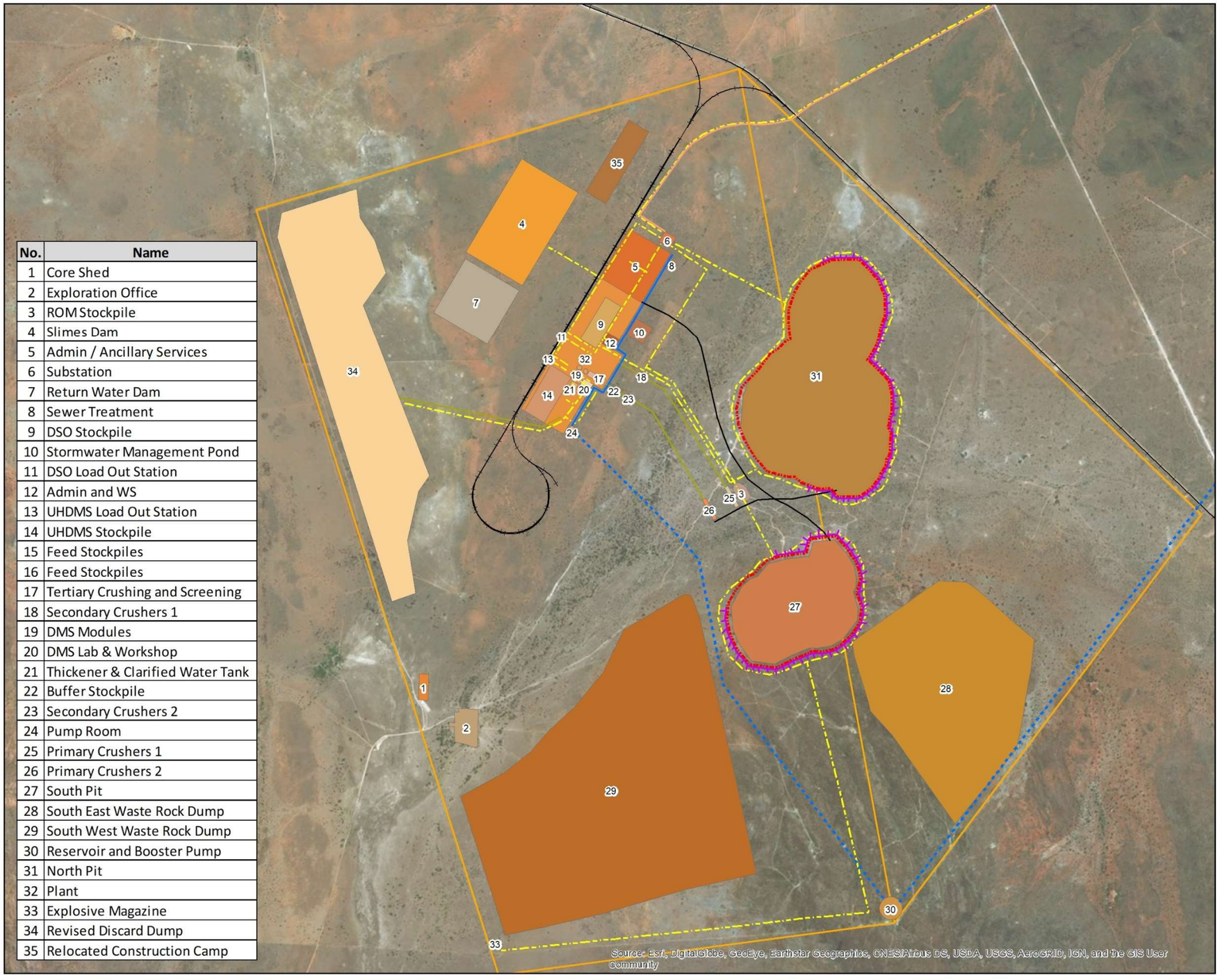
The Sishen Iron Ore Company (Pty) Ltd is proposing to incorporate the Heuningkranz Section into the existing Kolomela Mine mining right. The Heuningkranz Section includes the Farm 364 (Heuningkranz) and Farm 432 (Langverwacht), Portion 1, located approximately 18 km north west of Postmasburg, in the Tsantsabane Local Municipal area, and 18 km north north west of the main infrastructure area at Kolomela Mine.

The construction of infrastructure and the stripping of overburden is scheduled to commence at Heuningkranz in 2031, with the first ore being mined and processed in 2034. The inclusion of the Heuningkranz Section, will extend the life of Kolomela Mine by an additional 14 years, until 2048.

The proposed layout of infrastructure at Heuningkranz is given in Figure 1.

The purpose of this report is to present the results of the environmental impact assessment (EIA) undertaken for the Heuningkranz Project. The EIA has been completed in support of the following applications for environmental authorisation:

- Section 102 of the Mineral and Petroleum Resources Development Act No 28 of 2002 to extend the Kolomela Mining Right by the inclusion of the properties listed above as well as the amendment of the Kolomela mine works programme, social and labour plan and environmental management programme;
- Regulation 31 of Part 2 of Chapter 5 of the Environmental Impact Assessment Regulation GNR. 982 (as amended by GNR. 326 of 7 April 2017) under the National Environmental Management Act for amendment of the Environmental Management Programme.
- Environmental Impact Assessment Regulations GNR. 982-985 as amended GNR. 324-327 of 7 April 2014 for Activities 9, 12 & 24 of Listing Notice 1, Activities 4, 6, 12, 15 & 27 of Listing Notice 2 and Activities 8 & 14 of Listing Notice 3 for infrastructure to be developed.
- Regulation GNR. 921 as amended by GN. 633 of 24 July 2015 published under National Environmental Management: Waste Act for Activity 11 of Category B for the development of mine residue deposits.



No.	Name
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4	Slimes Dam
5	Admin / Ancillary Services
6	Substation
7	Return Water Dam
8	Sewer Treatment
9	DSO Stockpile
10	Stormwater Management Pond
11	DSO Load Out Station
12	Admin and WS
13	UHDMS Load Out Station
14	UHDMS Stockpile
15	Feed Stockpiles
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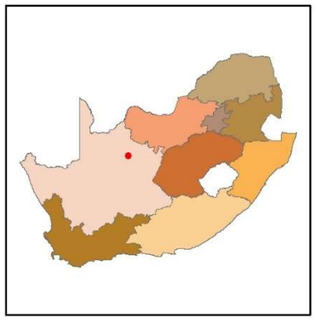
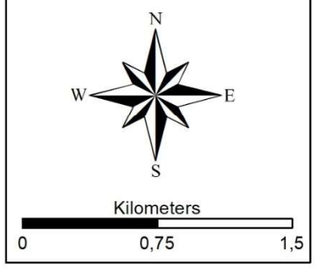
33	Explosive Magazine
34	Revised Discard Dump
35	Relocated Construction Camp

Legend

- Mitigated Access Road
- Conveyor Belt
- Dewatering Network
- Haul Road
- Railway Line
- Stormwater Berm
- Stormwater Channel
- Revised Electrical Line
- Property Boundary





Date: 2018/03/13

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Coordinate System: DMS	
Spheroid: WGS84	Central Meridian: LO

Heuningkranz Mitigated Layout

FIGURE 1-1: PROPOSED PROJECT LAYOUT HEUNINGKRANZ (MITIGATED)

1.2 Project Overview

Mining at the Heuningkranz Section will be from two (2) open pits, the Heuningkranz North and Heuningkranz South Pits. Overburden and waste rock originating from the Heuningkranz North and South Pits will be placed on surface to create waste rock dumps. The pits will require dewatering and the water will be pumped to a new Heuningkranz Reservoir and then piped over a distance of approximately 15 km to Sedibeng Water via the existing Beeshoek Reservoir.

It is planned that 6 million tonnes per annum (Mtpa) of iron ore will be processed by using ultra high dense media separation (UHDMS) at a new processing plant to be developed at Heuningkranz. Mineral waste from processing by UHDMS will be managed into two mine residue facilities: a discard dump and slimes dam, that will be developed at Heuningkranz. A further 4.2 Mtpa of high grade ore will be railed to Kolomela Mine, for processing at the existing Kolomela direct shipping ore (DSO) plant. Primary and secondary crushing of this ore will take place at Heuningkranz. A rail link will be developed at Heuningkranz both for the export of product directly from Heuningkranz as well as the transport of DSO material to Kolomela via the existing iron ore rail line for processing. The total maximum production from Heuningkranz will be 10.2 Mtpa.

Access to Heuningkranz will be via the R385 road linking Postmasburg and Olifantshoek and a new road. The R385 will be upgraded to accommodate additional traffic volumes. Supporting infrastructure to be developed at Heuningkranz includes: administration buildings, workshops, stores, fuel storage areas, an explosives magazine, sewage treatment works, pollution control dams, stormwater management infrastructure, dewatering infrastructure; pipelines, evaporation dams, mine haul and internal roads and overland conveyors. A construction village and construction infrastructure will be developed at Heuningkranz. No new housing will be necessary, as personnel will move from Kolomela to the Heuningkranz Section. The main administration services will remain at Kolomela.

1.3 Environmental Impacts

A summary of the key environmental impacts of the Heuningkranz Project if unmitigated and with the inclusion of mitigation are provided in is provided in Table 1-1.

TABLE 1-1: SUMMARY OF KEY POSITIVE AND NEGATIVE IMPACTS IDENTIFIED FOR THE MITIGATED AND UNMITIGATED SCENARIOS

ACTIVITY	ASPECT	POTENTIAL IMPACT	SIGNIFICANCE WITHOUT MITIGATION	MITIGATION	SIGNIFICANCE WITH MITIGATION
ACCESS ROAD	Air Quality	Increase in ambient dust levels due to traffic movement on access roads.	HIGH	The R385 is to be upgraded (recommend surfacing of the road as soon as practicable) to handle traffic volumes and control dust. Prior to surfacing of the road, the road is to be upgraded and maintained on a regular basis. Dust suppression is to be ongoing to control dust levels on unsurfaced access roads. Monitoring of fallout dust, PM10 and PM2.5.	LOW
DISCARD DUMP	Biodiversity	Disturbance of sensitive habitats due to discard dump footprint over wetland pan. Conveyor crossing drainage lines.	HIGH	Alter footprint to avoid destruction of wetland pan including catchment of pan. Conveyor crossing is to be lifted above drainage lines and disturbance of vegetation within drainage kept to a minimum.	LOW
	Surface Water Resources	Destruction of wetland pan within footprint area of discard dump. Development of conveyor crossing of drainage channels.	HIGH	See mitigation measures for protection of biodiversity.	HIGH
MINE PITS	Groundwater	Lowering of groundwater levels due to dewatering for mining.	HIGH	Monitoring (including installation of groundwater level date loggers) of groundwater levels at site and neighbouring properties. Ongoing collation of additional information on aquifer characteristics. Regular update of the model and revision of dewatering requirements and impacts as more information becomes available. Memorandum of Understanding applicable to Kolomela to be implemented at Heuningkranz. Investigation into opportunities for aquifer recharge and implementation of such measures in accordance with water use licence, once issued.	HIGH
	Biodiversity	Disturbance of catchments of wetland pans and drainage channels due to the development of pits.	HIGH	Drainage is to be diverted around pits and redirected back into the catchment in order to minimise downstream impacts. Biomonitoring to be undertaken downstream of mining operations prior to development and ongoing to assess impacts and identify mitigation should impacts warrant it.	LOW
	Surface Water Resources	Impedance of flow from upstream catchment and loss of catchment in pit area.	HIGH	Drainage is to be diverted around pits and redirected back into the catchment in order to minimise downstream impacts. Restore current impedance due to rail and boundary road.	LOW
	Cultural Heritage	Disturbance of heritage sites due to development of pits including blasting resulting in damage to sensitive sites.	HIGH	Phase 2 heritage assessment to be undertaken for HKZ2 to be impacted on by infrastructure around the South Pit. Phase 2 heritage assessment to be undertaken at LSA Shelters in valley (specifically HKZ9) as blasting will take place within close proximity to this significant site causing damage to the site.	LOW
WASTE ROCK DUMPS	Biodiversity	Disturbance of catchments of wetland pans and drainage channels due to the development of WRDs.	HIGH	Move North Eastern WRDs so as to avoid wetland pans.	LOW
	Cultural Heritage	Disturbance of heritage sites due to development of WRDs.	HIGH	Relocate NE WRD to ensure protection of LVW1 and LVW2.	LOW
	Visual Environment	Visual intrusion and loss of scenic quality.	HIGH	Maximise opportunities for in-pit dumping. Combine NE WRD and SE WRD to allow assimilation of all WRDs into surrounding topography. Ongoing rehabilitation of WRDs including reshaping of slopes to resemble surrounding landforms.	LOW
HEUNINGKRANZ PROJECT	Social Impacts	Continued pressure on municipal services and capacity due to rapidly growing population	HIGH	Capacity building and support initiatives to alleviate pressure on the municipality. Guide contractors to communicate and recruit responsibly.	LOW
		Prolonged shortage of proper and affordable housing due to the demand created by mining (poor living conditions in informal settlements)	HIGH	Local recruitment prioritised during construction and operation. Temporary housing provided during construction.	LOW
		Increased traffic & consequences on road networks.	HIGH	Upgrading of all roads to be used during construction and operations including R385 and D3326 and implementation of surface wetting to control dust. Ongoing maintenance of access roads. Surfacing of the R385 as soon as practicable.	LOW
		Local procurement and enterprise development due to construction activities at Heuningkranz.	HIGH	Preferential procurement plan for local suppliers. Kumba supplier development programme. Programmes run by the Zimele Business Development Support Centre.	HIGH
		Local employment of persons involved directly or indirectly in construction	HIGH	Social and Labour Plan commitments and implementation of the mine's local recruitment policy. Collaboration with the municipality's unemployment forum. Local employment commitments from contractors and monitoring thereof.	HIGH
		Added value to the economy due to capital input	VERY HIGH	Participation in the municipal IDP and LED Forums. Collaboration and engagement with local business organisations.	VERY HIGH
		Sustained employment opportunities due to extension of life of Kolomela Mine	HIGH	Implement local recruitment policy should existing positions become available.	HIGH
		Sustained Local Economic Development due to extension of LOM of Kolomela	HIGH	Identification of LED needs through participation in IDP and LED Forums.	HIGH
		Added value to the economy due to operational expenditure.	VERY HIGH	SLP commitments, aligned with the municipal IDP TSASSAMBA Public Private Partnership with Beeshoek Mine and Tsantsabane Local Municipality	VERY HIGH

1.3.1 Employment, Local Procurement and Economic Development

- The construction phase of the project will provide for 950 jobs. The predicted indirect job opportunities created, due to the capital input as predicted by modelling undertaken by Demacon Market Studies (January, 2018) will be 13 665.
- The operational phase of the project will provide for sustained job opportunities at Kolomela Mine due the extension of the LOM by 14 years. A total of 813 positions will be retained for the Heuningkranz operations. However, due to the annual operational expenditure associated with the mine, a total of 6 871 employment positions will be sustained due to the Heuningkranz Project (Demacon Market Studies, January 2018).
- The project will have a significant impact on the local and regional economy both during construction (~additional GGP of R6.2 billion) and during the life of the operations (~R3.1 billion per annum).

1.3.2 Influx of Persons

- The sustained life of mine at Kolomela Mine will mean that negative impacts associated with an influx of persons into Tsantsabane will continue. This includes pressure on housing, expansion of informal settlements, increased pressure on municipal services and increased crime levels, in particular theft.

1.3.3 Lowering of Groundwater levels

- Dewatering will be required for safe mining operations at Heuningkranz to continue to below the groundwater table.
- It is currently anticipated that ~ 416 m^3/hr will need to be pumped from the aquifer to allow for mining at Heuningkranz (Groundwater Complete, January 2018).
- Dewatering is expected to result in a drawdown of the natural groundwater levels up to 200 m below ground level at the site boundary north east of the pit operations.
- Boreholes of private land owners up to 5 km to the north east and 2 km to the south and west may be affected by dewatering with groundwater levels dropping by 5 m. The delivery of boreholes may also be affected.
- The groundwater model is to be updated on a regular basis as more information becomes available.
- Cumulative impact assessment on dewatering impacts to be undertaken prior to the application for water use licensing and result to be communicated with interested and affected parties.

1.3.4 Increased Dust Levels

- The main source of dust at Heuningkranz will be the movement of vehicles on haul roads.
- No non-compliances with the national ambient air quality standards (NAAQS) are however predicted at any surrounding receptors (Airshed Planning Professional[1], February 2018).
- Dust resulting from increased traffic on public access roads is considered to be a safety risk to persons travelling to Heuningkranz as well other users on the road.
- Access roads are to be upgraded and surface wetting applied to ensure dust levels are controlled.
- The surfacing of the R385 presents the safest option in the long term.

1.3.5 Disturbance of Watercourses

- The North Pit and the originally proposed North Eastern waste rock dump (WRD), if unmitigated, will result in the destruction of sections of the ephemeral drainage of the tributary of the Soutloop River at Heuningkranz.
- The relocation of the North Eastern WRD and consolidation of this material with the South Eastern WRD means that the main drainage system across the site has less impedance and loss to the catchment, although the water will still need to be diverted around the North Pit and returned to the natural drainage system.
- Conveyor and pipelines will cross the drainage lines posing the additional risk of impedance of flow disturbance of beds or contamination due to spillages.

1.3.6 Loss of Wetlands

- The originally proposes unmitigated layout would result in the destruction of 3 of the 6 wetland pans due the footprint of the North East WRD and the Discard Dump.
- Indirect impacts due to infrastructure being developed within the wetland buffer zones means that the impact would be greater if the layout is not altered.
- The Mitigated Layout (as shown in Figure 1-1) allows for the 3 wetland pans to be protected and infrastructure to be moved further from wetland pans.

1.3.7 Loss of Sensitive Biodiversity

- The wetlands are considered to have high biodiversity importance due to ecological functioning in the dry environmental conditions.
- Ephemeral drainage lines are also considered to be sensitive as they harbour protected species and also support downstream ecological functions.

- The protection of wetlands and watercourses is thus a priority for biodiversity protection at the site.

1.3.8 Heritage Protection

- LSA Site shelters located at the valley within the rocky ridge in the south eastern corner of the site is considered to be of high heritage significance. The site is to be protected but could be damaged due to blasting within pits.
- MSA and LSA lithics of high significance are located within the footprint of the North Eastern WRD (unmitigated). In the mitigated scenario the lithics are protected.

1.3.9 Traffic

- The access roads in their current condition cannot support increased traffic volumes due to the project (JG Afrika, January 2018)
- The access roads used are to be upgraded and maintained to support traffic volumes.
- Surface wetting (note that dust suppressants are not acceptable to the Northern Cape Department of Roads and Public Works) will need to be carried out on roads.
- The surfacing of the R385 should be undertaken as soon as practicable within the life of the project.

1.4 Conclusions and Recommendations

It is the opinion of the Environmental Assessment Practitioner that the activities at the Heuningkranz Project be authorised based on the following reasons:

- There is a significant socio-economic benefit in terms of capital projection and sustained support of local communities due to the implementation of the project and the extension of the life of Kolomela Mine.
- The negative impacts on water resources, biodiversity, heritage resources and neighbouring receptors can be successfully mitigated to acceptable levels by the implementation of the Mitigated Layout Plan and the implementation of the proposed management measures.

2. CONTACT PERSON AND CORRESPONDENCE ADDRESS

2.1 Details of EAP who prepared the report

Name of The Practitioner: Kerry Fairley

Affiliation: Head Environmental Management Services and Director, EXM Advisory Services

Tel No.: 082 871 2959 or 010 0073617

E-mail address: kerry@exm.co.za

2.2 Expertise of the EAP

Qualifications

- BSc Botany Honours (University of the Witwatersrand)
- Registered as Professional Natural Scientist with the South African Council for Natural and Scientific Professionals (SACNASP) Registration Number: 400054/03

Expertise and Experience

Kerry Fairley has over 18 years of experience in environmental management in the mining industry as one of the most experienced environmental assessment practitioners in South Africa. Kerry is the author of numerous environmental impact assessment reports for both green fields mining projects as well as for expansions and amendment to existing mining operations in South Africa and as well as other African countries (Namibia, Malawi).

Declaration of Independence

The undersigned declare that this report represents an independent and objective assessment of the risks associated with the proposed development.

Curriculum vitae and proof of registration of the EAP is provided in Appendix A.

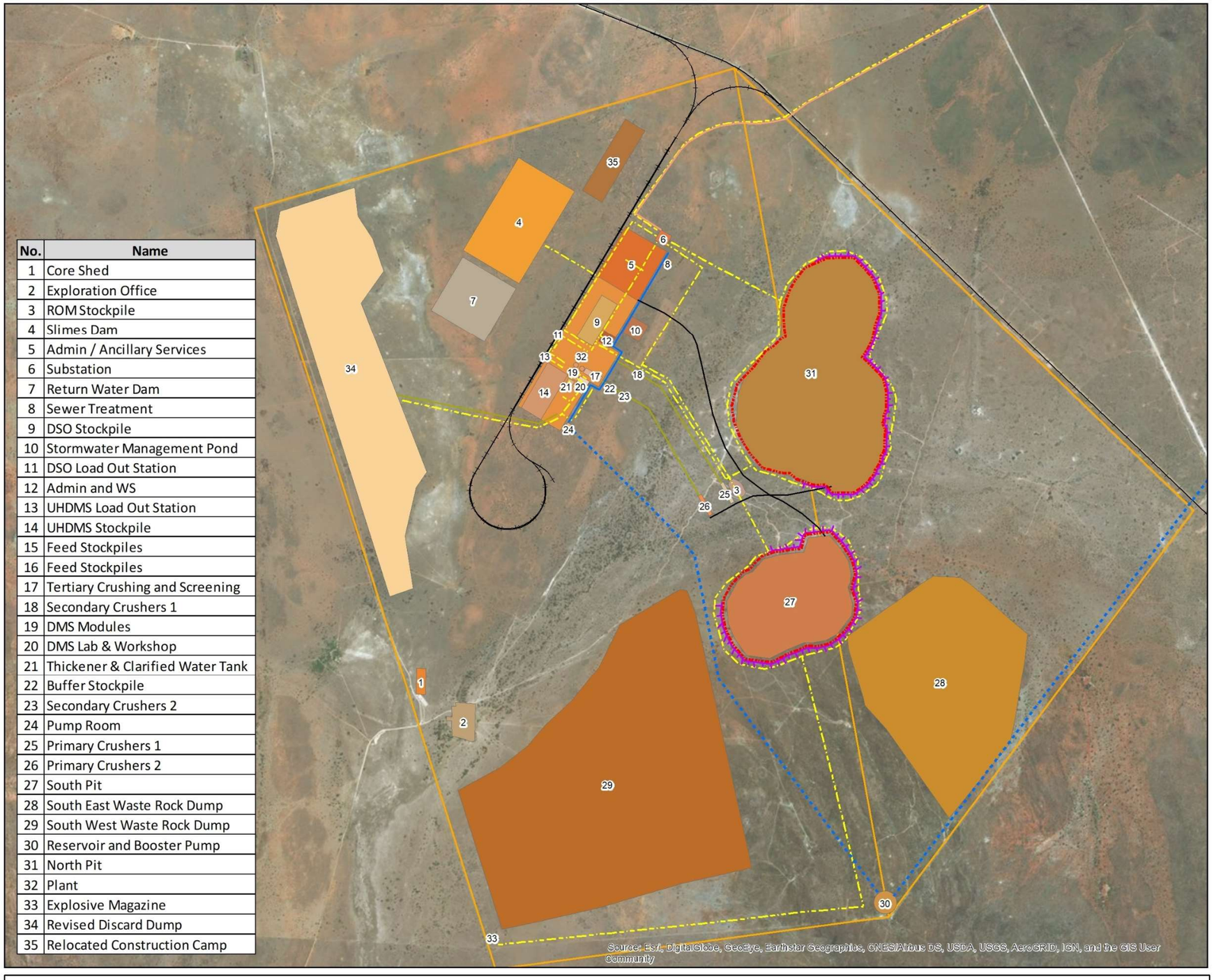
Name	Affiliation	Designation	Signature	Date
Kerry Fairley	EXM Advisory Services (Pty) Ltd	Pr.Sci.Nat. Director		23 April 2018

3. DESCRIPTION OF THE PROPERTY

Refer to Figures 3-1 and 3-2.

Farm Name:	The Heuningkranz Project will take place on the following properties: Mining Application Area (Section 102) Farm 364 (Heuningkranz) Farm 432 (Langverwacht) Portion 1 Infrastructure Affected Areas (linear infrastructure): Farm 432 (Langverwacht), Portion 2 (access road and water export pipeline) Farm 432 (Langverwacht), RE (access road) Mapedi 653 (rail link)
Application area (Ha)	Mining Application Area (Section 102) Farm 364 (Heuningkranz): 2 383.0861 ha Farm 432 (Langverwacht) Portion 1: 1 043.2560 ha Total application area: 3 426.3421 ha Infrastructure Affected Areas (linear infrastructure): Farm 432 (Langverwacht), Portion 2 (access road and water export pipeline) ~ 5 ha Farm 432 (Langverwacht), RE (access road) ~ 0.5 ha Mapedi 653 (rail link) ~ 5.5 ha Water export pipeline ~ 16 km
Magisterial district:	District Hay, Northern Cape Province
Distance and direction from nearest town	The proposed extension area (Heuningkranz) to Kolomela Mine is located approximately 18 km north west of Postmasburg
21 digit Surveyor General Code for each farm portion	Mining Application Area (Section 102) Farm 364 (Heuningkranz): C03100000000036400000 Farm 432 (Langverwacht), Portion 1: C03100000000043200001 Infrastructure Affected Areas (linear infrastructure): Farm 432 (Langverwacht), Portion 2: C03100000000043200002 Mapedi 653 (rail link): C03100000000065300000
Locality map	Attach a locality map at a scale not smaller than 1:250 000 and included as Figure 3-3
Description of the overall activity. (Indicate Mining Right, Mining Permit, Prospecting right, Bulk Sampling, Production Right,	The application includes construction and operation of mining and processing activities for the production of iron ore, as well as associated infrastructure on the Farm 364 (Heuningkranz) and the Portion 1 of Farm 432 (Langverwacht), collectively referred to as the "Heuningkranz Section". This section will form an extension to the existing Kolomela Mine and will include:

Exploration Right, Reconnaissance permit, Technical co-operation permit, Additional listed activity)	- A temporary construction village; - Two open pits, namely the Heuningkranz North and Heuningkranz South Pit; - Two waste rock dumps namely the south east and south west waste rock dumps; - Infrastructure (boreholes, pipelines and reservoir) for the dewatering of the pits and export of water to the Sedibeng Water Supply Scheme; - Haul roads within pits, to the waste rock dumps and processing areas; - Conveyors for the transport of iron ore for processing; - Two primary and two secondary crushers; - An Ultra High Dense Media Separation (UHDMS) processing plant including tertiary crushing and screening; - A slimes dam, return water dam (RWD) and discard dump for the management of solid process wastes originating from the UHDMS process; - Infrastructure to support the mining and processing operations including offices, workshops etc; - Domestic and hazardous waste storage areas; - Fuel storage facilities; - Explosives magazine; - Sewage treatment works; - Access road from the R385 and internal site roads; - Substation; - Railway balloon and link to the Kolomela export rail line to transport ore to the existing DSO Plant for further processing or to transport iron ore from the UHDMS to the Sishen-Saldanha rail line for direct export; and - Stormwater management infrastructure including berms and dams.



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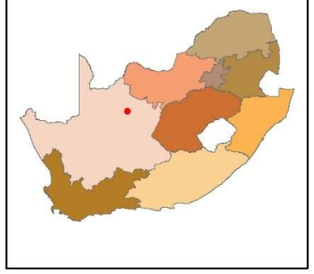

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Date: 2018/03/13

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Coordinate System: DMS	
Spheroid: WGS84	Central Meridian: LO

Heuningkranz Mitigated Layout

FIGURE 3-1: PROPOSED PROJECT LAYOUT HEUNINGKRANZ (MITIGATED)

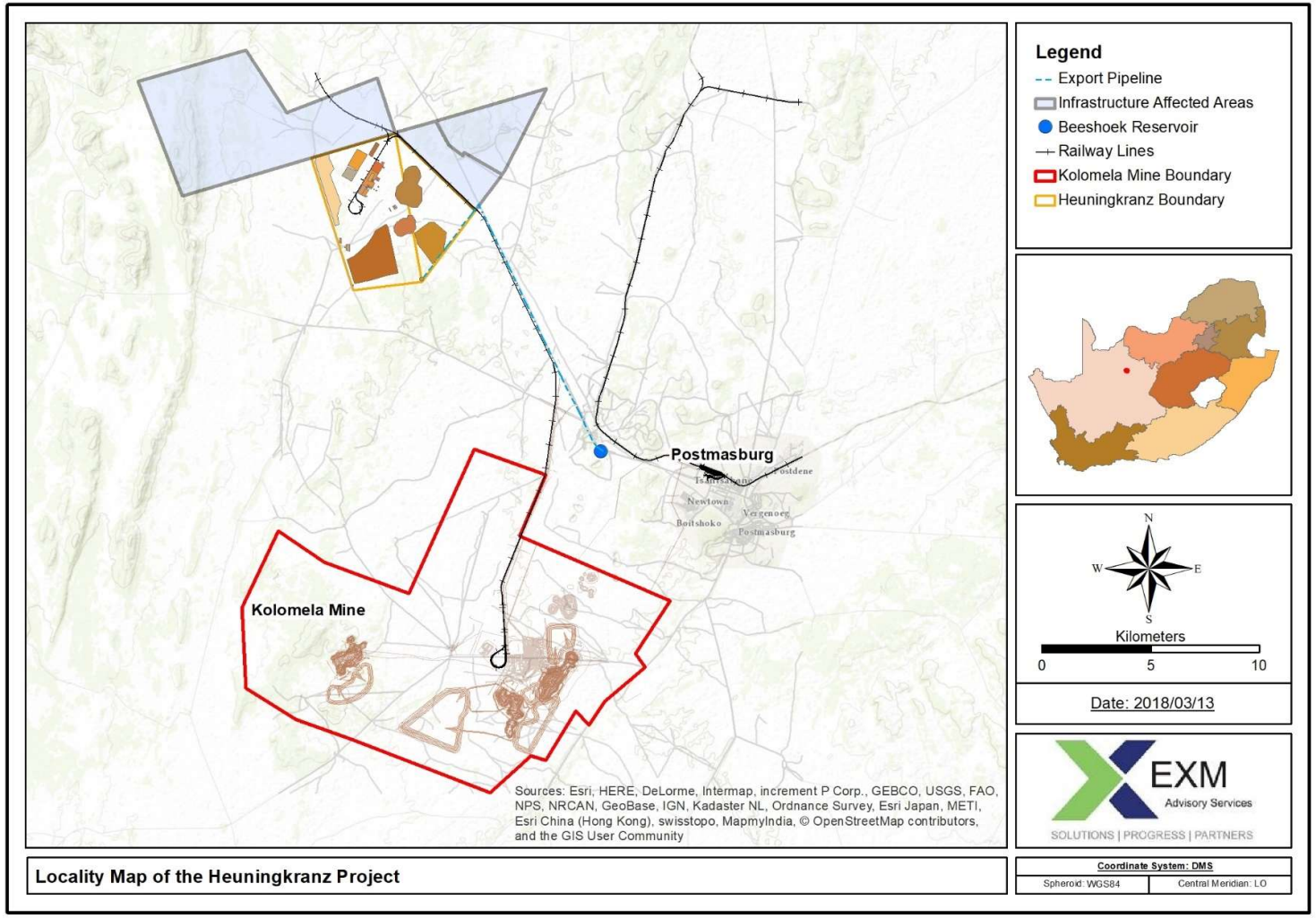

FIGURE 3-2: LOCALITY MAP OF THE HEUNINGKRANZ PROJECT

4. DESCRIPTION OF THE SCOPE OF THE PROPOSED OVERALL ACTIVITY

Listed and specified activities

NAME OF ACTIVITY (E.g. For prospecting - drill site, site camp, ablution facility, accommodation, equipment storage, sample storage, site office, access route etc…etc…etc E.g. for mining,- 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…etc…etc.)	Aerial extent of the Activity Ha or m²	LISTED ACTIVITY (Mark with an X where applicable or affected).	APPLICABLE LISTING NOTICE *(GNR 983, GNR 984 or GNR 985 as amended by GNR 327, GNR 325 and GNR 326)*	WASTE MANAGEMENT AUTHORISATION (Indicate whether an authorisation is required in terms of the Waste Management Act). (Mark with an X)	APPLICABLE LISTING NOTICE *(GNR 921 as amended by GN 633))*
Construction Village	~15 ha	X	**GNR 984** 15 (total site clearance total > 20 ha)		
Administration, Ancillary Services and Workshops	~20 ha	X	**GNR 983** 24 (roads) **GNR 984** 15 (site clearance)	X	**Category A:** **Activity 7 & 12** (Bioremediation Facility)
Sewage Treatment Works	~0.5 ha	-	**GNR 984** 6 (water use licence) 15 (site clearance total > 20 ha)		
Bulk Fuel Storage	Included elsewhere	X	**GNR 984** 4 (dangerous goods)		
Access Road	~4 km long and 12 m wide	X	**GNR 984** 27 (roads)		
Railway Link, Balloon and maintenance road	Balloon area ~ 34 ha Link ~ 4.5 km long by 32 m wide (including maintenance road)	X	**GNR 984** 12 (railway line) 27 (maintenance road) **GNR 985** 14 (NFEPA watercourse)		
Substation	~1 ha		**GNR 984** 15 (site clearance total > 20 ha)		
UHDMS Processing Plant	~55 ha	X	**GNR 984** 15 (site clearance)		
Slimes Dam and RWD	Slimes Dam ~ 46 ha RWD ~ 25 ha	X	**GNR 983** 12 (watercourse) **GNR 984** 15 (site clearance) 6 (water use licence) **GNR 985** 14 (NFEPA watercourse)	X	**Category B:** **Activity 11**
Discard Dump	~168 ha	X	**GNR 983** 12 (watercourse)	X	**Category B:** **Activity 11**

NAME OF ACTIVITY (E.g. For prospecting - drill site, site camp, ablution facility, accommodation, equipment storage, sample storage, site office, access route etc…etc…etc E.g. for mining,- 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…etc…etc.)	Aerial extent of the Activity Ha or m²	LISTED ACTIVITY (Mark with an X where applicable or affected).	APPLICABLE LISTING NOTICE *(GNR 983, GNR 984 or GNR 985 as amended by GNR 327, GNR 325 and GNR 326)*	WASTE MANAGEMENT AUTHORISATION (Indicate whether an authorisation is required in terms of the Waste Management Act). (Mark with an X)	APPLICABLE LISTING NOTICE *(GNR 921 as amended by GN 633))*
			GNR 984 6 (water use licence) 15 (site clearance) **GNR 985** 8 (conveyors) 14 (NFEPA watercourse)		
Dewatering Infrastructure	Pipeline ~18 km Reservoir ~ 0.25 ha	X	**GNR 983** 9 (pipelines) 12 (watercourse) **GNR 985** 14 (NFEPA watercourse)		
Stormwater Management infrastructure	Plant PCD ~ 2.5 ha Evaporation Ponds at pits tbc	X	**GNR 983** 12 (watercourse) **GNR 984** 6 (water use licence PCDs) **GNR 985** 14 (NFEPA watercourse)		
Primary, Secondary Crushers and Conveyors	~2 ha	X	**GNR 983** 12 (watercourse) **GNR 984** 15 (site clearance) **GNR 985** 8 (conveyors) 14 (NFEPA watercourse)		
Haul Roads	DSO Haul Road ~ 3 km by 30 m wide UHDMS Haul Road ~ 1 km by 30 m wide Pit and WRD Haul Roads tbc	X	**GNR 983** 12 (watercourse) **GNR 984** 27 (roads) **GNR 985** 14 (NFEPA watercourse)		
Explosives Magazine	~5.2 ha	X	**GNR 983** 4 (dangerous goods) **GNR 984** 15 (site clearance)		

NAME OF ACTIVITY (E.g. For prospecting - drill site, site camp, ablution facility, accommodation, equipment storage, sample storage, site office, access route etc…etc…etc E.g. for mining,- 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…etc…etc.)	Aerial extent of the Activity Ha or m²	LISTED ACTIVITY (Mark with an X where applicable or affected).	APPLICABLE LISTING NOTICE *(GNR 983, GNR 984 or GNR 985 as amended by GNR 327, GNR 325 and GNR 326)*	WASTE MANAGEMENT AUTHORISATION (Indicate whether an authorisation is required in terms of the Waste Management Act). (Mark with an X)	APPLICABLE LISTING NOTICE *(GNR 921 as amended by GN 633))*
Heuningkranz North and South Pits	North Pit ~ 165 ha South Pit ~ 80 ha	X	**GNR 983** 12 (watercourse) 19 (removal from watercourse) **GNR 984** 15 (site clearance) **GNR 985** 14 (NFEPA watercourse)		
Heuningkranz Waste Rock Dumps	SE WRD ~ 275 ha SW WRD ~ 370 ha	X	**GNR 983** 12 (watercourse) **GNR 984** 15 (site clearance) **GNR 985** 14 (NFEPA watercourse)	X	**Category B: Activity 11**

4.1 Description of activities to be undertaken

4.1.1 Overview

The Sishen Iron Ore Company (Pty) Ltd (part of Kumba Iron Ore Limited, Kumba) is proposing to incorporate the Heuningkranz Section into the existing Kolomela Mine mining right. Heuningkranz includes the Farm 364 (Heuningkranz) and Farm 432 (Langverwacht), Portion 1, located approximately 18 km north west of Postmasburg and 18 km north north west of the main infrastructure area at Kolomela Mine.

Mining at the Heuningkranz Section will be from two (2) open pits, the Heuningkranz North and Heuningkranz South Pits. Overburden and waste rock originating from the Heuningkranz North and South Pits will be placed on surface to create waste rock dumps (WRDs). The pits will require dewatering and the water will be pumped to a new Heuningkranz Reservoir and then piped over a distance of approximately 15 km to Sedibeng Water via the existing Beeshoek Reservoir.

It is planned that 6 million tonnes per annum (Mtpa) of iron ore will be processed by using ultra high dense media separation (UHDMS) at a new processing plant to be developed at Heuningkranz. Mineral waste from processing by UHDMS will be managed into two mine residue

facilities: a discard dump and slimes dam, that will be developed at Heuningkranz.

A further 4.2 Mtpa of high grade ore will be railed to Kolomela Mine, for processing at the existing Kolomela direct shipping ore (DSO) plant. Primary and secondary crushing of this ore will take place at Heuningkranz. A rail link will be developed at Heuningkranz both for the export of product directly from Heuningkranz as well as the transport of DSO material to Kolomela via the existing iron ore rail line for processing. The total maximum production from Heuningkranz will be 10.2 Mtpa.

Access to Heuningkranz will be via the R385 road linking Postmasburg and Olifantshoek and a new road from the R385 to the main infrastructure area at Heuningkranz will be constructed. The R385 will be upgraded to accommodate additional traffic volumes.

Supporting infrastructure to be developed at Heuningkranz includes: administration buildings, workshops, stores, fuel storage areas, an explosives magazine, sewage treatment works, pollution control dams, storm water management infrastructure, dewatering infrastructure; pipelines, evaporation dams, mine haul and internal roads and overland conveyors.

A construction village will be developed at Heuningkranz to house persons involved in developing the mine infrastructure, but no new housing will be necessary, as personnel will move from Kolomela to the Heuningkranz Section. The main administration services will remain at Kolomela.

See Figure 3-1 for the proposed layout of the Heuningkranz Section.

4.1.2 Life of Mine

The construction of infrastructure and the stripping of overburden is scheduled to commence at Heuningkranz in 2031, with the first ore being mined and processed in 2034. Activities at Heuningkranz are planned for a period of 17 years. The inclusion of the Heuningkranz Section, will extend the life of Kolomela Mine by an additional 14 years, until 2048.

The proposed ramp up and production schedule for the Heuningkranz Section is given in Figure 4-1.

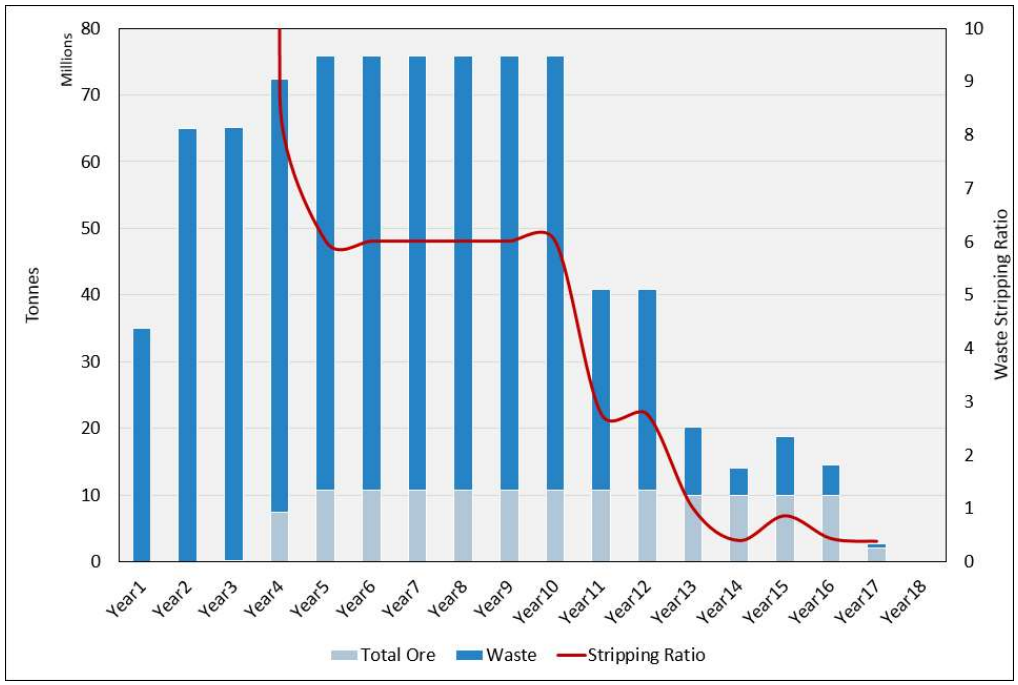

FIGURE 4-1: HEUNINGKRANZ: RAMP UP AND PRODUCTION

4.1.3 Employment

Heuningkranz will result in an extension of the life of Kolomela Mine, thus personnel involved at Kolomela will be deployed to Heuningkranz. No new permanent positions resulting from the Heuningkranz Project are thus expected, although the positions will be retained for a further 14 years due to the extension of the life of Kolomela Mine.

Construction activities are planned to commence three (3) years prior to the end of the current operations at Kolomela. It is anticipated that 950 employment opportunities will be created for the construction period.

Approximately 813 persons will be deployed from Kolomela to the Heuningkranz Section. The majority of personnel will however remain at Kolomela, which will continue to function as the main administrative centre for the mine.

The mining personnel (~608 persons) will be deployed from 2031 to commence with the stripping of overburden (waste).

4.1.4 Infrastructure and Associated Listed Activities

4.1.4.1 Construction Village

A construction camp will be constructed on site in order to accommodate the site offices, laydown areas and workshops for all the contractors, as well as any Kumba personnel on site during the construction. A construction village will need to be built in order to provide housing for the construction workers. This will be done by means of temporary housing constructed on site. Both the construction camp and the construction village will be supplied with water, sewer and electricity connections.

TABLE 4-1: LISTED ACTIVITIES FOR THE CONSTRUCTION CAMP AND VILLAGE

Listing Notice	Activity Number	Description
GNR 984	15 The clearance of an area of 20 hectares or more of indigenous vegetation, excluding where such clearance of indigenous vegetation is required for- (i) The undertaking of a linear activity; or (ii) Maintenance purposes undertaken in accordance with a maintenance plan.	The development of offices, laydown areas and workshops and temporary accommodation will require site clearance. Although the footprint is likely to be less than 20 ha, the cumulative area cleared during construction will be greater than 20 ha.

4.1.4.2 Administration, Ancillary Services and Workshops

Although the main administration services will continue from Kolomela, there will be some offices in place at Heuningkranz. Provision has also been made for a canteen and a clinic on the site within the administration area.

Provision is also made for workshops for maintenance of vehicles, washbays, and refuelling areas, including facilities for the storage of 1 million litres of diesel (1 000 cubic metres) in additional to smaller quantities of petrol and lubricants.

A Bioremediation Facility is also planned for the treatment of soils contaminated with hydrocarbons in order that these soils can be used for rehabilitation. The site will be provided with an impervious surface and all run-off will be contained and recycled back into the facility.

Water supply (approximately 82 m^3/day) will be sourced from the dewatering activities, stored on site in a potable water supply reservoir/dam and piped to all areas where potable water is required. The pipe line reticulation is expected to be 160 mm in diameter.

There will be a sewage treatment plant (package treatment plant) at the site to treat water from all ablution facilities. The quantity of effluent to be treated is estimated to be 65 m^3/day. The treated effluent will be recycled for reuse as process water at the plant. Sewage sludge will be dried on site and taken to the Bioremediation Facility for use in compositing.

TABLE 4-2: LISTED ACTIVITIES FOR THE ADMINSTRATION AREA, ANCILLARY SERVICES (INCLUDING SEWAGE TREATMENT WORKS) AND WORKSHOPS

Listing Notice	Activity Number	Description
GNR 983	24 The development of a road- (i) for which an environmental authorisation was obtained for the route determination in terms of activity 5 in Government Notice 387 of 2006 or activity 18 in Government Notice 545 of 2010; or (ii) with a reserve wider than 13,5 meters, or where no reserve exists where the road is wider than 8 metres; but excluding a road- (a) which is identified and included in activity 27 in Listing Notice 2 of 2014; (b) where the entire road falls within an urban area; or (c) which is 1 kilometre or shorter.	An access road ~4 km in length and 12 m in width
GNR 984	4 The development and related operation of facilities or infrastructure, for the storage, or storage and handling of a dangerous good, where such storage occurs in containers with a combined capacity of more than 500 cubic meters.	Bulk fuel storage facilities will be developed for the storage of diesel, petrol and other lubricants.
	6 The development of facilities or infrastructure for any process or activity which requires a permit or licence or an amended permit or licence in terms of national or provincial legislation governing the generation or release of emissions, pollution or effluent,	A water use licence will be required for the storage of treated effluent and sewage sludge drying areas.
	15 The clearance of an area of 20 hectares or more of indigenous vegetation, excluding where such clearance of indigenous vegetation is required for- (i) The undertaking of a linear activity; or (ii) Maintenance purposes undertaken in accordance with a maintenance plan.	The plant, ancillary services area and workshop area, including the sewage treatment works will require the clearance of over 20 ha.
GNR 981	Category A	
	7 – The treatment of hazardous waste using any form of treatment at a facility that has the capacity to process in excess of 500 kg but less than 1 ton per day excluding the treatment of effluent, wastewater or sewage. 12- The construction of a facility for a waste management activity listed in Category A of this Schedule (not in isolation to associated waste management activity). establishment or reclamation of a residue stockpiles or residue deposit resulting from activities which require a mining right, exploration right or production right in terms of the MPRDA.	Bioremediation activity for the treatment of soils that are contaminated with hydrocarbons.

4.1.4.3 Access Road

An access road will need to be provided from the existing R385. The R385 is surfaced (tarred) from Postmasburg to Tommy's Airfield. The remaining R385 to Olifantshoek, is unsurfaced (gravel). Kumba plans to upgrade the ~12 km road from Tommy's Field to the planned Heuningkranz turn-off and develop a new gravel access road to the site. The roads will be maintained and provided with a chemical suppressant (e.g. dust-a-side). Lighting will be provided along the access road. Note that based on the outcomes of this EIA, it is recommended that the R385 and the access road be surfaced as soon as possible in the life of the project.

TABLE 4-3: LISTED ACTIVITIES FOR THE ACCESS ROAD

Listing Notice	Activity Number	Description
GNR 983	24 The development of a road- (i) for which an environmental authorisation was obtained for the route determination in terms of activity 5 in Government Notice 387 of 2006 or activity 18 in Government Notice 545 of 2010; or (ii) with a reserve wider than 13,5 meters, or where no reserve exists where the road is wider than 8 metres; but excluding a road- (a) which is identified and included in activity 27 in Listing Notice 2 of 2014; (b) where the entire road falls within an urban area; or (c) which is 1 kilometre or shorter.	An access road ~4 km in length and 12 m in width will be constructed from the R385.

4.1.4.4 Railway Link, Balloon and Maintenance Road

The Transnet direct rail link from Kolomela Mine to the Sishen-Saldanha iron ore export rail runs along the eastern boundary of Heuningkranz. A railway line will be constructed to connect Heuningkranz to the direct rail link. DSO material produced at Heuningkranz will be transported to the Kolomela Plant for processing. Once Kolomela is mined out, all the rail infrastructure is freed up to receive DSO material from Heuningkranz. The only upgrades to the rail system at Kolomela will be the installation of a tippler to deal with the offloading of material from Heuningkranz.

In order to export the UHDMS ore via rail from Heuningkranz, a yard needs to be constructed. This yard will enable the loading of 3 rakes of 114 wagons at a time, as well as to establish the link to the Sishen-Saldanha link line. The operations will include the acceptance of an empty train with a loaded rake of wagons, and the swing set, staged in the yard. Two rakes will be loaded and coupled with the swing set and the train of 342 wagons will depart for Saldanha. The last empty rake will then be loaded and staged until the next empty train arrives.

A rail maintenance road will be constructed along the length of the rail to where it connects with the direct rail link.

TABLE 4-4: LISTED ACTIVITIES FOR THE RAIL LINK AND ASSOCIATED INFRASTRUCTURE

Listing Notice	Activity Number	Description
GNR 983	24 The development of a road- (i) for which an environmental authorisation was obtained for the route determination in terms of activity 5 in Government Notice 387 of 2006 or activity 18 in Government Notice 545 of 2010; or (ii) with a reserve wider than 13,5 meters, or where no reserve exists where the road is wider than 8 metres; but excluding a road- (a) which is identified and included in activity 27 in Listing Notice 2 of 2014; (b) where the entire road falls within an urban area; or (c) which is 1 kilometre or shorter.	The development of a maintenance road ~ 4.5 km and 8 m wide
GNR 984	12 The development of railway lines, stations or shunting yards excluding — (i) railway lines, shunting yards and railway stations in industrial complexes or zones; (ii) underground railway lines in a mining area; or (iii) additional railway lines within the railway line reserve.	The development of the railway line and associated infrastructure
GNR 985	14 The development of- (ii) infrastructure or structures with a physical footprint of 10 square metres or more; where such development occurs- (a) within a watercourse; (b) in front of a development setback; or (c) if no development setback has been adopted, within 32 metres of a watercourse, measured from the edge of a watercourse;	The rail and road will encroach on a tributary of the Soutloop River which is a NFEPA listed watercourse

4.1.4.5 Electricity Supply and Substation

It is proposed that power will be sourced from Eskom supply via a 132 kV overhead line from the MANCORP Substation. A 132/11kV Eskom substation will be developed at Heuningkranz. Eskom will be responsible for the power supply for the project.

TABLE 4-5: LISTED ACTIVITIES FOR THE HEUNINGKRANZ SUBSTATION

Listing Notice	Activity Number	Description
GNR 984	15 The clearance of an area of 20 hectares or more of indigenous vegetation, excluding where such clearance of indigenous vegetation is required for- (i) The undertaking of a linear activity; or	Site clearance is required for the development of the substation and associated power supply infrastructure. Although the clearance is less than 20 ha, the cumulative clearance for all activities on site will be greater than 20 ha.

Listing Notice	Activity Number	Description
	(ii) Maintenance purposes undertaken in accordance with a maintenance plan.	

4.1.4.6 Primary and Secondary Crushers

The ROM of the mine will be tipped directly into the Primary Crushers. Two primary crushers will be located on site at a position in close proximity to the North and South Pits, one for the DSO material and one for the UHDMS material. There will also be a ROM stockpile located adjacent to the crushers in case direct tipping is not possible. The material will then be conveyed to a DSO and UHDMS secondary crusher located east of the process plant area.

The DSO material will not be subject to further process at Heuningkranz and will be stockpiled on site for transport via rail to the DSO Plant at Kolomela. Material is reclaimed from the stockpiles with a bucket wheel reclaimer and conveyed to the DSO load out station where material is loaded onto carriages and transported to Kolomela.

The UHDMS material is stockpiled on a tertiary crusher buffer stockpile at the UHDMS Process Plant area.

TABLE 4-6: LISTED ACTIVITIES FOR THE PRIMARY AND SECONDARY CRUSHERS

Listing Notice	Activity Number	Description
GNR 983	12 The development of- (i) dams or weirs, where the dam or weir, including infrastructure and water surface area, exceeds 100 square metres; or (ii) infrastructure or structures with a physical footprint of 100 square metres or more; where such development occurs- (a) within a watercourse; (b) in front of a development setback; or (c) if no development setback exists, within 32 metres of a watercourse, measured from the edge of a watercourse;	Development of crushers will take place within 32 m of a watercourse
GNR 984	15 The clearance of an area of 20 hectares or more of indigenous vegetation, excluding where such clearance of indigenous vegetation is required for- (i) The undertaking of a linear activity; or (ii) Maintenance purposes undertaken in accordance with a maintenance plan.	Clearance of ~ 2 ha of vegetation in the footprint area of crushers and stockpiles. This clearance will add to the cumulative clearance of vegetation over the site.
GNR 985	8 The development and related operation of above ground cableways and funiculars.	Development of conveyors over watercourses that are tributaries of the Soutloop River which is a NFEPA listed watercourse.
	14 The development of- (ii) infrastructure or structures with a	The infrastructure will be within 32m of a NFEPA listed watercourse.

Listing Notice	Activity Number	Description
	physical footprint of 10 square metres or more; where such development occurs- (a) within a watercourse; (b) in front of a development setback; or (c) if no development setback has been adopted, within 32 metres of a watercourse, measured from the edge of a watercourse;	

4.1.4.7 UHDMS Process Plant

Tertiary crushing and wet screening will take place within the process plant area separating the material into a fine and lumpy intermediate product. Wet screening results in the separation of discard material and slimes from the ore material. The slimes will be pumped to a thickener for the purposes of dewatering prior to disposal at the slimes dam. Discard will be conveyed to the discard dump. A simplified UHDMS process flow diagram is provided in Figure 4-2.

The UHDMS circuit will consist of two fine modules, two course modules and a dual processing module. Waste from this process is also conveyed from the circuits to the discard dump. The product is placed on the fine and lumpy product stockpiles with a bucket wheel reclaimer and conveyed to the UHDMS load out station where material is loaded onto carriages and transported to the end user by rail.

TABLE 4-7: LISTED ACTIVITIES UHDMS PROCESSING PLANT

Listing Notice	Activity Number	Description
GNR 984	15 The clearance of an area of 20 hectares or more of indigenous vegetation, excluding where such clearance of indigenous vegetation is required for- (i) The undertaking of a linear activity; or (ii) Maintenance purposes undertaken in accordance with a maintenance plan.	Site clearance of ~55 ha is required for the UHDMS processing area, including process stockpiles, processing modules, thickener, workshops and product stockpile area.

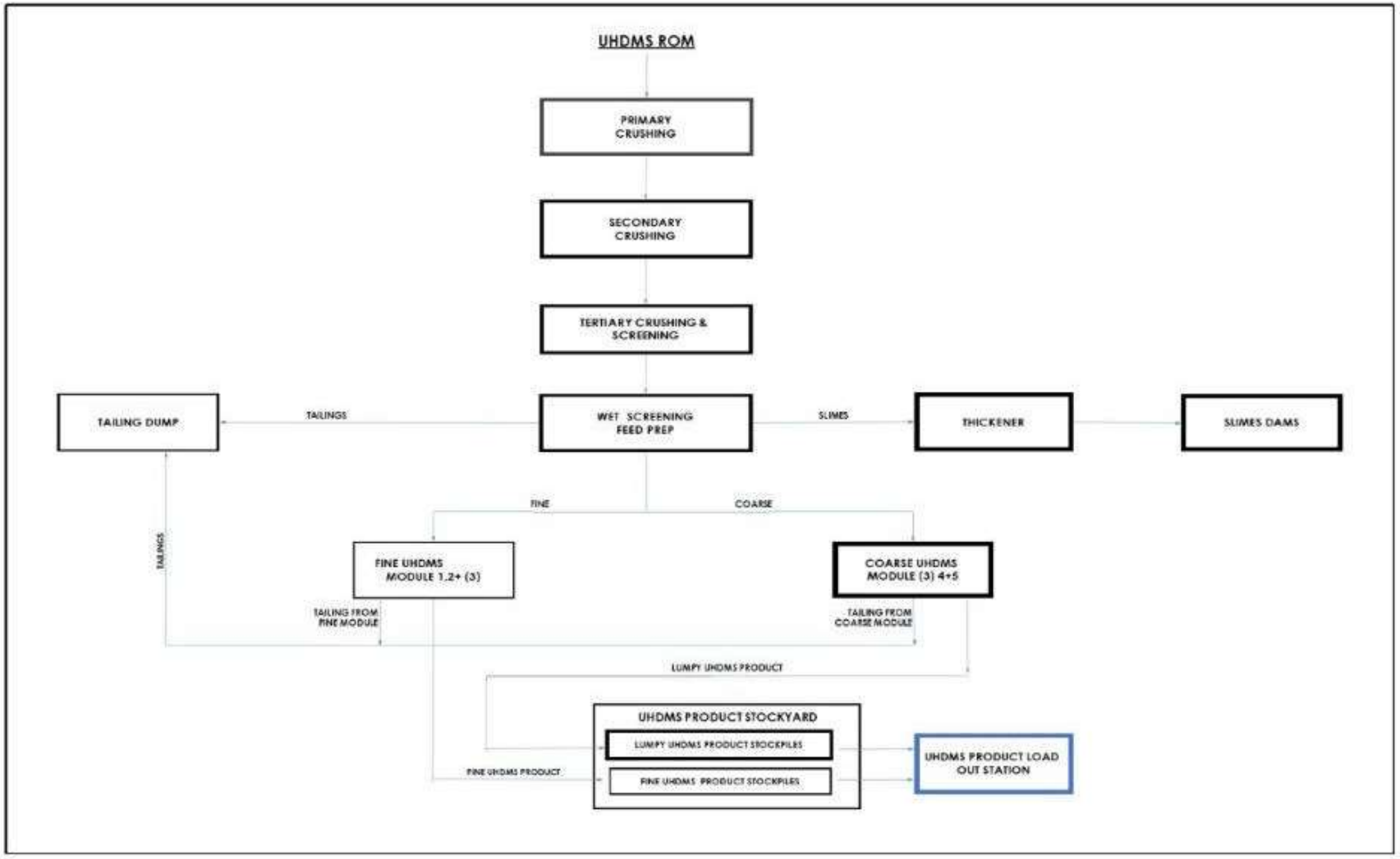

FIGURE 4-2: SIMPLIFIED UHDMS PROCESS FLOW DIAGRAM

4.1.4.8 Slimes Dam and Discard Dump

Slimes originating from the thickener at the UHDMS Plant will be deposited on a slimes dam. The slimes dam will be unlined and cover a footprint of ~ 46 ha. In the thickener, slimes are thickened to a solids content of 30% before being pumped to the slimes dam. Solids are settled in the slimes dam by gravity and recovered water will enter into a return water dam (RWD) of 25 ha. The slimes dam and RWD will have a wall of 5 m and a free board of 1 m has been provided for. No provision has been made for lining of the slimes dam. The RWD will be lined. Return water will be piped back to the process for re-use.

Discard material from the UHDMS process will be deposited on an unlined discard dump, with a final footprint estimated at 195 ha and height of 20 m above ground level with an angle of repose of 25°. In order to avoid negative impacts on the surrounding biodiversity, a mitigated scenario has been developed. In this scenario, the physical footprint has decreased from 195 ha to 168 ha; which will lead to a possible increase in the height of the discard dump from 20 m to 25 m above ground level. The cumulative mass of discard generated during the LOM was calculated in the mass balance to amount to 52,36 million tonnes which corresponds to a volume of 26,18 million m^3.

TABLE 4-8: LISTED ACTIVITIES SLIMES DAM, RWD AND DISCARD DUMP

Listing Notice	Activity Number	Description
GNR 983	12 The development of- (i) dams or weirs, where the dam or weir, including infrastructure and water surface area, exceeds 100 square metres; or (ii) infrastructure or structures with a physical footprint of 100 square metres or more; where such development occurs- (a) within a watercourse; (b) in front of a development setback; or (c) if no development setback exists, within 32 metres of a watercourse, measured from the edge of a watercourse;	The slimes dam, RWD and discard dump will be developed within 32 m of a watercourse.
GNR 984	6 The development of facilities or infrastructure for any process or activity which requires a permit or licence or an amended permit or licence in terms of national or provincial legislation governing the generation or release of emissions, pollution or effluent;	The slimes dam, RWD and discard dump require licensing under Section 21(g) the National Water Act.
	15 The clearance of an area of 20 hectares or more of indigenous vegetation, excluding where such clearance of indigenous vegetation is required for-	The development of the slimes dam, RWD and discard dump will require the clearance of ~ 46 ha, 25 ha and 168 ha, respectively.

Listing Notice	Activity Number	Description
	(i) The undertaking of a linear activity; or (ii) Maintenance purposes undertaken in accordance with a maintenance plan.	
GNR 985	8 The development and related operation of above ground cableways and funiculars.	Development of conveyor across a watercourse for the transport of discard from the plant to the dump.
	14 The development of- (ii) infrastructure or structures with a physical footprint of 10 square metres or more; where such development occurs- (a) within a watercourse; (b) in front of a development setback; or (c) if no development setback has been adopted, within 32 metres of a watercourse, measured from the edge of a watercourse;	The slimes dam, return water dam and discard dump will be developed within 32 m of a tributary of the Soutloop River which is a NFEPA watercourse.
GNR 981	Category B	
	11 - The establishment or reclamation of a residue stockpiles or residue deposit resulting from activities which require a mining right, exploration right or production right in terms of the MPRDA.	Residue deposits including a discard dump of 168 ha and a slimes dam of 46 ha will be developed.

4.1.4.9 North and South Pits

There will be two open pits, namely a North Pit and a South Pit, covering an area of 165 ha and 80 ha, respectively. The North Pit will be mined a to maximum depth of 320 m below ground level. The South Pit will be mined to a maximum depth of 240 m below ground level. Initially in-pit dumping will not be possible, however as mining progresses this will take place with waste from the active sections being deposited within the mined-out portions of the pits. Double-handling of waste rock will not take place. The complete filling of pits will also not be possible.

TABLE 4-9: LISTED ACTIVITIES MINE PITS

Listing Notice	Activity Number	Description
GNR 983	12 The development of- (i) dams or weirs, where the dam or weir, including infrastructure and water surface area, exceeds 100 square metres; or (ii) infrastructure or structures with a physical footprint of 100 square metres or more; where such development occurs- (a) within a watercourse; (b) in front of a development setback; or (c) if no development setback exists, within 32 metres of a watercourse, measured from the edge of a watercourse;	Sections of the pit will be developed within 32 m of watercourses.
	19 The infilling or depositing of any material of more than 10 cubic metres	The removal of overburden will include the removal of material from watercourses.

Listing Notice	Activity Number	Description
	into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 10 cubic metres from a watercourse;	
GNR 984	15 The clearance of an area of 20 hectares or more of indigenous vegetation, excluding where such clearance of indigenous vegetation is required for- (i) The undertaking of a linear activity; or (ii) Maintenance purposes undertaken in accordance with a maintenance plan.	As the development of the pits progresses vegetation will be cleared within the expanded footprint areas.
GNR 985	14 The development of- (ii) infrastructure or structures with a physical footprint of 10 square metres or more; where such development occurs- (a) within a watercourse; (b) in front of a development setback; or (c) if no development setback has been adopted, within 32 metres of a watercourse, measured from the edge of a watercourse;	The pits will be developed within 32 m of a tributary of the Soutloop River which is a NFEPA watercourse.

4.1.4.10 Waste Rock Dumps

Initially, three waste rock dumps (WRD) were to be developed comprising waste rock and overburden from the North and South Pits. The North Eastern WRD was to cover an area of 155 ha and reach a maximum final height of 80 m above ground level. The South Eastern WRD was to cover an area of 175 ha and reach a maximum height of 75 m above ground level. However, in order to avoid the destruction of a wetland and sensitive biodiversity, the North Eastern WRD was relocated and combined with the South Western WRD. The expanded South Western WRD will cover an area of 370 ha and reach a maximum height of 100 m above ground level. Waste/overburden will be removed at a maximum rate of ~ 65 Mtpa and it is estimated that the total volume of waste placed at all 3 dumps will be 708 million tons.

TABLE 4-10: LISTED ACTIVITIES WASTE ROCK DUMPS

Listing Notice	Activity Number	Description
GNR 983	12 The development of- (i) dams or weirs, where the dam or weir, including infrastructure and water surface area, exceeds 100 square metres; or (ii) infrastructure or structures with a physical footprint of 100 square metres or more; where such development occurs- (a) within a watercourse; (b) in front of a development setback; or (c) if no development setback exists,	Sections of the WRDs will developed within 32 m of watercourses.

Listing Notice	Activity Number	Description
	within 32 metres of a watercourse, measured from the edge of a watercourse;	
GNR 984	15 The clearance of an area of 20 hectares or more of indigenous vegetation, excluding where such clearance of indigenous vegetation is required for- (i) The undertaking of a linear activity; or (ii) Maintenance purposes undertaken in accordance with a maintenance plan.	As the development of the WRDs progresses vegetation will be cleared within the expanded footprint areas.
GNR 981	Category B	
	11 - The establishment or reclamation of a residue stockpiles or residue deposit resulting from activities which require a mining right, exploration right or production right in terms of the MPRDA.	The development of two WRDs.

4.1.4.11 Dewatering Infrastructure

In order for the iron ore to be safely removed from the pits, the pits will need to be dewatered. Some of this water will be used by the mine for processing, dust suppression and domestic use. In order to achieve the required dewatering capacity, boreholes with pumps will be placed around each of the pits. A series of 200 mm pipes will run around the pits, combining into a 600 mm line running towards the reservoir and pump room, located at the plant area. From here water will be abstracted for use at Heuningkranz (estimated to be a maximum of 200 m^3/hour) and the remaining water will be pumped to an on-site reservoir, located on a hill on the southern site of the mine. The water will then be pumped via a 600 mm line to the Beeshoek Reservoir. As is currently the case at Kolomela, this water will enter the Sedibeng Water Supply Scheme. The pipeline will run along the boundary of Heuningkranz and then parallel to the R385, where it will be buried until it joins the Beeshoek Reservoir.

Based on the simulated groundwater influx (Groundwater Complete, 2018), the maximum amount of dewatering required will be 116 l/s or 416 m^3/hr. The maximum amount of water to be exported will be ~ 216 m^3/hr. However, the modelled results are preliminary and based on the best information currently available, the model will be updated regularly as more information becomes available and before the commencement of the activities at Heuningkranz.

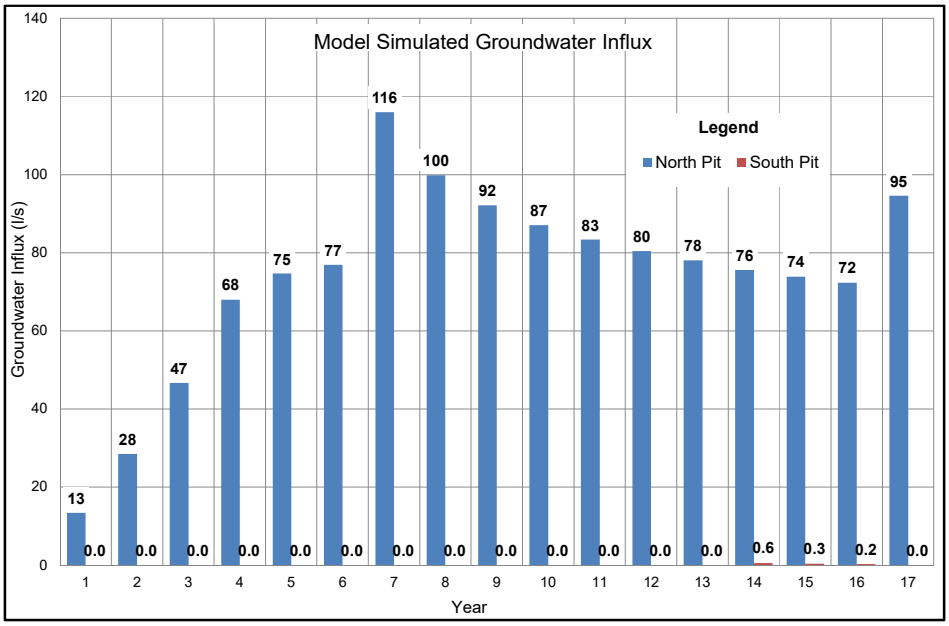

FIGURE 4-3: SIMULATED GROUNDWATER INFLUX INTO THE NORTH AND SOUTH PITS DURING THE LIFE OF THE HEUNINGKRANZ PROJECT

TABLE 4-11: LISTED ACTIVITIES DEWATERING INFRASTRUCTURE

Listing Notice	Activity Number	Description
GNR 983	9 The development of infrastructure exceeding 1 000 metres in length for the bulk transportation of water or storm water- (i) with an internal diameter of 0,36 metres or more; or (ii) with a peak throughput of 120 litres per second or more; excluding where— (a) such infrastructure is for bulk transportation of water or storm water or storm water drainage inside a road reserve or railway line reserve; or (b) where such development will occur within an urban area.	The dewatering and export pipeline will be 600 mm in diameter and may at time be required to convey in the order of 120 l/s.
	12 The development of- (i) dams or weirs, where the dam or weir, including infrastructure and water surface area, exceeds 100 square metres; or (ii) infrastructure or structures with a physical footprint of 100 square metres or more; where such development occurs- (a) within a watercourse; (b) in front of a development setback; or (c) if no development setback exists, within 32 metres of a watercourse, measured from the edge of a watercourse;	The pipelines will cross watercourses.
GNR 985	14 The development of- (ii) infrastructure or structures with a physical footprint of 10 square metres or	The pipelines will cross tributaries of the Soutloop River which is a NFEPA watercourse.

Listing Notice	Activity Number	Description
	more; where such development occurs- (a) within a watercourse; (b) in front of a development setback; or (c) if no development setback has been adopted, within 32 metres of a watercourse, measured from the edge of a watercourse;	

4.1.4.12 Stormwater Management

Stormwater berms will need to be constructed at Heuningkranz in order to protect the pits, particularly the Northern Pit which is located within the 1:100-year flood lines of ephemeral tributaries of the Soutloop River. These berms will range in height from 1 m to 2.5 m (see SMEC Stormwater Management Report, 2017).

In order to manage the runoff from the Administration, Ancillary Services and Process Plant area a 1 m deep stormwater channel with a longitudinal slope of 1: 1000 and side slopes of 1: 3, will be constructed along the southern side of the buildings' platform. The channel will direct the runoff into a Stormwater Management Pond. The pond will be 1m deep with width and length of 165 m providing a storage volume of 26.5 Ml.

In order to protect the natural water course from silt and possible contamination, the stormwater management pond above will be used as a sedimentation control dam.

TABLE 4-12: LISTED ACTIVITIES STORMWATER MANAGEMENT INFRASTRUCTURE

Listing Notice	Activity Number	Description
GNR 983	12 The development of- (i) dams or weirs, where the dam or weir, including infrastructure and water surface area, exceeds 100 square metres; or (ii) infrastructure or structures with a physical footprint of 100 square metres or more; where such development occurs- (a) within a watercourse; (b) in front of a development setback; or (c) if no development setback exists, within 32 metres of a watercourse, measured from the edge of a watercourse;	Stormwater management infrastructure i.e. berms will be developed within watercourses.
GNR 984	6 The development of facilities or infrastructure for any process or activity which requires a permit or licence or an amended permit or licence in terms of national or provincial legislation governing the generation or release of emissions, pollution or effluent,	The stormwater management pond will require licensing under Section 21(g) of the National Water Act.

Listing Notice	Activity Number	Description
GNR 985	14 The development of- (ii) infrastructure or structures with a physical footprint of 10 square metres or more; where such development occurs- (a) within a watercourse; (b) in front of a development setback; or (c) if no development setback has been adopted, within 32 metres of a watercourse, measured from the edge of a watercourse;	Stormwater management infrastructure i.e. berms will be developed within tributaries of a Soutloop River which is a NFEPA watercourse.

4.1.4.13 Haul Roads

Haul roads will be required to convey waste rock and overburden from pit areas to the waste rock dumps and ore to the primary crusher area. There will also be a haul road linking the mining areas to the workshops. Haul roads have a width of 30 m. Dust on permanent haul roads will be controlled with chemical suppressants (e.g. dust-a-side). Wet suppression will be used on temporary haul roads in pits and on dumps.

TABLE 4-13: LISTED ACTIVITIES HAUL ROADS

Listing Notice	Activity Number	Description
GNR 983	12 The development of- (i) dams or weirs, where the dam or weir, including infrastructure and water surface area, exceeds 100 square metres; or (ii) infrastructure or structures with a physical footprint of 100 square metres or more; where such development occurs- (a) within a watercourse; (b) in front of a development setback; or (c) if no development setback exists, within 32 metres of a watercourse, measured from the edge of a watercourse;	Haul roads will be developed across watercourses.
GNR 984	27 The development of a road- (i) … (ii) … (iii) with a reserve wider than 30 metres; or (iv) catering for more than one lane of traffic in both directions;	Development of haul roads which are 30 m – provision has however been made for a reserve wider than 30 m.
GNR 985	14 The development of- (ii) infrastructure or structures with a physical footprint of 10 square metres or more; where such development occurs- (a) within a watercourse; (b) in front of a development setback; or (c) if no development setback has been adopted, within 32 metres of a	Haul roads will be developed within tributaries of a Soutloop River which is a NFEPA watercourse.

Listing Notice	Activity Number	Description
	watercourse, measured from the edge of a watercourse;	

4.1.4.14 Explosives Magazine

It is proposed that an Explosives Magazine be developed in the south western corner of Heuningkranz. As for the existing infrastructure at Kolomela Mine, the explosives magazine includes the following infrastructure:

- Two explosives magazines case buildings designed for the storage (each with a capacity of 7 500 kg) of explosives material and accessories such as Expanfo and Explogel (packaged explosives that will be used for secondary blasting), primacord, trojan categories, Detacord, Y3 Boosters, zapcord, detonators and surface delay products (each with a capacity of 7 500 kg);
- A bunded diesel tank (with a capacity to store approximately 11 000 litres);
- Two bunded Prill silos (each with a capacity to store approximately 41 tonnes of Porous Prill Ammonium Nitrate);
- Two bunded Matrix silos (each with a capacity to store approximately 85 tonnes of Ammonium Nitrate and Calcium Nitrate solution);
- A chemical storage area used to store chemicals used in the process, such as Sodium Nitrate and Thiourea;
- An office block with parking area and a septic tank;
- An access road;
- A truck parking area; and
- A trench around the entire perimeter of the Explosives Magazine Facility

The magazine buildings will be encased within an earthen berm wall leaving only the area for the access door clear. All storage units are contained within bunded areas. Any additional contaminated run-off and spillages generated from storage units, explosive truck calibrations and decontamination of explosive trucks will be collected and disposed of by destroying in drill holes charged with explosives. The small quantities of packaging generated from the Expanfo and Explogel explosives are required by law to be burnt as a means of disposal. This will be carried out on site.

TABLE 4-14: LISTED ACTIVITIES EXPLOSIVES MAGAZINE

Listing Notice	Activity Number	Description
GNR 983	14 – The development of facilities or infrastructure, for the storage, or for the storage and handling of a dangerous good, where such storage occurs in containers with a combined capacity of 80 cubic metres or more but not exceeding 500 cubic metres.	The explosive magazine will provide for the storage of the following dangerous good: • 11 cubic metres of diesel; • 82 tonnes of Porous Prill Ammonium Nitrate • 170 tonnes of Ammonium Nitrate and Calcium Nitrate solution
GNR 984	15 The clearance of an area of 20 hectares or more of indigenous vegetation, excluding where such clearance of indigenous vegetation is required for- (i) The undertaking of a linear activity; or (ii) Maintenance purposes undertaken in accordance with a maintenance plan.	Site clearance of ~5.2 ha is required for the Explosives Magazine contributing to the cumulative clearance of more than 20 ha at Heuningkranz.

5. POLICY AND LEGISLATIVE CONTEXT

This document has been prepared strictly in accordance with the DMR Report template format. This is in accordance with the requirements of the MPRDA. In addition, this report complies with the requirements of the National Environmental Management Act (NEMA) (Act 107 of 1998) and the EIA Regulations (2014, as updated).

This section outlines the key legislative requirements applicable to the project.

5.1 Mineral and Petroleum Resources Development Act (No. 28 of 2002)

The Mineral and Petroleum Resources Development Act (MPRDA) regulates the requirements for a mining right in order to mine a mineral and undertake associated activities. Mining can either include removal of an underground mineral or mineral occurring in a residue deposit or residue stockpile. The MPRDA requires the holder of a mining right not to cause any significant pollution or environmental degradation.

A mining right for iron ore was granted to Sishen Iron Ore Company (Pty) Ltd - Kolomela Mine, by the Minister of Mineral Resources on 5 May 2008 to mine iron ore on the farms Ploegfontein 487, Remainder of Leeuwfontein 488, Strydfontein 614, remainder of Klipbankfontein 489, Portion 1,2,3, and the remainder of Kapstevel 541, Wolhaarkop 485, Welgevonden 476 and Welgevonden 486. Sishen Iron Ore Company (Pty) Ltd - Kolomela Mine is also the owner of the surface rights of these properties. The Kolomela mining right - MPT No 50/2009 (NC 069 MR), is valid until 17 September 2038 unless cancelled or suspended. Application has been made under Section 102 of the MPRDA for the inclusion of the mining of iron ore on the Farm 364 (Heuningkranz) and Farm 432 (Langverwacht) Portion 1 i.e. the Heuningkranz Section. This will involve an amendment to the mine works programme and an extension of the life of Kolomela by 14 years.

The Kolomela Mine EMPr is authorised under Section 39 of the MPRDA, and despite the Section being repealed with all future environmental authorisations being regulated under the National Environmental Management Act (Act No. 107 of 1998), existing authorisations remain valid in terms of the transitional arrangements.

Kolomela Mine is proposing to undertake operations on two additional farms, namely Farm 364 (Heuningkranz) and Farm 432 (Langverwacht), Portion 1, collectively termed the "Heuningkranz Section". The current description of mining and processing as documented in the approved EMPr or the amendments thereto, do not allow for the mining, processing and associated activities as proposed for the Heuningkranz Section. An amendment to the existing EMPr is thus required.

The proposed activities at Heuningkranz are not included in the existing approved Kolomela Mine EMPr or any amendments thereto and the EMPr thus requires amendment to include:

- A description of the additional activities to take place including: 2 new pits, new waste rock dumps, an Ultra High Dense Media Separation (UHDMS) processing plant, a slimes dam, a discard dump; an additional railway link to the existing Transnet iron ore railway line, access and other roads, haul roads, fuel storage areas, explosive magazine, dewatering infrastructure, waste storage areas, new offices, workshops and stores.
- A description of the baseline environment on the farms Heuningkranz 362 and Langverwacht 432, Portion 1;
- A description of additional impacts because of the extended operations;
- Identification of additional mitigation measures required.

Sections 53 and 54 of the Regulations require the holder of a mining right to make financial provision for rehabilitation and to action closure objectives of the Mine. These sections are however a consequence of Section 41 of the MPRDA (also now repealed) that requires the holder to make financial provision for closure and rehabilitation of the Mine. Financial provision for mine rehabilitation and closure is now regulated under NEMA and subsequent regulations However, since the MPRD Regulations are not repealed, Section 53 and 54 can still be considered to be applicable. The financial provision is to be updated to include the Heuningkranz Section.

Application has been in terms of Section 102 of the MPRDA for the amendment of the Kolomela Mine EMPr.

5.2 National Environmental Management Act (No. 107 of 1998)

Section 24 of the National Environmental Management Act (NEMA) provides for the Minister of Environmental Affairs to include activities in a list that require environmental authorisation before commencement. This has resulted in the promulgation of Listing Notices 1 (GNR. 983), 2 (GNR. 984) and 3 (GNR. 985) with the Environmental Impact Assessment (EIA) Regulations (GNR. 982) of December of 2014 as amended by GNR. 324-327 of 7 April 2017 guiding the requirements to undertake an environmental impact assessment and apply for an environmental authorisation, should a listed activity be triggered. As of 4 December 2014, activities at mining operations are also to be authorised under NEMA, with the DMR acting as the Competent Authority. Application has been made for several listed activities for the Heuningkranz Project (see Section 5.1).

Kolomela Mine operates under 2 existing environmental authorisations:

- Authorisation of Amendment of Kolomela Mine EMPr (Ref: NC 30/5/3/2/1/069EM) of 3/3/2011
- Integrated Environmental Authorisation for Expansion of Activities (Ref: NC30/5/1/2/2 00039MR or 069MR) of 29/8/2017

The amended EIA regulations (GNR. 326) state clearly that an application for amendment of an EMPr issued in terms of the MPRDA must be dealt with in terms of Part 1 or Part 2 of Chapter 5 of the EIA Regulations. Part 2 provides for the amendment where a change in scope occurs. The inclusion of the operations at the Heuningkranz Section into Kolomela Mine presents amendment in terms of Part 2 of Chapter 5 of the EIA Regulations.

The impacts of the operations at the Heuningkranz Section as well as any additional management measures required have been addressed in the Scoping Report and EIA Report/Environmental Management Programme in support of the application made for Environmental Authorisation of listed activities (GNR. 983-985 of 4 December 2014, as amended) as well as an application for a Waste Management Licence under GNR. 921 of 24 July 2015, as amended), submitted in accordance with the time frames legislated in the EIA Regulations (GNR. 982 of 4 December 2014, as amended) that are published in terms of the NEMA.

Authorisation is being sought for activities applicable to the Heuningkranz Section as listed in terms of EIA Listing Notices 1, 2 & 3 of GNR. 983-945, as amended.
Authorisation is being sought in terms of Regulation 31 of Part 2 of Chapter 5 of EIA Regulation GNR. 982 of 4 December 2014 as amended by GNR. 326 of 7 April 2017 under NEMA for the amendment of the Kolomela EMPr.

5.3 National Environmental Management: Waste Act (No. 59 of 2008)

In terms of Section 19 of the National Environmental Management: Waste Act (NEM: WA), a list of waste management activities that is likely have a detrimental effect on the environment was promulgated through Regulation GNR. 921 (November 2013). The listed activities were amended by GNR. 633 of 24 July 2015 to include waste management activities at mining operations.

The project will generate mineral waste in the form of waste rock, dry plant discard and tailings slurry which will be disposed at Heuningkranz. The waste facilities required for the management of such waste require licensing in terms of NEM: WA.

A waste classification and assessment of the process wastes (slimes and solid discard) will be undertaken in accordance with Regulation GNR. 634 and 635 of 23 August 2013 as part of the EIA process to assess any additional risks to the environment and appropriate mitigation will be put in place if required.

Application is made for a Waste Management Licence for the authorisation of Waste Management Activities under Regulation GNR. 921 as amended by GNR. 633 of 24 July 2015 under NEM: WA.

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

The National Environmental Management: Air Quality Act (NEM: AQA) controls and regulates atmospheric emissions and provides for Listed Activities (GNR. 893, November 2010) which have or may have a significant effect on the environment, including health, social conditions, economic conditions, ecological conditions or cultural heritage. Any activity captured under this list require the person undertaking the activity to apply for an Atmospheric Emissions Licence (AEL). The bulk storage of fuel at Heuningkranz for mining and light delivery vehicles will require an AEL as the activity is captured under Activity 2.4: Storage and Handling of Petroleum Products which includes all permanent immobile liquid storage facilities at a single site with a combined storage capacity of greater than 1 000 cubic metres.

Mining at Heuningkranz, as for Kolomela Mine is also required to comply with the National Dust Control Regulations (GNR. 827 of 1 November 2013) and the National Ambient Air Quality Standards (NAAQS, GNR. 1210 of 24 December 2009). The regulations provide limits for PM_{10} and dust fallout in residential and industrial areas.

5.5 National Environmental Management: Biodiversity Act (No. 10 of 2004)

Section 57 of National Environmental Management: Biodiversity Act (NEM: BA) restricts certain activities involving threatened and protected species (as listed in Regulation GNR. 151 and 152, February 2007) without a permit. Restricted activities applicable to the project are limited to the removal of Threatened or Protected Species (TOPS) plants during the clearance of vegetation.

5.6 Northern Cape Nature Conservation Act (No. 9 of 2009)

Section 49 and 50 of the Northern Cape Nature Conservation Act 9 of 2009 requires any person that intends to undertake a restricted activity in respect of protected plants as set out in Schedule I and Schedule II of the Act to apply for a permit from the Northern Cape Department of Environment and Nature Conservation. Restricted activities include the removal, replanting or selling of these plants. The project is a red fields development and no

disturbance of plant species is required. Application will need to be made for the necessary permits prior to the commencement of site clearance in areas where protected plants are present.

5.7 National Water Act (No. 36 of 1998)

Section 21 of the National Water Act requires any person undertaking a water use activity to either register or licence such use unless it was an existing lawful use prior to the Act. Kolomela Mine has an existing Integrated Water Use Licence (Licence No.: 10/D73A/ABCEGIJ/4125). Application will need to be made for licensing of the following activities planned for Heuningkranz:

- 21(a) – use of water for processing and domestic use;
- 21 (b) – storage of clean water in dams;
- 21(c)&(i)- disturbance of watercourses and wetland pans;
- 21(g) – mineral waste management facilities (waste rock dumps, slimes dams and discard dump) and dirty water storage dams (RWD, stormwater management pond at plant and evaporation ponds at pits);
- 21(j) – dewatering of mine pits to allow for safe mining conditions.

Regulations for the use of water for mining and related activities aimed at protected water resources (GNR.704, June 1999) were promulgated in terms of Section 26 of the NWA. These provide for:

- Restrictions on the locality with respect to residue deposits, dam or reservoirs as well as mining activities within the proximity of a watercourse.
- Restriction on the use of material that can pollute a water resource for the purposes of construction.
- Capacity requirements of clean and dirty water systems.
- Protection of water resources from pollution sources at the mine in particular the separation of clean and dirty water and the prevention of spillages from dirty water containment facilities.

Exemption will need to be sought in terms of Regulation 3 for activities that do not comply with GNR. 704.

5.8 National Heritage Resources Act (No. 25 of 1999)

The National Heritage Resources Act (NHRA) controls and regulates the interaction with heritage, archaeological, and paleontological artefacts and structures. Sections 34, 35 and

36 require that no person may demolish or alter any structure which is older than 60 years without a permit issued by the relevant provincial heritage resources agency. The NHRA further states that any person that disturbs any archaeological site, paleontological site or grave cannot do so without a permit. Various heritage sites have been identified at the Heuningkranz Section and these will need to be avoided where practicable. Should any site need to be altered or destroyed a permit will need to be obtained in terms of the NHRA.

6. NEED AND DESIRABILITY OF THE PROPOSED ACTIVITIES

The mining of the Heuningkranz Section will allow for the extension of the life of mine of Kolomela Mine. The Heuningkranz Section includes two pits that are planned for first production in 2033 when the Kolomela pits are near completion. This section will allow Kolomela to increase its life of mine to approximately 2048. The life of mine extension will also extend beyond the life of Sishen Mine, with the Sishen Mining Right expiring in 2039. The Heuningkranz Project will extend the life of SIOC's operations in the Northern Cape. With the pending closure of SIOC's Thabazimbi Mine, Sishen Mine and Kolomela Mine are SIOC's only two mining operations.

The Heuningkranz extension will include a new processing plant (UHDMS) for the processing of 6 million tonnes per annum of iron ore which will be used together with the existing DSO processing plant (will process 4.2 million tonnes per annum) at Kolomela Mine in order to allow for the processing of a total of 10.2 million tonnes of iron ore at Kolomela Mine.

Kolomela is a significant employer with over 2 000 persons working at the mine including permanent employees and contractors. The construction activities will also provide an opportunity for the employment of additional persons for the construction period (~950 persons).

The continuation and extension of the life of Kolomela Mine is needed and is desirable for the following reasons:

- It will enable Kolomela Mine and SIOC to stay in operation and earn a profit;
- Enable Kolomela Mine to continue to supply iron ore, to satisfy the various requirements of its clients;
- To safeguard the employment of employees;
- Increase future employment opportunities e.g. during construction phase;
- Safeguard and increase local economic development opportunities created by the existing Kolomela Mine.

7. 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

(The determination of the site layout taking into consideration the comparison of the original site plan with a plan which takes (1) environmental features; (2) current land uses, (3) issues raised by IAPs and (4) consideration of alternatives, to the initial layout into account.)

7.1 Details of the development footprint alternatives considered

7.1.1 Activity Alternative

SIOC has investigated 3 alternatives for the mining of the ore bodies at Heuningkranz.

7.1.1.1 Option 1: Stand-Alone Mine

This option involves the development of a mine with its own mining licence that can operate independent of and together with Kolomela Mine. That comprises the following:

- A mining operation supporting 10.2 Mtpa of ROM, consisting of DSO and UHDMS material.
- On- mine infrastructure including offices, workshops, stores, and dewatering infrastructure etc, similar to the existing Kolomela operation.
- A DSO plant treating 4,2 Mtpa, an UHDMS plant treating 6,0 Mtpa of ROM. Each plant has its own crushing facility.

The development will essentially comprise a development of similar scale to the existing Kolomela Mine. The capital cost associated with such a development is financially unattractive to SIOC as the iron ore deposit is substantially smaller than that of Kolomela. Personnel would need to be brought into the area which means additional demand on housing. SIOC will be required to develop additional housing and infrastructure to support the demand at an extensive cost to the project. Additional rail capacity requirements also place a constraint on the feasibility of the large stand-alone mining option.

The operation of two mining operations at the same time would mean that certain negative impacts including dewatering, dust emissions, lighting impacts, increased pressure on social services, traffic congestion etc. would take place simultaneously. Socio-economic benefits will only be boosted for a short period of time

For the above reasons the development of a Stand-Alone mine is not favoured by SIOC.

7.1.1.2 Option 2: A Small Mine expanding later into Full Capacity

This option provided for the development of a mine that starts as a small-scale operation, operating independently to Kolomela Mine in Phase 1, and then expands to a full operation in Phase 2, after mining at Kolomela is completed. The phases will comprise the following:

- Phase 1 -A UHDMS plant treating 1.5 Mtpa of DSO and UHDMS ROM material.
    - The plant will treat DSO and UHDMS material.
    - The UHDMS material will be fed into UHDMS modules consisting of a primary, secondary and tertiary crushing circuit designed for 6 Mtpa (for use in phase 2).
    - A stockyard for DSO (Fines and Coarse) and a stockyard for UHDMS product (Fines and Coarse). The quantity of product is so small that one stockyard can be used and split into a DSO and UHDMS portion.
    - Housing to support additional personnel required for a 1.5 Mtpa mine.
- Phase 2 – Expand the mine to full capacity as per the Stand-Alone option. The following deviations from the Stand-Alone option would apply:
    - The DSO material will be loaded at Heuningkranz on rail tipped at Kolomela and treated at Kolomela. So, no DSO plant will be built at Heuningkranz, only the crushing circuit (primary and secondary) without any screening. A stockyard would still be required. A trade off whether it is better to build a screening plant at Heuningkranz or build a tippler at Kolomela is the subject of a future study. Relocating plants is also a future option to be considered.
    - No additional housing is required as personnel are deployed from Kolomela.

Additional capital costs associated with the Phase 1 mining would be required. Although favoured over Option 1, such costs together with additional labour requirements still place constraints on the project not favoured for the mining of a small iron-ore deposit. Availability of rail capacity on the iron ore line is also a constraint on the ramped-up option.

Some cumulative impacts including those related to dewatering, water use, dust, traffic, influx of persons, pressure on local services etc. would occur simultaneously, but the scale would be substantially lower than that for the operation of two large-scale mines.

7.1.1.3 Option 3: Extension for the Life of Kolomela Mine

Heuningkranz will be mined at 10.5 Mtpa after the current ore bodies at Kolomela are mined, extending the life of Kolomela Mine. The mine is the same as the Stand-Alone mine with the following exceptions:

- The DSO material will be loaded at Heuningkranz on rail, tipped at Kolomela and treated at Kolomela. No DSO plant will be built at Heuningkranz, only the crushing circuit (primary and secondary) without any screening.
- A stockyard would still be required.
- No additional housing would be required as persons would be deployed from Kolomela.

The option is preferred from a cost perspective because much of the infrastructure used for the existing Kolomela operations can be used to support mining at Heuningkranz. Labour can also be deployed from Kolomela to the Heuningkranz Section.

From an environmental perspective the option is favoured as cumulative impacts of mining the two sections can be avoided, although the impacts will be relocated to the Heuningkranz Section and will continue for an extended period. The socio-economic benefits will however be sustained for a longer period of time.

7.1.2 Design or layout alternatives

The Heuningkranz Project will be located within properties currently included in the Heuningkranz Prospecting Right, namely Farm 364 (Heuningkranz) and Portion 1 of Farm 432 (Langverwacht). These properties are owned by SIOC. The location of the Heuningkranz orebodies, and thus the Heuningkranz North and South Pits, are fixed based on the results of extensive exploration that has taken place at the site since 2007. The layout design is restricted by the location of the proposed pits and the boundaries of the properties owned by SIOC based on a decision not to result in the displacement of private landowners as a result of the project.

7.1.2.1 Export Pipeline Route

The dewatering pipeline was relocated during the Scoping Study from the original routing based on a decision not to disturb private landowners or adjacent operations. The original and the revised routes are shown in Figure 7-1. The revised route will follow the R385 road linking Postmasburg to Olifantshoek. This will be buried within the road servitude, as far as practicable. Note the layout has been further revised base don outcomes of the EIA as indicated in Section 7.1.2.2

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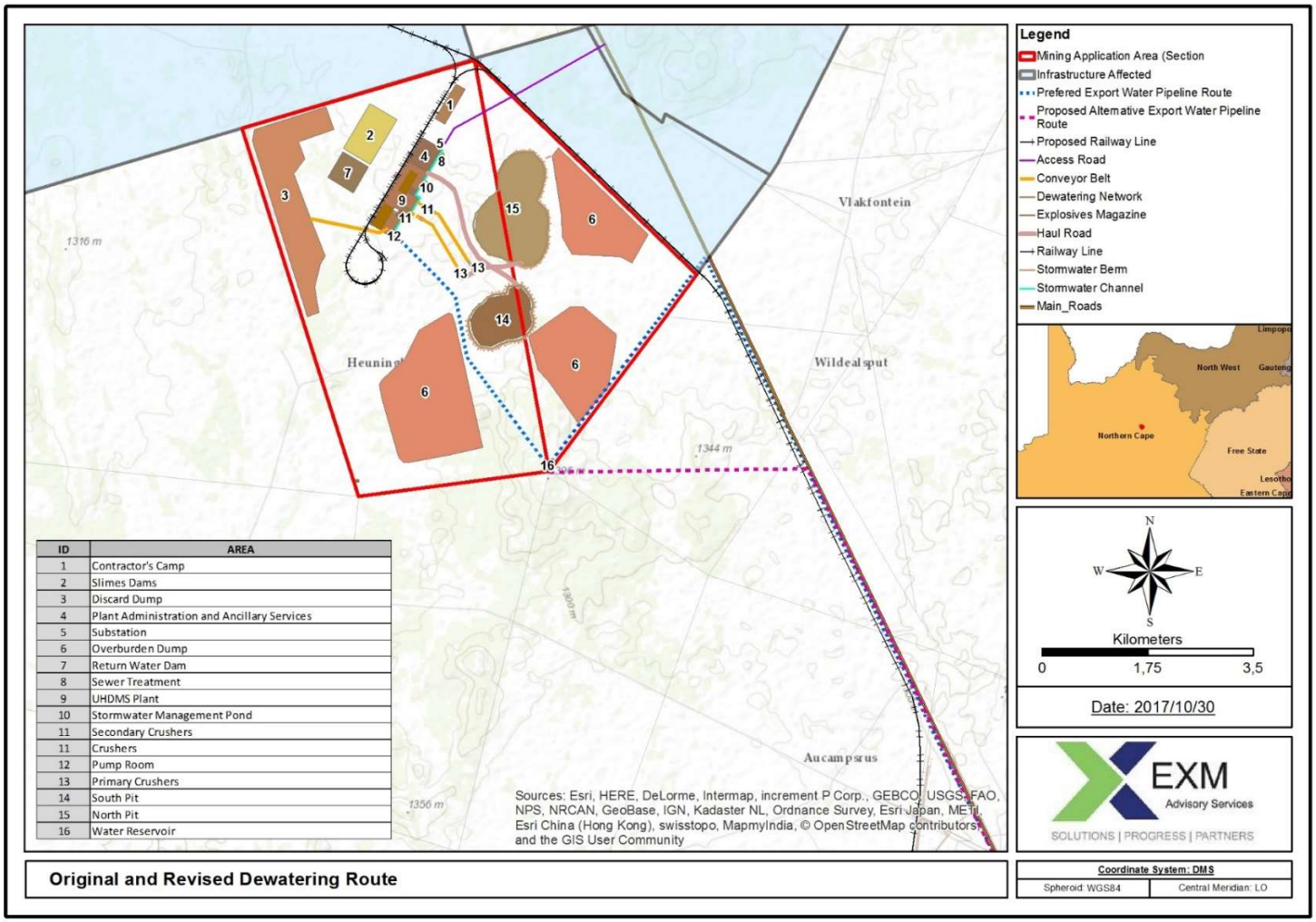


ID	AREA
1	Contractor's Camp
2	Slimes Dams
3	Discard Dump
4	Plant Administration and Ancillary Services
5	Substation
6	Overburden Dump
7	Return Water Dam
8	Sewer Treatment
9	UHDMS Plant
10	Stormwater Management Pond
11	Secondary Crushers
11	Crushers
12	Pump Room
13	Primary Crushers
14	South Pit
15	North Pit
16	Water Reservoir

FIGURE 7-1: ORIGINAL AND REVISED DEWATERING PIPELINE ROUTE

7.1.2.2 Relocation of Construction Villages, Waste Rock Dump and Discard Dump Layout

As described in Section 9.3.5, the original proposed layout (Unmitigated Scenario) would result in the destruction of wetland pans due the inclusion of the pans within the footprint areas of the North Eastern WRD and the Discard Dump (Figure 9-15). Wetland Pans are considered to be highly sensitive habitats and provide essential functions in terms of biodiversity. The layout was thus altered to promote the protection of three wetland pans at the site (Mitigated Scenario).

The Construction Village has also been moved outside of the 500 m buffer of wetland pans in order to reduce the risk of damage to the pan due to such activities. It is also recommended that the catchments of pans be delineated in further work to ensure that the pans can be protected by the protection of the catchments

The layout of the Unmitigated versus the Mitigated Scenarios are provided in Figure 9-18 and Figure 9-19, respectively.

7.1.2.3 Alignment of Linear Infrastructure

As described in Section 9.3.4, linear infrastructure such as the rail link, access road and powerline act as a barrier to the movement of livestock and other fauna at the site. This reduces the land capability of the remaining isolated land units. The revised layout in the Mitigated Scenario (Figure 9-19) provides for the alignment of the road and power line with the rail as far as possible to minimise the isolation of land units. In addition, the access road has been realigned to follow as close as possible to the farm boundary.

The relocation of the infrastructures also means that the infrastructure is further from a wetland pan and the risk to the pan is less.

7.1.3 Technology alternatives

The Heuningkranz Project will incorporate Ultra High Dense Media Separation (UHDMS) with a new processing plant planned to be developed at the site. UHDMS presents an alternative to beneficiation by Dense Media Separation (DMS). This incorporation of UHDMS into SIOC's operations was achieved through collaborative technology development with Exxaro and resulted in Kumba being licensed (by Exxaro) to use the technology at its operations. The process is similar to DMS processes. The separation efficiency has been demonstrated to be better than that of Jigs currently used for the processing of lower grades of iron ore, thereby allowing the ROM cut-off to be reduced, thus presenting the opportunity for processing material that previously could not be beneficiated. Higher grades of ore generated at

Heuningkranz will be processed at the existing Direct Shipping Ore (DSO) plant at Kolomela Mine.

7.1.4 Operational alternatives

High grade ore mined at the Heuningkranz Section will be processed at the existing DSO Plant at Kolomela. Various transport alternatives from Heuningkranz to the DSO plant were considered in a cost-benefit analysis. These included:

- Development of a haul road linking Heuningkranz to Kolomela.
- Development of a conveyor linking Heuningkranz to Kolomela.
- Development of a rail link to Kolomela Mine.

The rail option is both the most cost effective and also expected to have the least environmental impact as additional infrastructure would be limited to a link to the existing iron ore export line from Kolomela Mine. The conveyor and haul road links would require extensive development and disturbance over privately owned land.

7.1.5 Option of not implementing the activity

In accordance with the NEMA Regulations, the no-go alternative is required to be investigated and assessed. The no-go alternative would mean that the Heuningkranz Project will not be implemented, and the associated negative impacts will not occur. However, the socio-economic benefits of extending the life of the SIOC's operation will not be realised. Operations at Kolomela Mine would cease in 2034, employees would be retrenched, and procurement of goods and services would no longer be required. In addition, the opportunity for employment during construction phase (3 years) will not happen. The socio-economic benefits of the project will however need to be compared to the environmental and social impacts associated with the proposed Heuningkranz Project.

7.2 Details of the public participation process followed

7.2.1 Identification of interested and affected parties

Existing databases held by Kolomela Mine were updated for the purposes of this project. In terms of the EIA Regulations the following were also identified as IAPs for the project:

- Landowners or tenants adjacent to or within 100 m from the proposed study area.

  Farmers and neighbours of the properties proposed for the Heuningkranz Project have been included as IAPs.
- Representatives of the local municipality/ward councillor with jurisdiction in the area.

The office of the mayor of the Tsantsabane Local Municipality and the ZF Mgcawu District Municipality as well as the respective municipal managers have been included.

- Representatives of the local ratepayers association.
- Authority or organ of state having jurisdiction in respect of any aspect of the activity.

  The following organs of state have been notified:

  - Department of Mineral Resources – Northern Cape (the Competent Authority)
  - Department of Water and Sanitation – Northern Cape
  - Catchment Management Agency – Vaal Proto
  - Northern Cape Department of Environment and Nature Conservation
  - Office of the Premier – Northern Cape Provincial Government
  - Northern Cape Department of Land Reform and Rural Development
  - Northern Cape Department of Economic Development and Tourism
  - Northern Cape Department of Roads and Public Works
  - Northern Cape Department of Social Development
  - South African Heritage Resources Agency
- Persons who responded to the Background Information Document (BID), press advertisements and site posters
- Persons who attended the public meeting during the scoping phase

A list of all parties that have been identified thus far is included as Appendix B1. Note that the IAP database was updated as IAPs become apparent throughout the scoping and EIA phases. The BID/Notification letter is provided in Appendix B2.

7.2.2 Notifications

In accordance with the Section 41(2)(b) of Chapter 6 of the EIA Regulations (GN. 982 of 4 December 2014, as amended), written notification (including BID document by email or facsimile) has been given to:

- Surrounding landowners;
- Representatives of local government and the local municipalities;
- Ratepayer's association;
- Organs of state.

The notification is provided in Appendix B2. Proof of the notification is provided in Appendix B3. Persons on the IAP database were notified of the project and invited to the public

information-sharing meeting by:

- Email including BID (where email addresses are available); and/or
- SMS (where cell phone numbers are available); and/or
- Facsimile (where contact details are available); and/or

7.2.3 Media advertisements and site notices

Press advertisements were placed in the following newspapers:

- The Kalahari Bulletin (Local Paper) in English on 26 October 2017
- The Kathu Gazette (Local Paper) in English on 28 October 2017
- The Volksblad (Regional Paper) in Afrikaans on 27 October 2017
- The Kimberley Gazette (Local Paper) in Afrikaans on 3 November 2017

The advertisements in the first 3 papers included an invitation to the public information-sharing meeting held on 2 November 2017. The meeting could not be advertised in the Kimberley Gazette as the paper is a monthly paper and was only published after the meeting.

Site notices (A2 size) were placed (one in English and on in Afrikaans) at the entrance to access roads to the geological offices at Heuningkranz on 1 November 2017. Notices were also placed at strategic public locations in Postmasburg on 30 October 2017. These included:

- Postmasburg Post Office
- Postmasburg Municipal Offices
- The Postmasburg Spar
- Jimbos Convenience Store and Fuel Station

Proof of placement of advertisements and site notices is included in Appendix B4.

7.2.4 Public and authority meetings

An open public information-sharing meeting was held at Soetfontein Guest House near Postmasburg on Tuesday 2 November 2017 (see Appendix B5.1 for the minutes of the meeting).

EIA Public Feedback meetings were held at Soetfontein Guest House near Postmasburg and NG Church Hall in Postmasburg on 11 April 2018 (See Appendix B5.2 for the minutes of the meetings).

7.2.5 Public and authority review of draft scoping report

This draft scoping report was made available for review from 6 November – 5 December 2017. (30 calendar days) in accordance with Section 40 (3) of the 2014 EIA regulations. Written comments and responses received to date are provided in Appendix B6. Proof of notification is provided in Appendix B7.1.

7.2.6 Authority acceptance of final scoping report

The final scoping report was submitted to the DMR on 7 December 2017 and was accepted by the DMR on 13 December 2017. The letter of acceptance is included in Appendix B9.

7.2.7 Public and authority review of Draft EIA Report

The draft EIA Report including appendices and specialist study reports was made available for public review from 15 March 2018 until 18 April 2018 (30 calendar days, excluding public holidays). Proof of notification of the availability of the EIA Report and the EMPr is provided in Appendix 7.2. Proof of delivery of the reports to the Postmasburg Public Library, Department of Water & Sanitation and the Department of Environment and Nature Conservation is given in Appendix B8. The feedback received is included in Appendix B6.

7.3 Summary of issues raised by IAPs

Please refer to Appendix B5, for the full comments in minutes and correspondence with IAPs and authorities. Correspondence received to date is included in Appendix B6.

DATE	NAME	CORRESPONDENCE RECEIVED	EAPs RESPONSE TO ISSUES AS MANDATED BY THE APPLICANT	CONSULTATION STATUS (consensus, dispute, not finalised, etc.)
AFFECTED PARTIES				
Landowners/Lawful Occupiers of Adjacent Properties				
31 October 2017	G Claassens	Request for information letter to be sent in Afrikaans.	Afrikaans letter sent on 31 October 2017.	Finalised
31 October 2017	T Jooste	Registration of Mr N. Loubser of Ringside Trading as affected party and confirmation of attendance of public meeting.	Noted	Finalised.
31 October 2017	N. Loubser Ringside Trading (see Appendix B6)	Access to the Heuningkranz Section is via the D3326. The first 6 km of this road (from the train crossing to the Ringside mine entrance) is maintained by Ringside. SIOC and their contractors are currently using this road and are not contributing to the maintenance and upkeep of the first 6 km of the road. SIOC and their contractors are forced to maintain the road from our mine entrance to the Heuningkranz entrance because of their heavy traffic flow. The SIOC traffic flow is already placing a huge financial burden on us for the upkeep of the first section of the road. Will SIOC now start to contribute to the maintenance of this section of the road especially now that we can expect additional SIOC traffic flow?	Access to the planned mining operations will be via the R385 and not the D3326. Current issues regarding access to Heuningkranz should be addressed to Kumba Geosciences. The letter has been passed onto Kumba Geosciences for their attention. The issue seems to be related to current prospecting activities at Heuningkranz and not the project. The letter has been passed onto the responsible persons at Kumba Geosciences. The EMPr (see Part B, Section 5) provides for the upgrading and maintenance of access roads to be used for the Heuningkranz Project	Document passed onto Kumba Geosciences. Kumba Geosciences will arrange a meeting with Ringside to discuss.

DATE	NAME	CORRESPONDENCE RECEIVED	EAPs RESPONSE TO ISSUES AS MANDATED BY THE APPLICANT	CONSULTATION STATUS (consensus, dispute, not finalised, etc.)
		Will SIOC ensure that the traffic rules, specifically speed limits on the D3326 are adhered to by SIOC personnel, contractors and service providers? Due to your planned mining activities below the water table we can expect large scale dewatering to take place at Heuningkranz. The impact of the dewatering could have an adverse effect on Ringsides mining activities. Will SIOC provide Ringside with dewatering water should the groundwater table be depleted; or will SIOC provide alternative water sources to Ringside?	Kolomela Mine has an existing memorandum of understanding with neighbouring landowners that addresses how impacts on neighbours will be addressed. Heuningkranz as part of Kolomela will be subject to the same understanding. Persons impacted on will be reinstated in terms of water supply in accordance with the understanding.	
2 November 2017	Adam Wahl (see minutes of public meeting Appendix B5.1)	Questioned the proximity of mining activities to his fence line.	Mr Wahl is the Owner of the Farm Vlakfontein Portion 1 and 2. The waste rock dumps will be adjacent to the fence line of Mr Wahls Farm (Vlakfontein Portion 1) and they will be visible from his house. The dewatering water reservoir will be developed on the koppie adjacent to farm and the pipeline will run along the boundary.	Note the Mr Wahl indicated that he would attend the public meeting to discuss the results of the impact assessment. He however did not attend. SIOC will continue to liaise with neighbours as to progress on the project planning until the project is implemented. Communications will be on-going.
9 November 2017	Adam Wahl	Dominant wind direction is mainly north to north west (dust) Blasting: flying rock occurring from the first 3 levels during blasting. Only one borehole in that area for cattle drinking (dewatering) Traffic on the R385 plus the trains transporting the high grade ore to Kolomela (Moving of cattle over the railway line and back)	The impacts on Mr Wahl have been investigated. Current indications are that the groundwater levels within the farm will be impacted on by the cone of depression caused by dewatering. Currently a lowering of 5 m is expected over the long term. The groundwater model will be updated regularly and the predicted impacts communicated with surrounding landowners via the Kolomela Environmental Forum.	

DATE	NAME	CORRESPONDENCE RECEIVED	EAPs RESPONSE TO ISSUES AS MANDATED BY THE APPLICANT	CONSULTATION STATUS (consensus, dispute, not finalised, etc.)
		Employee vehicles to work on the R385 I will be affected in many aspects by the project.	As indicated in the EMPr, Part B- Section 7.1, the borehole on the farm will be monitored on an annual basis, and then quarterly from 1 year prior to implementation. Noise and dust impacts experienced as a result of the project are currently predicted to be negligible. As indicated in the EMPr Part B – Sections 7.2 and 7.3, noise monitoring will be undertaken at Mr Wahls residence on an annual basis and an additional dust fallout bucket will also be put in place on his farm Vlakfontein Portion 1. .	
2 November 2017	Bok Wessels (see minutes of public meeting Appendix B5.1)	Raised concern regarding the status of the access road R385	The road from town to the access to Heuningkranz will be upgraded. The road will be upgraded to a tarred road from the point where the current tar ends near Tommy's Field Airstrip to the access to Heuningkranz. The outcomes of the specialist study (see Part C-Appendix 9) suggest that the R385 will need to be upgraded and maintained in order to handle the traffic volumes predicted for the Heuningkranz Project. Surface wetting will also have to be carried out. It is suggested that in the long term it will be more cost efficient to surface the road up until the Heuningkranz access road turn-off.	Finalised

DATE	NAME	CORRESPONDENCE RECEIVED	EAPs RESPONSE TO ISSUES AS MANDATED BY THE APPLICANT	CONSULTATION STATUS (consensus, dispute, not finalised, etc.)
			The outcomes of the EIA suggest that the access road should be surfaced as soonas practicable within the life of the project. This is included in the EMPr Part B – Section 5.	
		Raised concern regarding blasting affecting his solar panels.	Blasting is not expected to cause an impact on solar panels. Should such impacts occur the landownee will be compensated. Complaints should be raised through the Kolomela Complaints Procedure.	Finalised
		Raised concern regarding Kumba not having fire breaks.	Heuningkranz forms part of Kolomela's land managed already and fire breaks are in place with the exception of a few areas where there are access restrictions.	Finalised
2 November 2017	Chris Claassens	The access road to Lynput will be disturbed by the discard dump.	The access road will remain in place as part of the layout planning and Mr Claassens will continue to have access to his property via the existing route.	Finalised
11 April 2018	Johan Kotze See minutes of public meetings Appendix B5.2).	Below is a summary of the essence of the discussions held at the meeting: 1) The delivery of boreholes not only depths is of importance when testing boreholes? 2) Concerned that the impact predictions are not corrected as the aquifers and underground water conditions are not well understood. Boreholes are being impacted on since the mine started and the geohydrologists indicate that it is not as a result of the dewatering at the mine.	As explained at the public meeting, aquifer testing is still to be carried out and the this will be undertaken in the near future by Kumba's geohydrogists. The models will be updated based on the findings. Ferdi Goussard the Kumba geohydrologist indicated that not all boreholes will be tested as this is impractical and as for Kolomela Mine, only boreholes that supply water for irrigation under licence will be tested.	Testing will be undertaken prior to commencement of construction.

DATE	NAME	CORRESPONDENCE RECEIVED	EAPs RESPONSE TO ISSUES AS MANDATED BY THE APPLICANT	CONSULTATION STATUS (consensus, dispute, not finalised, etc.)
			However, all boreholes within the predicted area of impact will be documented including the existing infrastructure and the supply requirements of the hole. Plans for future use by potentially impacted landowners will also be documented, The matter of borehole/s being impacted on at the farm Floradale does not relate directly to the project and is an existing dispute between Kolomela and Mr Kotze. The project has committed to updating impact predictions as more information on the geohydrological conditions becomes apparent and this will be communicated to all landowners including Mr Kotze. However, based on discussions held at the public meetings it is clear that the monitoring of groundwater levels to address impacts does not satisfy the surrounding landowners and the issue of a change in the delivery of the boreholes needs to be addressed. It is suggested that Kumba address this need as the issue will remain unresolved until there is a plan in place to address this concern. This can be addressed through the existing Kolomela Environmental Forum.	Issue of borehole testing is to be addressed by Kolomela through the Environmental Forum. The matter remains unresolved but is not related to the project at this stage.

DATE	NAME	CORRESPONDENCE RECEIVED	EAPs RESPONSE TO ISSUES AS MANDATED BY THE APPLICANT	CONSULTATION STATUS (consensus, dispute, not finalised, etc.)
16 April 2018	John Kotze	1) The information of the loggers to be installed, should be available for interested and affected parties to be viewed at any time. 2) The retained water (dewatering water not be pumped out of the catchment) should be used to recharge around the area of impact for Heningkrantz, as well as for Kolomela mines.	The request for availability of data logger information has been forwarded to Kolomela Mine. Jaco Lambrechts has indicated that access will be made available to the data. A procedure will be developed as to how persons can gain access to the data. This will be placed on the agenda for discussion at Kolomela Environmental Forum. The requirement for investigation into aquifer recharge has been included as a mitigation measures and a recommended condition of the environmental authorisation.	Not finalised Kolomela to respond on request on information on data loggers being available to be addressed,
13 April 2018	N. Loubser	Mr Loubser contacted the EAP telephonically and indicated the following: 1) No response ahs been received from Kumba as to the maintenance of the current access road to Heuningkranz. 2) He does not agree with the dewatering impacts predicted for the project and requests that the impacts be looked at cumulatively. 3) He was confused as to why the EMPr was not a consolidation with Kolomela's existing EMPr, as the application was for a Section 102 amendment to include Heuningkranz into Kolomela.	EXM has passed on the issue of the maintenance of the road to Kumba Geosciences, which together with Ringside currently maintain portions of the road. It was requested that Kumba personnel go and meet with Mr Loubser to discuss the issue. It was indicated that the groundwater model will be updated once more information becomes available. The need for a cumulative impact asssessment is noted and this has been recommended as a condition of the authorisation.	Not finalised Kumba to meet with Mr Loubser to discuss the issue of maintenance of the road.

DATE	NAME	CORRESPONDENCE RECEIVED	EAPs RESPONSE TO ISSUES AS MANDATED BY THE APPLICANT	CONSULTATION STATUS (consensus, dispute, not finalised, etc.)
			With respect to the process. The process followed is for environmental authorisation of listed activities and the EMPr is per the required format required for the authorisation of such activities. The reports also support as motivation for authorisation in terms of Section 102 of the MPRDA. It is agreed that there is a need for consolidation of EMPr at Kolomela and Kumba will discuss this process with the DMR.	
Local Authorities No comments received				
Traditional Leaders No comments received yet.				
Competent Authorities affected No comments received yet.				
Organs of state (Responsible for infrastructure that may be affected Roads Department, Eskom, Telkom, DWA etc.)				
19 March 2018	Albertus Viljoen Tshiping WUA	1) Will you please make electronic copies available?	A copy of the report was sent to Mr Viljoen via WeTransfer, as requested. An electronic copy was also given to Mr Viljoen on a flash drive at the public meeting on 11 April 2018.	Finalised
13 April 2018	Albertus Viljoen Tshiping WUA	NOISE 1) How is the international standard for noise been determined?	The international standard used has been determined by the IFC (World Bank). IFC, 2007. *General Environmental, Health and Safety Guidelines,* s.l.: s.n. Noise monitoring will be undertaken on annual basis to improve the baseline database. It is agreed that sampling should be more representative and future monitoring should include monitoring over an extended period.	Regular consultations to be held on updated information regarding groundwater impacts.

DATE	NAME	CORRESPONDENCE RECEIVED	EAPs RESPONSE TO ISSUES AS MANDATED BY THE APPLICANT	CONSULTATION STATUS (consensus, dispute, not finalised, etc.)
		2) To do a once off sound recording of 1 or 2 days is not representative of the areas baseline. Considering the wind directions, temperature, etc, I suggest that a baseline is established over at least a 7-day period during each season. GROUNDWATER 3) The impact of the dewatering should be done in conjunction with surrounding impacts of other mines. This cannot be done in isolation. 4) A reserve determination should be done and reviewed against the Tshiping WUA database. 5. Groundwater monitoring: a. Establish what aquifers are present. b. Depth specific monitoring on each aquifer and not water level monitoring of combined aquifers. c. Dip meter readings on a quarterly or annual basis is not sufficient. Logger installations should be done to have a continuous time serious on how water levels react. d. Loggers should be installed together with rain meters and ground moister loggers to determine the recharge available in the mine area. 6) The forecasted area of 38km² should be monitored as mentioned above to register early changes in aquifers.	A cumulative impact assessment is to be undertaken that includes other operations. This has been included as a mitigation measures and recommended condition of the authorisation. The reserve determination has been compiled by DWS. The Tshiping WUA database is to be considered when application is made for a water use licence. Boreholes are currently planned for the testing of aquifers and will provide more information on the aquifers present. Once the aquifers are better understood it is agreed that depth specific monitoring per aquifer should be considered. This has been included in the mitigation and monitoring proposed. Loggers will be installed at selected boreholes and rainfall is already monitored at Heuningkranz. The monitoring programme will give cognisance to the location of geological structures. The option of aquifer recharge has been included as a mitigation measure and a recommended conditionof the authorisation.	

DATE	NAME	CORRESPONDENCE RECEIVED	EAPs RESPONSE TO ISSUES AS MANDATED BY THE APPLICANT	CONSULTATION STATUS (consensus, dispute, not finalised, etc.)
		7) Water levels in known geological structures should be monitored as well. 8) Export of dewatered groundwater should be prohibited, to offset the impact of existing mine dewatering. This should be done as a condition in the WULA. Excess water can be used for recharge and be made available to local communities and infrastructure. 9. A complete review of the WULA will be done by Tshiping WUA when submitted.		
INTERESTED PARTIES				
2 November 2017	Willie Uys (see Appendix B6 for original submitted in Afrikaans and minutes of meeting in Appendix B5.1)	1) What is the goal and how will inputs into the meeting be handled further? 2) How will feedback be given? We have experience that no feedback was given on the expansion of Sishen's Water Use Licence. 3) There is mistrust as to how Kumba handles water problems. At Sishen, complaints disappear and are not handed to the Department of Water during audits. Certain assumptions are taken as fact and implemented as fact e.g. impermeable structures, blockage of boreholes, too far from the mine without taking into account the topography and the ground formations.	The aim of the meeting was to inform interested and affected parties of the proposed project and the legal processes to be followed to obtain authorisation of such a project. The purpose is to collate issues and concerns for consideration in the studies. Feedback will be given at a follow-up public meeting and persons will be given an opportunity to review the impact reports as well as supporting specialist reports. There is a memorandum of understanding in place between Kolomela Mine and surrounding landowners with respect to the investigation and agreement on compensation.	The EIA and Specialist Reports were provided to Mr Uys for comment and review. Additional comments have been provided by Mr Uys for consideration in the authorisation process.

DATE	NAME	CORRESPONDENCE RECEIVED	EAPs RESPONSE TO ISSUES AS MANDATED BY THE APPLICANT	CONSULTATION STATUS (consensus, dispute, not finalised, etc.)
		4) The feeling is that complaints are handled in such a way to prove that the mine is not affecting the farm rather than trying to identify the problem e.g. Floradale. 5) There is currently research being undertaken by Dr Keven Petersen driven by Agri Northern Cape motivated by the various differences in findings by specialists. Is it not necessary to first look at the outcomes of such a study before decisions are taken regarding Heuningkranz. The results will be available in November. 6) There needs to be a proper water balance study undertaken in the region before a water use licence is considered. There is no such study and the law requires this. This is required as the amount of water available is not known and there is already a lot of water taken. There is already a plan to pump the water away. 7) Before large scale dewatering commences there must be a thorough database of water sources in the area. This database must include information on depth, strength, water levels and the date the borehole was drilled. There are already disputes as to when a borehole is impacted on – is it the water level or the yield. 8) The region has a history of water problems as a result of dewatering by the mine. 9) The boreholes at Heuningkranz did dry up previously as a result of dewatering activities at Heuningkranz. The boreholes had to be drilled deeper.	There is also a formal complaints procedure in place and aggrieved persons log complaints via the procedure. The study being undertaken by Dr Petersen is acknowledged and if available within the time frames of the EIA process the findings will be taken into consideration. Mr Uys is requested to assist us with updates as to when the document will be available. There is a reserve calculation for the catchment determined by the DWS. The DWS as the custodian of water is the responsible authority for determining the fate of water in the region. There is an extensive database available on the boreholes in the area and these are monitored by Kumba as part of a regional hydrocensus with water levels checked at least annually. The issues regarding when a borehole is impacted on has been dealt with in the memorandum of understanding between Kumba and surrounding landowners. Mr Uys is referred to Mr Jaco Lambrechts, the Environmental Section Manager at Kolomela, should he require more details on this memorandum. It is known that the dewatering activities are impacting on boreholes as has been predicted in studies undertaken.	

DATE	NAME	CORRESPONDENCE RECEIVED	EAPs RESPONSE TO ISSUES AS MANDATED BY THE APPLICANT	CONSULTATION STATUS (consensus, dispute, not finalised, etc.)
		10) Boreholes drilled for the purpose of the developing the iron ore export line at Wildealsput also dried up. 11) Soetfontein, Ploegfontein and Klipbankfontein water are drying up. 12) Kolomela is pumping Beeshoek dry. 13) Some boreholes on farms in the vicinity of Kolomela are drying up. 14) The Soutspruit, Heuningkranz wetlands. 15) It is not far enough to stay 250 m away from a wetland if you dewater. That is what the law prescribes. The density of the wetland floor can't be confirmed. The amount of water abstracted is more important than the distance from a wetland. Is there going to be a second Gamagara issue? 16) Before an application for a water use licence is made there must first be discussions with the CMA. 17) The conditions of the licence need to be investigated and explained.	Note that since the planned activities at Heuningkranz will only commence in 2031, the current applications do not include a water use licence application. The focus of the applications is on including Heuningkranz into the Kolomela Mining Right in order that Kumba can secure the rights for future mining. The comments regarding the water use licence consultations and conditions are noted but are not of relevance to the current work undertaken and will be addressed at a later stage when the water use licence application is submitted.	
2 November 2017	Thembi Nikani (see minutes of public meeting in Appendix B5.1)	Raised concern about the venue of the public meeting being outside of town and thus some people could not attend.	Noted. George Benjamin of Kumba will be asked to assist with setting up meeting/s to discuss social issues regarding the project in particular. Future meetings on the project will be held in town.	Feedback meeting was held at the NG Church Hall in the centre of town . .
		Disagreed that the project would create new jobs.	The project will create jobs during the construction phase and the positions at Kolomela will be extended by 14 years thus jobs will be sustained.	Not finalised

DATE	NAME	CORRESPONDENCE RECEIVED	EAPs RESPONSE TO ISSUES AS MANDATED BY THE APPLICANT	CONSULTATION STATUS (consensus, dispute, not finalised, etc.)
			The issue raised stems from broader issues related to employment at Kolomela Mine which are being looked at by Kolomela's Social Specialist. Kolomela has SLP commitments with respect to upskilling the members of the community. The project will only commence in 2034 thus there is an opportunity for persons to ensure that they are prepared and take advantage of the opportunity that will be made available at that time.	Meetings to be held to address in particular social issues in town. George Benjamin's input and involvement is required.
11 April 2018	Willie Uys (see Appendix B6 for original submitted in Afrikaans and minutes of meeting in Appendix B5.2)	1.) Expressed concern regarding the existing and further cumulative impact of dewatering by the mines on groundwater availability in the region. 2.) A regional water balance is to be undertaken to determine how much water is available, what percentage is being abstracted, what happens to the water and what is the sustainability of the aquifer systems. 3.) Expressed concern regarding the transport of water away for use outside the region by Sedibeng Water. 4.) Requested that recharge into the aquifer be considered. 5.) Requested that parties need to work together. Concern that landowners have to accept findings and that their side in the situation is not given due consideration. 6.) Requests that DWS does not allow for water from the dewatering activities at Heuningkranz be taken out of the region.	An application for a water use licence will be made closer to the time of implementation of the project, should environmental authorisation be issued. It is agreed that it is necessary to consider the cumulative impact of Heuningkranz with other mining operations in the region. The requirement for such a study to be undertaken prior to the application for a water use has thus been added as a condition in this report. It is understood the Tshiping are currently undertaking a study to determine the regional water use in the area. SIOC cannot take responsibility for decisions made by the DWS to use the mining operations as a source of water for water supply schemes. Investigation into opportunities for aquifer recharge are to be considered by the project and this is included in the mitigation identified in this report.	Regular consultations to be held on updated information regarding groundwater impacts.

DATE	NAME	CORRESPONDENCE RECEIVED	EAPs RESPONSE TO ISSUES AS MANDATED BY THE APPLICANT	CONSULTATION STATUS (consensus, dispute, not finalised, etc.)
		7.) Requests Kolomela Mine and Tshiping WUA to collate information on the water resources in the area including test on water supply.	Kolomela has indicated that they will make note of all water supply infrastructure and water use of neighbours to Heuningkranz in the manner that they did for Kolomela. Data will be collected on water use at each site, however pump tests cannot be carried out at every water supply point.	
11 April 2018	Johan Viljoen (see minutes of meeting Appendix B5.2)	The option of aquifer recharge is to be considered with water from dewatering placed in an aquifer recharge project.	The requirement for the investigation into the possibility of aquifer recharge has been indicated as a mitigation requirement in the EIA and EMPr. SIOC has committed to investigating aquifer recharge for Heuningkranz.	Finalised

8. THE ENVIRONMENTAL ATTRIBUTES ASSOCIATED WITH THE DEVELOPMENT FOOTPRINT ALTERNATIVES

8.1 Type of baseline environment affected by the proposed project

8.1.1 Climate

Wind fields recorded from Heuningkranz weather station are dominated by winds from the north-west (see Figure 8-1). The strongest winds (>7 m/s) are also from these directions. Calm conditions occurred for less than 1% of the time, with the average wind speed being 5.2 m/s. During the day the predominant wind direction are predominantly from the north west. At night winds tend to blow from the north and north north east. Wind direction and speed is important as it contributes to the dispersion of pollutants originating from activities at the site.

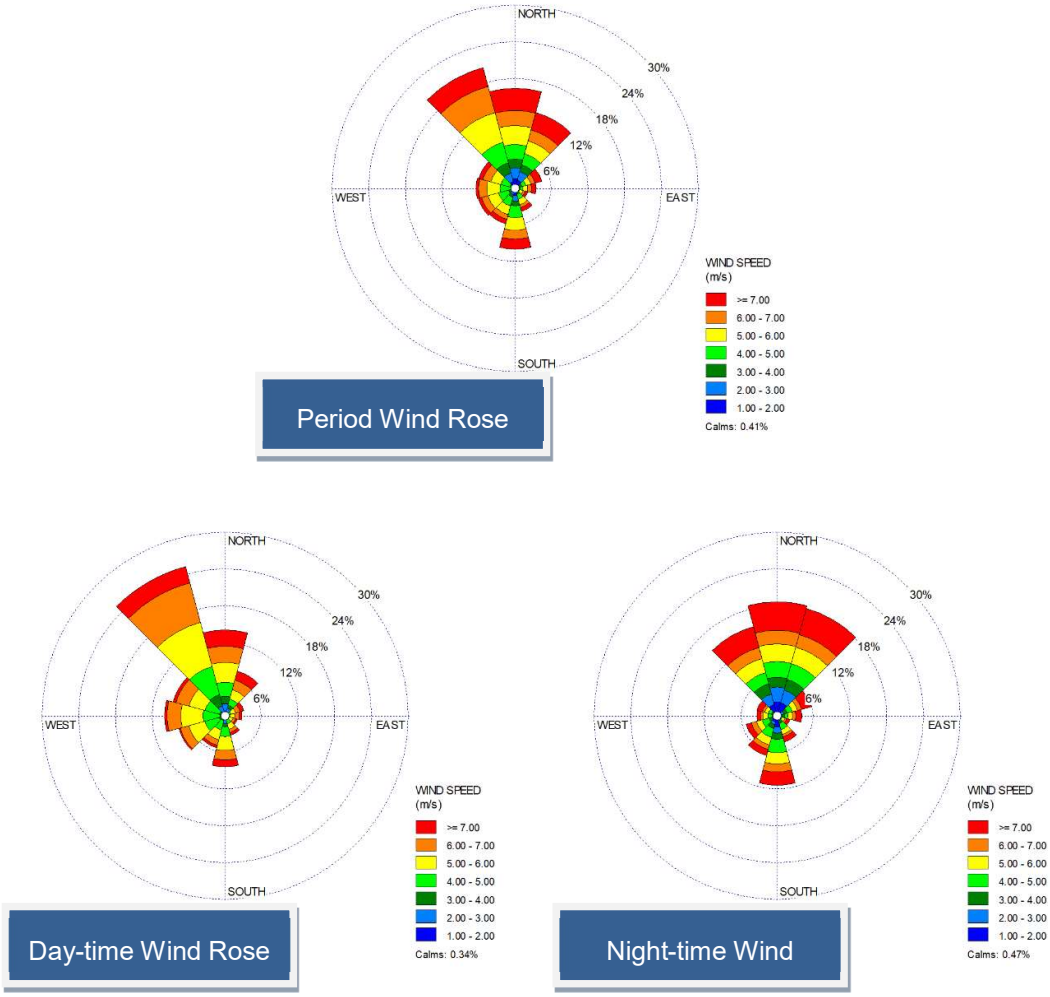
Air temperature is also important as it also affects the potential for air pollutants to be dispersed due to buoyancy, and the potential for the development of mixing and dispersion layers (see Airshed Planning Professionals[1] (February 2018). Monthly mean and hourly maximum and minimum temperatures are given in Table 8-1. Temperatures range between -8.1 °C and 41.4 °C. The highest temperatures occur in December and the lowest in July.

TABLE 8-1: MONTHLY TEMPERATURES SUMMARY FOR HEUNINGKRANZ

Hourly Minimum, Hourly Maximum and Monthly Average Temperatures (°C)												
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Minimum	10.0	9.4	3.6	2.0	-1.1	-5.1	-8.1	-6.3	-0.8	1.8	4.8	10.9
Maximum	41.4	37.2	35.7	34.1	28.1	26.3	26.9	31.7	35.9	39.0	39.3	39.5
Average	25.0	24.5	22.1	18.0	14.0	10.7	10.1	13.9	17.3	22.2	23.8	27.1

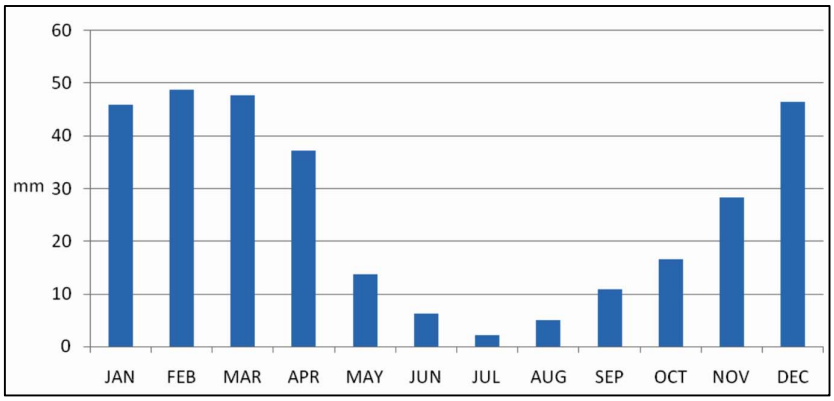
Source: Airshed Planning Professionals[1] (February, 2018)

Precipitation and evaporation are important, as it determines storm water management requirements on the site. There is no ambient rainfall data available from the Heuningkranz weather station. Postmasburg occurs within a low rainfall area (see Figure 8-2) with a mean annual rainfall of approximately 285 mm. Rainfall is highly unpredictable with most rainfall occurring between November and April. The rainfall usually falls as a result of thunderstorms when tropical thunderstorm activity extends southwards over the Kalahari. Mean annual evaporation (2 450mm) is higher than annual rainfall (332 mm), which results in a major net moisture deficit of over 2 000 mm throughout the year.



Source: Airshed Planning Professionals[1] (February 2018)

FIGURE 8-1: PERIOD, DAY AND NIGHT-TIME WIND ROSES FROM HEUNINGKRANZ WEATHER STATION (MAY 2015 – AUGUST 2017)



Source: Synergistics (2015)

FIGURE 8-2: RAINFALL STATISTICS (POSTMASBURG WEATHER STATION – 1917 TO 1991)

8.1.2 Topography

Heuningkranz lies within the Griqua Fold Belt with the Langberg/Korana Mountains being the most prominent landform in the area. A series of topographical ridges run from north to south, reaching an elevation of 1 540 masl in the Langberg, approximately 18 km west of Heuningkranz. This is approximately 290 m above the surface level at the centre of Heuningkranz which is at 1 250 masl. The fold belt also presents as a prominent koppie in the south eastern section of Heuningkranz at an elevation of 1 386 masl. The site is characterised by ephemeral drainage running from the north east (1 260 masl) to the south west (1 238 masl) of the site. The prominent topographical features are shown in Figure 8-3.

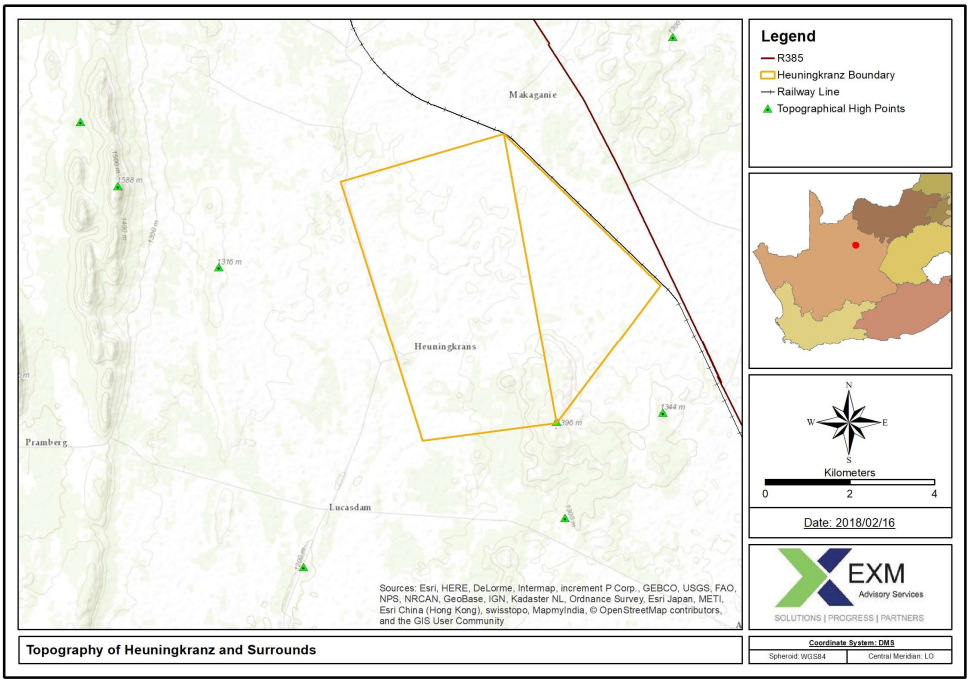


FIGURE 8-3: TOPOGRAPHY OF HEUNINGKRANZ AND SURROUNDS

8.1.3 Geology

The description of the geology has been extracted from the Geohydrological Report (Groundwater Complete, January 2018), see Part C – Appendix 1.

A geological map of the Heuningkranz area is given in Figure 8-4.

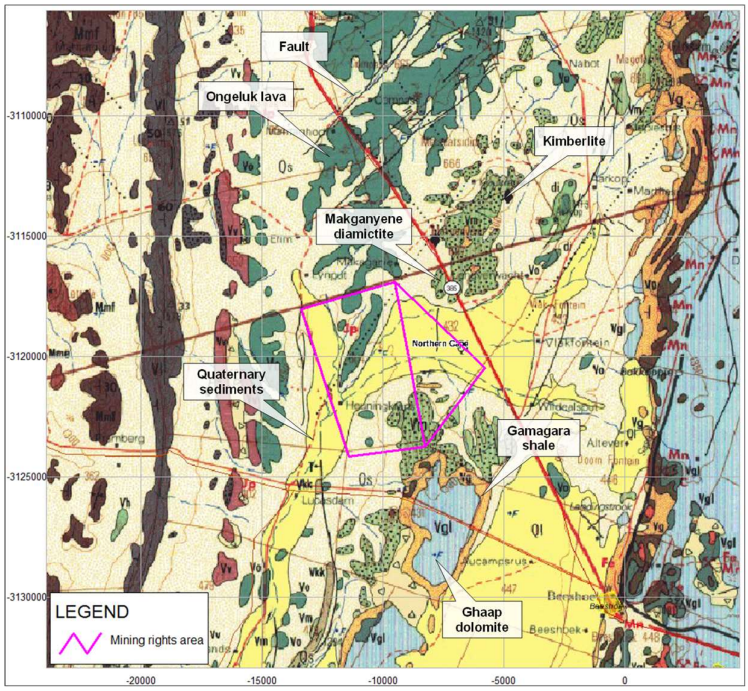
The Sishen, Kolomela and Heuningkranz deposits are situated in the vicinity of the Maremane Dome. The Campbellrand Subgroup carbonates form the basement to the Asbestos Hills Subgroup in the area. The chert-breccia unit (Wolhaarkop Formation), comprising angular to sub rounded chert fragments in a grey-brown chert matrix, unconformably overlies the carbonates. The breccia is thought to be the result of solution collapse and cavity formation within the underlying dolomites. With the collapse of the underlying dolomite, the overlying chert broke-up and accumulated in the cavity.

The banded iron formations (BIF) within the area belong to the Kuruman Iron Formation and have locally been named the Manganore Iron Formation. The formation represents remnants of the Asbestos Hills Subgroup that slumped into sinkhole structures in the Campbellrand dolomites during a hiatus preceding the deposition of the Gamagara Formation

South of Postmasburg the iron formations of the Asbestos Hills Subgroup are overlain by mixed chemical and clastic sediments of the Koegas Subgroup. The Koegas Subgroup is conformably overlain by the diamictite of the Makganyene Formation, upon which the lavas of the Ongeluk Formation have been subaqueously extruded.

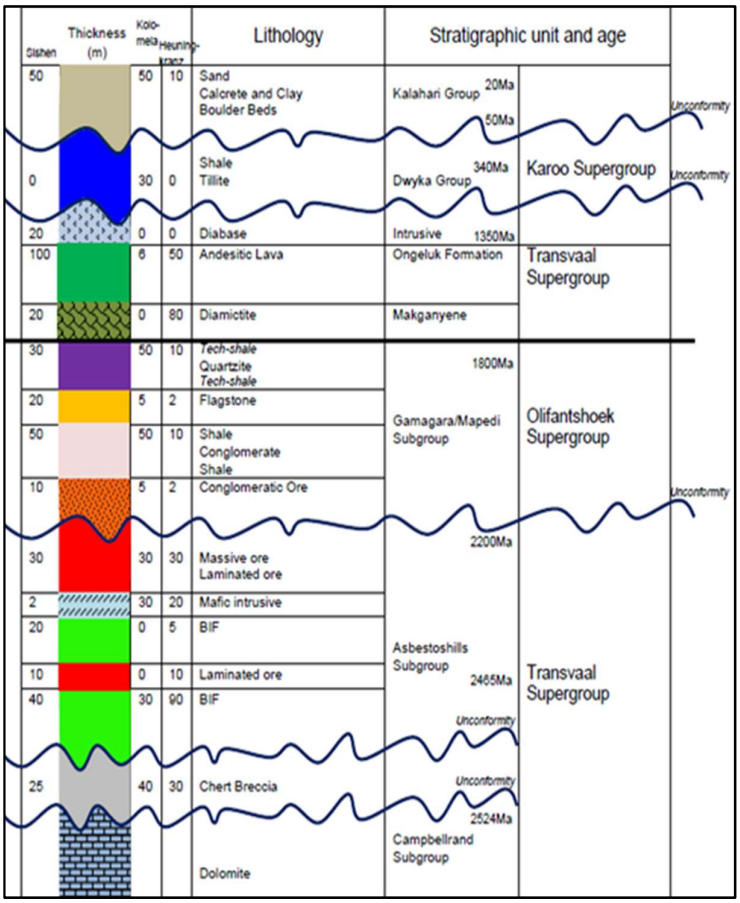
Within the Kolomela deposits, the Postmasburg Group rocks fill synclinal basins around the Wolhaarkop Dome, having been thrust onto the Gamagara Formation. A clastic succession of conglomerates, shales, flagstones and quartzites of the Gamagara Formation was deposited above an uncomformity surface formed on the upper part of the Asbestos Hills Subgroup. This unit has been correlated with the Mapedi Formation and constitutes the lowermost unit of the Olifantshoek Supergroup, which is the old recognised red-bed sequence in the region.

The Heuningkranz deposit is characterised by the absence of the Dwyka tillite, thick Ongeluk lave or Makganyene Diamictite cover and poorly developed Gamagara sequence unconformably overlying the Transvaal Supergroup. Commonly the Gamagara Formation overlies a thin BIF intersection, followed by 5-10 m intervals of interlayered hematite and BIF (see Figure 8-5).



Source: Groundwater Complete (January, 2018)

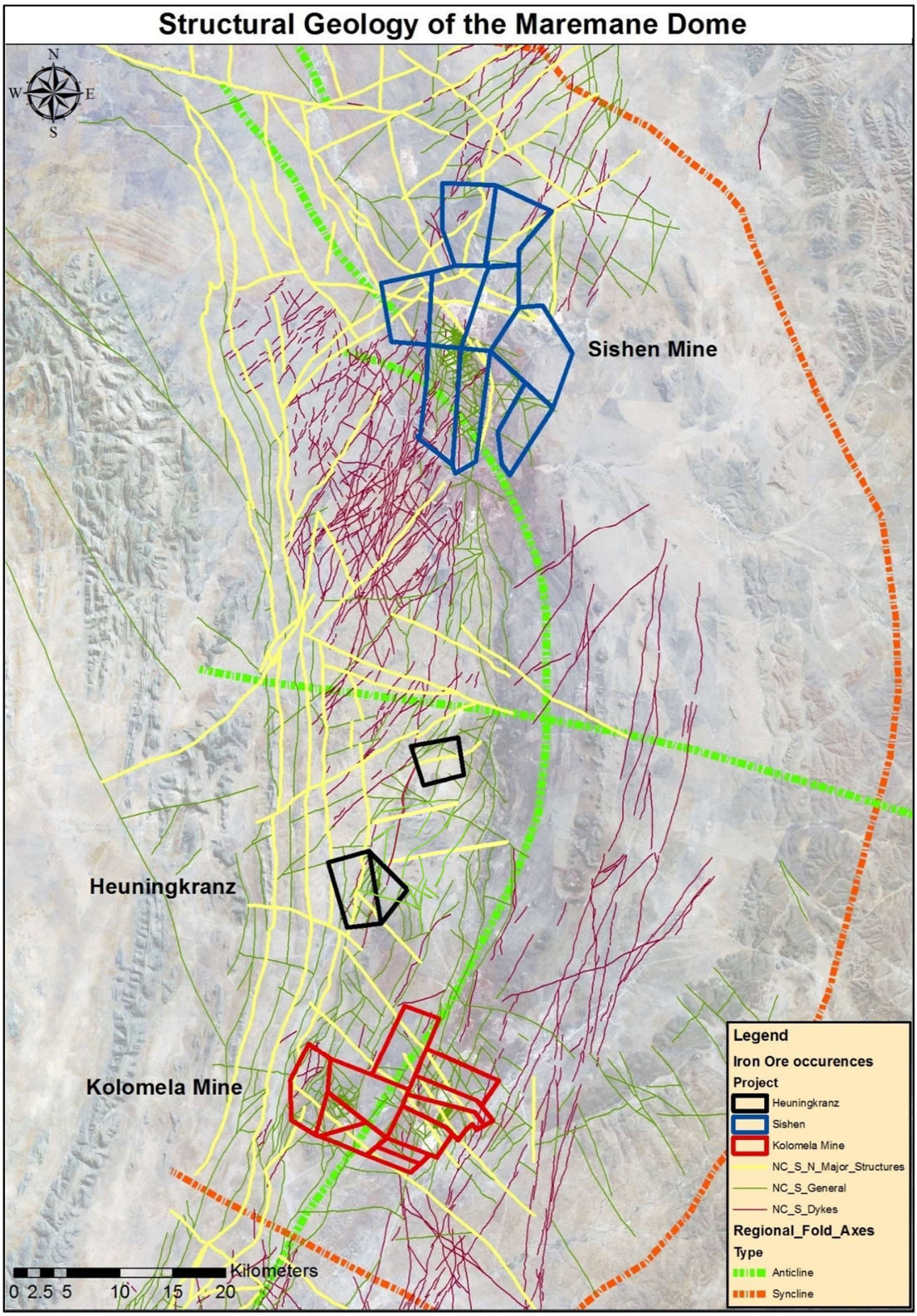
FIGURE 8-4: GEOLOGICAL MAP OF HEUNINGRANZ



Source: Groundwater Complete (January, 2018)

FIGURE 8-5: SIMPLIFIED STRATIGRAPHY OF THE POSTMASBURG AREA

Dykes and faults occur widespread throughout the mining areas (see Figure 8-6).



Source: Groundwater Complete (January, 2018)

FIGURE 8-6: STRUCTURAL GEOLOGY OF THE MAREMANE DOME

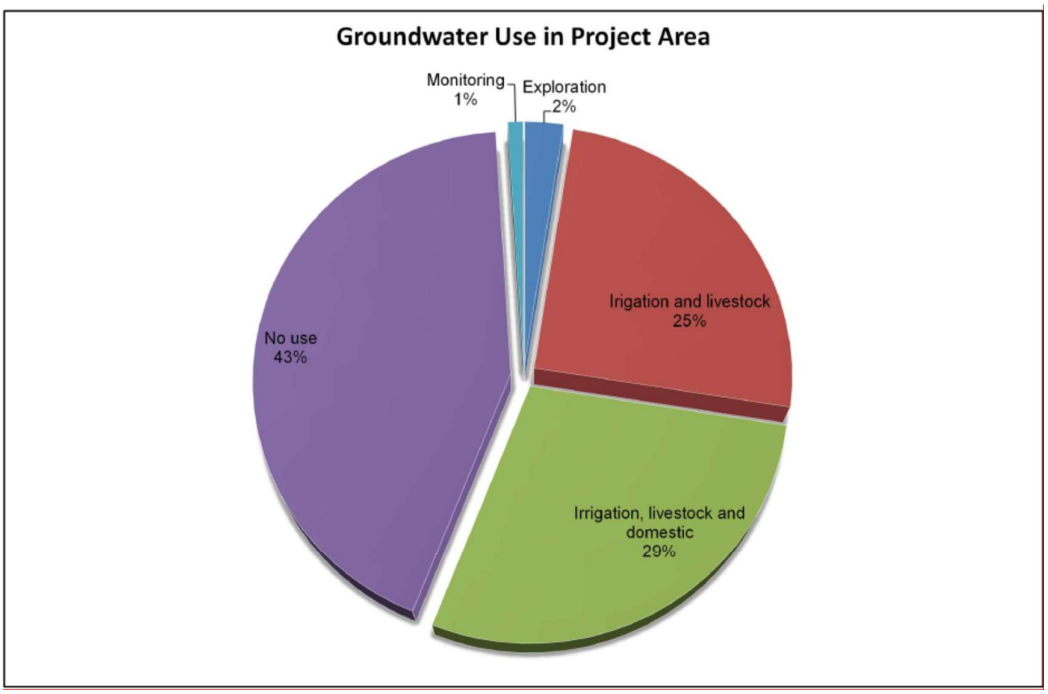
Numerous faults and/or igneous intrusions (dykes) occur throughout the project area and are of significant importance to the geohydrology. Open faults, fractures and/or discontinuities have the potential to act as preferred pathways along which groundwater and potential contamination may flow at increased rates. Dykes may effectively act as barriers for the flow of groundwater, consequently forming groundwater compartments.

8.1.4 Groundwater

The description of the groundwater environment has been extracted from the Geohydrological Report (Groundwater Complete, January 2018), see Part C – Appendix 1.

8.1.4.1 Groundwater Use

Groundwater is the sole source of water supply for all intents in the Heuningkranz area. A pie chart of groundwater use distribution for the area is presented in Figure 8-7. Some 54% of boreholes identified in the area are used for domestic purposes, livestock water and irrigation.



Source: Groundwater Complete (January, 2018)

FIGURE 8-7: GROUNDWATER USES IN HEUNINGKRANZ THE PROJECT AREA

8.1.4.2 Groundwater Aquifers

Two possible aquifer types have been found present in the Heuningkranz area. The first aquifer is a shallow, double porosity, unconfined or semi-confined aquifer within the upper 2 to 20 meters of the geological profile. Farmers in the region use this aquifer widely for domestic and livestock water supply. Borehole yields in the calcrete aquifer generally vary from 0.2 to approximately 2 l/s. Extensive test work in the Groenwaterspruit water course indicated yields of up to 12 l/s where

alluvial deposits (e.g. gravel) or weathered calcrete (or other bedrock) occurs near surface. In the Soutloop watercourse the yields are relatively low at less than 2 l/s and occurred mostly in the weathered lava below the surface calcrete. Consideration of the shallow aquifer system is especially important in this study because the shallow, weathered zone is where base flow, discharge and interaction with surface water take place. Any contamination (seepage or leachate) at surface will affect this aquifer most directly.

The second aquifer is the deeper, secondary porosity aquifer that occurs at depths usually exceeding 20 meters below surface and is the main aquifer system in the area when it comes to mine dewatering or groundwater supply. The aquifer is mostly semiconfined but can be fully confined in some areas. Fracturing in the aquifer usually occurs in the chert breccia (Manganese Marker) banded iron formation and to a lesser extent the underlying dolomite. The yields in the aquifer may vary from 1 to more than 40 l/s. Fracturing is usually concentrated near the haematite ore bodies where mineralization and preservation of ore bodies occurred through folding, thrusting, fracturing and sinkhole formation/slumping. This aquifer system usually displays semiconfined or confined characteristics with piezometric heads often significantly higher than the water-bearing fracture position. The fractures may occur in any of the coexisting host rocks due to different tectonic, structural and depositional processes.

Recharge to the aquifer underlying the project area is believed to be in the region of 2.4% of the mean annual precipitation but can be higher. Where outcrop occurs or in areas where the soil cover is thin, the effective recharge percentage can be slightly higher. The effective recharge is expected to be lower or even zero in low-lying topographies where discharge generally occurs and thicker sediment deposition is present.

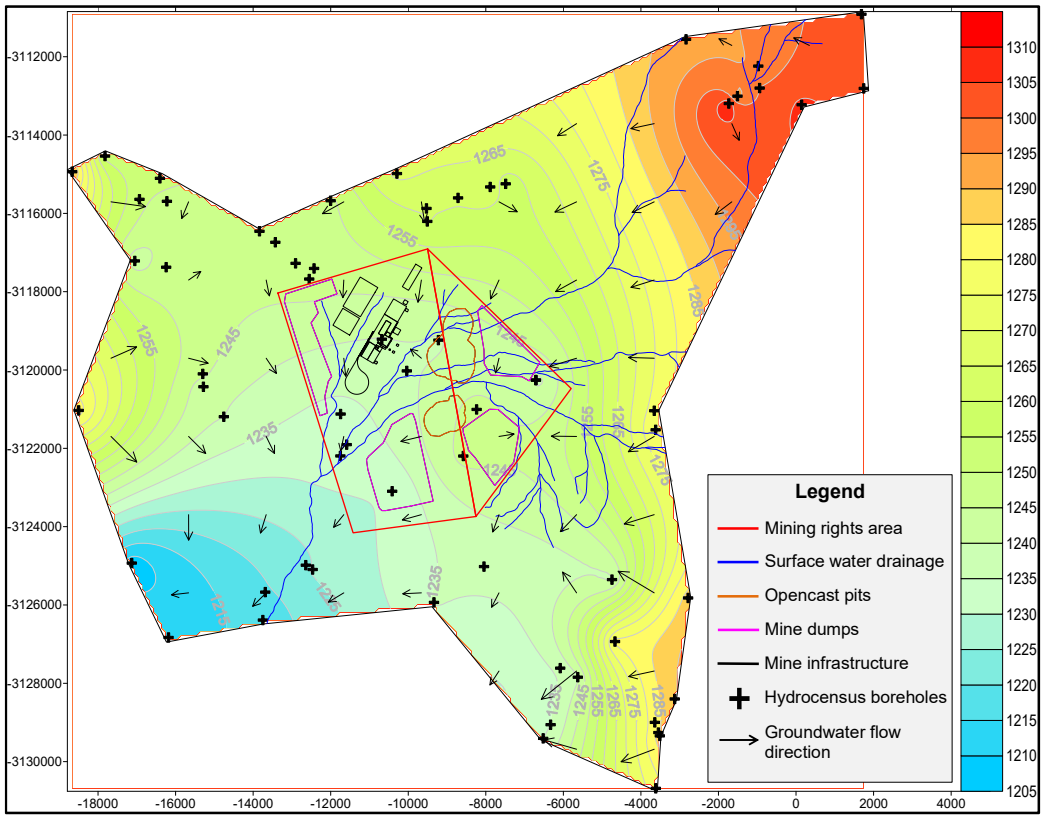
8.1.4.3 Groundwater Levels and Flow Direction

Static water levels in the project area (farm boundaries) mostly varied between 7 and 17 meters below surface (mbs) during the last few years. Water levels are deeper on the higher surface topographies and shallowest in the valley bottoms such as along the drainage areas. The shallowest water levels were measured in boreholes drilled in the Soutloop water course area and these levels were between 7 and 12 mbs. The following is ~1 m, and the unsaturated zone (the "space" for artificial recharge), has never been less than 7 m. The observation simply means that static (natural, steady state) water levels in the Soutloop watercourse in the Floradale area were deeper than 7 mbs over the last 9 years, which correlate 100% with the static levels in the same water course at Heuningkranz.

Groundwater abstraction for domestic purposes and/or farming related activities has already caused a lowering of the groundwater levels, however very localised. The average ambient

groundwater level depth is in the order of 10 meters below surface, while water levels in excess of 20 mbs are considered to be affected. Despite the localised impacts on groundwater levels, groundwater still follows the ambient flow directions (i.e. from north to south and north-east to south-west through the mining rights area).

A static groundwater elevation contour map is provided in Figure 8-8. The lowest measured static groundwater elevation of approximately 1 205 meters above mean sea level (mamsl) occurs in the down gradient groundwater flow direction towards the south/south-west, while the highest elevation of approximately 1 310 mamsl is found to the north-east of the study area. Groundwater flow directions are also indicated in Figure 8-8.



Source: Groundwater Complete (January, 2018)

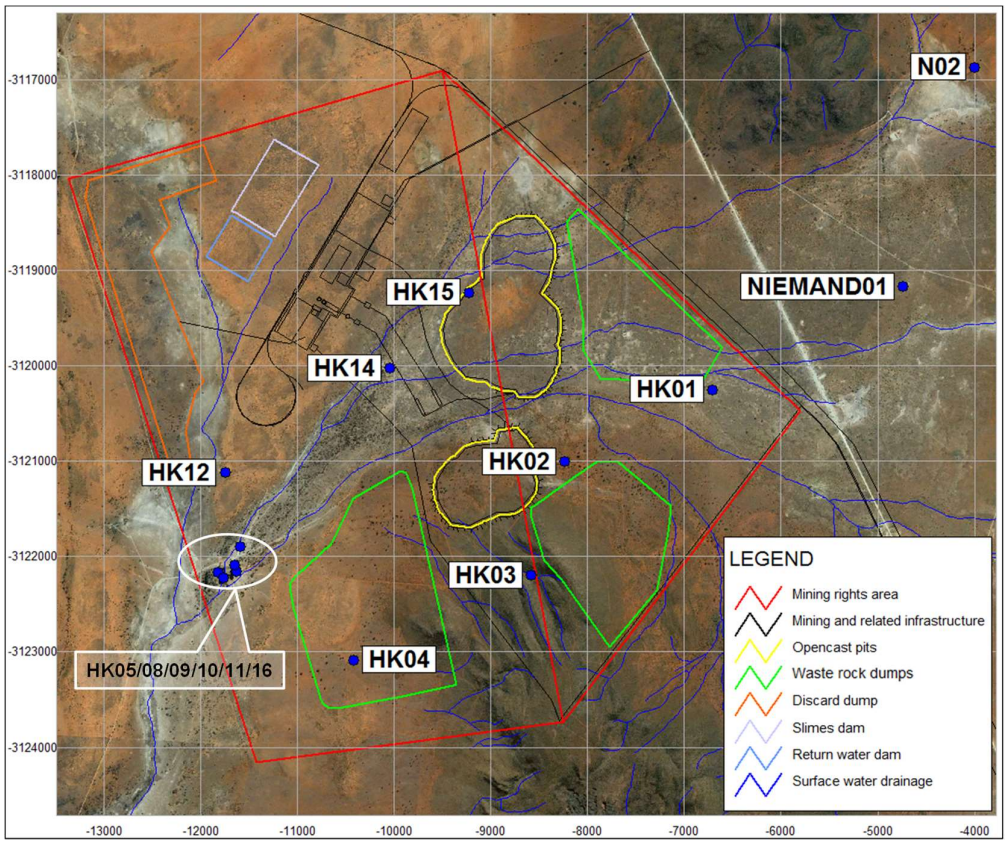
FIGURE 8-8: CONTOUR MAP OF GROUNDWATER ELEVATIONS (masl)

8.1.4.4 Groundwater Quality

Groundwater is generally considered to be of good quality according to the South African National Standards for drinking water (SANS 241: 2015) and groundwater from the majority of boreholes is suitable for human consumption, domestic use, livestock watering and irrigation. Groundwater total dissolved solids (TDS) concentrations measured in the site-specific groundwater user boreholes vary between 150 mg/l and 583 mg/l, which are well below the maximum permissible SANS value of 1 200 mg/l. Groundwater pH values vary from 7.9 to 8.7,

which are within recommended SANS ranges for drinking water purposes. The calcrete (calcium carbonate) found widespread throughout the project area is believed to be responsible for the slightly alkaline groundwater pH conditions.

Nitrate concentrations of nearly 12 mg/l and 11 mg/l were measured in boreholes HK02 and HK04 respectively (see Figure 8-9 for the location of the boreholes), which exceed the maximum permissible SANS value of 11 mg/l. Moreover, borehole NIEMAND01 displayed an even higher concentration of almost 16 mg/l. Since no mining occurs within the immediate vicinity of these three boreholes, the nitrate contamination is believed to originate from other sources. Therefore, in terms of drinking water, nitrate is the parameter of concern. The origin of the elevated nitrate levels is uncertain; however, it is believed that animal dung and urine with high nitrate content concentrated in kraals over many years is the most likely source.



Source: Groundwater Complete (January, 2018)

FIGURE 8-9: POSITION OF GROUNDWATER MONITORING BOREHOLES

Groundwater magnesium concentrations are relatively low and vary between ± 16 mg/l and 77 mg/l. There are no significant health risks associated with the intake of magnesium. However, there is the risk of diarrhoea, if consumed at very high concentrations (>200 mg/l). Boreholes display groundwater chloride concentrations of between approximately 14 mg/l and 65 mg/l, which are well below the maximum permissible SANS value of 300 mg/l. In terms of ammonium,

borehole HK16, had an ammonium concentration of 1.8 mg/l which was the only borehole that exceeded the maximum permissible SANS value of 1.5 mg/l. There was no reasonable explanation as to why this may be the case, as this borehole had only been sampled once.

Overall, groundwater is considered to be of good quality and also suitable for human consumption according to the SANS for drinking water (SANS 241:2015). Groundwater within the Heuningkranz farm boundary area is dominated by calcium and magnesium cations, while bicarbonate alkalinity dominates the anion content. The calcrete (calcium carbonate) found widespread throughout the project area is believed to play a significant role in the chemical composition of the groundwater, especially in terms of the bicarbonate content.

8.1.5 Air Quality

The description of the existing air quality environment has been extracted from the Air Quality Specialist Report (Airshed Planning Professionals[1], February 2018), see Part C – Appendix 2.

The region is characterised by being relatively dry, arid and dusty. Dust is the most important pollutant with existing mining operations in the area contributing to dust fallout and particulates (PM_{10} and $PM_{2.5}$). Local sources include wind erosion from exposed areas, fugitive dust from agricultural and mining activities, and vehicle entrainment from roads and veld burning. PM_{10} and $PM_{2.5}$ data have been recorded at Heuningkranz since May 2015 (see Table 8-2 and Table 8-3).

TABLE 8-2: SUMMARY OF PM_{10} CONCENTRATIONS FOR HEUNINGKRANZ

Year	Data Availability	NAAQS (µg/m³)	Annual average (µg/m³)	Highest daily average (µg/m³)	Number of exceedance of 75 µg/m³ (4 days allowed)
2015	59%	40	22	113	2
2016	81%	40	14	112	1
2017	62%	40	17	65	0

Source: Airshed Planning Professionals[1] (February 2018)

TABLE 8-3: SUMMARY OF $PM_{2.5}$ CONCENTRATIONS FOR HEUNINGKRANZ

Year	Data Availability	NAAQS (µg/m³)	Annual average (µg/m³)	Highest daily average (µg/m³)	Number of exceedance of 40 µg/m³ (4 days allowed)
2015	59%	20	6	35	0
2016	81%	20	6	31	0
2017	62%	20	6	22	0

Source: Airshed Planning Professionals[1] (February 2018)

The ambient air quality at Heuningkranz is in compliance with the NAAQS for PM_{10} and $PM_{2.5}$.

Dust fallout monitoring has been undertaken at Heuningkranz since July 2013. The position of the single bucket monitoring points is provided in Figure 8-10. Only the single bucket results are reported here, as the directional buckets can't be used for comparison with the National Dust Control Regulations.

In general, the baseline dust levels in the area exceed the residential standard of 600 mg/m^2/day which can be contributed to the dry environmental conditions. The monitoring results (see Figure 8-11) show that the following dust bucket locations are non-compliance with the National Dust Control Regulations for non-residential areas (exceed 1 200 mg/m^2/day either more than twice a year or in two consecutive months):

- 2013 – Lucasdam
- 2014 - Lucasdam and Putjie
- 2015 – Lucasdam and Putjie
- 2016 - Lucasdam and Putjie
- 2017 – Lucasdam, Putjie and Langverwacht.

It is expected that traffic along gravel roads contributes to the exceedances, with increases in prospecting activities in the area possibly resulting in more traffic that will contribute to dust fallout.

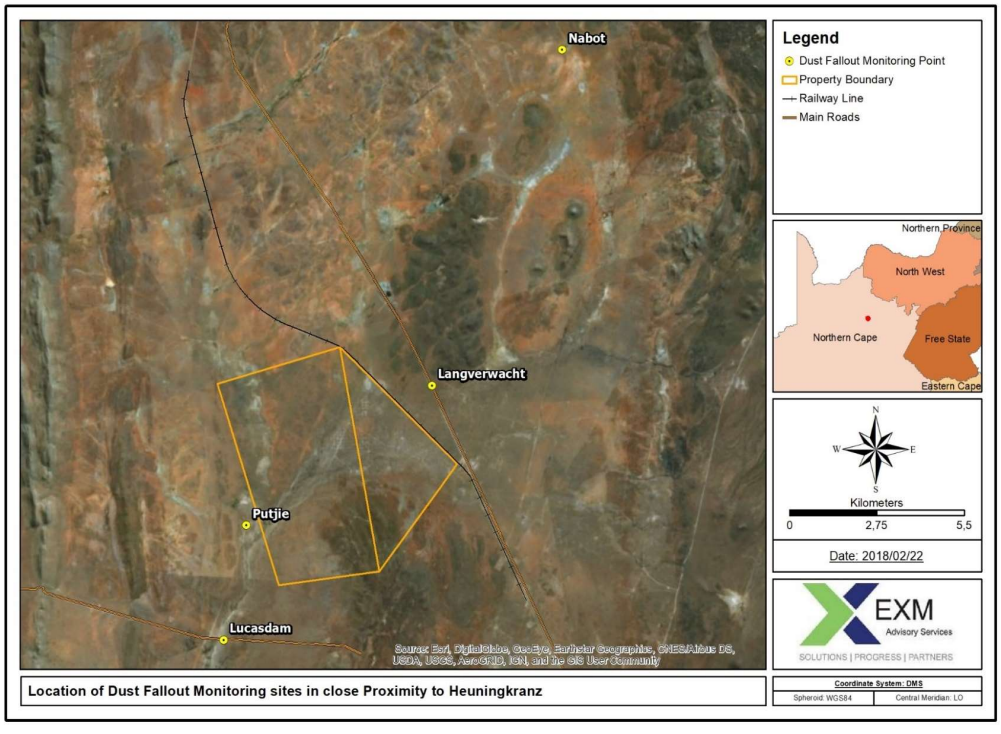
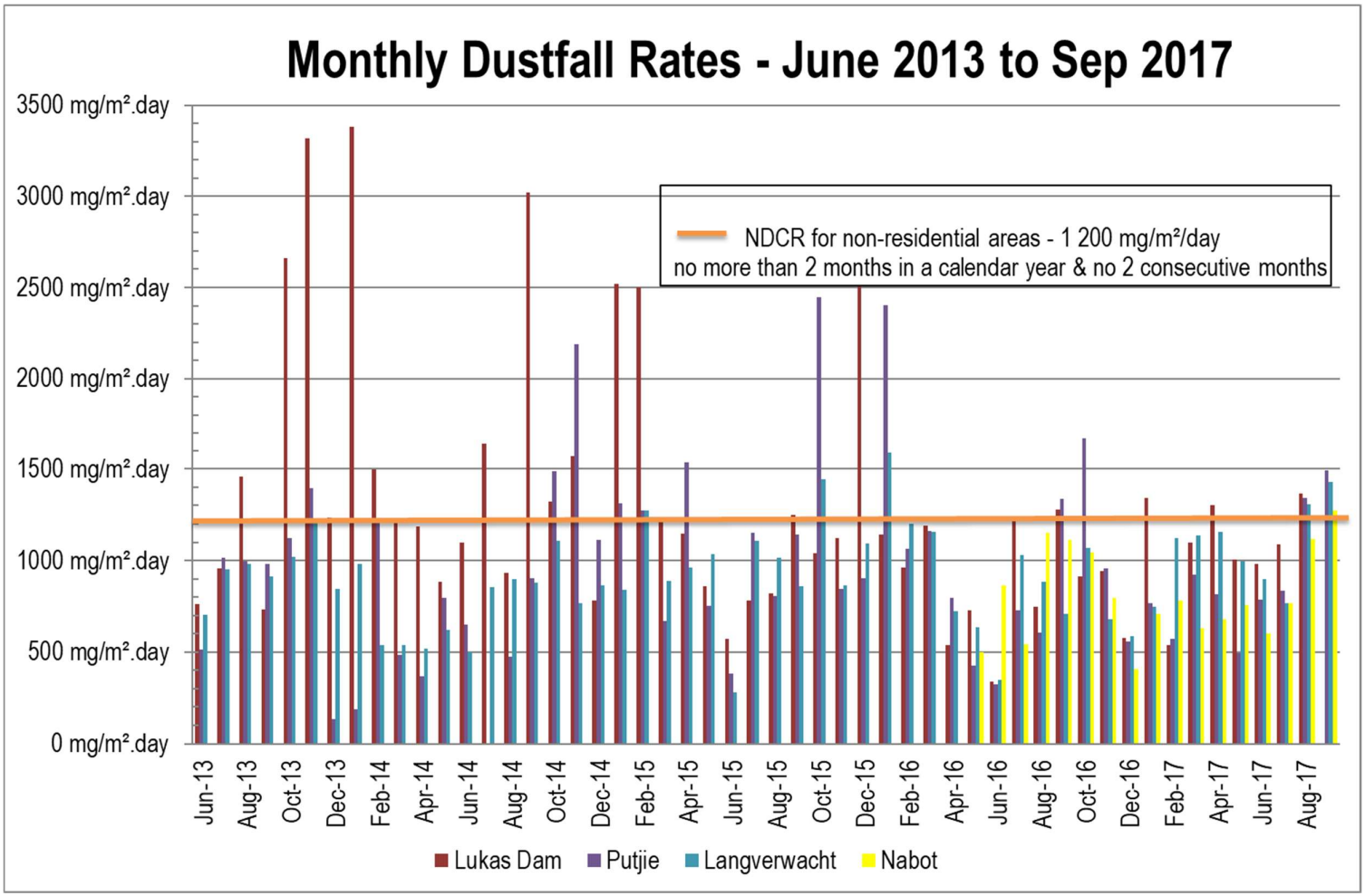


FIGURE 8-10: LOCATION OF DUST FALLOUT MONITORING POSITIONS (SINGLE BUCKETS)



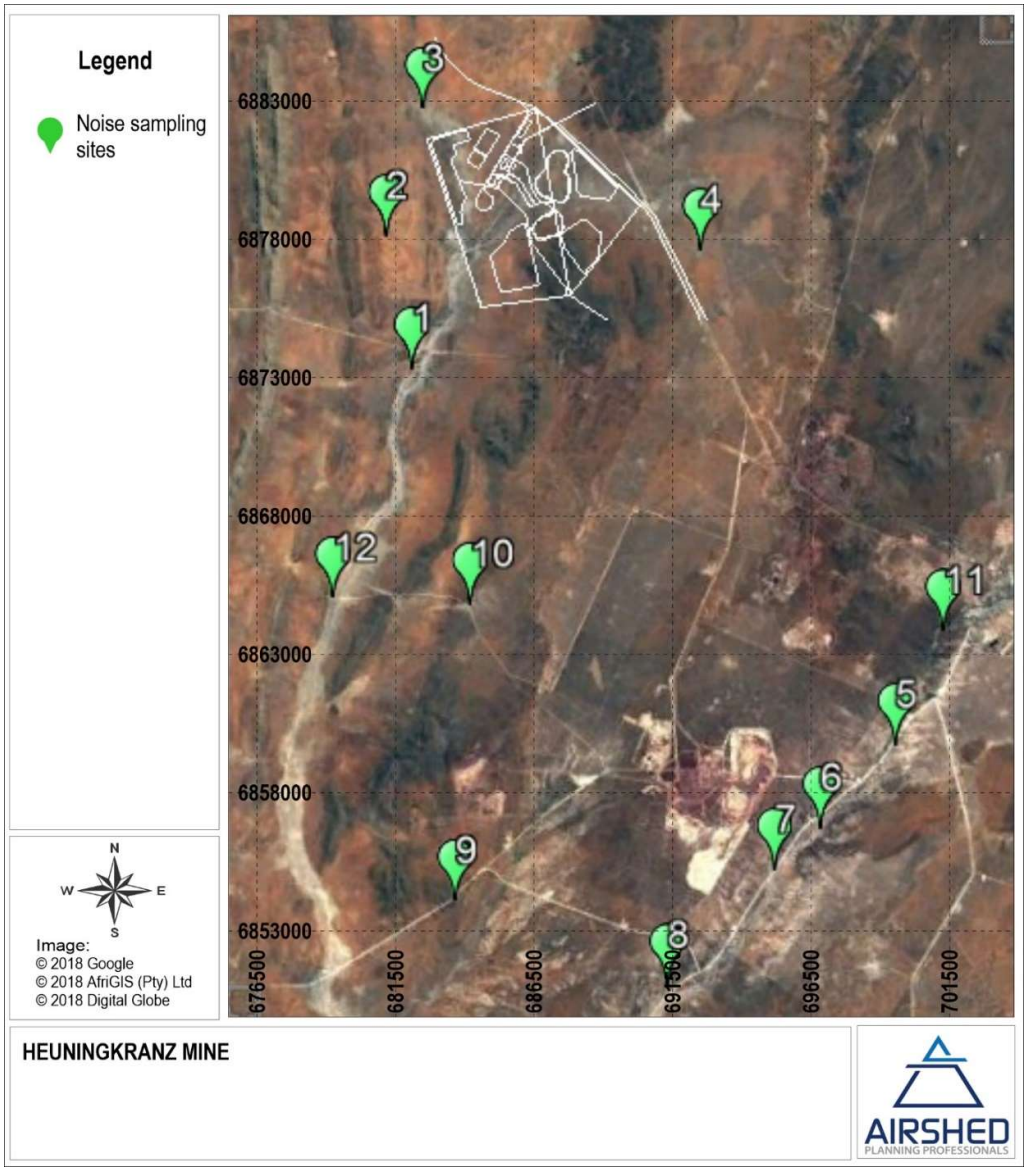
Source: Airshed Planning Professionals[1] (February 2018)

FIGURE 8-11: DUST FALLOUT RECORDED TO DATE AT HEUNINGKRANZ MONITORING SITES (SINGLE DUST BUCKETS)

8.1.6 Noise

The description of the existing ambient noise environment has been sourced from work undertaken as part of the Noise Specialist Study (Airshed Planning Professionals[2], February 2018), see Part C – Appendix 3.

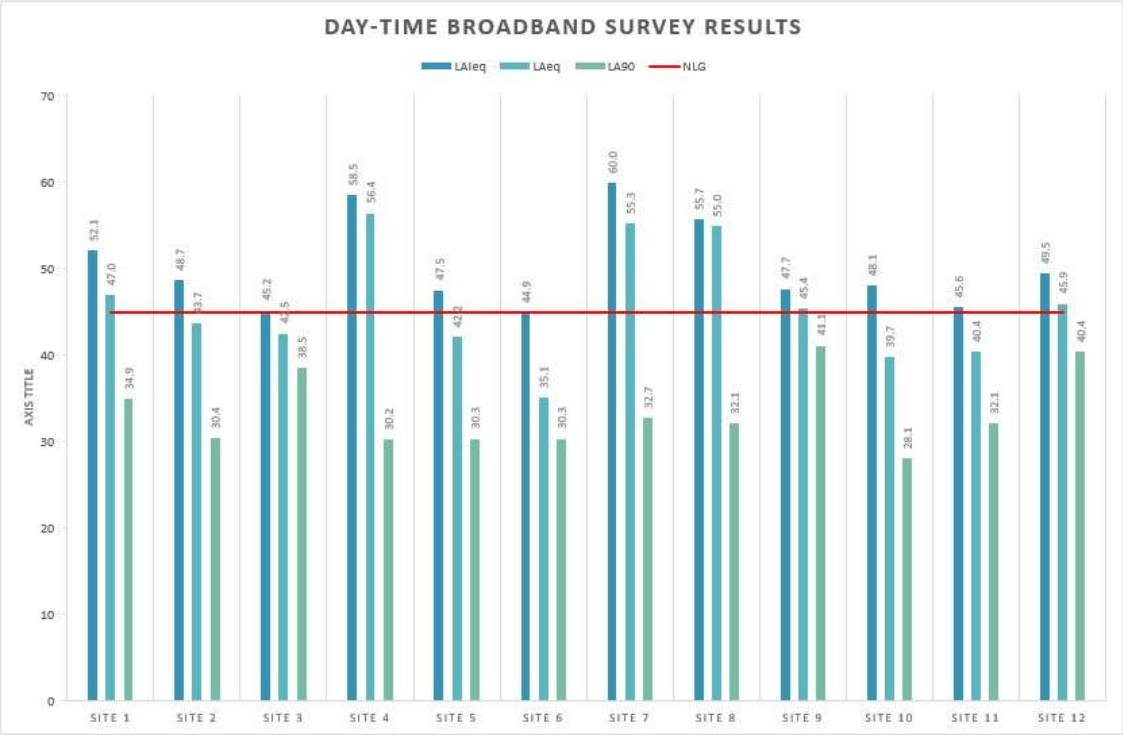
Ambient noise levels in the region are affected by traffic, trains, mining and prospecting activities and farming activities (animals and operating equipment). Day- and night-time noise measurements were taken for Heuningkranz on 20 and 21 November 2017, 24 and 25 January 2018 and 30 and 31 January 2018 at the twelve locations shown in Figure 8-12.



Source: Airshed Planning Professionals[2] (February 2018)

FIGURE 8-12: LOCATION OF THE NOISE SURVEY SITES

Recorded LA90, LAeq and LAIeq[1] during the day and night are presented in Figure 8-13 and Figure 8-14, respectively. During the day, the acoustic environment at all sites were influenced by birds, insects, frogs, some livestock such as sheep and chickens, and the local community. At night, Jackal were noted at site 12 and mining activities were audible at sites 6, 7, 8 and 11. Results are compared to noise level guidelines typically found in rural areas as per SANS 10103 (2008). Acceptable noise levels according to IFC guidelines for residential areas are 55 dBA[1] during the day and 45 dBA during the night.



Source: Airshed Planning Professionals[2] (February 2018)

FIGURE 8-13: DAY-TIME NOISE SURVEY RESULTS

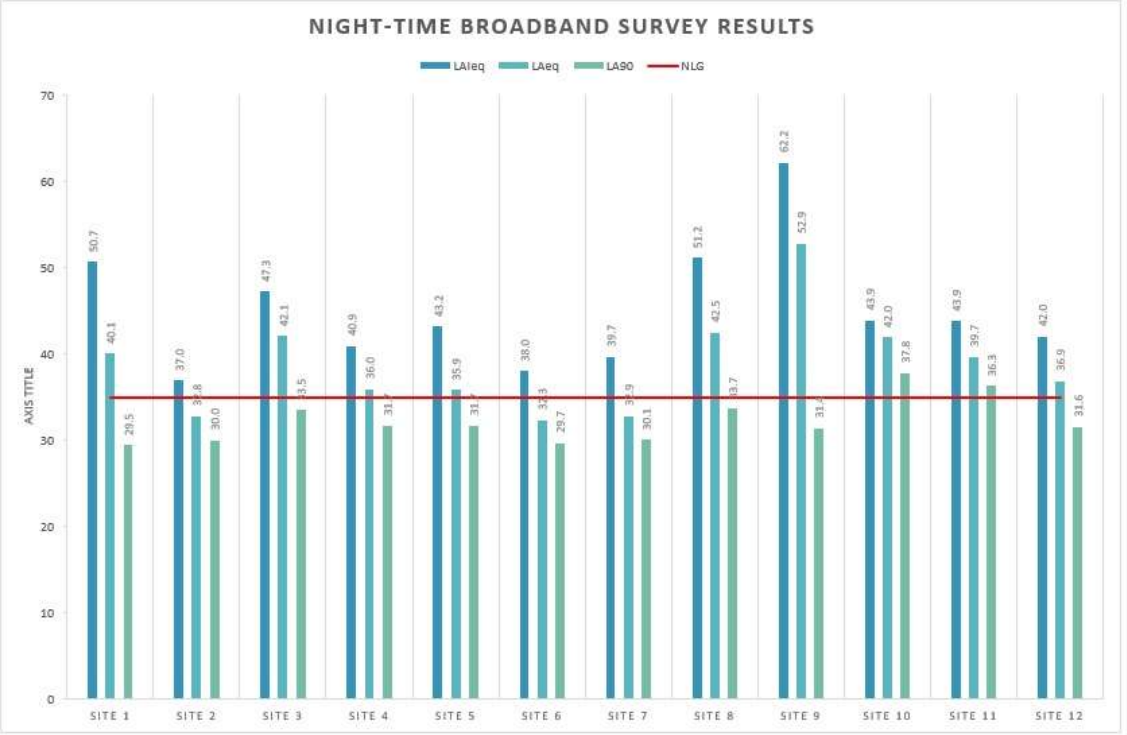
[1] Notes:

dBA - Descriptor that is used to indicate 10 times a logarithmic ratio of quantities that have the same units, in this case sound pressure that has been A-weighted to simulate human hearing.

LA90 - The A-weighted 90% statistical noise level, i.e. the noise level that is exceeded during 90% of the measurement period. It is a very useful descriptor which provides an indication of what the LAeq could have been in the absence of noisy single events and is considered representative of background noise levels (LA90) (in dBA)

LAeq - The A-weighted equivalent sound pressure level, where T indicates the time over which the noise is averaged (calculated or measured) (in dBA)

LAIeq - The impulse corrected A-weighted equivalent sound pressure level, where T indicates the time over which the noise is averaged (calculated or measured) (in dBA)



Source: Airshed Planning Professionals[2] (February 2018)

FIGURE 8-14: NIGHT-TIME NOISE SURVEY RESULTS

Figure 8-15 shows the assumed baseline noise levels at the different noise sensitive receptors. In order to illustrate the increase in ambient noise levels as a result of the project, the following background noise levels (based on the lowest survey measurement as a conservative approach) were used:

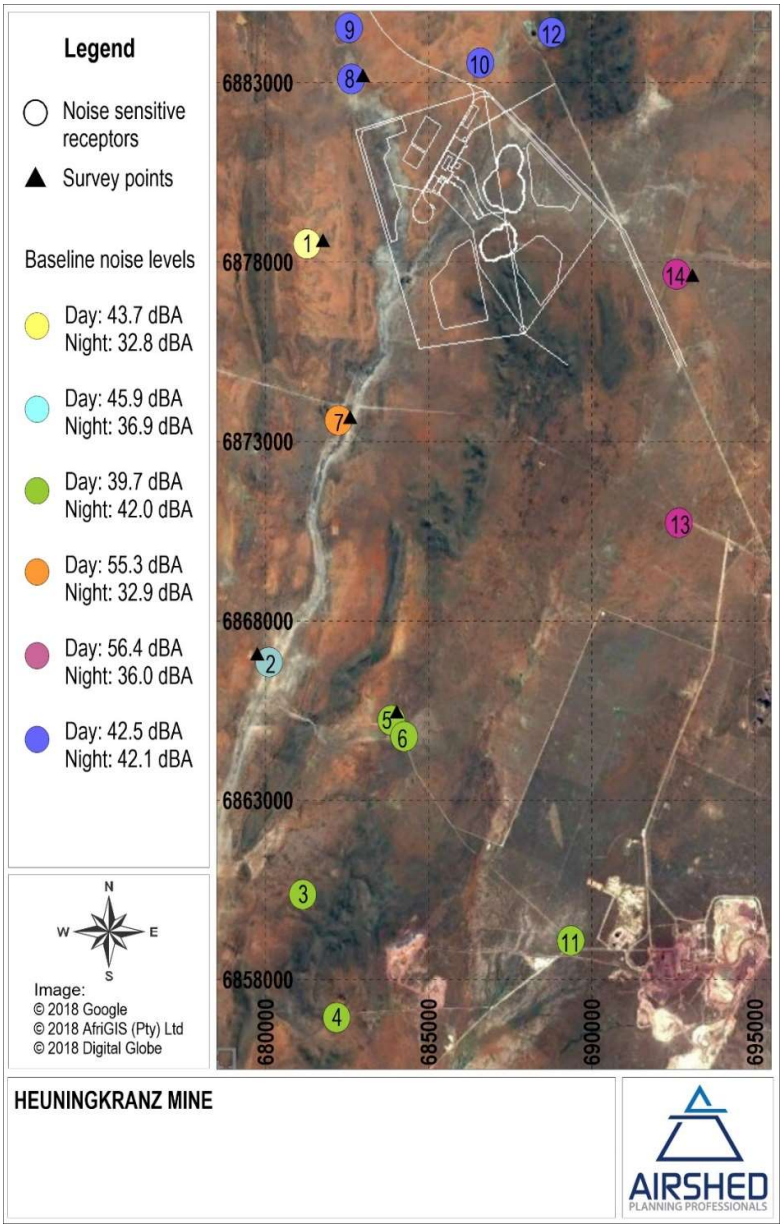
- LReq,d – 35.1 dBA;
- LReq,n – 32.3 dBA; and
- LR,dn[2] – 39 dBA.

[2] Notes

LReq,d - The LAeq rated for impulsive sound and tonality in accordance with SANS 10103 for the day-time period, i.e. from 06:00 to 22:00.

LReq,n - The LAeq rated for impulsive sound and tonality in accordance with SANS 10103 for the night-time period, i.e. from 22:00 to 06:00.

LR,dn - The LAeq rated for impulsive sound and tonality in accordance with SANS 10103 for the period of a day and night, i.e. 24 hours, and wherein the LReq,n has been weighted with 10dB in order to account for the additional disturbance caused by noise during the night.



Source: Airshed Planning Professionals[2] (February 2018)

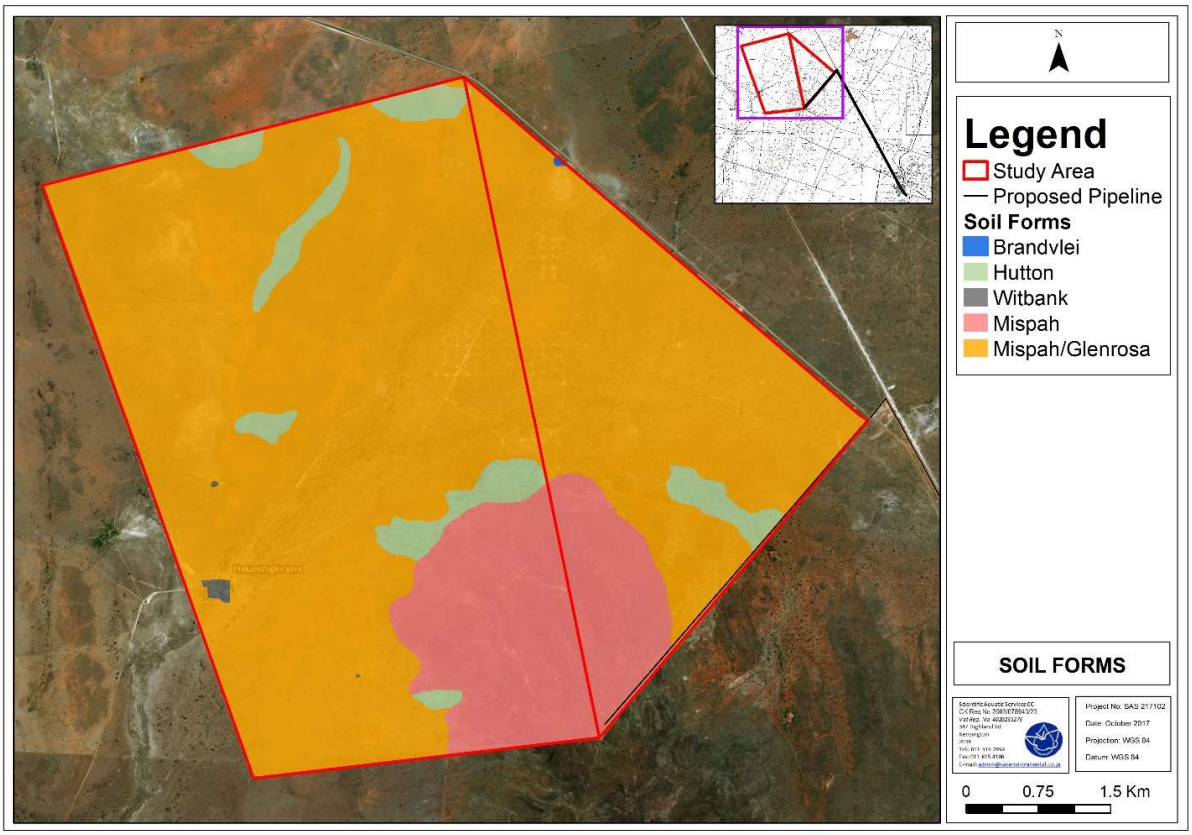
FIGURE 8-15: BASELINE NOISE LEVELS ASSIGNED TO NOISE RECEPTORS

8.1.7 Soils and Land Capability

The baseline description of the soils and land capability has been extracted from the specialist Scientific Aquatic Services (SAS). Their report is included as Part C – Appendix 4.

The Heuningkranz area is largely dominated by shallow soils (see Figure 8-16), such as Glenrosa (Gs) and Mispah (Ms) and moderately deep Hutton soils occurring in small patches due to limited weathering (SAS, 2017). The Brandvlei soil form is associated with wetland features located in the north eastern section of the area. Witbank (WB) soil forms (anthrosols) also

occur.



Source: Scientific Aquatic Services[1] (January 2018)

FIGURE 8-16: SOIL FORMS IDENTIFIED AT HEUNINGKRANZ

The shallow soils have low agricultural potential with some minor areas comprising high agricultural potential (Hutton soils). Livestock grazing and wildlife/wilderness are the dominant land uses within the study area, with mining activities occurring in the surrounding area. The proposed mining areas as well as the associated pipeline route are dominated by Glenrosa (Gs) and Mispah (Ms) soils, with moderately deep Hutton soils occurring in smaller patches. Other soils which were identified include the Brandvlei soil form (associated with a wetland feature located in the north eastern section of the study area) and the Witbank (Wb) soil forms (observed within the 10 m buffer associated with the proposed pipeline – including roads/gravel with highly disturbed topsoil material). Table 8-4 below shows the land capability classes for soil forms identified with the proposed mining sites and associated pipeline.

TABLE 8-4: LAND CAPABILITY CLASSES FOR SOIL FORMS AT HEUNINGKRANZ

Land Capability	Soil Forms
Arable Class II	Hutton (Hu)
Arable Class IV	Brandvlei (Br)

Land Capability	Soil Forms
Grazing – Class VI	Glenrosa (Gs) and Mispah (Ms)
Wildlife/Wilderness (Class VIII)	Witbank (anthosols) (Wb)

Source: Scientific Aquatic Services[1] (January 2017)

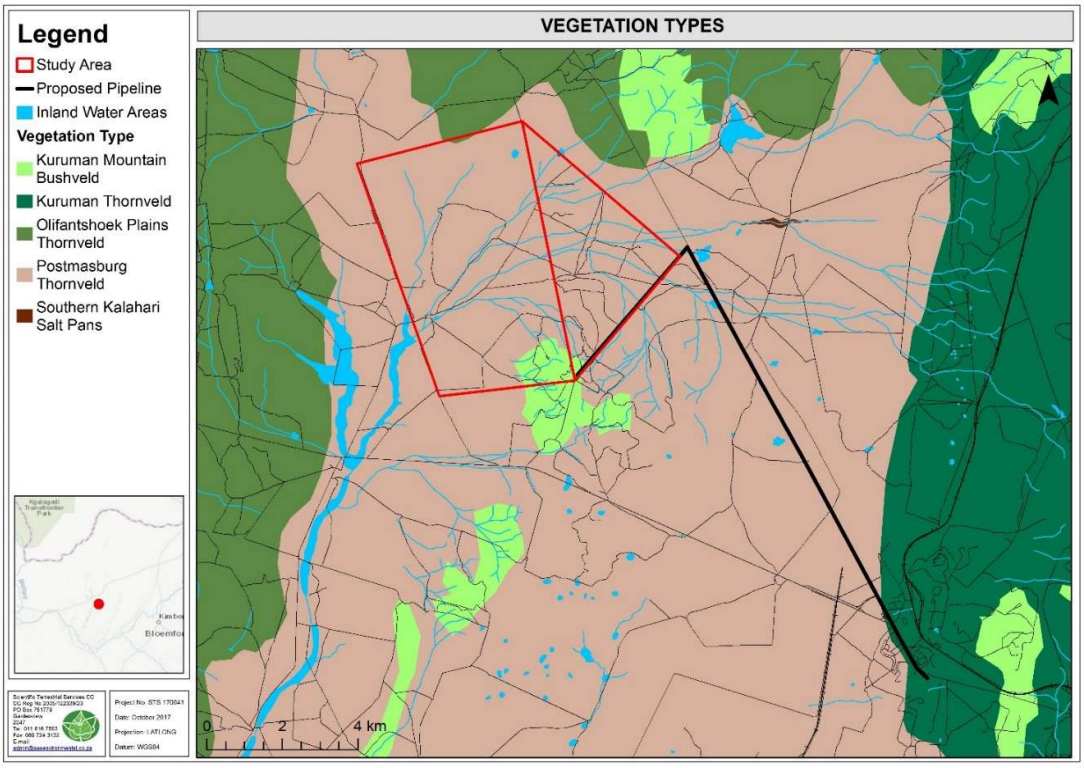
In terms of land capability, the study area is dominated by shallow soils which have low agricultural potential. In some cases, the Ms and GS soil forms might be suitable for grazing, and Hutton soils are considered prime agricultural soils. However, given the limited rainfall, lack of irrigation and high temperatures in the area, these soils are not likely to contribute to sustainable national food production. The soils are therefore not considered sufficient for viable cultivated commercial farming. Although the study area is dominated by soils with a land capability which is suitable for grazing, it is only considered marginal for small scale commercial livestock farming,

8.1.8 Terrestrial Biodiversity

The baseline description of the terrestrial biodiversity has been extracted from the specialist Scientific Terrestrial Services (February, 2018). Their report is included as Part C – Appendix 5

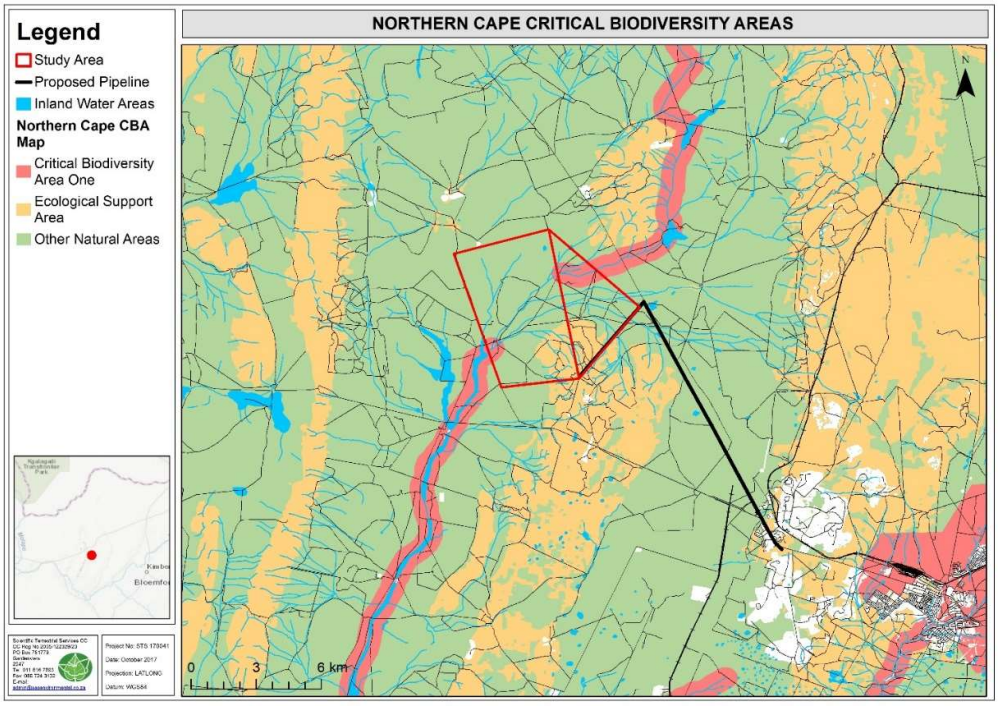
The study area falls within the Savanna Biome, the Eastern Kalahari Bushveld Bioregion and within the Kuruman Mountain Bushveld, Postmasburg Thornveld and Olifantshoek Plains Thornveld vegetation types (Musina & Rutherford, 2006). These are shown in Figure 8-17. The vegetation types (Postmasburg Thornveld and Kuruman Thornveld) within the study area boundary are considered to be of "least concern" in terms of conservation value. However, according to the Northern Cape Provincial Spatial Development Framework (2012) the study area falls within the Griqualand West Centre (GWC) of Endemism. The vegetation of the GWC is still fairly intact, although extremely poorly conserved.

Two areas associated with ephemeral drainage lines in the northern and southern section of the site have been identified by the National Freshwater Ecosystem Priority Areas (NFEPA) database as Critical Biodiversity Areas (CBA) 1. CBAs are areas that must remain in good ecological condition for meeting biodiversity targets for ecosystem types, species of special concern or ecological processes. CBA 1 are areas that are irreplaceable, or near irreplaceable for meeting biodiversity targets. The CBAs are shown in Figure 8-18.



Source: Scientific Terrestrial Services (February 2018)

FIGURE 8-17: VEGETATION TYPES ASSOCIATED WITH THE STUDY AREA (MUCINA & RUTHERFORD, 2012)



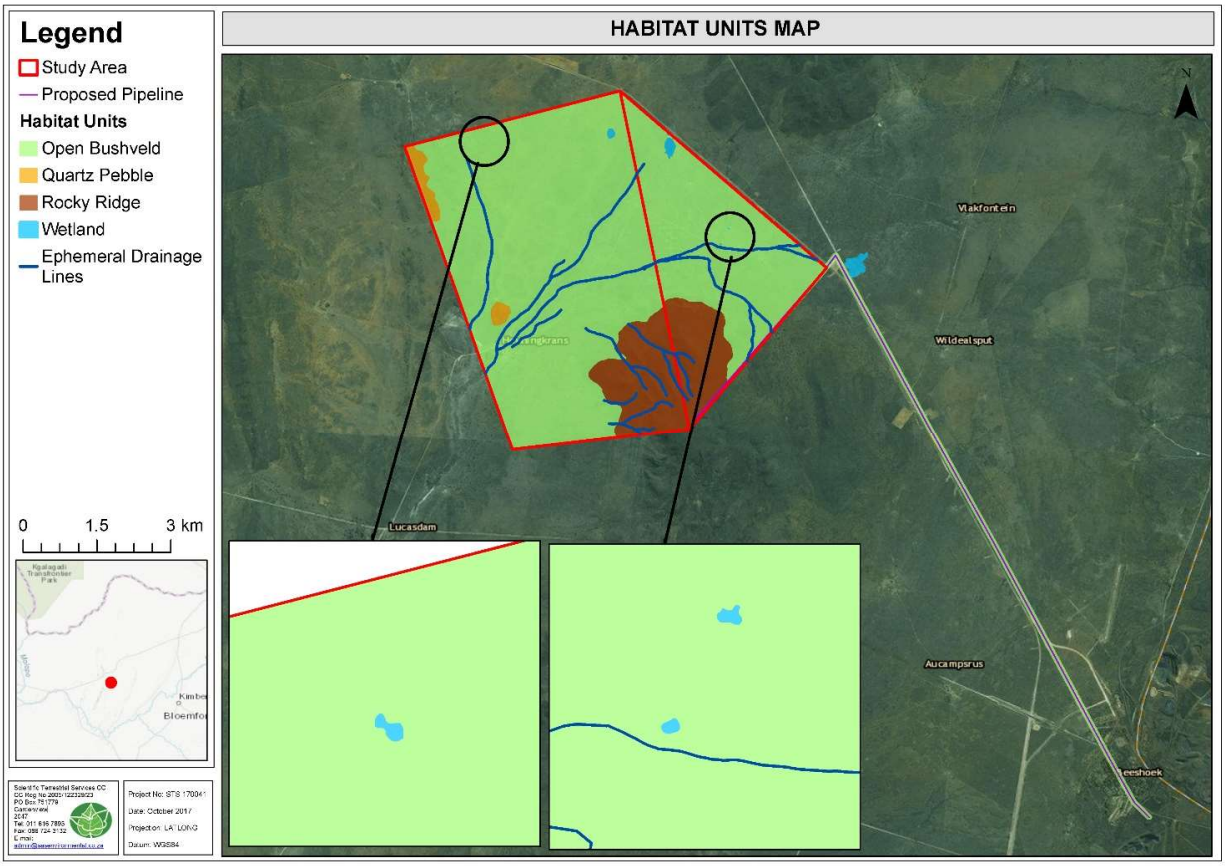
Source: Scientific Terrestrial Services (February 2018)

FIGURE 8-8-18: CRITICAL BIODIVERSITY AREAS AND ECOLOGICAL SUPPORT AREAS AT HEUNINGKRANZ

Ecological Support Areas (ESA) have also been identified at Heuningkranz and surrounds (see Figure 8-18). ESAs are areas which must retain their ecological processes that have not been met in CBAs or protected areas in order to meet biodiversity targets (SRS, 2017). The Tsantsabane Spatial Development Framework (Aurecon, 2015) identifies the area south of Heuningkranz including the Soutloop area as an area for the development of a conservation area.

Scientific Terrestrial Services (2017) has classified the Heuningkranz area into the following habitat units (see Figure 8-19):

- Open Veld/Bushveld habitat;
- Quartz Pebble habitat;
- Rocky Ridge habitat;
- Wetland Pan habitat; and
- Ephemeral drainage feature habitat.



Source: Scientific Terrestrial Services (February 2018)

FIGURE 8-19: HABITAT UNITS AT HEUNINGKRANZ

Vegetation within the Open Veld/Bushveld habitat unit which surrounds rocky ridge areas was found to support higher densities of *Vachellia erioloba* and *Vachellia haematoxylon* (both formerly Acacia) which are listed as protected trees within the National Forests Act. Therefore, the Open Veld/Bushveld vegetation surrounding rocky ridge areas is considered to be of a high ecological importance while the remaining extent of the Open Veld/Bushveld habitat unit is considered to be of a moderate ecological importance and sensitivity (see Figure 8-19).

Of importance is the discovery of what is thought to be a specimen of *Ledebouria coriaceae* (see Plate 8-1) by Dr PC Zietsman at the site. The species is considered as Critically Endangered due to its limited distribution. It was previously only known from a very small population in the Port Elizabeth region. The main threat to this species is habitat loss. The position where the specimen of *L. coriaceae* was is located is shown is Figure 8-20. Note that only one specimen has been located on the site to date and the extent of the distribution of the species at the site is no known.

Photo: PC Zietsman (2017)

PLATE 8-1: LEDEBOURIA CORIACEAE SPECIMEN LOCATED AT HEUNINGKRANZ

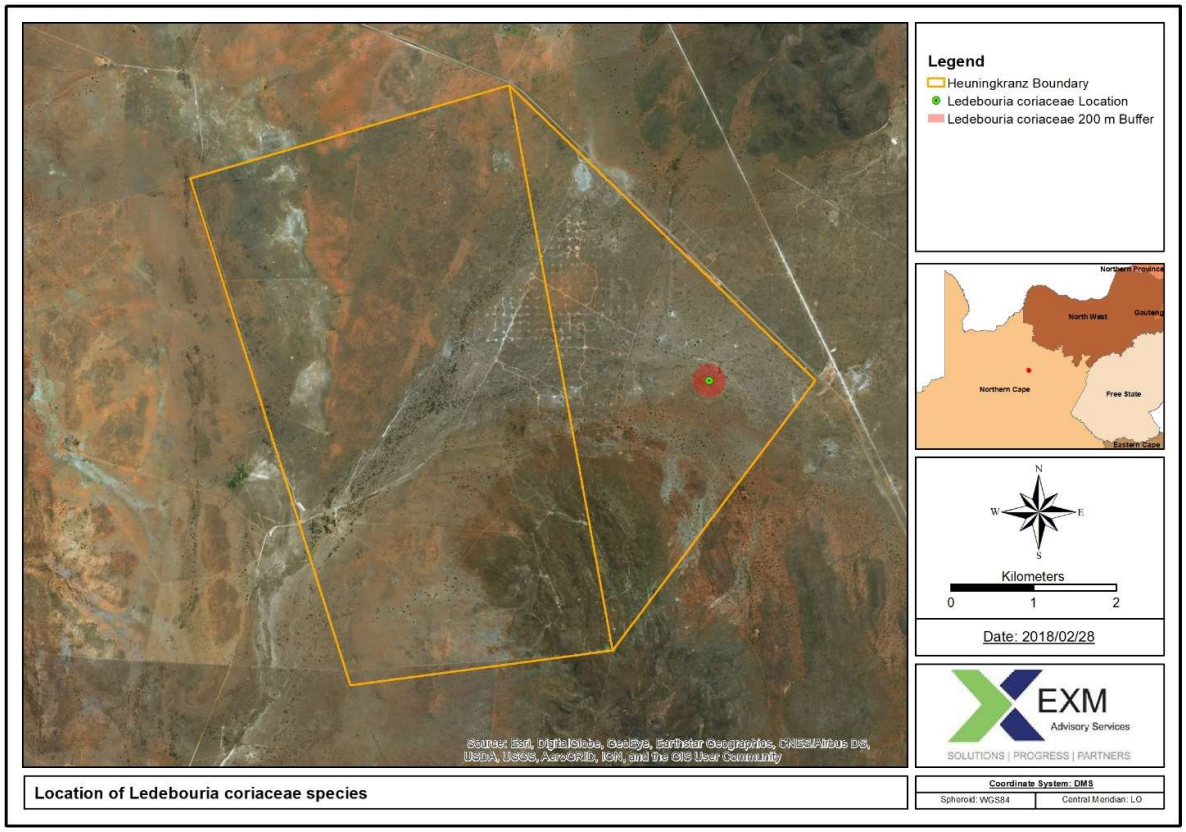


FIGURE 8-20: POSITION WHERE LEDEBORIA CORIACEAE IS LOCATED AT HEUNINGKRANZ

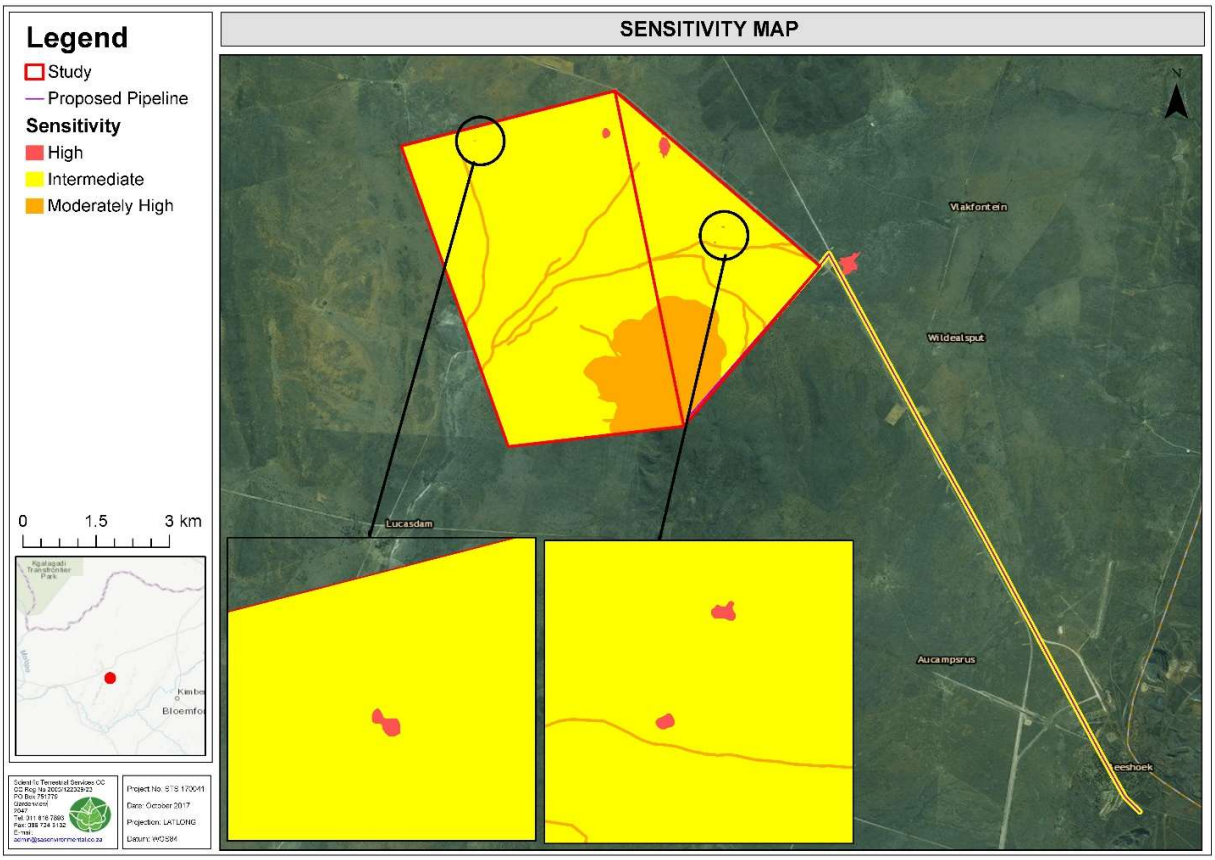
The Quartz Pebble habitat unit was found to support a higher diversity of floral species than surrounding areas. A large number of the protected floral species, *Bulbine narcissifolia*, were identified within a small quartz pebble outcrop area within the western portion of the study area. The endemic floral species, *Lebeckia macrantha*, was found to dominate the quartz pebble outcrop area within the north western corner of the area.

The high ecological functionality and intact habitat integrity of the Rocky Ridge habitat unit as well as the potential migratory connectivity provided by rocky ridge areas when considered in combination, increase the ecological sensitivity and conservation value of this habitat unit. Furthermore, it has been determined that the lower slopes of the Rocky Ridge habitat unit provide habitat for a large number of *Boscia albitrunca*, which is a protected species in terms of the National Forests Act. Therefore, the rocky ridge habitat unit is considered to be of high ecological importance and sensitivity (see Figure 8-21).

Wetland pans are dominated by the facultative wetland species *Eragrostics bicolor* which is restricted to the temporary zone of the wetlands, with a distinctive increase of *Pentzia calcarean* and *Lycium cinereum* within adjacent terrestrial areas. Wetland pans are

considered to be of increased sensitivity and ecological importance as they provide habitat to sustain wetland dependent floral species in a relatively dry region.

The ephemeral drainage features are characterised by an abundance of woody species. Although the ephemeral drainage features do not hold water to sustain wetland species, they are of ecological importance in terms of the augmentation of flow and soil moisture in areas downstream of the study area. Five protected species, *Ammocharis coranica*, *Crinum* macowanii, *Ornithogalum sp*, *Nerine laticoma* and *Gymnosporia buxifolia* (protected under the Northern Cape Nature Conservation Act) were identified within the drainage lines.



Source: Scientific Terrestrial Services (February 2018)

FIGURE 8-21: HEUNINGKRANZ ECOLOGICAL SENSITIVITY MAP

The mammal and avifaunal diversity at the site is higher than expected, with protected species such as *Ardeotis kori (*Kori Bustard) and *Saggittarius sepentarius* (Secretary Bird) occurring on the site. Information regarding the distribution of reptile species in the area is lacking but reptile abundance at the site is also high. Baboon spiders of the genus *Pterinochilus* and burrowing scorpions have been observed within the sandy soils at the site. Little is known about the species and distribution of these invertebrates.

Burrows and tracks of Otycterpus afer (Aardvark) and Otocyin megalotis (Bat-eared fox) were observed within the study area, whilst it is considered highly likely that species such as *Vulpes chama* (Cape Fox) and *Felis nigripes* (Black-footed Cat) also occur. Evidence of these species is known from the surrounds (see Plate 8-2). These species are listed as Protected in the National Environmental Management: Biodiversity Act.

PLATE 8-2: BLACK-FOOTED CAT (ROAD KILL) RECORDED ON THE D3326 NEAR HEUNINGKRANZ

The lowland bushveld areas, wetlands and drainage lines form the main habitats for food resources as within these habitats, grazing, browsing and edible roots are readily available. Due the limited development within the study area, as well as the use of natural grazing for cattle, the overall availability of the habitat at the site has been preserved.

8.1.9 Surface/Fresh Water Resources

The baseline description of the surface water resources has been extracted from the Freshwater Resource Ecological Specialist Assessment (Scientific Aquatic Services, February 2018). The report is included as Part C – Appendix 6.

The Heuningkranz Project falls within the Lower Vaal Water Management Area and the Molopo sub Water Management Area. It is in the Southern Kalahari Aquatic Ecoregion, D73A quaternary catchment. The runoff for the quaternary catchment over D73A is 15 mm per annum. The quaternary catchment is classified as a Freshwater Ecosystem Priority Areas (FEPA). Scientific Aquatic Services (February 2017) have described the drainage lines in the area as having low Ecological Importance and Ecological Class of low to very low (Class D).

Watercourses in the area are ephemeral, only flowing intermittently after heavy rainfall events. The main drainage features in the region is the Groenwaterspruit which flows in a southerly direction through Postmasburg and to the east of Kolomela Mine. A tributary of the Soutloop River originates south of Heuningkranz and joins the 'Welgevondenspruit' south of Kolomela Mine (see Figure 8-22). The confluence of Soutloop and Welgevondenspruit with the Groenwaterspruit ends in a major depression; Vleiput approximately 20 km to the southwest of Kolomela Mine, which has no outlet.

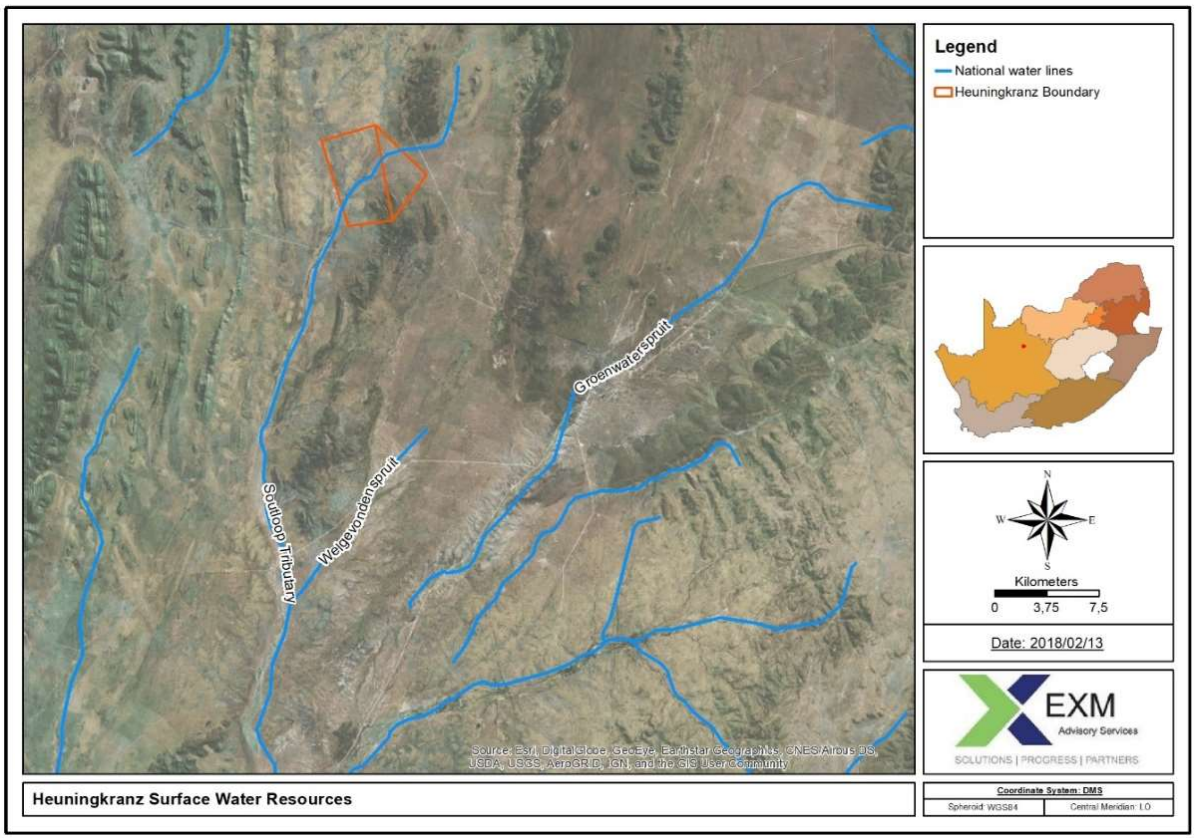


FIGURE 8-22: EPHEMERAL **DRAINAGE FEATURES IN THE POSTMASBURG AREA**

Two unnamed ephemeral tributaries of the Soutloop River flow through Heuningkranz and comprise a catchment of approximately 222 km^2. Ephemeral drainage at Heuningkranz is shown in Figure 8-23. Note that the drainage lines do not however retain water long enough for the formation of hydromorphic soils that support facultative wetland flora species. As a result, these systems are not regarded as wetlands. Six wetland pans have also been identified at Heuningkranz (see Section 8.1.10).

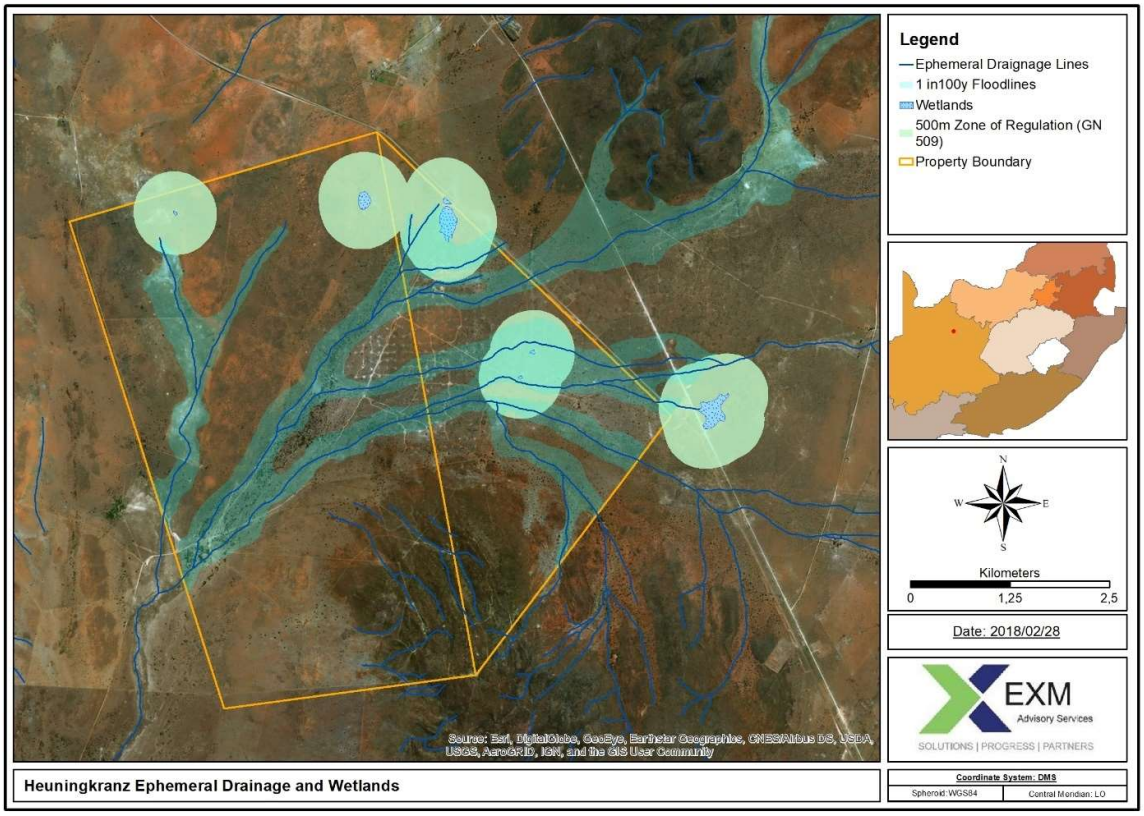


FIGURE 8-23: SURFACE WATER RESOURCES AT HEUNINGKRANZ

The railway line and the northern farm boundary road have resulted in the isolation of several ephemeral drainage lines entering from the north-east. Although there are a number of culverts along the railway line, there are no culverts along the road. This prevents the recharge of downstream drainage lines and affects the hydrological regime of the downstream environment.

The hydrological simulations were run on rainfall data obtained from the Postmasburg weather station (0321110_W) using the Design Rainfall extractor. The rainfall from the Postmasburg Weather Station (0321110_W) was used to compute the appropriate and relevant storm rainfall for the area (SRK, 2013). The Mean Annual Precipitation was hence determined to be 332 mm. The output is indicated in Table 8-5.

TABLE 8-5: COMPUTED STORM INTENSITY FOR HEUNINGKRANZ

Duration	Return Period and Rainfall (mm)						
	1:2yr	1:5yr	1:10yr	1:20yr	1:50yr	1:100yr	1:200yr
1 day	42	59	72	86	107	125	145
2 days	52	77	97	119	151	179	210
3 days	56	84	106	130	166	197	232
7 days	69	105	133	164	211	251	295

Source: SRK (April 2013)

8.1.10 Wetlands

The baseline description of wetlands has also been extracted from the Freshwater Resource Ecological Specialist Assessment (Scientific Aquatic Services, February 2018). The report is included as Part C – Appendix 6.

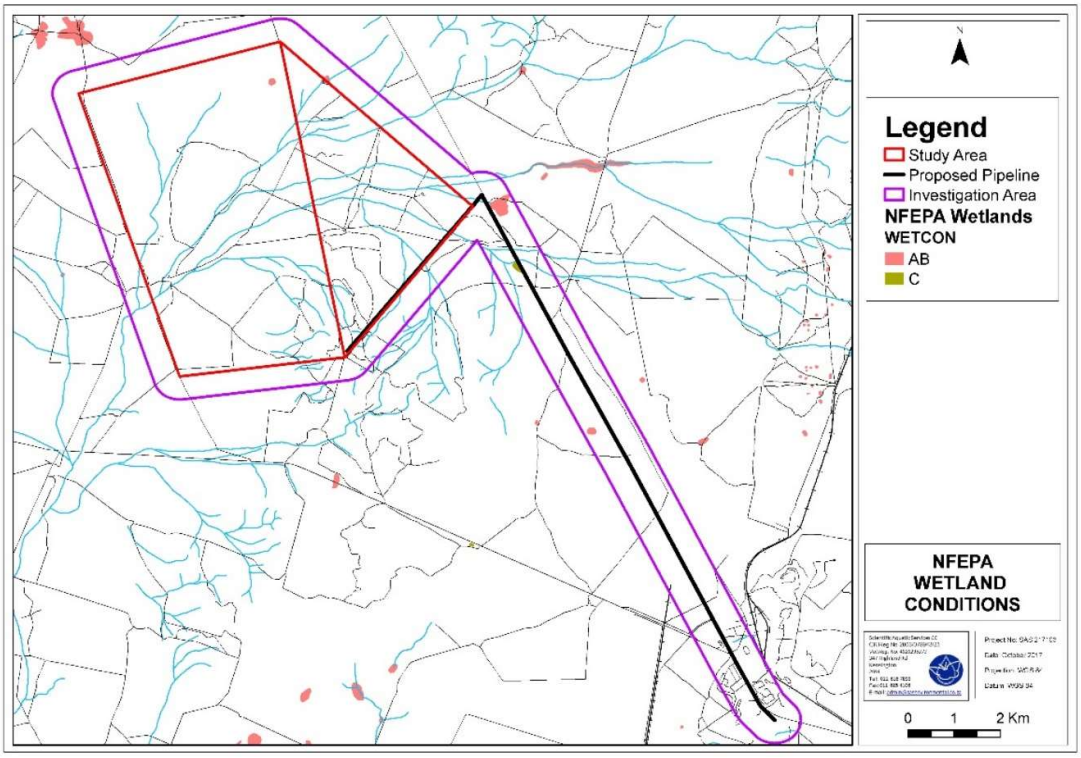
According to the National FEPA Database there are two natural wetland features situated within the study area, and a natural wetland feature is traversed by the proposed pipeline (Figure 8-24). The wetland features associated with the study area are considered to be in a-natural or good ecological condition (Class AB). The wetland feature traversed by the proposed pipeline is considered to be in a moderately modified ecological condition (Class C).

Six wetland pans (see Figure 8-23) have been identified on the site (SAS, February 2017). For a pan to be considered a wetland pan, wetland habitat needed to be present within the depression. Typical wetland habitat within the study area was defined as "a wetland temporary zone in which soil is saturated for a short period of the year, but is saturated for a sufficient period, under normal circumstances, to allow for the formation of hydromorphic soils and the growth of facultative vegetation".

The wetland pans are considered to still be in a largely natural condition, although one of the pans has already been impacted on by the railway which has resulted in the formation of two smaller pan features and limited loss of the wetland habitat (see Plate 8-3). Furthermore, connection between the two smaller pans is still maintained with culverts underneath the railway line.

Source: Kumba Geosciences (Julian Schmidt)

PLATE 8-3: WETLAND PAN IMPACTED ON BY RAILWAY RESULTING IN THE FORMATION OF TWO SMALLER PAN FEATURES



Source: Scientific Aquatic Services (February 2018)

FIGURE 8-24: CONDITION OF WETLAND FEATURES AS INDCIATED BY THE NFEPA (2011) DATABASE (AB = GOOD CONDITION AND C = MODERATELY MODIFIED).

Wetlands have however been subjected to a higher level of grazing and thus are assigned a Present Ecological Status (PES) of Category B. The Ecoservice function is regarded as moderately low due to the lack of water for extended periods of time. These systems are endorheic and hydrologically isolated. As a result the Ecological Importance and Sensitivity (EIS) is lowered to Category C. The recommended ecological class (REC) of Category B is considered appropriate for these wetlands.

8.1.11 Socio-Economic Environment

The baseline description of the social-economic environment has been based on the Social Baseline Assessment undertaken by Atlegang Social Intelligence (Atlegang, January 2018) and the Economic Impact Assessment undertaken by Demacon Market Studies (Demacon, January 2018). The reports are included in Part C – Appendix 7 and 8, respectively.

Heuningkranz is situated in the Tsantsabane Local Municipality (LM), within the ZF Mgcawu District Municipality (DM). The local and district municipalities are shown in Figure 8-25. The nearest towns are Postmasburg and Olifantshoek, located 18 km south east and 30 km north west, respectively. The municipality also includes Beeshoek, Boitchoko, Ditloung, Glosam,

Goedgedacht, Tsantsabane (Postmasburg non-urban areas) and Vergenoeg.

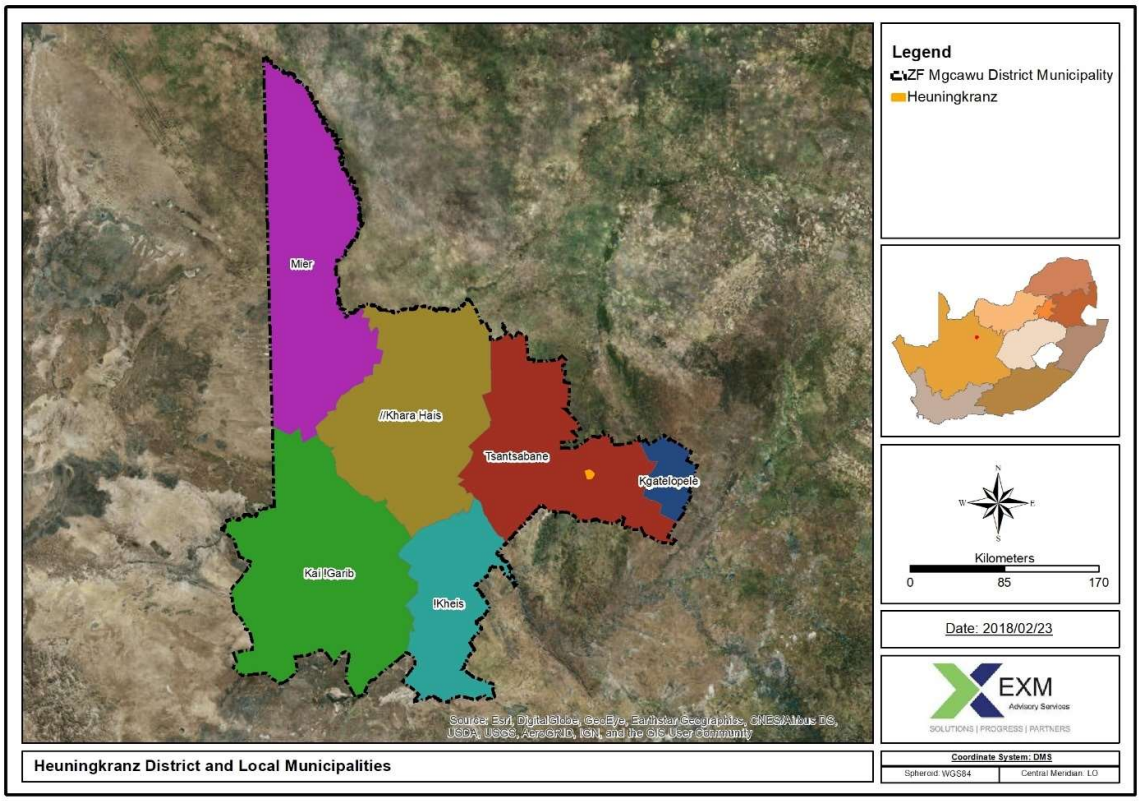


FIGURE 8-25: LOCATION OF THE PROJECT IN RELATION TO LOCAL AND DISTRICT MUNICIPALITIES

8.1.11.1 Population Size

The population of Tsantsabane LM and ZF. Mgcawu DM are summarised in Table 8-6. The Tsantsabane LM has seen an increase in the population size by 6 220 people between 2011 and 2017. The current population at Tsantsabane LM stands at 41 305. In the ZF. Mgcawa DM the population has increased by 24 255 from 2011 to 2017. The current population stands at 261 009.

TABLE 8-6: POPULATION SIZE OF THE HOST, SURROUNDING MUNICIPALITIES &THE ZF MGCAWU DM

Area	Population	
	2011	2017
Tsantsabane LM	35 085	41 305
Kheis LM	16 647	16 228
Kai Garib LM	65 829	70 591
Kgatelopele LM	18 669	21 509
Dawid Kruiper LM	100 524	111 377
ZF. Mgcawa DM	236 754	261 185

Source: Demacon (January 2018)

The significant growth rate is attributed to the construction of Kolomela that took place between 2007 and 2011; in that period, the population grew from 28 005 to 35 093. The arrival of Kolomela has changed the face of the town significantly and provided new impetus for economic development, but also challenges for services and infrastructure to keep up with the needs of the growing population. Since 2012, the population growth rate has decreased and stabilised since Kolomela went into full production; however, it continues to grow at a greater pace than the years prior to Kolomela's construction.

In Tsantsabane, the largest portion of the population resides in the greater Postmasburg area, particularly Newtown, Postdene and Boichoko. These areas are most likely where low income workers and work seekers reside when they first arrive in Tsantsabane. Newtown, being the most populous, has experienced the greatest amount of in-migration.

Low, medium and high growth scenarios as predicted by Demacon (January, 2018) and are presented below. The information gives projections as to how the population might grow from 2011 to 2035 under the three different growth scenarios.

- Low Growth Scenario:
    - Population: from 29 340 in 2011 to 25 579 by 2035
    - Households: from 8 150 in 2011 to 6 090 by 2035
- Medium Growth Scenario:
    - Population: from 29 340 in 2011 to 73 491 by 2035
    - Households: from 8 150 in 2011 to 18 297 by 2035
- High Growth Scenario:
    - Population: from 29 340 in 2011 to 75 704 by 2035
    - Households: from 8 150 in 2011 to 26 755 by 2035

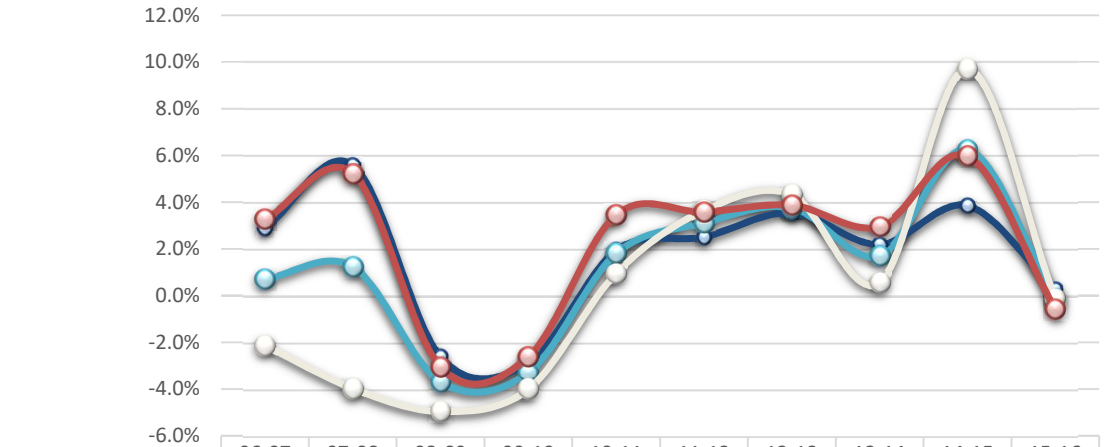
Based on the future population and household projections, it has been identified that residential development will amount to 408 hectares, while land required for urban development will amount to 273 hectares.

8.1.11.2 Employment

The following employment figures refer to those between the ages of 15 and 64 that are economically active. These are the people who are willing and able to participate in the labour force. The Tsantsabane LM has a 74 % employment rate, with the ZF Mgcawu DM having an 80.8 % employment rate. The Tsantsabane LM and ZF. Mgcawu DM have unemployment rates of 26 % and 19.2 %, respectively, both of which are lower than the national average of 27.7 %.

According to Demacon (January 2018), employment from the mining sector has decreased

from 2012 to 2016. As of 2016, mining contributes 12.0 % of the total employment of the Tsantsabane LM and 2.3 % of the ZF Mgcawu DM. The trends observed in both the LM and DM are similar to those observed on the provincial and national scale (see Figure 8-26).



	06-07	07-08	08-09	09-10	10-11	11-12	12-13	13-14	14-15	15-16
South Africa	2.9%	5.6%	-2.6%	-2.9%	1.9%	2.5%	3.6%	2.2%	3.8%	0.3%
Northern Cape	0.7%	1.2%	-3.7%	-3.3%	1.8%	3.1%	3.8%	1.7%	6.2%	-0.1%
ZF. Mgawu DM	-2.1%	-4.0%	-5.0%	-4.0%	1.0%	3.6%	4.3%	0.6%	9.7%	-0.1%
Tsantsabane LM	3.3%	5.2%	-3.1%	-2.6%	3.5%	3.6%	3.9%	3.0%	6.0%	-0.6%

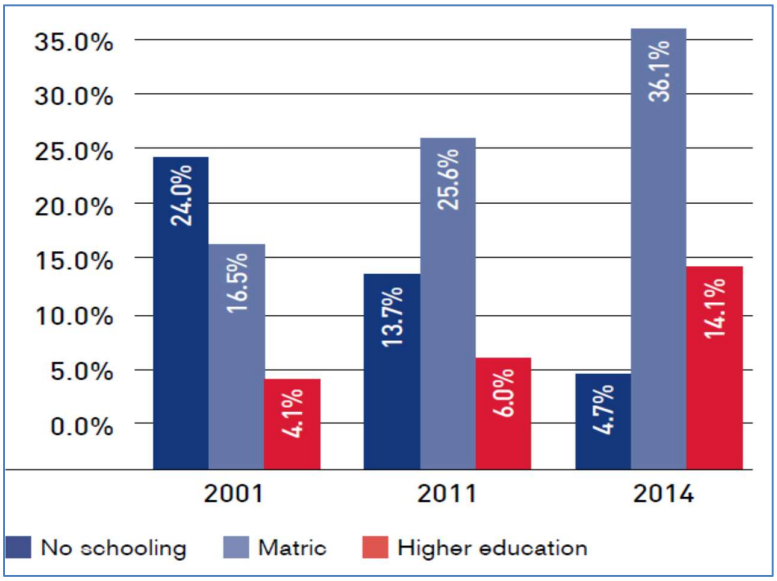
Source: Demacon (January 2018)

FIGURE 8-26: AVERAGE ANNUAL GROWTH RAE OF EMPLOYMENT IN TSANTSABANE LM COMPARED TO DISTRICT, PROVINCIAL AND NATIONAL GROWTH (2006 TO 2016)

8.1.11.3 Education

In the Tsantsabane LM, 11.1 % of people do not have any schooling while the majority of the population (33.1 %) have completed some secondary school.

Although education levels are low, they have improved significantly over the years (see Figure 8-27). In 2001, 24% of adults had no schooling while 16.5% had grade 12 and only 4.1% had a higher education. In 2011, the proportion of people with no schooling had dropped by just over 10% while the proportion of those with grade 12 had increased by 9% and those with a higher education had increased slightly (1.9%). Between 2011 and 2014, the proportion of people without an education had dropped by 9% to only 4.7% while the proportion of those with matric grew by over 10% to 36.1%. The proportion of those with higher qualifications grew by 8.1%. The improvements of education levels are to be expected given importation of scarce skills as well as higher investments in education by the mines in the area (see Figure 8-27)



Source: Kolomela Mine SEAT Report (2014)

FIGURE 8-27: CHANGES IN EDUCATION LEVELS IN TSANTABANE (2001-2014)

According to the Kolomela SEAT (2014), there are 18 Early Childhood Development (ECD) Centres & creches, 9 primary schools and 3 secondary schools in Tsantsabane (see Table 8-7).

TABLE 8-7: EDUCATION FACILITIES IN THE TSANTSABANE MUNICIPALITY

Area	ECD Centre / Creche	Primary School	Total number of learners	Secondary school	Total number of learners
Postmasburg	2	2	1 031	1	400
Postdene	3	2	1 542	1	1 396
Newtown	5	1	1 085	0	N/A
Boichoko	3	1	1 280	1	985
Jen Haven	1	1	118	0	N/A
Skyfontein	2	1	63	0	N/A
Groenwater	2	1	190	0	N/A

Source: Kolomela Mine SEAT Report, 2014

8.1.11.4 Housing

According to the Kolomela SEAT (2014), the area is experiencing a shortage of affordable and proper housing, partly as a result of the presence of the mines. This shortage has led to a growing number of households renting out rooms as a form of earning an income. Four percent of households are rented out a room/s. The types of rented rooms differed by area, for instance, in Boichoko, 50% of tenants stayed in informal structures while 100% of tenants in Postmansburg resided in formal structures.

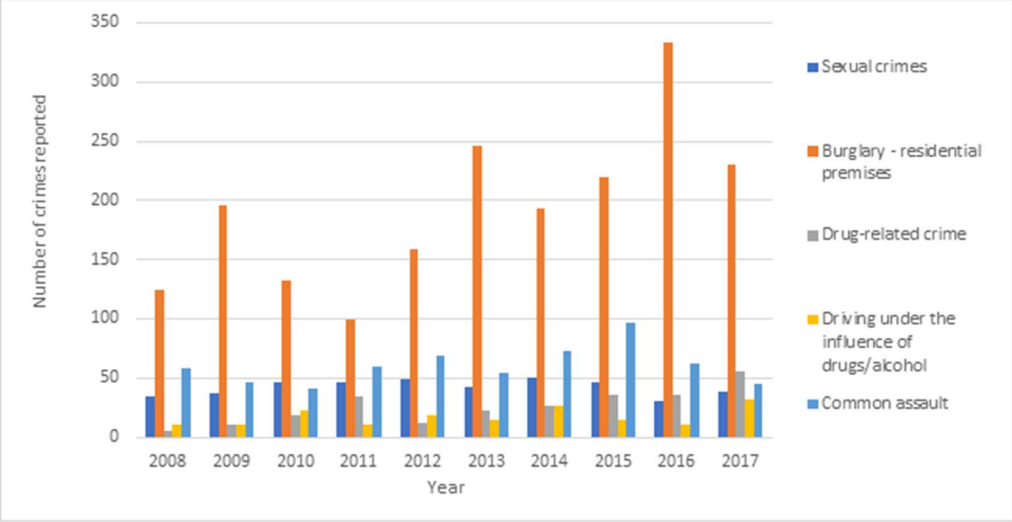
The proportion of formal and informal dwellings in Tsantsabane is influenced by the presence of and activities of Kolomela's (and other mines') in the municipality. There was an 11%

increase in the proportion of informal dwellings from 2001 to 2011. The increase is attributed to the influx of construction workers and job seekers during the construction of Kolomela (and potentially to an extent the Beeshoek Mine's construction of a JIG plant, which commenced in 2001). After the completion of the construction of Kolomela, the proportion of informal dwellings dropped significantly as construction workers moved on from the area to find alternative employment. It should be noted that a further contributor to the lessened proportion of informal dwellings in 2011 was the construction of over 700 homes for employees by Kolomela as well as the lifting of a moratorium on the allocation of land for development that was in place between 2001 and 2011.

In the Tsantsabane LM, 68.7 % of dwellings are house or brick structures; 25.7 % are informal dwellings; and 1.8 % are flats, clusters, townhouses or semi-detached dwellings. In terms of tenure status; 42.4 % are owned (paid) tenure; 27.6 % are occupied rent-free; 25.4 % are rented tenure; and 4.6 % are owned (not paid) tenure.

8.1.11.5 Crime

There has been a steady increase of crimes reported in the Tsantsabane LM since 2008 (see Figure 8-28). Since then, the number of crimes reported have doubled. More specifically, burglaries at residential premises, assault with the intent to inflict grievous bodily harm, malicious damage to property and theft have increased significantly. The Kolomela SEAT (2014) notes that the local police station was under-resourced and could not effectively deal with the increase in crime.

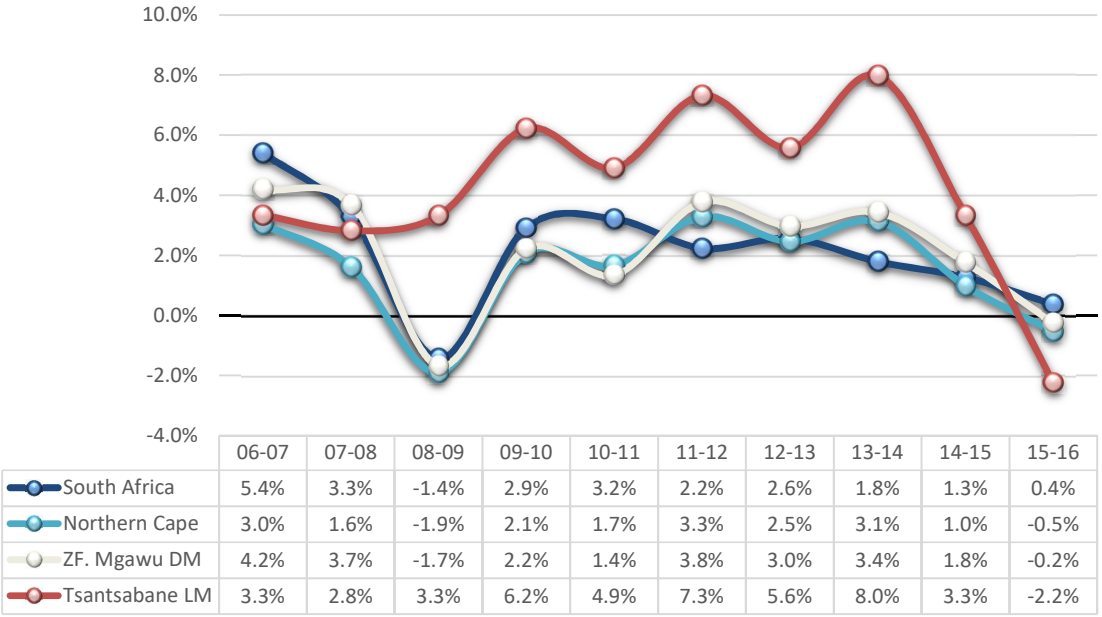


Source: Crime Stats SA, 2017.

FIGURE 8-28: CRIME STATISTICS RECORDED FOR TSANTSABANE LM (2008-2017)

8.1.11.6 Economic Profile

Demacon (January 2018) report that the annual economic growth rate for the Tsantsabane LM economy has shown fluctuations over time. The growth rate saw an increased trend between 2006 and 2014. Since 2015 however, there has been a decrease in the annual growth rate of the area (see Figure 8-29). This can be attributed to external factors such as the downgrading of the South African economy by rating agencies, resulting in decreased productivity of the mining industry. Despite this, the Tsantsabane LM economy has seen an average annual growth rate of 4.3 % between 2011 and 2016, while ZF. Mgcawu DM has seen an average annual growth rate of 2.3 % for the same time period. These growth rates are considerably higher than both the provincial (1.9 %) and national economy (1.6 %).



	06-07	07-08	08-09	09-10	10-11	11-12	12-13	13-14	14-15	15-16
South Africa	5.4%	3.3%	-1.4%	2.9%	3.2%	2.2%	2.6%	1.8%	1.3%	0.4%
Northern Cape	3.0%	1.6%	-1.9%	2.1%	1.7%	3.3%	2.5%	3.1%	1.0%	-0.5%
ZF. Mgawu DM	4.2%	3.7%	-1.7%	2.2%	1.4%	3.8%	3.0%	3.4%	1.8%	-0.2%
Tsantsabane LM	3.3%	2.8%	3.3%	6.2%	4.9%	7.3%	5.6%	8.0%	3.3%	-2.2%

Source: Demacon (January 2018)

FIGURE 8-29: AVERAGE ANNUAL GROWTH RATE OF THE TSANTSABANE LM COMPARED TO DISTRICT, PROVINCIAL AND NATIONAL GROWTH (2006 TO 2016) – CONSTANT 2010 PRICES

As of 2016, the mining sector makes up 44.6 % of the Total Gross Value Adding (GVA) sectors for Tsantsabane LM, and 15.1 % of the Total GVA for ZF Mgcawu DM (Demacon, January 2018). This is the most dominant contributing sector to these economies. It can be noted, however that these figures have been decreasing since 2012; while other sectors such as transport and storage, wholesale and retail trade and construction have shown increased contributions.

8.1.12 Traffic

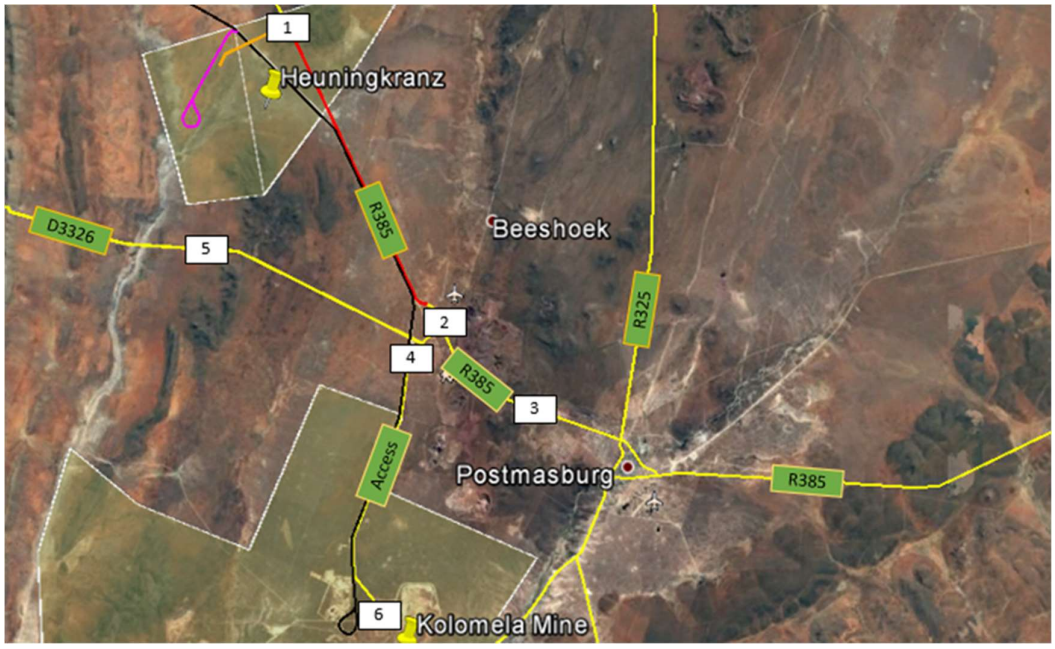
The baseline description of the traffic in the vicinity of the project has been extracted from the Traffic Impact Assessment (JG Afrika, January 2018). The report is included as Part C – Appendix 9.

An assessment of the road conditions and traffic flow is important as changes in traffic flow and the consequent changes to road conditions can affect the safety of persons travelling on the road, including traffic to and from the Heuningkranz Project as well as other road users.

The R385 (MR882) is surfaced from Postmasburg up to a point close to Tommy's Field (airfield). The gravel portion up to the proposed Heuningkranz access road is indicated in red in Figure 8-30. The D3326 is also a gravel road and both unsurfaced sections are approximately 12 km in length. The D3326 is being used as access during the exploration phase of Heuningkranz.

The R385 falls under the jurisdiction of the Northern Cape Department of Roads and Public Works. It is a lower order road (gravel) and links Postmasburg with Olifantshoek. It mainly serves the rural farming community but is also used by Kolomela employees staying as far away as Olifantshoek. There are no known plans to upgrade the road.

Six nodes (reference) points were allocated for identification of sections of the roads in the vicinity of the Heuningkranz Project (Figure 8-30)



Source: JG Africa (January 2018)

FIGURE 8-30: TRAFFIC NODES IN THE VICINITY OF KOLOMELA AND HEUNINGKRANZ

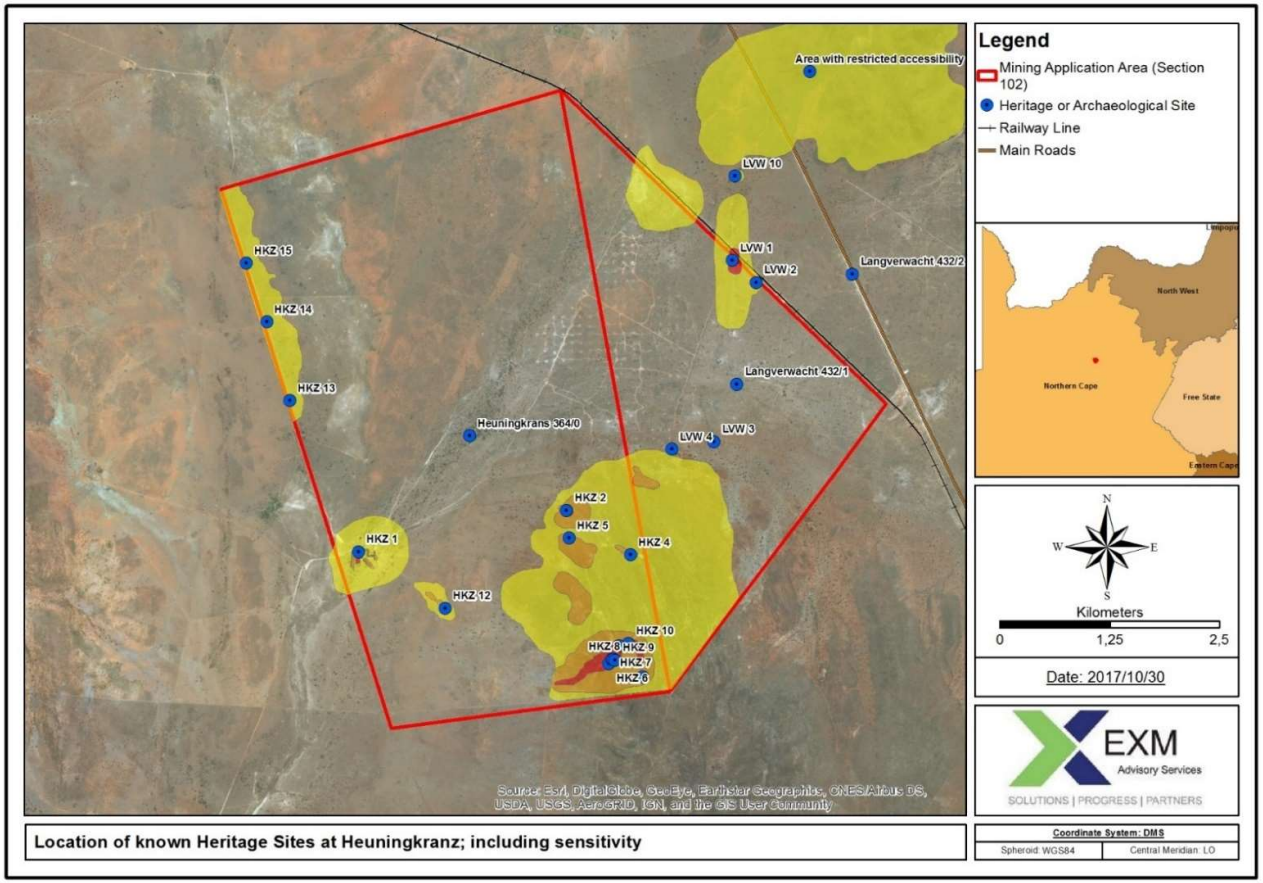
The R385 (between nodes 1 and 2) is mostly gravel with the exception of a small section to the turn-off to Tommy's Field. Traffic on this section of the road is made up of light vehicles which are primarily residents and staff travelling to/from town and Kolomela, respectively. Heavy vehicles on this road are mostly farming (i.e. livestock) related. The R385 road (between nodes 2 and 3) is a surfaced road and includes access to Beeshoek. Light vehicles are from residents and staff. This road experiences morning and afternoon peaks, with high volumes during the day. Heavy vehicles include haulage of ore to Kolomela by emerging miners, haulage to/from Beeshoek, delivery and fuel, with limited farming related vehicles.

The road between nodes 4 and 6 is a private surfaced road providing access to Kolomela Mine. Light vehicles are primarily staff and some private visitors, while the heavy vehicles include staff busses, delivery vehicles, fuel tankers and emerging miner ore side tippers. Traffic patterns see morning and afternoon peaks due to staff shifts, while heavy vehicle traffic is more constant, with some platooning in the mornings. Traffic on the R358 (between nodes 4 and 5) comprise mainly of residents, staff and other mining operations such as ringside and exploration activities at Heuningkranz. Heavy vehicles include exploration and other mining vehicles, with some occasional farming related vehicles.

8.1.13 Cultural Heritage

A Cultural Heritage Assessment was undertaken for the site in 2013 (African Heritage Consultants, September 2013). The report is included in Part C – Appendix 10.

The Heuningkranz area is rich in cultural heritage (African Heritage Consultants, 2013). Heritage sites at Heuningkranz have been mapped and are indicated in Figure 8-31. Also shown is the relative sensitivity of the sites. The structures deemed the most sensitive are shelters relating to the Later Stone Age (LSA), which are of a high archaeological value. These sites are associated with the rocky ridges, located in the south-eastern section of Heuningkranz. Some infrastructure around the Heuningkranz homestead are also to be of historical significance. A description of the heritage sites documented for Heuningkranz are shown in Table 8-8.



Source: African Heritage Consultants (September 2013)

FIGURE 8-31: LOCATION OF KNOWN HERITAGE SITES AT HEUNINGKRANZ[3]

[3] Red — High Sensitivity: These are areas with confirmed archaeological features of significance and require specific management actions associated with each site.
Orange — Medium Sensitivity: These polygons represent areas with localised scatters of archaeological material or areas with a high probability of containing heritage resources.
Yellow — Low Sensitivity: These are areas that may potentially contain archaeological or heritage resources.

TABLE 8-8: HEUNINGKRANZ ADVANCED EXPLORATION – HERITAGE SITES

Site	Description	
HKZ 1 HEUNINGKRANZ FARMSTEAD	Old House, Main house, Dam, Garden-midden, workers midden, tree lanes and widely dispersed lithics around homestead	  
HKZ 2	Banded Ironstone Formations (BIFs) used for the manufacture of mainly MSA and some ESA lithic tool types	
HKZ 3		
HKZ 4		
HKZ 5		
HKZ 6	Heuningkranz valley with LSA shelters	
HKZ 7		
HKZ 8		
HKZ 9		
HKZ 10		
HKZ 11		
HKZ 12	Quartz pebble layer with LSA lithics	
HKZ 13	MSA and LSA lithics in low densities	
HKZ 14		
HKZ 15		

Site	Description	
LVW 1	MSA/transitional ESA/MSA	
LVW 2	BIFs with low densities of mostly MSA lithics	
LVW 3	Rubble of structure, walls built of old car doors in drainage line	
LVW 4	Dam, windmill, garden, outbuilding	
LVW 5	Dam, windmill, garden	
LVW 6	Langverwacht homestead	
LVW 7a	Dip, holding pen, well	
LVW 7b		
LVW 8a	Labourer cottages	
LVW 8b		
LVW 9a	Remains of structure	
LVW 9b		
LVW 9c	Remains of Kraal	
LVW 10	Remains of dam	

8.1.14 Palaeontology

A Palaeontology Desktop Assessment has been undertaken by specialist Gideon Groenewald of HIA Consultants (HIA, February 2018). The report is included as Part C – Appendix 11.

Tsantsabane LM area is underlain by Vaalian aged rocks of the Postmasburg Group and Quaternary aged sediments of the much younger Kalahari Group and Recent limestone and windblown sand. Highly significant fossil finds are therefore expected in this region. In these Vaalian aged rocks the moderate chance of finding significant stromatolite structures is retained and in the more recent sediments, the high possibility of finding younger aged fossils is also retained.

Shale, quartzite and conglomerate formations are most dominant in the area. These formations are only moderately significant for Palaeontological Heritage. However, the Makganyane Formation can contain highly significant stromatolites. No significant fossils are expected in the Ongeluk Formation. Quaternary Limestone and Quaternary windblown sand, as part of the Kalahari Group, do not form part of the economic target of the mine. It is therefore unlikely that any mining activity will involve excavation into these beds. It must be noted however, that these beds could contain significant remains of a very wide range of possible fossils.

Figure 8-32 shows the palaeontological sensitivity within the Heuningkranz boundary.

Source: HIA Consultants (February 2018)

FIGURE 8-32: PALAEONTOLOGICAL SENSITIVITY WITHIN THE HEUNINGKRANZ BOUNDARY

The orange area represents high palaeontological sensitivity/vulnerability, while the green represents moderate palaeontological sensitivity/vulnerability. The moderate to high sensitivity which was allocated within the study area is a result of the highly weathered nature of the material and that significant fossils are expected to be found after excavation for foundations that exceed 1.5 m.

8.1.15 Visual Environment

A Visual Impact Assessment has been undertaken by EXM Advisory Services (February 2018). The report is included as Part C – Appendix 12.

8.1.15.1 Visual Receptors

Visual receptors were identified within a 10 km radius of the boundary of the Heuningkranz Project and are illustrated in Figure 8-33. The zone of visual influence was determined to be 10 km and all homesteads within this zone have been regarded as visual receptors. At distances of greater than 10 km, the development will diminish into the background view and will completely be absorbed into the landscape

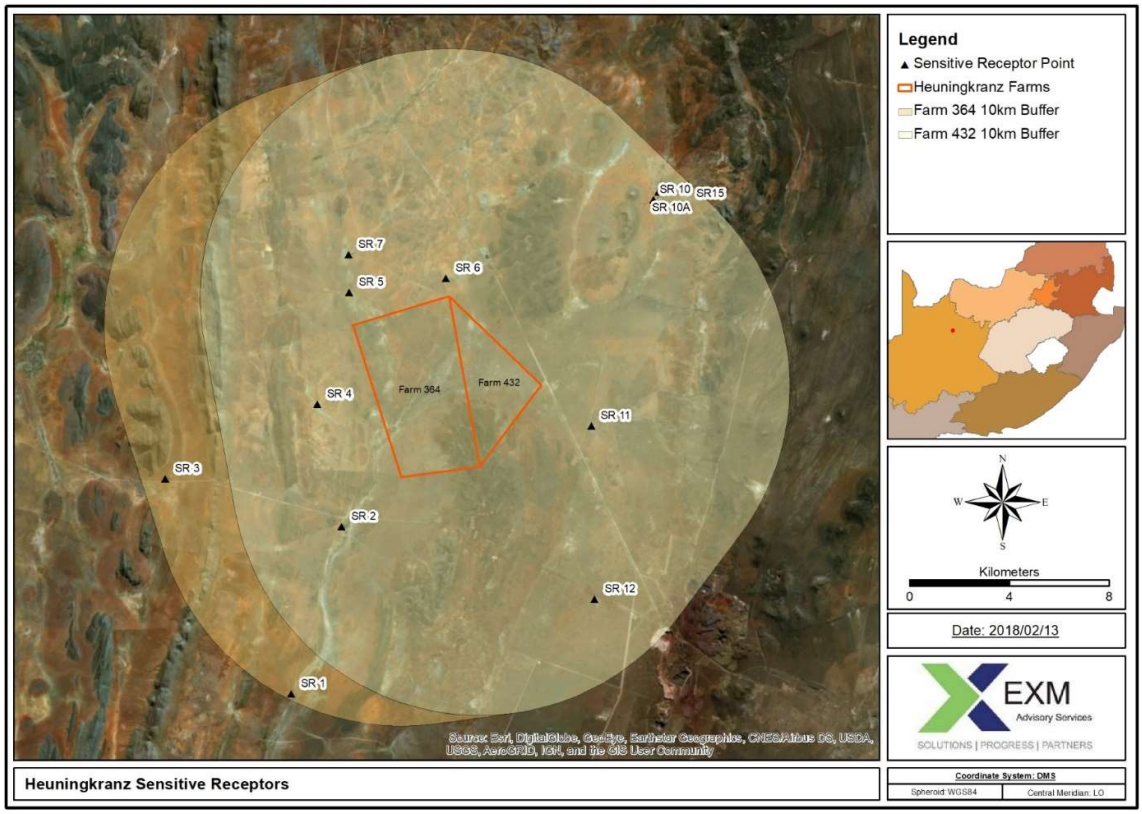


FIGURE 8-33: VISUAL RECEPTORS WITHIN THE VICINITY OF HEUNINGKRANZ

8.1.15.2 Scenic Quality

The visual quality of a landscape can be quantified by utilising physical quality criteria for the landscape as well the type of viewers exposed. Landforms, vegetation, water bodies, colour, landscape scarcity and cultural modifications all contribute to the scenic quality of the environment.

Local topographical variations as a result of Griqua Fold Mountains (see Plate 8-4) enhance the scenic quality of the area but no dramatical landforms are present. There are some variations in the vegetation cover. These variations are not dramatic although the variation in colour, especially after rain, does add value to the visual environment. There are no major water bodies present although wetland pans and drainage areas do enhance the visual character (see Plate 8-5). Some modifications have occurred e.g. prospecting, but the landscape at Heuningkranz and surrounds is still largely rural. The overall Scenic Quality is regarded Moderate (EXM, February 2018).

PLATE 8-4: VIEW OF LANGBERG MOUNTAINS FROM THE KOPPIE SOUTH EAST OF HEUNINGKRANZ

PLATE 8-5: GRASSY FLOOD PLAIN OF THE TRIBUTARY OF THE SOUTLOOP RIVER SOUTH OF HEUNINGKRANZ WITH THE LANGBERG MOUNTAINS IN THE DISTANCE

8.1.15.3 Light Pollution

Sky glow results when light propagating from artificial light sources is partially scattered back towards the ground producing a diffuse glow or dome of light that can be seen for large distances (see Plate 8-6)

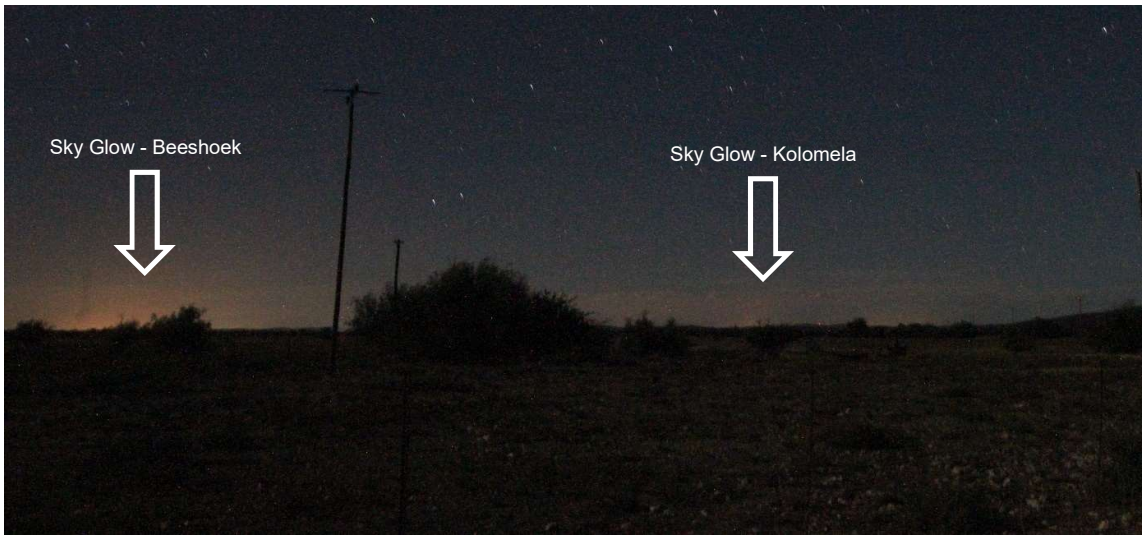
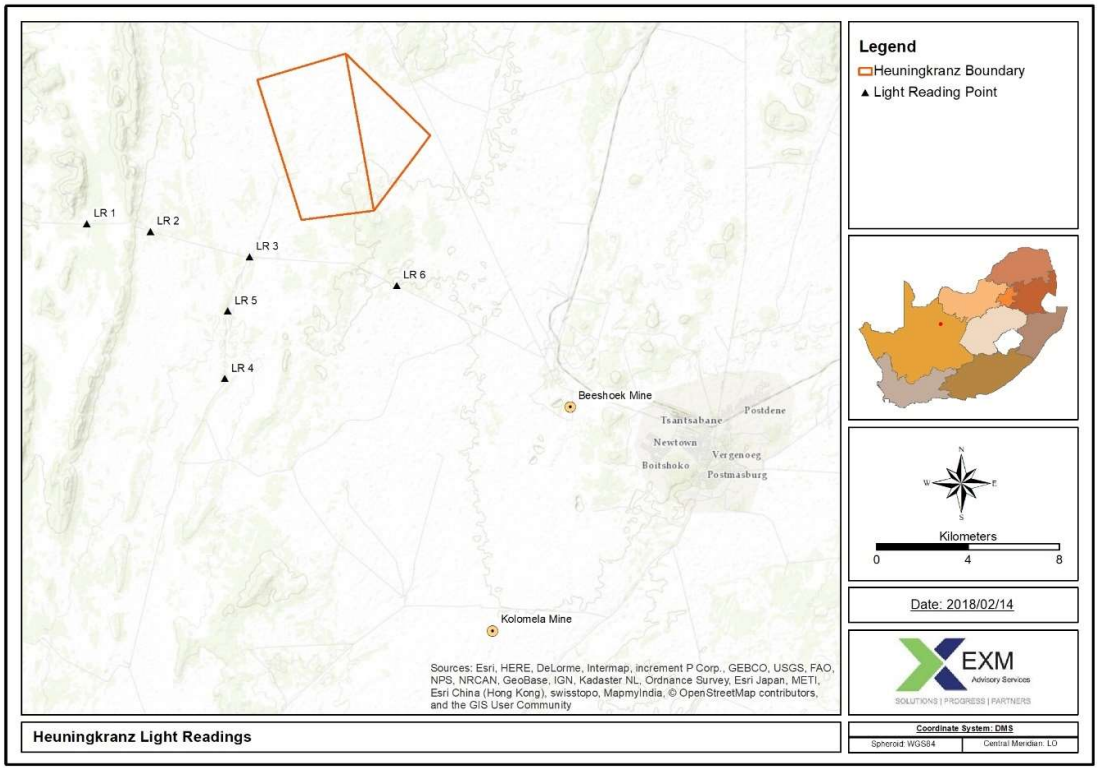


PLATE 8-6: SKY GLOW AS OBSERVED FROM 20 KM FROM BEESHOEK AND KOLOMELA MINES

The skyglow hides the stars and masks natural light which can impact on nocturnal animals and plants and may also affect the well-being of persons through the loss of darkness, which affects sleep rhythms and also sense of place. Sky Quality Meters (SQM) measure the amount of light that enters a sensor providing a reading in magnitudes per square arc-second. The higher the reading the darker the sky. A meter reading of 21.00 indicates a very dark site (unpolluted), while a reading of 16.00 indicates a light polluted sky. Sky glow readings taken in the vicinity of the Heuningkranz Project (see Figure 8-34) are provided in Table 8-9.

TABLE 8-9: SKY GLOW READINGS IN THE VICINITY OF HEUNINGKRANZ

Reference	Location	SQM Reading	Description
LR 1	28°14'0"S 22°47'17"E	20.52	Very dark with some evidence of sky pollution but shielded by to the topographical highs to the east.
LR 2	28°14'11"S 22°48'59"E	19.96	Some light pollution evident, caused by sky glow being more visible due higher elevation
LR 3	28°14'47"S 22°51'38"E	20.67	Darkest point as in the valley of the tributary of the Soutloop and thus shielded from the sky glow.
LR 4	28°17'40"S 22°50'58"E	19.98	Some light pollution evident caused by Kolomela located to the east of the site
LR 5	28°16'4"S 22°51'03"E	20.39	Very dark as also in the valley of the tributary of the Soutloop.
LR 6	28°15'28"S 22°55'34"E	20.08	Some light pollution evident as closer to Beeshoek and Kolomela Mine.



Source: EXM (February 2018)

FIGURE 8-34: LOCATION OF SKY GLOW READINGS RELATIVE TO THE HEUNINGKRANZ PROJECT, BEESHOEK MINE AND KOLOMELA MINE

8.1.16 Light Trespass

Light trespass is light that spills into an area where it is unwanted (see Plate 8-7). There are currently no major sources of light trespass in the Heuningkranz Project area. Lighting of the rail link to Kolomela Mine is spilling into the surrounding landscape.

PLATE 8-7: LIGHT TRESPASS ALONG THE RAIL LINK TO KOLOMELA MINE

8.1.17 Glare

Glare results when there is too much light, excessive and uncontrolled brightness. The excessive brightness of the light makes it difficult to see. Bright white light results in more glare than yellow light, as can be observed from lighting at the process plant at Kolomela Mine (see Plate 8-8). There are currently no sources of glare at Heuningkranz or the surroundings.

PLATE 8-8: LIGHTING AT THE KOLOMELA MINE PROCESS PLANT TAKEN FROM THE ACCESS ROAD TO THE MINE – SHOWING THE BLINDING EFFECT DUE TO THE GLARE OF WHITE LIGHTING COMPARED TO YELLOW LIGHTING

8.2 Description of current land uses

8.2.1 Current Land Use

SIOC is currently involved in extensive exploration activities at the site under the existing prospecting right (see Plates 8-8 and 8-9). The direct rail link linking Kolomela to Sishen's iron ore export line is located along the northern boundary of Farm 432, Portion 1 (Langverwacht). There is also an Eskom powerline supplying farmsteads running along the Soutloop River from the south towards the Heuningkranz homestead. The R385 road runs to the north east of the project area crossing Farm 432 (Langverwacht), Portion 2. A gravel access road to the farm Lynput (Mapedi 653) runs along the western boundary of the Farm 364 (Heuningkranz).

SIOC as the landowner and under Kolomela Mine's land management unit uses the land for the grazing of livestock including cattle and game. Note that some of the proposed linear infrastructure i.e. rail link, access road and export pipeline will traverse adjacent properties and are included in the application for environmental authorisation. The land tenure and current uses of properties to be affected by the project are provided in Table 8-10.

TABLE 8-10: CURRENT LAND USES IN THE APPLICATION AREA

Property	Owner	Current Land Use
Mining Application Areas (Section 102)		
Farm 364 (Heuningkranz)	SIOC	Prospecting, geological offices and core shed, livestock grazing (cattle and game) Access toad to Lynput homestads.
Farm 432 (Langverwacht), Portion 1	SIOC	Prospecting, livestock grazing (cattle and game).
Infrastructure Affected Areas (access road, rail and water export pipeline)		
Farm 432 (Langverwacht), Portion 2 (access road and water export pipeline)	SIOC	Livestock grazing (cattle and game). SIOC in the process of applying of closure of prospecting right. New prospecting right application pending.
Farm 432 (Langverwacht), RE (access road to be developed)	SIOC	Livestock grazing (cattle and game). SIOC in the process of applying of closure of prospecting right. New prospecting right application pending.
Mapedi 653 (rail link)	Lynput Trust	Livestock grazing (cattle and game)
R385 (access road link and water export pipeline)	Northern Cape Department of Roads and Public Works	Gravel road linking Postmasburg to Olifantshoek
Direct Rail Link (rail link)	Transnet	Railway line and rail maintenance road

PLATE 8-4: TYPICAL ACTIVE EXPLORATION DRILL SITES AT HEUNINGKRANZ

PLATE 8-5: TYPICAL REHABILITATED EXPLORATION DRILL SITES AT HEUNINGKRANZ

8.2.2 Surrounding Land Use

The neighbouring properties, homesteads and land uses are indicated in Figure 8-35. Persons residing in the occupied houses are largely involved in agricultural activities. See Table 8-11 for a description of land uses on each of the neighbouring properties.

TABLE 8-11: DESCRIPTION OF LAND USES ON SURROUNDING PROPERTIES

Property	Owner	Current Land Use
Makganyene 667 Portion 1	JC Boerdery cc	Livestock grazing, homestead.
Mapedi 653	Lynput Trust	Livestock grazing, homestead.
Middelplaats 636	Putjie FamilieTrust	Livestock grazing, homestead.
Lucas Dam 402	Lucasdam Boerdery Pty Ltd	Livestock grazing, prospecting, homestead.
Farm 431 RE	IM van Wyk	Livestock grazing, mining of iron ore by Ringside Trading, homestead.
Farm 431 Portion 1	Lucasdam Boerdery Pty Ltd	Livestock grazing, prospecting.
Farm 433 Portion 1	AJ Wahl	Livestock grazing.
Farm 433 Portion 2	AJ Wahl	Livestock grazing, homestead.
Farm 432 (Langverwacht), Portion 2	SIOC	Livestock grazing (cattle and game). SIOC in the process of applying of closure of prospecting right. New prospecting right application pending.

8.3 Description of specific environmental features and infrastructure on the site

The environmental sensitivities at Heuningkranz are provided in Figure 8-36. The current land use surrounding the area is also shown in Figure 8-35.

8.4 Environmental and current land-use map

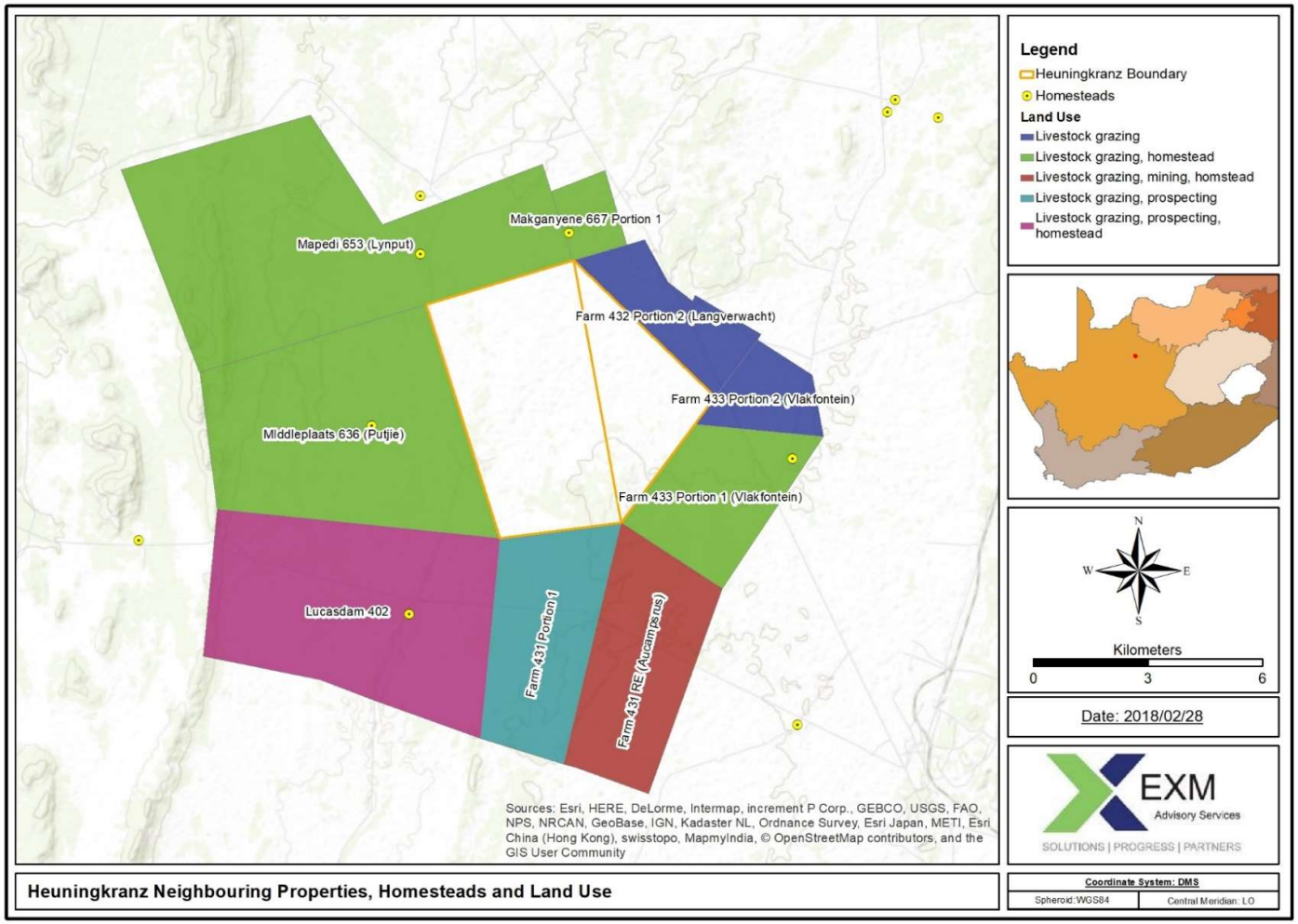


FIGURE 8-35: HEUNINGKRANZ NEIGHBOURING PROPERTIES, HOMESTEADS AND LAND USE

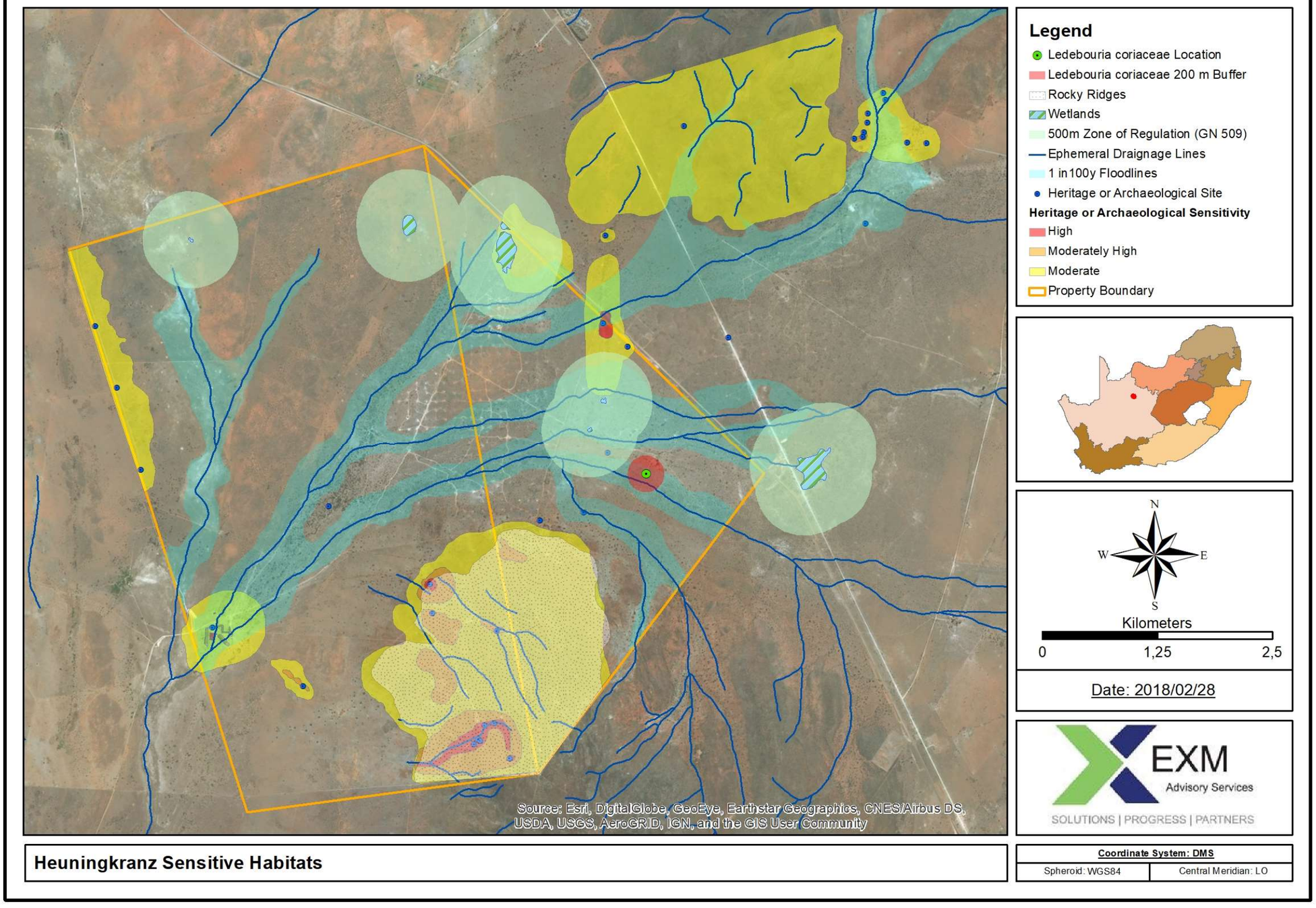


FIGURE 8-36: ENVIRONMENTAL SENSITIVITIES WITHIN THE HEUNINGKANZ PROJECT AREA

9. IMPACTS AND RISKS IDENTIFIED INCLUDING THE NATURE, SIGNIFICANCE, CONSEQUENCE, EXTENT, DURATION IN AND PROBABILITY OF THE IMPACTS, INCLUDING THE DEGREE TO WHICH THESE IMPACTS CAN BE REVERSED, AVOIDED, MANAGED, MITIGATED AND EXTENT TO WHICH THEY MAY CAUSE IRREPLACEABLE LOSS OF RESOURCES

9.1 List of impacts of activities in initial site layout

The list of the potential impacts of the activities that will be undertaken, as per the initial site layout planning are included below. This list of impacts has been informed by both the typical known impacts of such activities and consultation with interested and affected parties.

9.2 Methodology used in determining the significance of environmental impacts

9.2.1 Impact Ranking Criteria

The impact assessment method used in this assessment takes into account the current environment, the details of the proposed amendment activities and the findings of the specialist studies. Cognisance has been given to both positive and negative impacts that may result from the developments. The significance of the impact is dependent on the consequence and the probability that the impact will occur.

impact significance = (consequence x probability)

Where:

consequence = (severity + extent)/2

and

severity = [intensity + duration]/2

Each criterion is given a score from 1 to 5 based on the definitions given below. Although the criteria used for the assessment of impacts attempts to quantify the significance, it is important to note that the assessment is generally a qualitative process and therefore the application of this criteria is open to interpretation. The process adopted will therefore include the application of scientific measurements and professional judgement to determine the significance of environmental impacts associated with the project. The assessment thus largely relies on experience of the environmental assessment practitioner (EAP) and the information provided by the specialists appointed to undertake studies for the EIA.

Where the consequence of an event is not known or cannot be determined, the "precautionary principle" has been applied and the worst-case scenario assumed. Where possible, mitigation measures to reduce the significance of negative impacts and enhance positive impacts will be recommended. The significance of the impact in light of the mitigation measures has also been rated based on a confidence rating of the mitigation measures.

Consideration will be given to the phase of the project during which the impact occurs. The phase of the development during which the impact will occur will be noted to assist with the scheduling and implementation of management measures.

TABLE 9-1: SEVERITY CRITERIA FOR ASSESSING THE IMPACT SIGNIFICANCE

INTENSITY = MAGNITUDE OF IMPACT	**RATING**
Insignificant: impact is of a very low magnitude	1
Low: impact is of low magnitude	2
Medium: impact is of medium magnitude	3
High: impact is of high magnitude	4
Very high: impact is of highest order possible	5
DURATION = HOW LONG THE IMPACT LASTS	**RATING**
Very short-term: impact lasts for a very short time	**1**
Short-term: impact lasts for a short time e.g. construction period	**2**
Medium-term: impact lasts for the for less than the life of operation.	**3**
Long-term: impact occurs over the operational life of the project	**4**
Residual: impact is permanent (remains after mine closure)	**5**
EXTENT = SPATIAL SCOPE OF IMPACT/FOOTPRINT AREA/NUMBER OF RECEPTORS	**RATING**
Limited: Impact only affects the mine site or part there of	**1**
Neighbours: Limited to the immediate surroundings;	**2**
Local: Affecting a larger area (beyond immediate surroundings or neighbours)	**3**
District: Affects entire district	**4**
Regional: Affects an entire region e.g. Province	**5**
PROBABILITY = LIKELIHOOD THAT THE IMPACT WILL OCCUR	**RATING**
Highly unlikely: the impact is highly unlikely to occur	**0.2**
Unlikely: the impact is unlikely to occur	**0.4**
Possible: the impact could possibly occur	**0.6**
Probable: the impact will probably occur	**0.8**
Definite: the impact will occur	**1**

IMPACT SIGNIFICANCE

NEGATIVE IMPACTS

≤1	Very low	Impact is negligible. No mitigation required.
>1≤2	Low	Impact is of a low order. Mitigation could be considered to reduce impacts. But does not affect environmental acceptability.
>2≤3	Moderate	Impact is real but not substantial in relation to other impacts. Mitigation should be implemented to reduce impacts.
>3≤4	High	Impact is substantial. Mitigation is required to lower impacts to acceptable levels.
>4≤5	Very High	Impact is of the highest order possible. Mitigation is required to lower impacts to acceptable levels. Potential Fatal Flaw.

POSITIVE IMPACTS

≤1	Very low	Impact is negligible.
>1≤2	Low	Impact is of a low order.
>2≤3	Moderate	Impact is real but not substantial in relation to other impacts.
>3≤4	High	Impact is substantial.
>4≤5	Very High	Impact is of the highest order possible.

DEVELOPMENT PHASE

C	Impact is applicable to the CONSTRUCTION PHASE ONLY
O	Impact is applicable to the OPERATIONAL PHASE ONLY
C&O	Impact is applicable to the CONSTRUCTION AND OPERATIONAL PHASE

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

NOTE: A COMPREHENSIVE ASSESSMENT OF ALL IMPACTS IS GIVEN IN SECTION 9.5. A SHORT DESCRIPTION OF KEY IMPACTS IS PROVIDED BELOW. THE MITIGATED LAYOUT IS PROVIDED IN SITE LAYOUT PLAN 3 (FIGURE 3.1 & 6.3).

9.3.1 Groundwater

Impacts on groundwater are described in the Geohydrological Investigation Report (Groundwater Complete, January 2018). The report is included in Part C – Appendix 1.

9.3.1.1 Groundwater Levels

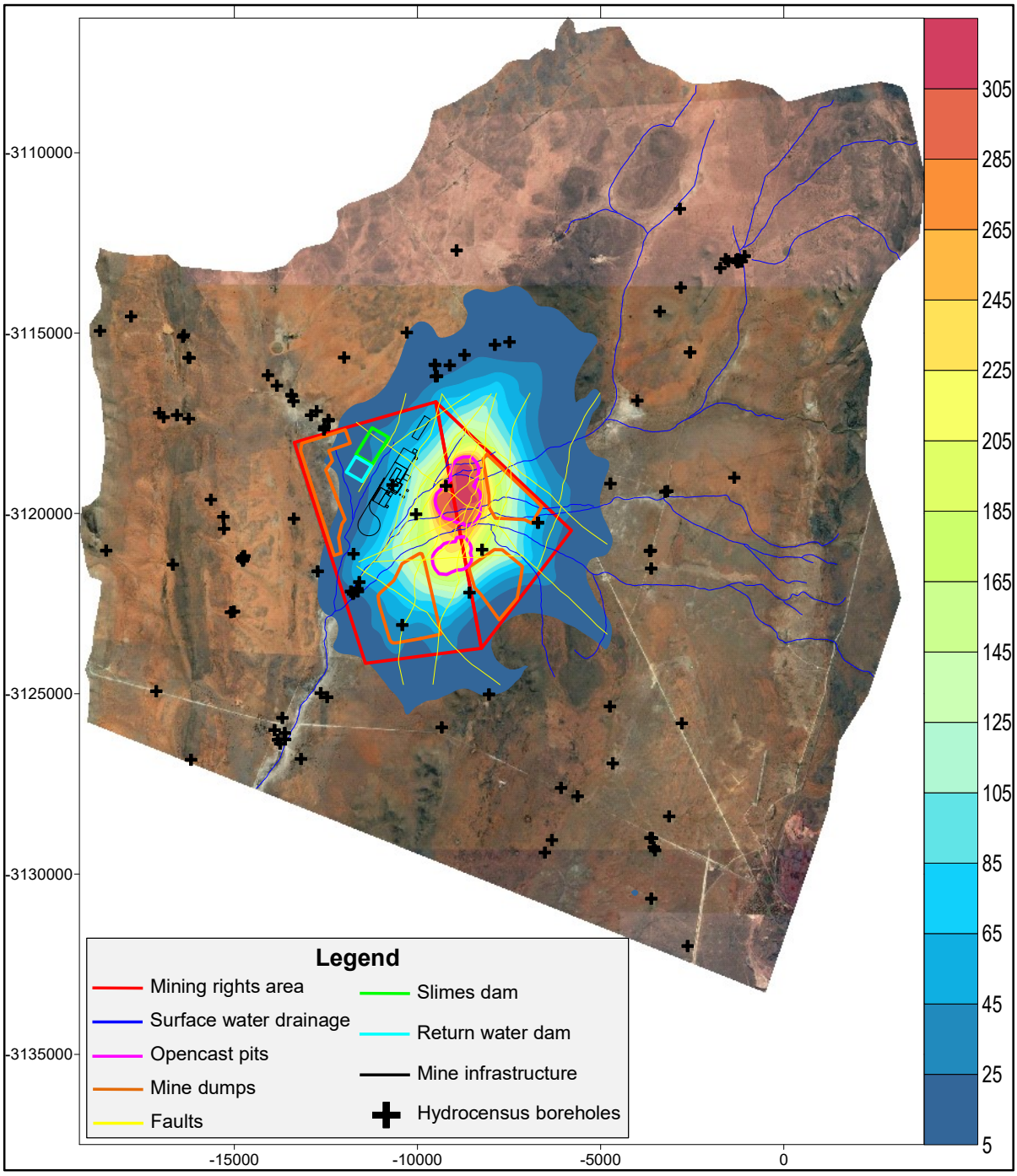
Impacts on groundwater levels are expected to occur as a result of pit dewatering (groundwater depression cone) and artificial aquifer recharge (groundwater mounding). A numerical groundwater flow model was consequently used to simulate/predict these impacts as accurately as possible. Furthermore, the flow model was also used to simulate/predict groundwater influx volumes from year one through to mine closure (refer to Section 4.1.2).

The following is to be noted with respect to the modelling of the potential drawdown as a result of the dewatering of mining operations at Heuningkranz:

- The secondary fractured rock aquifer is a highly complex system and is by no means homogeneous.
- Coupled with numerous model restrictions, one is expected to come across either over- or under-estimations of the predicted groundwater impacts. The model results are therefore regarded as being qualitative rather than quantitative for use in planning of management and mitigation measures.

A contour map of the model simulated groundwater depression cone at mine closure (17 years) is given in Figure 9-1.

The shape and extent of the depression cone are largely determined by the hydraulic properties of the surrounding aquifer/s and geological structures. Impacts on groundwater levels are exacerbated along transmissive geological structures (i.e. open fractures and discontinuities), while structures such as dykes form groundwater barriers that inhibit impacts on groundwater levels. The general south-west by north-east orientation of faults that cut through the mining rights area are responsible for the elongation of the depression cone in these general directions. Dewatering will result in a groundwater drawdown beyond the site boundaries, especially to the north of Heuningkranz. The greatest impact will be experienced at Langverwacht Portion 2 and RE, land to which SIOC has the surface rights, and private water users (including existing boreholes) up to a distance of ~5 km north. Groundwater levels are also expected to drop in an area ~2 km to the south and east of the boundary while the area to the west and north west is predicted to not be as affected. It should however be noted that the model results will need to be verified and updated regularly by means of a comprehensive groundwater monitoring programme.



Source: Groundwater Complete (January 2018)

FIGURE 9-1: MODEL SIMULATED GROUNDWATER DEPRESSION CONE AT MINE CLOSURE (M)

9.3.1.2 Contamination of Underlying Aquifers

The impact prediction is based on the findings of the Heuningkranz Waste Assessment Undertaken by Jones & Wagener Consulting Civil Engineers (October 2017). The report is included in Part C- Appendix 13.

The various mineral waste streams to be produced at Heuningkranz were assessed in terms of the National Norms and Standards for the Assessment of Waste for Landfill Disposal (GNR. 635 of 23 August 2013). These regulations consider the leachable concentrations (LC) and total concentrations (TC) of potential contaminants compared to legislated limits. The wastes are then defined as types based on the risk to the environment. The containment barriers required to protect the environment from the different waste types are defined in the National Norms and Standards for Disposal of Waste to Landfill (GNR. 636 of 23 August 2013).

Since no waste streams have been produced at Heuningkranz; representative samples of DMS tailings and discard were obtained from Kolomela Mine. Geological core material was used to form composite samples of what would be considered to be representative of overburden material, waste rock and ore. The results of the waste assessment are presented in Table 9-2.

TABLE 9-2: SUMMARY OF WASTE ASSESSMENT RESULTS

Waste	Description	LC Results	TC Results	Overall Result
Kolomela Tailings	Iron exceed leachable limits* Barium, cadmium & fluoride exceed total limits. Near neutral	Type 3[4]	Type 3	Type 3
Kolomela Discard	Iron exceed leachable limits* Barium, cadmium & fluoride exceed total limits. Alkaline	Type 3	Type 3	Type 3
Heuningkranz: South Pit Waste	No constituents exceed leachable limits Barium, cadmium, manganese & fluoride exceed total limits. Slightly alkaline	Type 4	Type 3	Type 3
Heuningkranz: Low Grade Ore	No constituents exceed leachable limits Barium, cadmium, & fluoride exceed total limits. Slightly alkaline	Type 4	Type 3	Type 3
Heuningkranz: Overburden	No constituents exceed leachable limits	Type 4	Type 3	Type 3

[4] Waste types as per GNR 636 of 23 August 2013

Waste	Description	LC Results	TC Results	Overall Result
	Barium, cadmium, manganese, nickel & fluoride exceed total limits. Highly alkaline			
Heuningkranz: North Pit Waste	Sulfate exceeds leachable limits Cadmium & fluoride exceed total limits. Slightly alkaline	Type 3	Type 3	Type 3
Heuningkranz: High Grade Ore	Sulfate exceeds leachable limits Cadmium & fluoride exceed total limits. Slightly alkaline	Type 3	Type 3	Type 3

Source: Jones & Wagener (October 2017)

* Although iron is not listed in the National Norms and Standards, it was compared to the SANS 241 2015 drinking water standard of 2.0 mg/ℓ, the chronic health limit, which is also the LCT0 value.

Type 3 wastes require a Class C barrier system (see Figure 9-2).

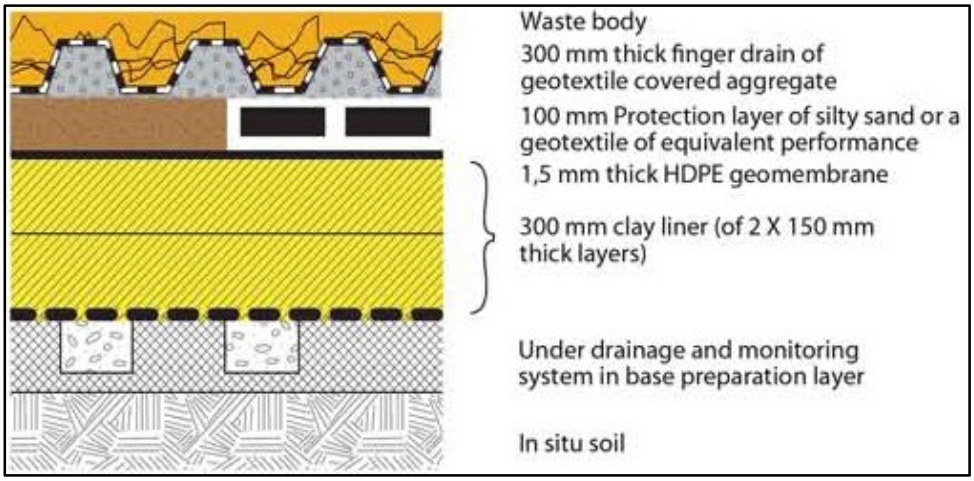
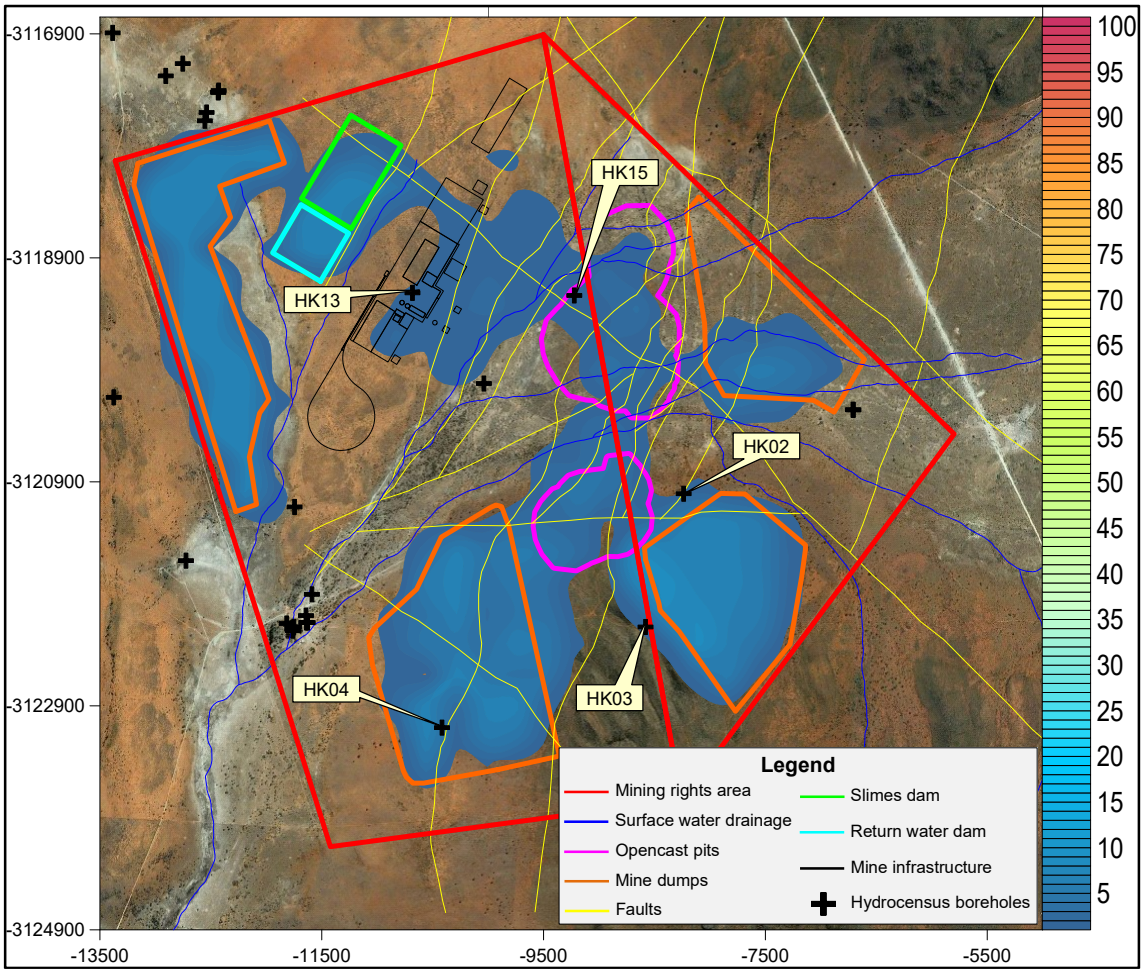


FIGURE 9-2: CLASS C BARRIER SYSTEM

With the exception of North Pit waste material which shows the potential for elevated sulfate levels in the leach, the waste streams do not produce leachable concentrations of contaminants that are considered to pose a risk to the environment. Furthermore, mass transport modelling undertaken by Groundwater Complete (January, 2018) shows that the potential dispersion of contaminants will be limited to within the boundaries of the mine at closure (see Figure 9-3).



Source: Jones & Wagener (October 2017)

FIGURE 9-3: MODEL SIMULATED CONTAMINANT PLUMES AT MINE CLOSURE (AS A PERCENTAGE OF SOURCE)

Even after 50 years, water levels would still not have fully recovered from the impacts of pit dewatering. Therefore the pits continue to act as sinks for both groundwater and contamination, and contamination will have decreased to 10 km^2, 50 years after closure. This is because the pit areas will continue to act as sinks if left open or only partially filled with waste rock. Given that the material is of an inert nature and the fact that contaminants concentrations will be low and unlikely to ever reach receptors, it is motivated that barriers would not be required for the protection of the environment from overburden and waste rock material. The implementation of a Class C barrier systems at waste rock dumps is not practable and is not considered to add any additional barrier in terms of the protection fo the environment. This is further motivated by the fact that groundwater monitoring at both Kolomela Mine and Sishen Mine have not shown any potential risk of groundwater contamination due to the disposal of waste rock directly onto surface.

The DMS discard and tailings material sourced from Kolomela only show potential for the leaching of iron. Based on work undertaken of similar material at Sishen Mine (Exigo[3], 2014), it has been motivated that these wastes are unlikely to be subject to the chemical processes that mobilise metals and anions, as the residues are generally resistant to chemcial weathering and thus have slow reaction rates. It is thereferore considered that the dsicard and the tailings will not have a significant impact on the water environment. The wastes at Sishen have been classified as Type 4 wastes. For the purposes of this assessment it has been assumed that the risks to groundwater at Heuningkranz will be the same and no liners have been provided for the discard and slimes dam.

The tailings water fractions at Sishen have however been found to have elevated nitrate concentrations and the groundwater in the vicinity of the tailings disposal facility appears to have been impacted by nitrate. It is expected that similar conditions will be applicable to Heuningkranz. It is thus recommended that the slimes return water dam be lined with a Class C barrier or equivalent in order to ensure protection of the groundwater environment. Furthermore, a barrier may be required for the slimes dam. This should be confirmed by source-pathway-receptor modelling of groundwater impacts.

Since the stormwater management pond will result in the containment of dirty water run-off, which includes workshops, hydrocarbon and refuelling areas, it is has been recommended that the dam also be lined. However, the need for lining this dam may be negated should internal lined pollution control dams be put in place that intercepts water from key pollution sources.

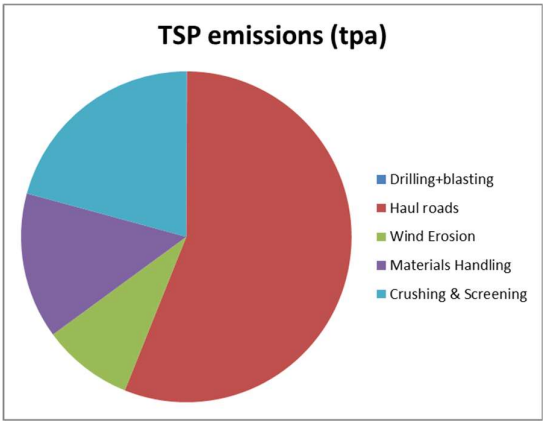
9.3.2 Air Quality

An air quality impact assessment has been undertaken for the project (Airshed Planning Professionals[1], February 2018). The report is included in Part C – Appendix 2.

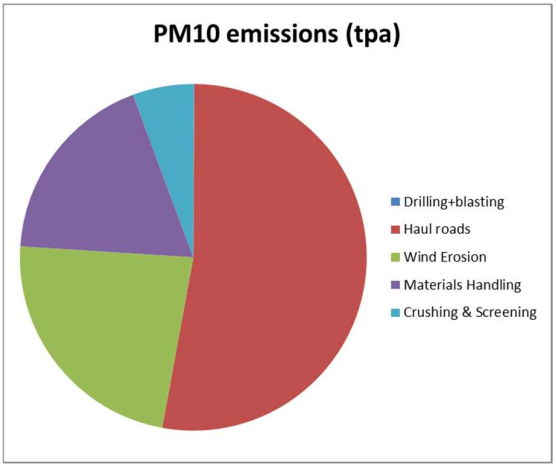
The establishment of a comprehensive emissions inventory formed the basis for the assessment of the air quality impacts from the project's emissions on the receiving environment. In the quantification of emissions, use was made of emission factors which associate the quantity of a pollutant to the activity associated with the release of that pollutant. Year 2035 was used for the purposes of impact modelling. This is the year with maximum quantities of ROM. The ROM coming from the pit closest to the sensitive receptors, i.e. the North pit – 10.8 Mtpa ore and 65 Mtpa waste rock – 75.8 Mtpa to be handled and transported, with all the ore and waste coming from the North pit.

9.3.2.1 Emission Sources

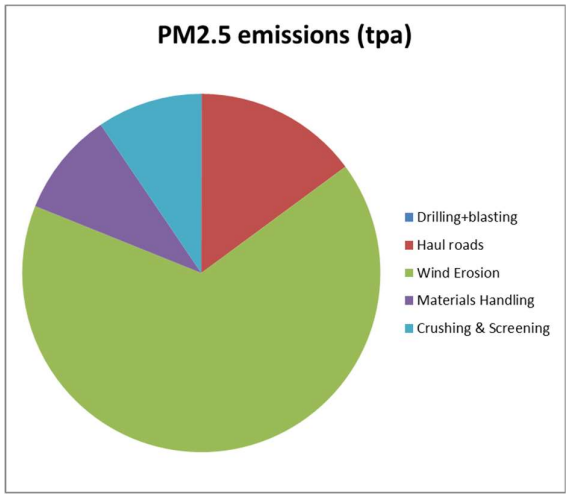
In the simulation of ambient air pollutant concentrations and dustfall rates, use was made of the US EPA AERMOD atmospheric dispersion modelling suite. The estimated annual emisson of total suspended particulates (TSP/fallout dust), PM_{10} and $PM_{2.5,}$ from various sources are shown in Figure 9-4.



a) TSP emissions



b) PM_{10} emissions



c) $PM_{2.5}$ emissions

Source: Airshed Planning Professionals[1] (February 2018)

FIGURE 9-4: ESTIMATED MAXIMUM ANNUAL PARTICULATE MATTER EMISSIONS FROM VARIOUS SOURCES

The following is noted with regards to the emissions inventory:

- Operational phase particulate matter emissions amount to 6 146 t/a TSP, 2 262 t/a PM_{10} and 673 t/a $PM_{2.5}$.
- Maximum TSP emissions result mostly from unpaved roads and crushing (Figure 9-4(a)).
- The top contributors to PM_{10} are unpaved roads and wind erosion (Figure 9-4(b)).
- $PM_{2.5}$ emissions result mostly from wind erosion and unpaved roads (Figure 9-4(c)).

9.3.2.2 Predicted PM_{10} and $PM_{2.5}$ Levels

Dispersion modelling was undertaken to determine highest hourly, highest daily and annual average ground level concentrations for each of the pollutants. Averaging periods were selected to facilitate the comparison of predicted pollutant concentrations to relevant ambient air quality and inhalation health criteria.

Simulated ambient PM_{10} concentrations as a result of the operational phase of Heuningkranz Mine are within annual and daily NAAQS at all neighbouring receptors. Exceedances of criteria are only expected in close proximity to areas of operation (Figure 9-5 to Figure 9-8).

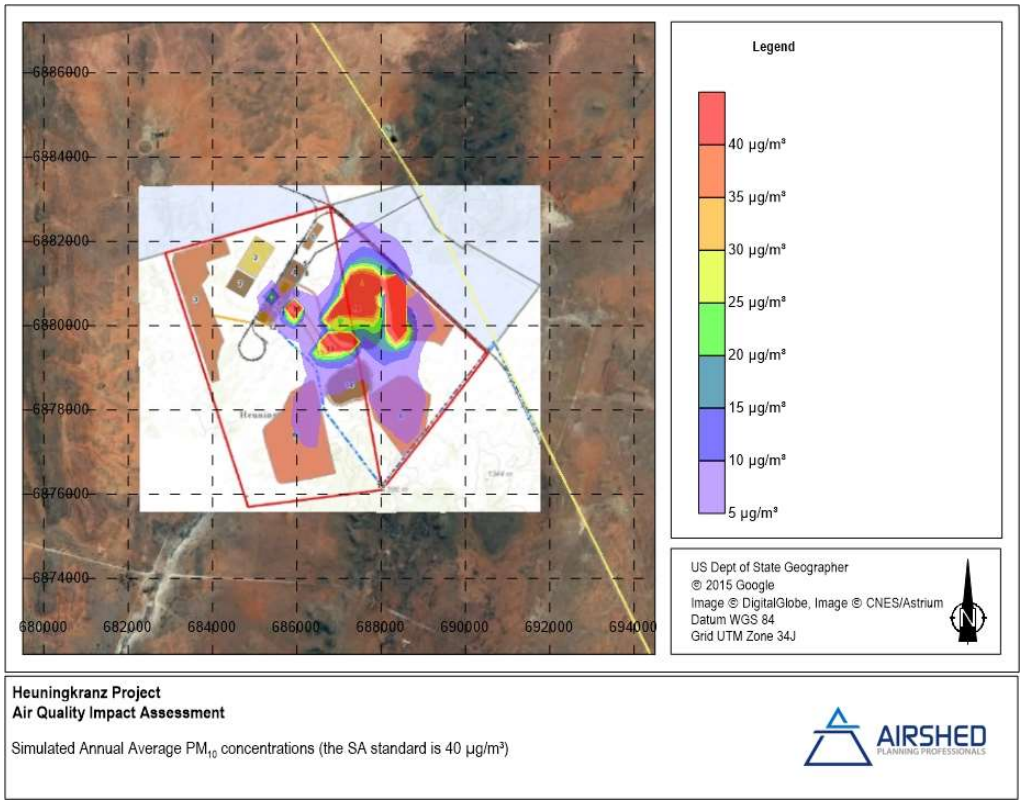
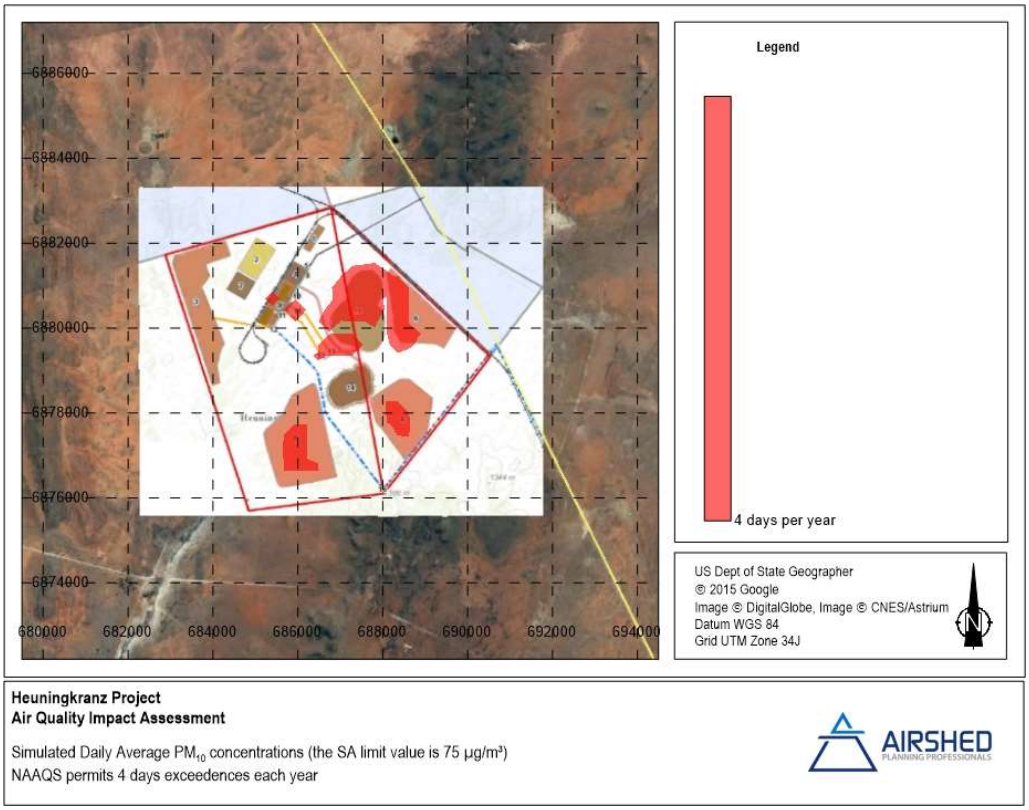


FIGURE 9-5: SIMULATED ANNUAL AVERAGE PM_{10} CONCENTRATIONS



Source: Airshed Planning Professionals[2] (February 2018)

FIGURE 9-6: SIMULATED NO. OF DAYS OF EXCEEDANCE OF THE PM_{10} NAAQS LIMIT VALUE OF 75 µg/m^3

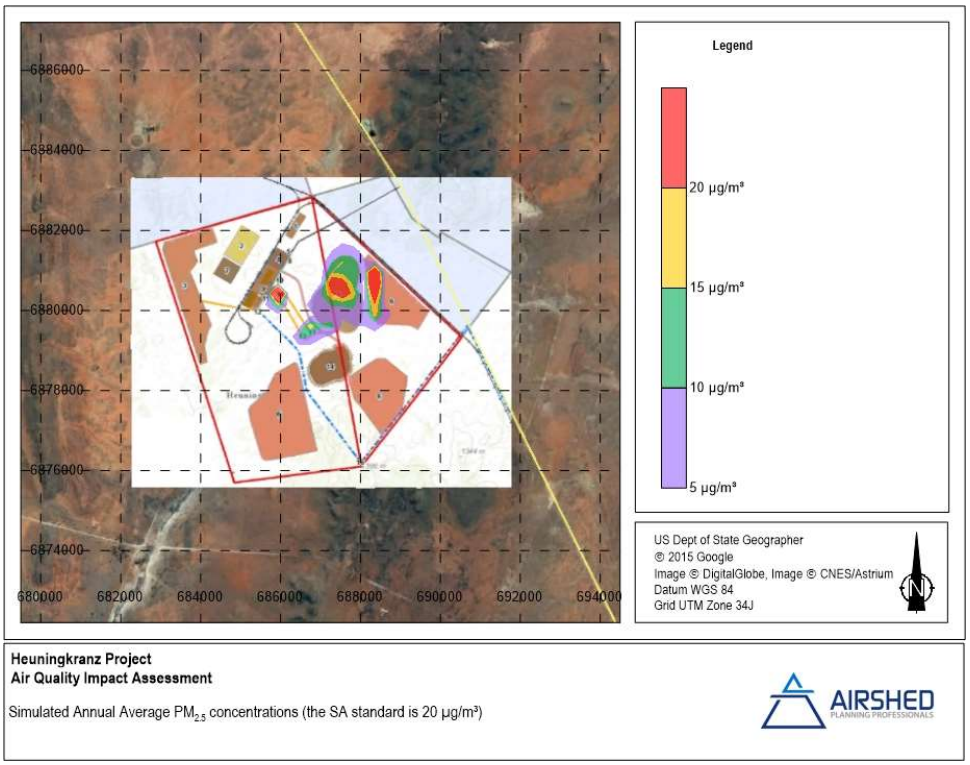
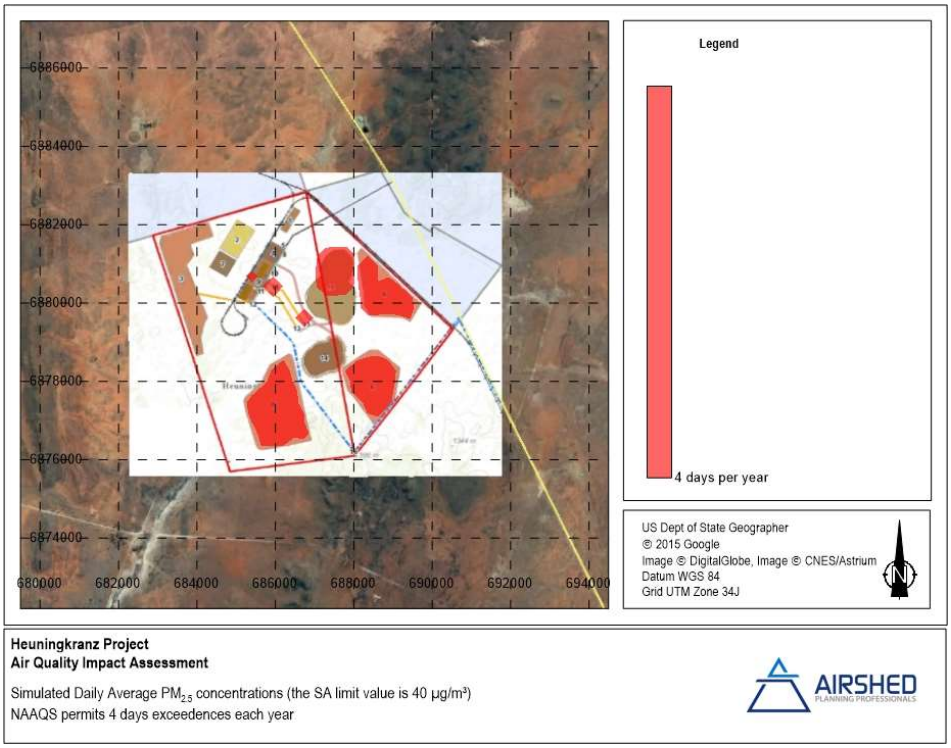


FIGURE 9-7: SIMULATED ANNUAL AVERAGE $PM_{2.5}$ CONCENTRATIONS

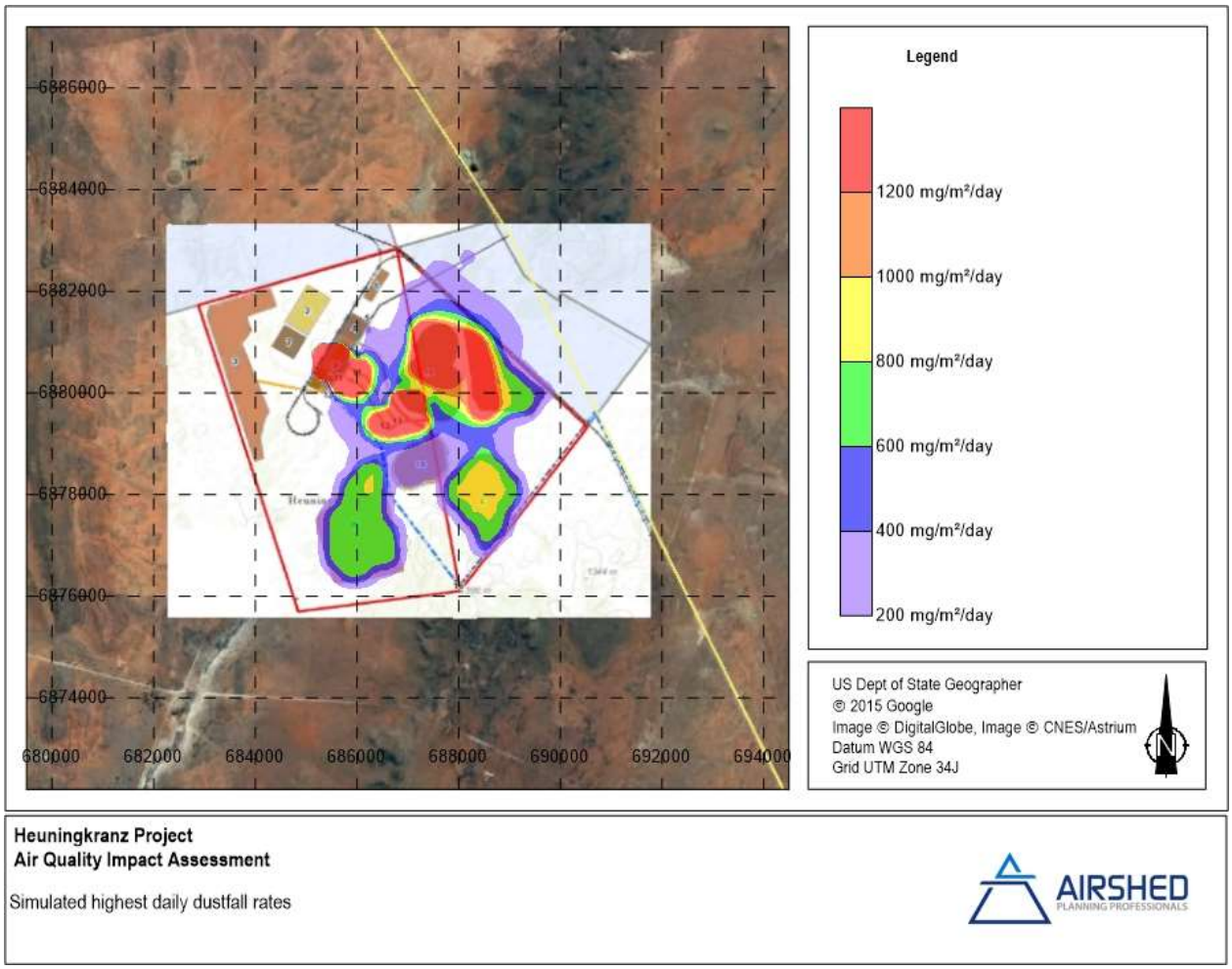


Source: Airshed Planning Professionals[1] (February 2018)

FIGURE 9-8: SIMULATED NO. OF DAYS OF EXCEEDANCE OF THE $PM_{2.5}$ NAAQS LIMIT VALUE OF 40 µg/m^3

9.3.2.3 Dust Fallout

Simulated dustfall rates at Heuningkranz Mine are low and within the National Dust Control Regulations for residential areas (600 mg/m²/day) at all neighbouring receptors. Although incremental dustfall rates are below National Dust Control Regulations at neighbouring homesteads, exceedances of requirements for industrial areas (1 200 mg/m²/day) are expected in close proximity to areas of operation (Figure 9-9).



Source: Airshed Planning Professionals[1] (February 2018)

FIGURE 9-9: SIMULATED HIGHEST DAILY DUSTFALL RATES

9.3.3 Noise Impacts

A noise impact assessment has been undertaken for the project (Airshed Planning Professionals[2], February 2018). The report is included in Part C – Appendix 3.

As for air quality impacts, year 2035 was used for the purposes of noise impact modelling. This presents the year of maximum production. The propagation of noise from proposed activities was simulated with the DataKustic CadnaA software. Use was made of the International

Organisation for Standardization's (ISO) 9613 module for outdoor noise propagation from industrial noise sources.

Simulated noise levels were assessed according to guidelines published in SANS 10103 and by the IFC. To assess annoyance at nearby places of residence, the increase in noise levels above the baseline as recorded at receptor points (see Section 8-12) were calculated and compared to guidelines published in SANS 10103.

The simulated equivalent continuous day-time rating level ($L_{Req,d}$) of 45 dBA (noise guideline level) extends ~50 m from the project boundary to the north east (see Figure 9-10). The simulated equivalent continuous night-time rating level ($L_{Req,n}$) of 35 dBA (noise guideline level) extends ~1 200 m from the project boundary to the north east (see Figure 9-12). The closest sensitive receptor is ~800 m to the north of the project boundary.

Operational phase related noise due to the project is not predicted to exceed the selected noise guidelines at the receptors surrounding the project with an increase above the baseline of less than 3 dBA at all of the sites (see Figure 9-11 and 9-13). For a person with average hearing acuity an increase of less than 3 dBA in the general ambient noise level is not detectable. According to SANS 10103 (2008); 'little' reaction with 'sporadic complaints' may be expected from the community for increased noise levels up to 10 dBA. 'Little' reaction is therefore expected from the community due to the project with changes in the general ambient noise levels barely being detectable (for a person with average hearing acuity).

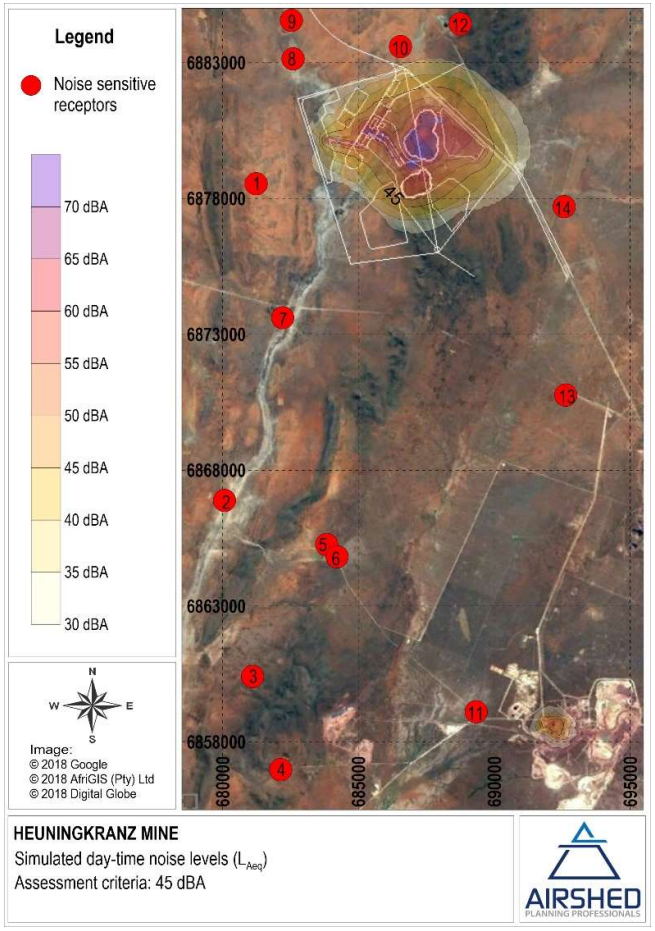


FIGURE 9-10: SIMULATED EQUIVALENT CONTINUOUS DAY-TIME RATING LEVEL ($L_{REQ,D}$) FOR PROJECT ACTIVITIES

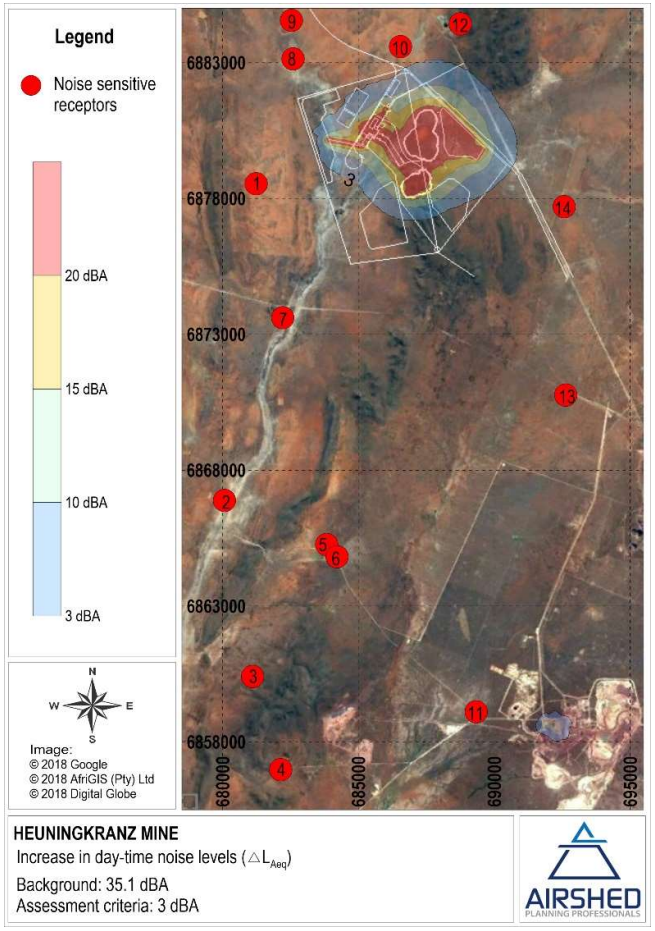


FIGURE 9-11: SIMULATED INCREASE IN EQUIVALENT CONTINUOUS DAY-TIME RATING LEVEL ($\triangle L_{REQ,D}$) ABOVE THE BASELINE

Source: Airshed Planning Professionals[2] (February 2018)

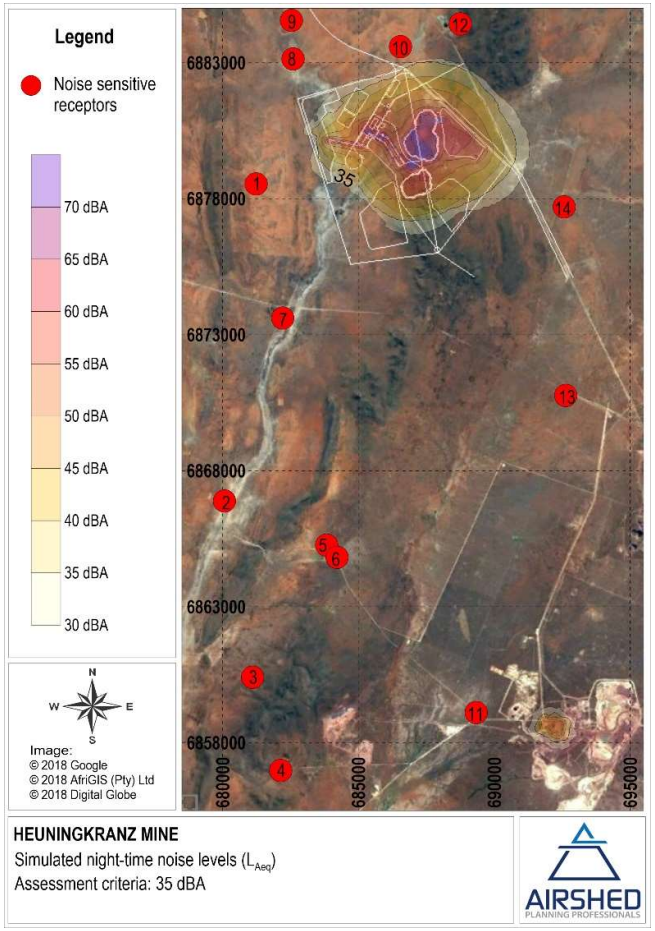


FIGURE 9-12: SIMULATED EQUIVALENT CONTINUOUS NIGHT-TIME RATING LEVEL ($L_{REQ,N}$) FOR PROJECT ACTIVITIES

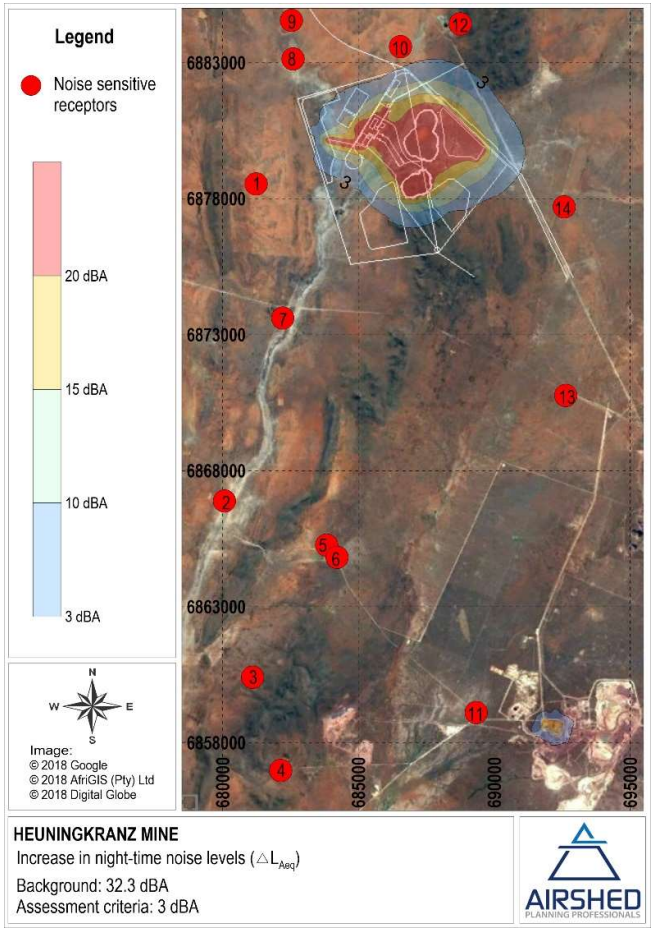


FIGURE 9-13: SIMULATED INCREASE IN EQUIVALENT CONTINUOUS NIGHT-TIME RATING LEVEL ($\Delta L_{REQ,N}$) ABOVE THE BASELINE

Source: Airshed Planning Professionals[2] (February 2018)

9.3.4 Soils, Land Capability and Land Use

The impact on soils and land capability was assessed by Scientific Aquatic Services (January, 2018). The report is included in Part C – Appendix 4.

Although the Heuningkranz area does include Hutton soils which are considered to be primary agricultural soils, the productivity of these soils is likely to be limited due to the low rainfall received in the area. Furthermore, high temperatures will affect crop yield. The area is therefore unsuitable for commercial agricultural purposes.

Due to the predominance of Mispah and Glenrosa (shallow soils) soil forms, relatively low impact is foreseen on these from a land capability perspective. However, the soils are important in maintaining the suitability of the area for the maintenance of wildlife and livestock. The Witbank soils (Anthrosols) have already been disturbed and thus have no arable or grazing capability.

The Heuningkranz area is predominantly flat having a slope of less than 3%, with some rocky outcrops consisting of Mispah soils which would have the greatest risk of erosion. Erosion is thus considered to be a medium risk in the area. Hutton and Brandvlei soils will have a moderate risk of compaction due to the loamy sandy texture, while soils with a shallow bedrock such as Glenrosa/Mispah, are anticipated to be less prone to compaction due to the resistance offered by the bedrock. Given the limited availability of soils for rehabilitation, soils are to be protected to ensure that the land can be restored to at least livestock grazing capability.

The development of linear infrastructure acts as a barrier restricting the movement of livestock and wildlife. The mitigated layout (see Figure 9-19) provides for the consolidation of the impacts and preventing the formation of small isolated farm units as far as practicable. Given the low carrying capacity of the land, the aim is to maximise the land capability of the remaining portions in order that it can continue to be used for livestock grazing during the life of the operations.

Note that the access road to the homesteads on the farms to the north run along the western edge of the mine property adjacent to the discard dump. The access to Lynput is to be maintained throughout the life of the operation.

9.3.5 Terrestrial Biodiversity

The potential impact on terrestrial biodiversity has been assessed by Scientific Terrestrial Services (February, 2018). The report is included in Part C – Appendix 5.

Of the five habitat units identified at Heuningkranz (see Section 8.1.8), the wetlands are considered to have the highest sensitivity. The wetland habitats are important freshwater systems and during periods of high rainfall are a source of water. These habitats provide habitat for faunal and floral species dependent on such systems with a dry environment.

Although the ephemeral drainage features do not hold water to sustain wetland species, they are of ecological importance in terms of the augmentation of flow and soil moisture in areas downstream of the study area and are therefore regarded as having moderately high sensitivity. A number of species of conservation concern are also associated with the drainage areas.

The rocky ridges are relatively intact and support a large number of protected species (specifically *Boscia albitrunca*). The protection of wetlands and ephemeral drainage, and to a lesser extent rocky ridges, is thus considered to be important in terms of protecting terrestrial biodiversity.

The proposed project will result in the complete disturbance of wetland pans should the unmitigated layout be implemented (see Figure 9-14). This is as a result of the proposed layout of the discard dump and the North Eastern WRD. Furthermore, the encroachment of the northern pit and the construction camp footprint on the wetland buffer zones, could mean that the catchments of additional wetland pans are disturbed which could result in a loss of functionality of the wetland. The Northern Pit and North Eastern WRD will also intercept ephemeral drainage originating north east of Heuningkranz.

A mitigated layout provides for the protection of the wetland pans, by the alteration of the layout of the discard dump and the consolidation of the North Eastern and South Eastern WRD (see Mitigated Layout in Figure 9-18).

The Construction Village is temporary in nature and is to be moved outside of the buffer of the wetland pan to decrease the risk to the pan. The mitigated layout will however result in an increase in impacts on ephemeral drainage from the south east, but this habitat is considered to be of lower ecological sensitivity than the wetlands.

In addition, the mitigated layout allows for the re-routing of the access road (and the Eskom powerline) in line with the railway, which will reduce the risk to the nearby wetland pan (although the buffer is still affected). It is recommended that the catchment of the pan be delineated in order to better understand the buffer zones required for the protection of this and other wetlands on the site. If the catchments cannot be avoided, it will be necessary to place culverts under the linear infrastructure to ensure that rainwater feeding the pan can be maintained.

Of importance is the numerous pipeline and conveyor crossings over drainage channels at Heuningkranz. Damage to the vegetation within the drainage channels will impact on both the

onsite biodiversity and downstream ecology that are dependent on these systems. The crossings cannot be avoided due to the number and extent of drainage channels at that site. However, it is important that crossings are raised above the flood levels and disturbance of vegetation avoided as far as practicable. In addition, measures to contain spillages from such conveyances during the life of the operation are required.

Of importance is the discovery of what is thought to be the Critically Endangered *Ledebouria coriaceae* at the site. The project layout does not impact on the known site. However, the extent of the population is not known. The precautionary principle is to be applied and a maximum buffer (200 m) placed around the known site restricting development until further information becomes available (see mitigated layout Figure 9-18). Further work will be undertaken to clarify details with respect to this plant species.

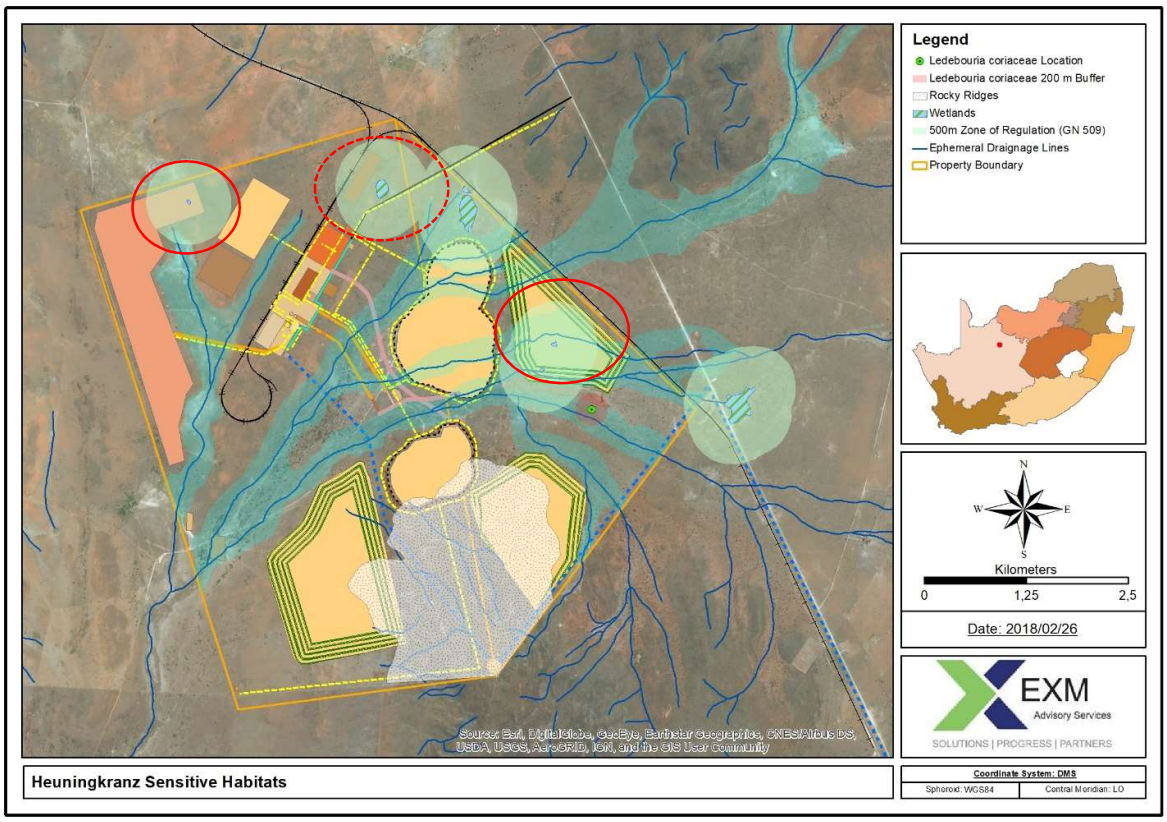


FIGURE 9-14: IMPACT OF PROJECT ON WETLAND PANS (UNMITIGATED SCENARIO)

9.3.6 Freshwater Resources and Wetlands

The Freshwater Resource Ecological Specialist Assessment (Scientific Aquatic Services, February 2018) provides detail on the impact on the freshwater ecology. The report is included as Part C – Appendix 6.

The wetland pans in the study area are of high ecological integrity (PES of B) and largely in a natural condition. As indicated in Section 9.3.5, the proposed location (unmitigated scenario) of the North Eastern WRD and the Discard Dump will result in the direct loss of three wetland pans. The loss of the pans is regarded as being of high significance, and Scientific Aquatic Services (February 2018) has recommended that the locations of these dumps be reconsidered to avoid the loss of these surface water resources. However, there is a consequent increase in the impact on ephemeral drainage from the south east, which cannot be avoided but is considered to be of lesser importance than the major tributary from the north east. The mitigated scenario as provided in Figure 9-18 allows for the avoidance of pans.

The Construction Village has also been relocated outside of the 500 m wetland buffer area, in order to reduce the risk to an additional wetland pan. The road and access road have also been rerouted in the mitigated layout to be further away from the wetland pan.

The Northern Pit will intercept drainage from the north east of the site. The ephemeral drainage lines are key to the downstream conveyance of water during high rainfall events whilst providing habitat and food resources to terrestrial biota. The drainage is also of importance for the hydrological regime of the tributary of the Soutloop River downstream of Heuningkranz, which has both ecological and agricultural importance. The impacts can be reduced by the implementation of effective stormwater/run-off diversion around pits and waste rock dumps to ensure that water from the upper reaches of the catchment is returned to the natural drainage systems downstream of these impedances.

As described in Section 8.1.9, the railway line and the northern farm boundary road have resulted in the isolation of several ephemeral drainage lines entering from the north-east. The cut-off of this drainage needs to be remediated as a matter of urgency to restore the recharge of the catchment to the downstream tributaries of the Soutloop River. SIOC is to liaise with Transnet to address this issue.

9.3.7 Socio-Economics

The Economic Impacts of the Heuningkranz Project to extend the life of Kolomela Mine have been predicted by Demacon Market Studies (January, 2018). The Economic Impact Assessment is included in Part C, - Appendix 8.

The economic impact is predicted using national multipliers. The multiplier effect refers to the increase in final income arising from any new injection of demand. The following is evident for iron ore mining in the Northern Cape:

- Output/Sales: For every R1 million in final demand from iron ore mining there is R1.37

million downstream variation in output/sales generated across the entire economy.

- Labour remuneration: Salaries and wages within the mining sector are on average higher than in the agricultural sector. As a result, the economy-wide impact is higher, as workers earn more, and can spend more money on goods and services than those in the agricultural sector. For every R1 million variation in final demand, labour remuneration gains R320 000.
- Employment: A total of 2 employment opportunities are created within the formal and informal sectors across the entire economy due to a R1 million variation in mining demand. The reverse is also true, with a loss in 2 employment opportunities across the economy if there is a R1 million decreased in iron ore mining demand.

The construction phase of the project will last 3 years employing ~ 950 people. The predicted overall economic and employment impact of the construction phase of the Heuningkranz Project based on the current estimations of the capital expenditure are provided in Table 9-3. The economy wide impact includes direct, indirect and induced impacts. The construction phase of the project is predicted to result in the following short-term impacts:

- Additional business sales of R9.2 billion;
- Additional GGP of R6.2 billion; and
- Additional employment of 13 665.

The economic impacts to the local and regional economies are significant.

TABLE 9-3: ECONOMIC IMPACT DURING THE CONSTRUCTION PHASE OF HEUNINGKRANZ

Variable	Direct Impact	Indirect Impact	Induced Impact	Total Impact
Additional Business Sales	R6 871 796 451	R125 405 555	R2 152 778 350	R9 149 980 357
Additional GGP	R5 240 486 390	R54 702 924	R956 101 064	R6 251 290 378
Additional Employment	8 313	224	5 128	13 665

Source: Demacon Market Studies (January 2018)

The Heuningkranz project will result in the extension of the life of Kolomela Mine by 14 years. Thus, although the project will not result in additional economic impacts, economic benefits of the mine will be sustained over the additional period, thus the economic benefits of Kolomela Mine will be experienced over a longer period.

The sustained annual economic impacts of the Heuningkranz Project as predicted by Demacon Market Studies (January 2018) based on the operational expenditure for Heuningkranz, are provided in Table 9-4. The Heuningkranz Project will result in the following sustained annual impact on the economy:

- Additional business sales of R4.6 billion;
- Additional GGP of R 3.1 million; and
- Additional employment of 6 871.

The Heuningkranz Project will mean that Kolomela Mine will continue to be a significant contributor to the local and regional economies.

TABLE 9-4: ECONOMIC IMPACT DURING THE OPERATIONAL PHASE OF HEUNINGKRANZ

Variable	Direct Impact	Indirect Impact	Induced Impact	Total Impact
Additional Business Sales	R3 455 271 961	R63 056 335	R1 082 458 528	R4 600 786 824
Additional GGP	R2 635 017 759	R27 505 687	R480 749 079	R3 143 269 524
Additional Employment	4 180	113	2 578	6 871

Source: Demacon Market Studies (January 2018)

The extension of the life of Kolomela would mean that the social issues experienced in Tsantsabane, as a result of the rapidly expanded development, may be prolonged if not adequately addressed in the interim. The influx of people into the area attracted by the potential for employment has resulted in a demand for additional housing, consequent expansion of informal settlements, increased crime and demand on municipal services. This also puts pressure and health, education and policing resources within the LM.

Kolomela Mine through its Social and Labour Plan commitments and Local Economic Development Programme provides support in addressing the social impacts in the expanding community. Kolomela Mine will continue to support the local community including a long-term view of the Heuningkranz Project and extended life of Kolomela Mine.

Given that the Heuningkranz Project is planned for the future and the pending sustained life of Kolomela Mine, there is an opportunity to ensure that current and predicted future impacts are addressed. Of importance is the focus on local employment and procurement. The local community together with SIOC have time to prepare, in order to ensure that the skills base within the local community through education and training initiatives is enhanced in anticipation of the construction of Heuningkranz and the sustained life of Kolomela.

9.3.8 Traffic

An assessment of the road conditions and traffic flow and the predicted impact of the Heuningkranz Project has been assessed by JG Afrika (January 2018). The report is included as Part C – Appendix 9.

The existing facilities at Kolomela Mine will continue to provide the main administrative services to the mine even after the implementation of Heuningkranz. The DSO plant and rail will also continue to function. The R385 is proposed as the link to the access road to the Heuningkranz Section. The majority of traffic associated with the mine will however traverse the R385. Although the traffic volumes are considered to be low, the significance is that this is a gravel road.

According to JG Afrika (January 2018) an average traffic figure of 400 vehicles is sufficient to warrant for a bituminous surfacing of the road. This is as a result of higher maintenance costs, deterioration of the road surface leading to discomfort to the road user, additional vehicle maintenance and running costs, and safety due to road conditions and poor visibility leading to unsafe conditions. The traffic on the R385 gravel road is expected to increase to 512 and 763 vehicles per day during the construction and operational phases of Heuningkranz, respectively.

It should however be noted that regional roads department do not have the financial means to maintain or upgrade the road. The mitigation measures will thus have to be implemented by the project under the approval of the Northern Cape Department of Roads and Public Works who will foremost consider safety and the impact on the road user.

Mitigation measures should keep the road surface and geometry in a safe and reasonable condition and minimise dust to ensure safe sight distances always. This can be achieved by initial upgrading of the road and scheduled routine maintenance thereafter; as well as dust suppression by regular watering or the application of a propriety dust suppressant. The measures should overcome the problems experienced with calcrete gravel roads subjected to excessive wetting and drying cycles as well as excessive traffic volumes. During discussions with the Roads Department in the past, they expressed their concern over the use of propriety dust suppressants given their past experience with the product on public roads. The main concern relates to complaints over contamination of private vehicles with dust suppressant. Having a maintenance team on hand and doing dust suppression can be a costly exercise and should be budgeted for. The maintenance team will work on a public road under traffic as this is a high-risk operation.

The ideal solution in mitigation of all the above is a low cost surfaced road making optimal use of available materials.

9.3.9 Cultural Heritage

A Cultural Heritage Assessment was undertaken for the site in 2013 (African Heritage Consultants, September 2013). The report is included in Part C – Appendix 10.

The project layout will result in a definite impact on heritage resources, with known artefacts (see Figure 9-15). The LSA shelters on the rocky ridge (HKZ 6-11) are considered to be the most significant heritage feature at the site and will not be impacted on by the proposed development. The entire valley holds significance of the scale and importance of water resources in close proximity to shelters that have been occupied during the LSA. From several rock cisterns, it is evident that the small valleys hold water following wet spells. After rains, the small streams in the valley bed also carry water. Within the context of this arid landscape, all localities that contain water resources, shelters and good toolstone, are rare and would be significant in the worldview of former inhabitants. This is a contained valley and cultural landscape that exhibits all the elements and resources required by a hunter-gatherer lifestyle. African Heritage Consultants (September 2013) have recommended that a Phase 2 Assessment be undertaken at the site should mining occur at Heuningkranz (within in 5 km of the site) with a specific focus on HKZ9. This is further motivated by the exponential mining activities that result in the destruction of significant archaeological resources and the lack of scientific data on small shelter siites. It is also recommended that a buffer of 200 m be maintained around the sites.

Banded Ironstone Formations (BIFs) used for the manufacture of mainly MSA and some ESA lithic tool types were found at HKZ 2. These are located along the perimeter of the South Pit and is likely to be destroyed by stormwater infrastructure and/or the dewatering infrastructure around the pit. The artefacts have been regarded as having high heritage significance (African Heritage Consultants, September 2013). It is likely that this site will be damaged or destroyed due to its proximity to the pit. A Phase 2 Heritage Assessment is required for this site.

In the unmitigated scenario the North Eastern WRD encroaches on LVW1 and LVW2 which is also a BIF with low densities of ESA and MSA lithics. It is likely that the site would be damaged due to its proximity to the dump. It would then be recommended that a Phase 2 Heritage Assessment be undertaken for LVW1. This is the site which is regarded as being of high significance as it is the only area where hand axes, the characteristic tool type of the ESA, and transitional industries between the ESA and MSA have been recorded. A buffer of 200 m is recommended around the site. In the mitigated scenario, the dump has been moved and the sites are protected (see Figure 9-16).

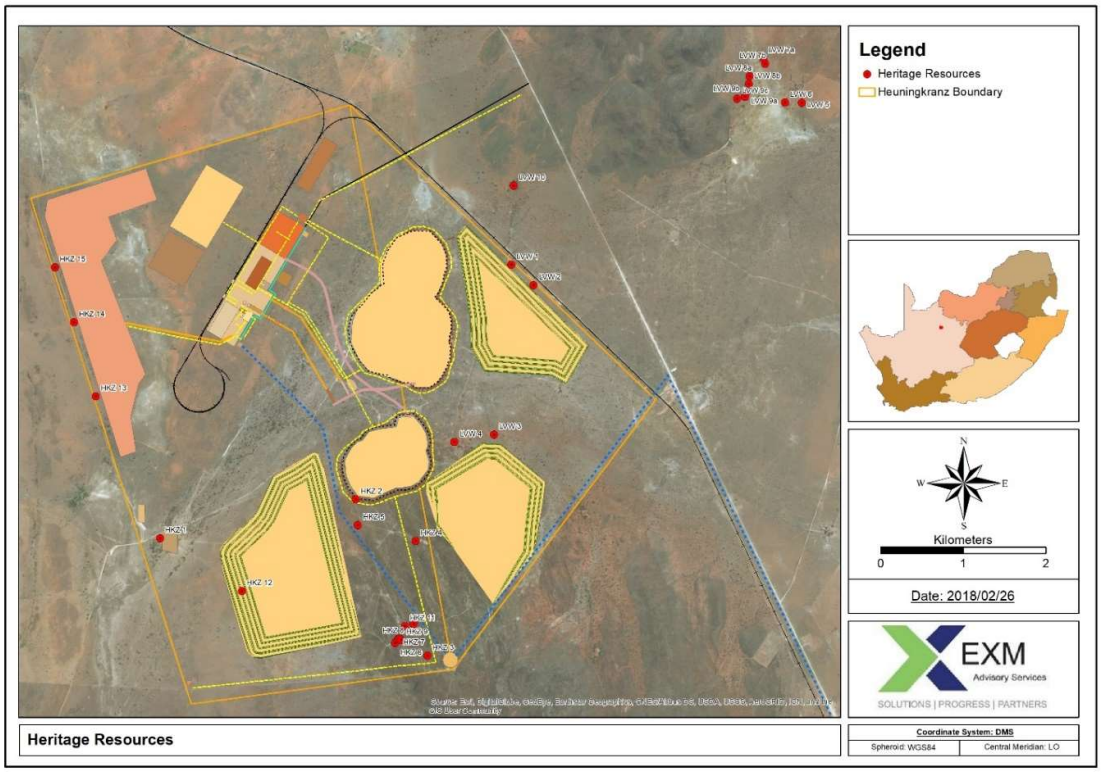


FIGURE 9-15: IMPACT OF PROJECT ON HERITAGE RESOURCES (UNMITIGATED SCENARIO)

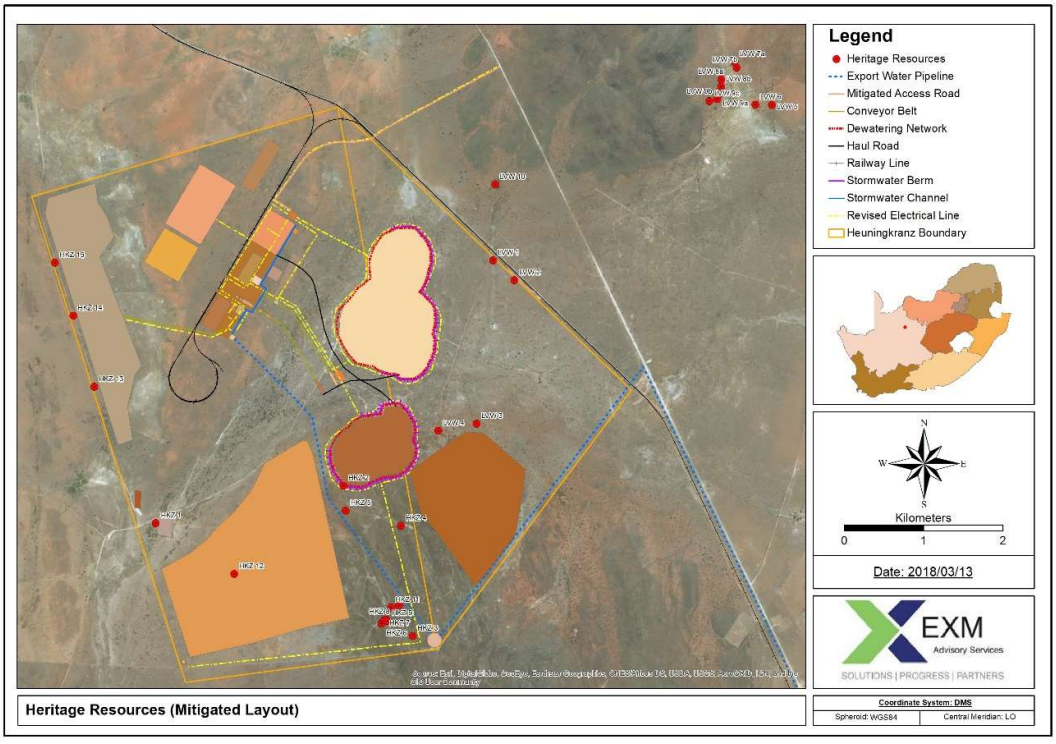


FIGURE 9-16: IMPACT OF PROJECT ON HERITAGE RESOURCES (MITIGATED SCENARIO)

MSA and LSA lithics in low densities (HKZ13-15) have been found along the western boundary of the site designated for the development of the Discard Dump. It is anticipated that these will be damaged due to the close proximity to the dump. HKZ 12 is which is similar in nature is also destroyed by the South Western Waste Rock Dump. These sites are however regarded as being of low-medium heritage significance and no mitigation has been recommended.

9.3.10 Palaeontology

A Palaeontology Desktop Assessment has been undertaken by specialist Gideon Groenewald of HIA Consultants (HIA, February 2018). The report is included as Part C – Appendix 11.

The Heuningkranz Project area is underlain by Vaalian aged rocks of the Postmasburg Group and Quaternary aged sediments of the much younger Kalahari Group and Recent limestone and windblown sand. Highly significant fossil finds are therefore expected in this study area and are likely to be unearthed during mining activities. Due to relatively deep sandy soils that cover the potentially rich fossil zones and the fact that the Vaallian aged rocks contain only micro-fossils, little information on the palaeontological heritage of the site is known. Recording of fossils during excavation for mining will contribute significantly to our understanding of the palaeo-environments of the region. The Moderate to High Palaeontological Sensitivity for the sites underlain by potentially fossiliferous rocks are retained. A Chance Find Protocol has been recommended by HIA (February, 2018) for inclusion in the environmental management programme. No additional mitigation is required.

9.3.11 Visual Impacts

A Visual Impact Assessment has been undertaken by EXM Advisory Services (February 2018). The report is included as Part C – Appendix 12.

The project will be visually intrusive to neighbouring receptors mainly as a result of their close proximity to infrastructure. The discard dump (reaching a height of 20 m), in particular, will be highly visible to receptors to the west and north of the site. In the mitigated scenario, the discard dump is likely to be higher due to a reduced footprint area. The extensive height of the proposed waste rock dumps (up to 100 m above surface), means that they will from a significant part of the landscape view from receptor sites.

The mitigated layout scenario gives consideration to the recommendation (EXM, February 2018) for consolidation of the waste rock dumps and the incorporation of the topographical changes into the existing landscape features. The possibility of including waste rock from the north western waste rock as an abutment to the koppie will substantially decrease the visual intrusiveness of the dump, especially once rehabilitated. The reshaping of slopes to mimic those

which occur naturally in the area, together with the implementation of a vegetation cover that resembles that of the surrounding natural environment will substantially decrease the change in the scenic quality of the environment. Opportunities for the in pit dumping as part of the mine planning, thus reducing the volume of waste rock produced, is to be investigated.

It can be expected that the lighting at the Heuningkranz Project will be similar to that currently observed at Kolomela. Receptors in close proximity to the process plant area, administration and ancillary plant buildings can be expected to experience glare from the lighting. Light trespass is expected as infrastructure is located within close proximity to neighbouring properties and also as a result of the lighting of linear infrastructure routes such as the access road and the rail link. The lighting will also contribute to sky glow and as for Kolomela and Beeshoek Mines, it is expected that this will be visible up to 20 km from the project area.

Visual screening e.g. through the use of berms and/or trees can substantially reduce the impact on nearby receptors by enhancing the visual absorption capacity of the environment and intercepting the lines of site from nearby receptor points. The discard dump itself can serve as a screen, but only if it is sloped and vegetated early in the life of the operations. It is recommended that consideration be given to relocating the construction village to reduce the impact on the neighbouring homestead.

Mitigation of lighting impacts is to be a serious consideration during the planning of the mine. Excessive and unnecessary lighting is to be avoided. Lighting is to maximise the desired effects of good vision without a compromise on safety. Shielding is required to maximise the desired effects of lighting by controlling the light output and minimising the glare, light trespass and light that travels straight up. Consideration is also to given to the type of light that is provided with orange light resulting in less glare than white light (due to the amount of blue light emitted). In addition, blue light brightens the night sky more than any other colour of light resulting in sky glow.

9.4 The possible mitigation measures that could be applied and the level of residual risk

The mitigation measures for each of the identified impacts are included in **Table 9.5 of Section 9.8**. Mitigation of key impacts and risks are also discussed in detail in Section 9.3.

The significance of the impact with mitigation has been weighted by multiplying the significance rating without significance by the following, depending on the confidence placed in the successful implementation of the mitigation measures or the effectiveness of those measures in reducing the impact.

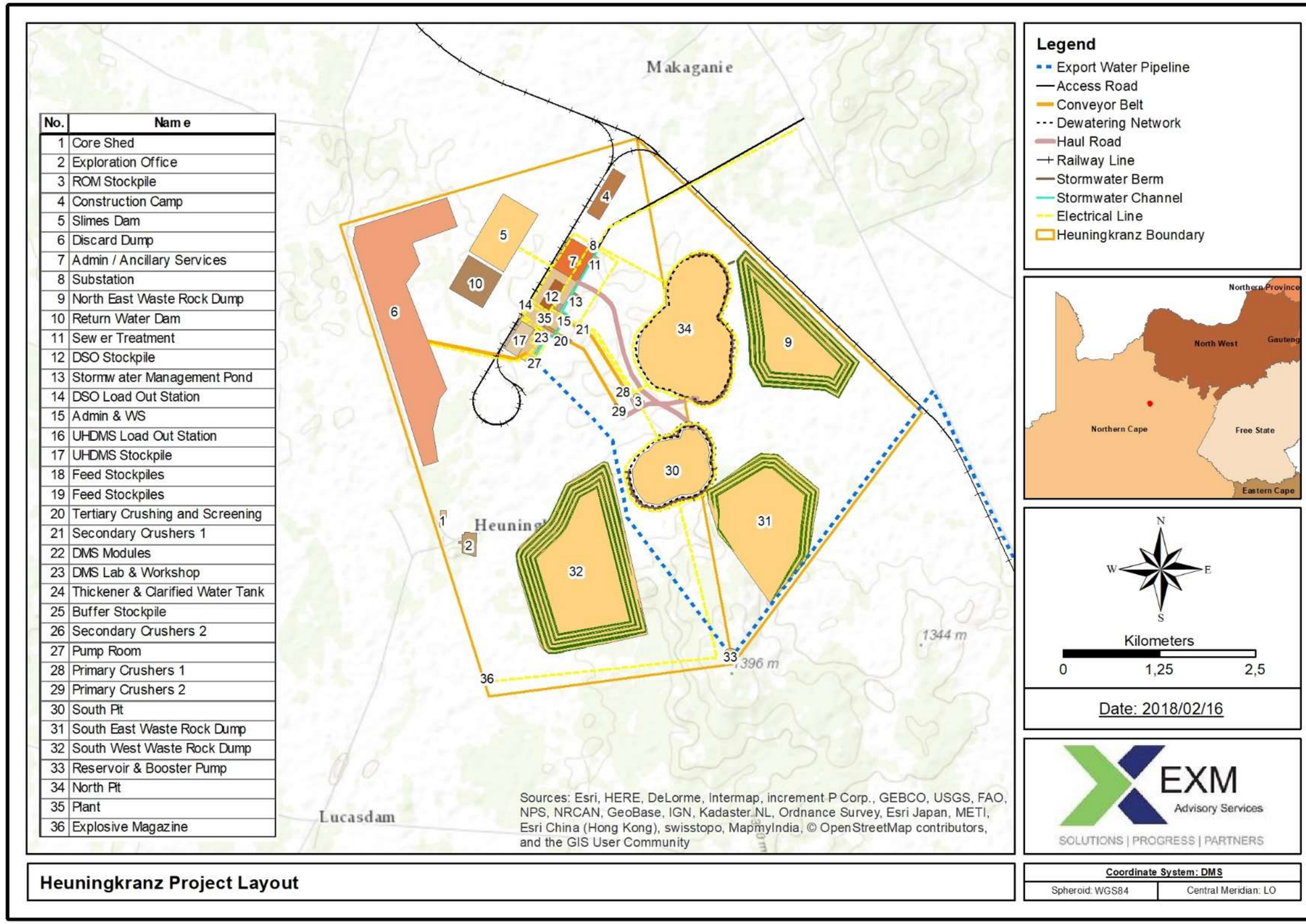
1	Very low	Measures are very difficult or expensive to implement or are not expected to be effective in reducing the impact (No Confidence)
0.8	Low	Measures are difficult or expensive to implement or are expected to have limited effectiveness in reducing the impact (20% Confidence)
0.5	Moderate	Measures can be implemented with some effort and cost and/or the measures can be effective in mitigating the impact if implemented (50% Confidence)
0.2	High	There is high confidence that mitigation measures can be implemented and can be effective in mitigating the impact (80% Confidence)

9.5 Motivation where no alternative sites were considered

Not applicable as alternatives layouts have been considered based on the mitigation of impacts. The unmitigated and mitigated scenarios are proved in Figure 9-17 and Figure 9-18, respectively.

9.6 Statement motivating the alternative development location within the overall site

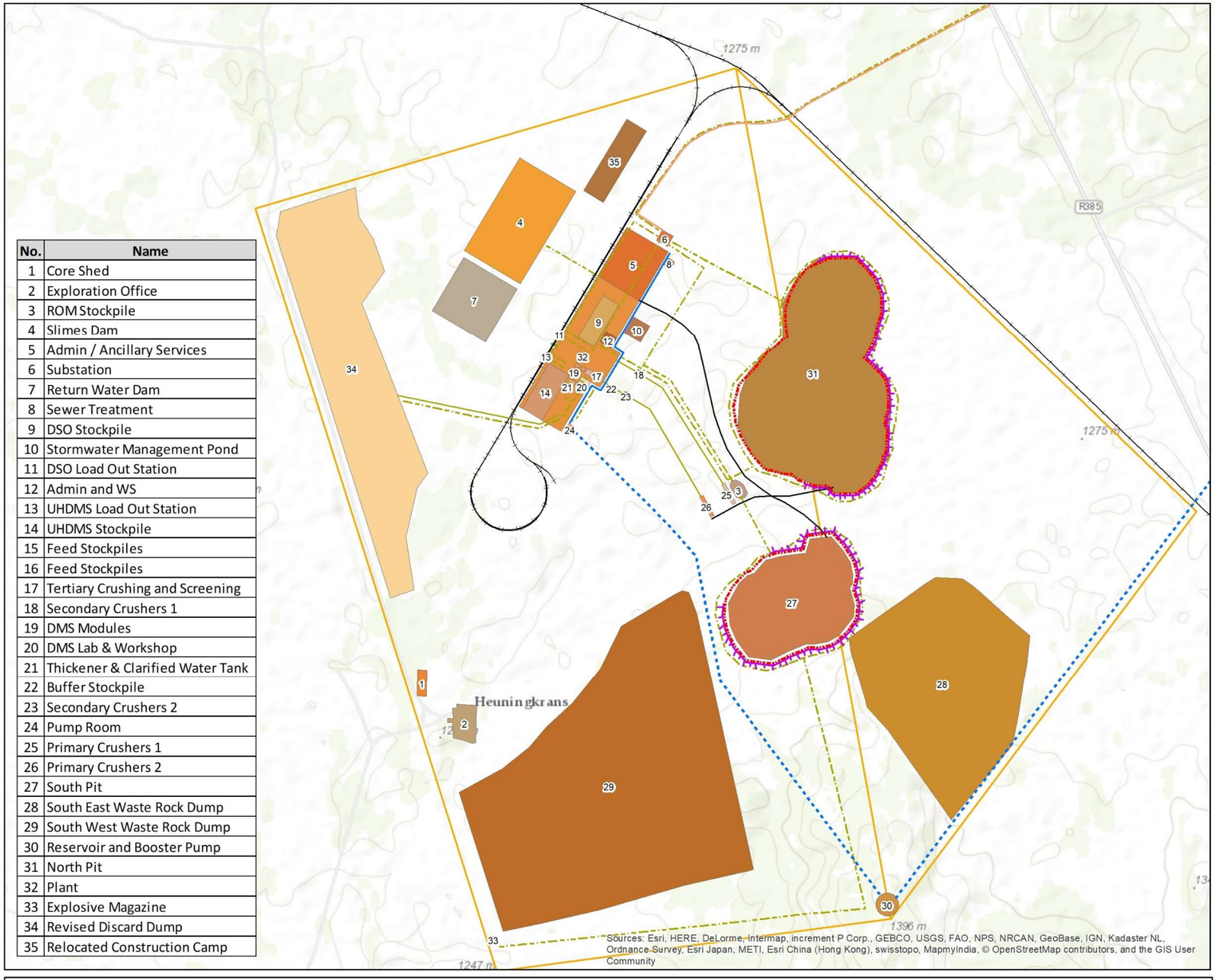
The layout for the development has been revised in order to avoid and/or reduce impacts as far as possible. The unmitigated and mitigated layouts are provided in Figure 9-17 and 9-18, respectively



No.	Name
1	Core Shed
2	Exploration Office
3	ROM Stockpile
4	Construction Camp
5	Slimes Dam
6	Discard Dump
7	Admin / Ancillary Services
8	Substation
9	North East Waste Rock Dump
10	Return Water Dam
11	Sewer Treatment
12	DSO Stockpile
13	Stormwater Management Pond
14	DSO Load Out Station
15	Admin & WS
16	UHDMS Load Out Station
17	UHDMS Stockpile
18	Feed Stockpiles
19	Feed Stockpiles
20	Tertiary Crushing and Screening
21	Secondary Crushers 1
22	DMS Modules
23	DMS Lab & Workshop
24	Thickener & Clarified Water Tank
25	Buffer Stockpile
26	Secondary Crushers 2
27	Pump Room
28	Primary Crushers 1
29	Primary Crushers 2
30	South Pit
31	South East Waste Rock Dump
32	South West Waste Rock Dump
33	Reservoir & Booster Pump
34	North Pit
35	Plant
36	Explosive Magazine

Heuningkranz Project Layout

FIGURE 9-17: HEUNINGKRANZ PROJECT LAYOUT UNMITIGATED SCENARIO



No.	Name
1	Core Shed
2	Exploration Office
3	ROM Stockpile
4	Slimes Dam
5	Admin / Ancillary Services
6	Substation
7	Return Water Dam
8	Sewer Treatment
9	DSO Stockpile
10	Stormwater Management Pond
11	DSO Load Out Station
12	Admin and WS
13	UHDMS Load Out Station
14	UHDMS Stockpile
15	Feed Stockpiles
16	Feed Stockpiles
17	Tertiary Crushing and Screening
18	Secondary Crushers 1
19	DMS Modules
20	DMS Lab & Workshop
21	Thickener & Clarified Water Tank
22	Buffer Stockpile
23	Secondary Crushers 2
24	Pump Room
25	Primary Crushers 1
26	Primary Crushers 2
27	South Pit
28	South East Waste Rock Dump
29	South West Waste Rock Dump
30	Reservoir and Booster Pump
31	North Pit
32	Plant
33	Explosive Magazine
34	Revised Discard Dump
35	Relocated Construction Camp

Legend

- Mitigated Access Road
- Conveyor Belt
- Dewatering Network
- Haul Road
- Railway Line
- Stormwater Berm
- Stormwater Channel
- Revised Electrical Line
- Property Boundary

N
W E
S

Kilometers
0 0,75 1,5

Date: 2018/03/13

EXM Advisory Services
SOLUTIONS | PROGRESS | PARTNERS

Coordinate System: DMS	
Spheroid: WGS84	Central Meridian: LO

Heuningkranz Mitigated Layout

FIGURE 9-18: HEUNINGKRANZ PROJECT LAYOUT MITIGATED SCENARIO

Figure 9-18 presents the mitigated scenario which is motivated as the preferred alternative development location of the Heuningkranz project.

The mitigated scenario provides for the protection of wetland pans, through the relocation of the North Eastern WRD (consolidated with the South Eastern WRD), which are regarded as sensitive environments in terms of supporting local biodiversity. The relocation of the WRD also means that heritage sites of significance are protected from potential disturbance due to the proximity to the dump. The impedance of drainage from the north east of the site by the North Eastern WRD is also removed, although this flow will still need to be diverted around the North Pit area. The consolidation of the dumps against the rocky ridge on the site, also means that the substantial change in the landform due to the development of WRDs will be assimilated into the surrounding landscape. This is expected to reduce the visual impact of the project.

The road and electrical line have been moved in line with the rail to allow for the consolidation of impacts due to linear infrastructure. This means that impacts on land use potential and land capability are likely to be decreased due there being less isolation of land management units. The risk to wetland pans is also reduced as the infrastructure is further from the pan. The Construction Village, Workshops and Laydown areas have also been moved to ensure protection of wetland pans at the site.

Impacts on drainage/watercourses has been reduced from HIGH to VERY LOW by changing the layout of the Klipbankfontein At Pit Facility. Impact on drainage at the Kapstevel DMS Plant has also been reduced from HIGH to LOW.

THE CHANGE IN THE LAYOUT TO THE MITIGATED SCENARIO 3 PRESENTS A SUBSTANTIAL REDUCTION OF ENVIRONMENTAL RISKS/IMPACTS

9.7 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

Please refer to Section 9.2 for the methodology used in the ranking of impacts. Please refer to Section 9.4 for the methodology used for the application of a mitigation confidence ranking to the impact ranking.

9.8 Assessment of each identified potentially significant impact risk

IMPACT SIGNIFICANCE

NEGATIVE IMPACTS

≤1	Very low	Impact is negligible. No mitigation required.
>1≤2	Low	Impact is of a low order. Mitigation could be considered to reduce impacts. But does not affect environmental acceptability.

>2≤3	Moderate	Impact is real but not substantial in relation to other impacts. Mitigation should be implemented to reduce impacts.
>3≤4	High	Impact is substantial. Mitigation is required to lower impacts to acceptable levels.
>4≤5	Very High	Impact is of the highest order possible. Mitigation is required to lower impacts to acceptable levels. Potential Fatal Flaw.

POSITIVE IMPACTS

≤1	Very low	Impact is negligible.
>1≤2	Low	Impact is of a low order.
>2≤3	Moderate	Impact is real but not substantial in relation to other impacts.
>3≤4	High	Impact is substantial.
>4≤5	Very High	Impact is of the highest order possible.

TABLE 9.5: IMPACT RISK ASSESSMENT

CONSTRUCTION VILLAGE, LAYDOWN AREAS, WORKSHOPS AND ASSOCIATED INFRASTRUCTURE

ASPECT	ACTIVITY	POTENTIAL IMPACT	PHASE	INTENSITY	DURATION	CONSEQUENCE	EXTENT	SEVERITY	PROBABILITY	SIGNIFICANCE WITHOUT MITIGATION	MITIGATION	MITIGATION CONFIDENCE	SIGNIFICANCE WITH MITIGATION
CONSTRUCTION VILLAGE, LAYDOWN AREAS, WORKSHOPS AND ASSOCIATED INFRASTRUCTURE	Topography	Levelling of topography to create platforms for infrastructure	C	2	2	2	1	1.5	1	1.5	Infrastructure and platforms to be removed after construction. Footprint area to be restored to pre-construction landform after construction.	0.6	0.9
	Groundwater	Contamination of underlying aquifers due to storage and handling of potential pollutants at workshops and laydown areas.	C	3	2	2.5	2	2.25	0.8	1.8	Protection of groundwater resources from seepage that may originate from the storage and handling of hazardous substances (incl. fuels, oils, greases, lubricants, solvents) by the implementation of bunding and impermeable surfaces. Wastes to be stored in temporary facilities in line with regulatory requirements. No waste to be disposed of on site. Adequate sanitation to be provided during construction and priority to be given to the construction of the sewage treatment works for the management of sewage from the construction village. Implement spill prevention and emergency response procedure.	0.4	0.72
	Air Quality	Dust generated due to earth moving activities and movement of vehicles and entrainment due to the movement of vehicles, on the site associated with construction of villages, laydown areas and workshops used in construction.	C	2	2	2	2	2	1	2	Dust suppression (wet suppression) on main construction roads. Speed limit on site to be restricted to 40 km/hr. Monitoring of fallout dust, PM_{10} and $PM_{2.5}$. Additional mitigation to be identified and implemented should dust monitoring indicate dust levels at receptor points exceed limits.	0.6	1.2
	Noise	Increase in ambient noise levels due to persons residing on site, vehicle traffic, construction blasting, and operation of construction machinery.	C	2	2	2	2	2	0.8	1.6	Noisy activities (e.g. loud music etc) is to be prohibited at construction village. All vehicles and machinery must be kept in a high level of maintenance. Regular maintenance of access and site roads. Noise monitoring to be undertaken annually or in response to complaints. Continue to implement Kolomela Complaints Procedure and ensure that all affected parties are aware of the procedure for complaints.	0.6	0.96
	Soils	Loss of available soils due to improper handling during construction.	C	2	5	3.5	1	2.25	0.8	1.8	Minimise footprint of disturbance to that needed for operations. Strip available topsoil. Protect stockpiles from erosion.	0.6	1.08
	Soils	Compaction of soils due to movement of machinery and vehicles.	C	1	5	3	1	2	0.8	1.6	Minimise footprint areas of disturbance. Movement of machinery and vehicles to be restricted to work areas and access routes. Compacted areas to be ripped to reduce compaction.	0.4	0.64
	Soils	Soil contamination due to spillages of hydrocarbons and other chemicals used in construction at construction infrastructure.	C	2	3	2.5	1	1.75	0.8	1.4	Implement measures as indicated for the protection of groundwater. Implement measures for the containment of dirty water run-off during construction. Contaminated soils are to be bioremediated on site.	0.2	0.28
	Land Capability and Land Use	Loss of agricultural land for livestock farming.	C	2	5	3.5	1	2.25	0.6	1.35	Implement measures to protect soil in order that these can be used in rehabilitation and restoring the land to that suitable for livestock grazing. Remove infrastructure and rehabilitate footprint to resemble pre-mining environment on completion of construction.	0.4	0.54

ASPECT	ACTIVITY	POTENTIAL IMPACT	PHASE	INTENSITY	DURATION	CONSEQUENCE	EXTENT	SEVERITY	PROBABILITY	SIGNIFICANCE WITHOUT MITIGATION	MITIGATION	MITIGATION CONFIDENCE	SIGNIFICANCE WITH MITIGATION
	Biodiversity	Disturbance of wetland pans due to the construction of construction village, laydown areas, workshops and associated activities.	C	5	5	5	2	3.5	0.8	2.8	The catchment of the wetland area is to be delineated and the buffer updated based on ensuring the avoidance of the catchment area. No construction infrastructure to be development within the buffer of wetland pans.	0.2	0.56
	Biodiversity	Poaching of wildlife	C	3	2	2.5	2	2.25	0.6	1.35	Poaching is to be prohibited and disciplinary action taken against transgressors.	0.4	0.54
	Biodiversity	Disturbance of floral species of conservation concern.	C	3	5	4	2	3	0.8	2.4	All protected species within the footprint area of disturbance are to be demarcated and disturbance avoided for the development of the construction village, laydown areas, workshops and associated activities, where possible. Where the disturbance of protected plants and trees cannot be avoided, the necessary permits are to be in place prior to disturbance.	0.4	0.96
	Surface Water Resources	Contaminated run-off entering into natural drainage or catchments of wetland pans.	C	2	2	2	2	2	0.8	1.6	Clean water is to be diverted from areas that could result in the contamination of such stormwater (including diversion around cleared footprint areas). All contaminated run-off is to be contained and prevented from entering natural drainage.	0.4	0.64
	Cultural Heritage	Disturbance of heritage sites in footprint area used for construction infrastructure.	C	3	5	4	1	2.5	0.4	1	There are no heritage sites known to occur in the footprint area.	0.2	0.2
	Palaeontology	Disturbance of fossils due to excavations for construction infrastructure	C	3	5	4	2	3	0.2	0.6	It is unlikely that fossils will be unearthed during the development of the construction of infrastructure.	0.2	0.12
	Visual Environment	Visual intrusion and loss of scenic quality.	C	3	2	2.5	2	2.25	1	2.25	Construction infrastructure to be located further from receptors. Remove infrastructure and rehabilitate footprint to resemble pre-mining environment on completion of construction.	0.4	0.9
	Visual Environment	Lighting of construction infrastructure resulting in disturbance of neighbours	C	3	2	2.5	2	2.25	0.8	1.8	Implement measures to reduce light trespass, glare and sky glow.	0.6	1.08

ADMINISTRATION, ANCILLARY SERVICES, WORKSHOPS

ASPECT	ACTIVITY	POTENTIAL IMPACT	PHASE	INTENSITY	DURATION	CONSEQUENCE	EXTENT	SEVERITY	PROBABILITY	SIGNIFICANCE WITHOUT MITIGATION	MITIGATION	MITIGATION CONFIDENCE	SIGNIFICANCE WITH MITIGATION
ADMINISTRATION, ANCILLARY SERVICES, WORKSHOPS	Topography	Levelling of topography to create platforms for administration offices, workshops etc.	C	2	5	3.5	1	2.25	1	2.25	Minimise footprint area required for infrastructure development. Infrastructure to be removed at end of life and platforms rehabilitated to pre-construction landform.	0.8	1.8
	Groundwater	Contamination of underlying aquifers due to storage and handling of potential pollutants.	O	4	5	4.5	2	3.25	0.8	2.6	Protection of groundwater resources from seepage that may originate from the storage and handling of hazardous substances (incl. fuels, oils, greases, lubricants, solvents) by the implementation of bunding and impervious surfaces with sufficient capacity to contain entire volume included in bunded area. Dirty water run-off to be contained in the stormwater management pond which is to be lined. Wastes to be stored in temporary facilities in line with regulatory requirements. No waste to be disposed on site. Sewage managed through sewage treatment works. Implement spill prevention and emergency response procedure.	0.6	1.56
	Air Quality	Increase in ambient dust levels due to earth moving activities and movement of vehicles on the site associated with construction.	C	3	2	2.5	2	2.25	1	2.25	Dust suppression (wet suppression) in main construction areas. Speed limit on site to be restricted to 40 km/hr. Monitoring of fallout dust, PM_{10} and $PM_{2.5}$. Additional mitigation to be identified and implemented should dust monitoring indicate dust levels at receptor points exceed limits.	0.6	1.35
	Air Quality	Volatile organic carbon emissions from bulk fuel storage areas.	O	2	4	3	2	2.5	1	2.5	Obtain atsmospheric emissions licence (AEL) for bulk fuel storage. Leak detection and repair management programme. Monitoring in accordance with licence requirements.	0.4	1
	Air Quality	Increase in ambient dust generated due to movement of vehicles on internal roads as well as erosion of cleared areas at administration areas, workshops and ancillary services.	O	2	4	3	2	2.5	1	2.5	Parking areas and roads at adminstration areas to be paved/surfaced to minimise entrainment of dust. Landscaping and vegetation of gardens at adminstration areas. Use of chemical suppressants on unsurfaced roads at workshops and ancillary services.	0.4	1
	Noise	Increase in ambient noise levels due construction of administration offices, workshops and ancillary service areas.	C	1	2	1.5	2	1.75	0.6	1.05	All vehicles and machinery must be kept in a high level of maintenance. Regular maintenance of access and site roads. Noise monitoring to be undertaken annually or in response to complaints. Continue to implement Kolomela Complaints Procedure and ensure that all affected parties are aware of the procedure for complaints.	0.6	0.63
	Noise	Increase in ambient noise due to movement of vehicles, operation of machinery and equipment for administration, workshops and ancillary services.	O	1	4	2.5	2	2.25	0.6	1.35	All vehicles, machinery and equipment must be kept in a high level of maintenance. Regular maintenance of access and site roads. Noise monitoring to be undertaken annually or in response to complaints. Continue to implement Kolomela Complaints Procedure and ensure that all affected parties are aware of the procedure for complaints.	0.8	1.08

ASPECT	ACTIVITY	POTENTIAL IMPACT	PHASE	INTENSITY	DURATION	CONSEQUENCE	EXTENT	SEVERITY	PROBABILITY	SIGNIFICANCE WITHOUT MITIGATION	MITIGATION	MITIGATION CONFIDENCE	SIGNIFICANCE WITH MITIGATION
	Soils	Loss of available soils due to improper handling during construction.	C	2	5	3.5	1	2.25	0.8	1.8	Minimise footprint of disturbance to that needed for development of infrastructure. Strip available topsoil for use in rehabilitation. Protect stockpiles from erosion.	0.6	1.08
	Soils	Compaction of soils due to movement of machinery and vehicles during construction.	C	1	5	3	1	2	0.8	1.6	Minimise footprint areas of disturbance. Movement of machinery and vehicles to be restricted to work areas and access routes. Compacted areas to be ripped to reduce compaction.	0.4	0.64
	Soils	Soil contamination due to spillages of hydrocarbons and other chemicals used in construction or the improper management of sewage.	C	1	4	2.5	1	1.75	0.6	1.05	Hydrocarbons and other chemicals used in construction are to be stored within bunded areas at workshops and stores. Should maintenance and repairs be required in the field; this is to be done over impervous srufaces. Implement spill response and management procedure. Contaminated soils are to be bioremediated on site.	0.2	0.21
	Soils	Soil contamination due to spillages and leaks from the storage and handling of hydrocarbons and other chemicals used at stores.	O	4	5	4.5	1	2.75	0.8	2.2	Implement measures as listed for the protection of groundwater.	0.4	0.88
	Land Capability and Land Use	Loss of agricultural land for livestock farming.	C	2	5	3.5	1	2.25	1	2.25	Implement measures to protect soil in order that these can be used in rehabilitation, restoring the land to that suitable for livestock grazing. Remove infrastructure and rehabilitate footprint to resemble pre-mining environment on completion of operations.	0.4	0.9
	Biodiversity	Disturbance of sensitive sites such as drainage lines due to disturbance during construction of the administration, workshops and ancillary service areas.	C	3	5	4	1	2.5	0.6	1.5	Clean water is to be diverted from areas that could result in the contamination of such stormwater (including diversion around cleared footprint areas). All contaminated run-off is to be contained and prevented from entering natural drainage.	0.4	0.6
	Biodiversity	Poaching of wildlife	C&O	2	2	2	2	2	0.6	1.2	Poaching is to be prohibited and disciplinary action taken against transgressors.	0.4	0.48
	Biodiversity	Restriction of faunal movement due to fencing.	O	3	4	3.5	1	2.25	0.6	1.35	Internal fencing to allow for the movement of animals across the properties.	0.4	0.54
	Biodiversity	Disturbance of floral species of conservation concern.	C	3	5	4	2	3	0.8	2.4	All protected species within the footprint area of disturbance are to be demarcated during a site walkover. Where the disturbance of protected plants and trees cannot be avoided, the necessary permits are to be in place pior to disturbance. Relocation of protected plants to be undertaken where possible.	0.4	0.96
	Surface Water Resources	Contaminated run-off from construction entering into natural drainage.	C	2	2	2	3	2.5	0.6	1.5	See measures to protect biodiversity and sensitive habitats.	0.4	0.6
	Surface Water Resources	Contaminated run-off from operational areas including workshops and stores entering into natural drainage.	O	4	4	4	3	3.5	0.6	2.1	Clean water is to be diverted from areas that could result in the contamination of such stormwater. All contaminated run-off is to be contained in stormwater management pond and prevented from entering natural drainage. Stormwater management pond is to have sufficient capacity to contain the 1: 50-year flood event and a minimum free board of 800 mm maintained. Water is to be recycled for re-use.	0.4	0.84

ASPECT	ACTIVITY	POTENTIAL IMPACT	PHASE	INTENSITY	DURATION	CONSEQUENCE	EXTENT	SEVERITY	PROBABILITY	SIGNIFICANCE WITHOUT MITIGATION	MITIGATION	MITIGATION CONFIDENCE	SIGNIFICANCE WITH MITIGATION
	Cultural Heritage	Disturbance of heritage sites in footprint area used for the administration, workshops and ancillary services.	C	3	5	4	1	2.5	0.4	1	There are no known heritage sites known to occur in the footprint area.	0.2	0.2
	Palaeontology	Disturbance of fossils due to excavations for the development of the administration area, workshops and ancillary services.	C	3	5	4	2	3	0.6	1.8	It is possible that fossils will be unearthed during the development of the construction of infrastructure. Implement Chance Find Protocol	0.2	0.36
	Visual Environment	Visual intrusion and loss of scenic quality	O	2	4	3	2	2.5	0.6	1.5	Screening of lines of site from visual receptor points. Remove infrastructure and rehabilitate footprint to resemble pre-mining environment on completion of construction.	1	1.5
	Visual Environment	Lighting of administration area, workshops and ancillary service area.	O	3	4	3.5	2	2.75	0.8	2.2	Implement measures to reduce light trespass, glare and sky glow.	0.6	1.32

ACCESS ROAD

ASPECT	ACTIVITY	POTENTIAL IMPACT	PHASE	INTENSITY	DURATION	CONSEQUENCE	EXTENT	SEVERITY	PROBABILITY	SIGNIFICANCE WITHOUT MITIGATION	MITIGATION	MITIGATION CONFIDENCE	SIGNIFICANCE WITH MITIGATION
ACCESS ROAD	Topography	Levelling of topography for road infrastructure development.	C	1	5	3	2	2.5	1	2.5	Minimise footprint area required for infrastructure development. Infrastructure to be removed at end of life and topography rehabilitated to pre-construction landform.	0.8	2
	Groundwater	Contamination of underlying aquifers due to storage and handling of potential pollutants used in road construction.	C	1	2	1.5	2	1.75	0.4	0.7	Mobile toilet facilities to be provided for persons involved in construction. Implement spill prevention and emergency response procedure.	0.6	0.42
	Air Quality	Increase in ambient dust levels due to earth moving activities and entrainment due to the movement of vehicles associated with construction of access road and upgrading of roads to site.	C	2	2	2	2	2	1	2	Upgrading of access roads used on site to accommodate construction traffic. Speed limit on site to be restricted to 40 km/hr. Speed limits to be restricted to 60 km/hr on public access roads. Dust monitoring network to be expanded prior to construction. Additional mitigation to be identified and implemented should dust monitoring indicate dust levels at receptor points exceed limits.	0.6	1.2
	Air Quality	Increase in ambient dust levels due to traffic movement on access roads.	O	3	4	3.5	3	3.25	1	3.25	The R385 is to be upgraded (recommend surfacing of the road as soon as practicable) to handle traffic volumes and control dust. Prior to surfacing of the road, the road is to be upgraded and maintained on a regular basis. Dust suppression is to be ongoing to control dust levels on unsurfaced access roads. Monitoring of fallout dust, PM10 and PM2.5.	0.4	1.3
	Noise	Increase in ambient noise levels due operation of equipment and machinery used in the construction of access road.	C	2	2	2	2	2	0.6	1.2	All vehicles and machinery must be kept in a high level of maintenance. Regular maintenance of access and site roads. Noise monitoring to be undertaken annually or in response to complaints. Continue to implement Kolomela Complaints Procedures to ensure that all affected parties are aware of the procedure for complaints.	0.6	0.72
	Noise	Increase in ambient noise levels due traffic flow along the access road and the R385.	O	2	4	3	2	2.5	0.6	1.5	All vehicles, machinery and equipment must be kept in a high level of maintenance. Regular maintenance of access and site roads. Noise monitoring to be undertaken annually or in response to complaints. Continue to implement Kolomela Complaints Procedure and ensure that all affected parties are aware of the procedure for complaints.	0.6	0.9
	Soils	Loss of available soils due to improper handling during construction.	C	1	5	3	2	2.5	0.6	1.5	Minimise footprint of disturbance to that needed for construction of the road. Strip available topsoil for use in construction rehabilitation. Protect stockpiles from erosion.	0.6	0.9
	Soils	Compaction of soils due to movement of machnery and vehicles.	C	1	5	3	2	2.5	0.8	2	Minimise footprint areas of disturbance. Movement of machinery and vehicles to be restricted to work areas and access routes. Compacted areas to be ripped to reduce compaction.	0.4	0.8

ASPECT	ACTIVITY	POTENTIAL IMPACT	PHASE	INTENSITY	DURATION	CONSEQUENCE	EXTENT	SEVERITY	PROBABILITY	SIGNIFICANCE WITHOUT MITIGATION	MITIGATION	MITIGATION CONFIDENCE	SIGNIFICANCE WITH MITIGATION
	Soils	Soil contamination due to spillages of hydrocarbons and other chemicals used in construction.	C	2	3	2.5	2	2.25	0.8	1.8	Hydrocarbons and other chemicals used in construction are to be stored within bunded areas at workshops and stores. Should maintenance and repairs be required in the field, this is to be done over impervious surfaces. Implement spill response and management procedure. Contaminated soils are to be bioremediated on site.	0.2	0.36
	Land Capability and Land Use	Loss of agricultural land for livestock farming. Isolation of agricultural land making it unproductive.	C	3	5	4	2	3	1	3	Implement measures to protect soil in order that these can be used in rehabilitation, restoring the land to that suitable for livestock grazing. Remove infrastructure and rehabilitate footprint to resemble pre-mining environment on completion of operations. Re-align access route (and power line) to minimise isolation of farm units. Provide underpasses where practicable to promote movement of livestock and wildlife between areas isolated by linear infrastructure.	0.8	2.4
	Biodiversity	Disturbance of sensitive sites due to the routing of the road.	C	4	5	4.5	2	3.25	0.8	2.6	Re-align access route to follow rail infrastructure. Determine catchments of wetland pans. Provide culverts aimed at allowing flow towards wetland pans.	0.8	2.08
	Biodiversity	Poaching of wildlife	C&O	2	2	2	2	2	0.6	1.2	Poaching is to be prohibited and disciplinary action taken against transgressors.	0.4	0.48
	Biodiversity	Disturbance of floral species of conservation concern.	C	3	5	4	2	3	0.8	2.4	All protected species within the footprint area of disturbance are to be demarcated during a site walkover. Where the disturbance of protected plants and trees cannot be avoided, the necessary permits are to be in place pior to disturbance. Relocation of protected plants to be undertaken where possible.	0.4	0.96
	Biodiversity	Restriction of faunal movement due to linear infrastructure.	O	3	4	3.5	1	2.25	0.6	1.35	Provide for sufficient underpasses to allow for movement of animals under the road.	0.4	0.54
	Surface Water Resources	Contaminated run-off from construction entering into natural drainage.	C	2	2	2	2	2	0.6	1.2	Contaminated run-off to be prevented from entering drainage channels or catchments of wetland pans.	0.8	0.96
	Surface Water Resources	Interception of drainage channels or catchment of wetland pans.	C	3	5	4	2	3	0.6	1.8	Implement measures as described for the protection of biodiversity and sensitive sites.	0.8	1.44
	Cultural Heritage	Disturbance of heritage sites in footprint area of the access road.	C	3	5	4	2	3	0.2	0.6	There are no heritage sites known to occur in the footprint area.	0.2	0.12
	Palaeontology	Disturbance of fossils due to excavations for the development of the access road.	C	3	5	4	2	3	0.2	0.6	It is unlikely that fossils will be unearthed during the development of the construction of infrastructure.	0.2	0.12
	Visual Environment	Visual intrusion on receptors and loss of scenic quality	O	2	4	3	2	2.5	0.8	2	Screening of lines of site from visual receptor points. Remove infrastructure and rehabilitate footprint to resemble pre-mining environment on completion of construction.	1	2
	Visual Environment	Lighting of access road.	O	3	4	3.5	2	2.75	0.8	2.2	Implement measures to reduce light trespass, glare and sky glow.	0.6	1.32

RAIL LINK, BALLOON AND MAINTENANCE ROAD

ASPECT	ACTIVITY	POTENTIAL IMPACT	PHASE	INTENSITY	DURATION	CONSEQUENCE	EXTENT	SEVERITY	PROBABILITY	SIGNIFICANCE WITHOUT MITIGATION	MITIGATION	MITIGATION CONFIDENCE	SIGNIFICANCE WITH MITIGATION
RAIL LINK, BALLOON AND MAINTENANCE ROAD	Topography	Levelling of topography for rail infrastructure development.	C	1	5	3	2	2.5	1	2.5	Minimise footprint area required for infrastructure development. Infrastructure to be removed at end of life and topography rehabilitated to pre-construction landform.	0.8	2
	Groundwater	Contamination of underlying aquifers due to storage and handling of potential pollutants used in rail construction.	C	1	2	1.5	2	1.75	0.4	0.7	Mobile toilet facilities to be provided for persons involved in construction. Implement spill prevention and emergency response procedure.	0.6	0.42
	Air Quality	Increase in ambient dust levels due to earth moving activities and entrainment due to the movement of vehicles associated with construction of rail and associated infrastructure.	C	2	2	2	2	2	1	2	Dust suppression to be implemented in areas of work. Dust monitoring network to be expanded prior to construction. Additional mitigation to be identified and implemented should dust monitoring indicate dust levels at receptor points to exceed limits.	0.6	1.2
	Air Quality	Materials handling and transport of material by rail.	O	2	2	2	2	3	0.6	1.8	Dust suppression at material handling points.	0.6	1.08
	Noise	Increase in ambient noise levels due operation of equipment and machinery used in the construction of rail and associated infrastructure.	C	2	2	2	2	2	0.6	1.2	All vehicles and machinery must be kept in a high level of maintenance. Regular maintenance of access and site roads. Noise monitoring to be undertaken annually or in response to complaints. Continue to implement Kolomela Complaints Procedure and ensure that all affected parties are aware of the procedure for complaints.	0.6	0.72
	Noise	Increase in ambient noise levels due to operations of rail.	O	2	4	3	2	2.5	0.6	1.5	All vehicles and machinery must be kept in a high level of maintenance. Regular maintenance of access and site roads. Noise monitoring to be undertaken annually or in response to complaints. Continue to implement Kolomela Complaints Procedure and ensure that all affected parties are aware of the procedure for complaints.	0.8	1.2
	Soils	Loss of available soils due to improper handling during construction.	C	1	5	3	2	2.5	0.6	1.5	Minimise footprint of disturbance to that needed for construction of the road. Strip available topsoil for use in construction rehabilitation. Protect stockpiles from erosion.	0.6	0.9
	Soils	Compaction of soils due to movement of machinery and vehicles.	C	1	5	3	2	2.5	0.8	2	Minimise footprint areas of disturbance. Movement of machinery and vehicles to be restricted to work areas and access routes. Compacted areas to be ripped to reduce compaction.	0.4	0.8
	Soils	Soil contamination due to spillages of hydrocarbons and other chemicals used in construction.	C	2	3	2.5	2	2.25	0.8	1.8	Hydrocarbons and other chemicals used in construction are to be stored within bunded areas at workshops and stores. Should maintenace and repairs be required in the field this is to be done over impervous srufaces. Implement spill response and management procedure. Contaminated soils are to be bioremediated on site.	0.2	0.36

ASPECT	ACTIVITY	POTENTIAL IMPACT	PHASE	INTENSITY	DURATION	CONSEQUENCE	EXTENT	SEVERITY	PROBABILITY	SIGNIFICANCE WITHOUT MITIGATION	MITIGATION	MITIGATION CONFIDENCE	SIGNIFICANCE WITH MITIGATION
	Land Capability and Land Use	Loss of agricultural land for livestock farming. Isolation of agricultural land making it unproductive.	C&O	1	5	3	2	2.5	1	2.5	Implement measures to protect soil in order that these can be used in rehabilitation; restoring the land to that suitable for livestock grazing. Remove infrastructure and rehabilitate footprint to resemble pre-mining environment on completion of operations. Alignment of linear infrastructure to consolidate impact areas.	0.6	1.5
	Biodiversity	Disturbance of sensitive sites due to the rail infrastructure.	C	3	5	4	2	3	0.8	2.4	Determine catchments of wetland pans. Provide culverts to allow continued flow into wetland pans during the life of the operation.	0.6	1.44
	Biodiversity	Restriction of faunal movement due to linear infratructure.	O	3	4	3.5	1	2.25	0.6	1.35	Provide for sufficeint underpasses to allow for movement of animals under the rail and along with road in areas where these are parallel to each other.	0.4	0.54
	Biodiversity	Disturbance of floral species of conservation concern.	C	3	5	4	2	3	0.8	2.4	All protected species within the footprint area of disturbance are to be demarcated during a site walkover. Where the disturbance of protected plants and trees cannot be avoided, the necessary permits are to be in place pior to disturbance. Relocation of protected plants to be undertaken where possible.	0.4	0.96
	Surface Water Resources	Contaminated run-off from construction entering into natural drainage.	C	2	2	2	2	2	0.6	1.2	Contaminated run-off to be prevented from entering drainage channels or catchments of wetland pans.	0.8	0.96
	Surface Water Resources	Interception of drainage channels or catchment of wetland pans.	C	3	5	4	2	3	0.6	1.8	Implement measures as described for the protection of biodiversity and sensitive sites.	0.8	1.44
	Cultural Heritage	Disturbance of heritage sites in footprint area of the rail infrastructure.	C	3	5	4	2	3	0.2	0.6	There are no heritage sites known to occur in the footprint area.	0.2	0.12
	Palaeontology	Disturbance of fossils due to excavations for the development of the rail infrastructure.	C	3	5	4	2	3	0.2	0.6	It is unlikely that fossils will be unearthed during the development of the construction of infrastructure.	0.2	0.12
	Visual Environment	Visual intrusion on receptors due to view of rail infrastructure and loss of scenic quality.	O	2	4	3	2	2.5	0.8	2	Screening of lines of site from visual receptor points. Remove infrastructure and rehabilitate footprint to resemble pre-mining environment on completion of construction.	1	2
	Visual Environment	Lighting of rail link.	O	3	4	3.5	2	2.75	0.8	2.2	Implement measures to reduce light trespass, glare and sky glow.	0.6	1.32

PRIMARY AND SECONDARY CRUSHERS AND ROM STOCKPILE AREA

ASPECT	ACTIVITY	POTENTIAL IMPACT	PHASE	INTENSITY	DURATION	CONSEQUENCE	EXTENT	SEVERITY	PROBABILITY	SIGNIFICANCE WITHOUT MITIGATION	MITIGATION	MITIGATION CONFIDENCE	SIGNIFICANCE WITH MITIGATION
PRIMARY AND SECONDARY CRUSHERS AND ROM STOCKPILE AREA	Topography	Levelling of topography for the development of primary & secondary crushers and ROM stockpile area.	C	1	5	3	1	2	1	2	Minimise footprint area required for infrastructure development. Infrastructure to be removed at end of life and topography rehabilitated to pre-construction landform.	0.8	1.6
	Groundwater	Contamination of underlying aquifers due to storage and handling of potential pollutants.	O	2	4	3	1	2	0.6	1.2	Protection of groundwater resources from seepage that may originate from the storage and handling of hazardous substances (incl. fuels, oils, greases, lubricants, solvents) by the implementation of bunding and impervious surfaces. Dirty water run-off to be contained and prevented from entering any watercourse or wetland pan. Implement spill prevention and emergency response procedure.	0.6	0.72
	Air Quality	Increase in ambient dust levels due to earth moving activities and entrainment due to the movement of vehicles associated with construction.	C	2	2	2	2	2	0.6	1.2	Dust suppression (wet suppression) in main construction areas. Speed limit on site to be restricted to 40 km/hr. Monitoring of fallout dust, PM_{10} and $PM_{2.5}$. Additional mitigation to be identified and implemented should dust monitoring indicate dust levels at receptor points exceed limits.	0.6	0.72
	Air Quality	Incease in ambient dust emissions due to primary and secondary crushing.	O	4	2	3	2	2.5	0.6	1.5	Dust extraction to be in place at crushers. Wet suppression to be in place at all handling points.	0.6	0.9
	Noise	Increase in ambient noise levels due operation of equipment and machinery used in the construction of curshers.	C	1	2	1.5	2	1.75	0.4	0.7	All vehicles, machinery and equipment must be kept in a high level of maintenance. Regular maintenance of access and site roads. Noise monitoring to be undertaken annually or in response to complaints. Continue to implement Kolomela Complaints Procedure and ensure that all affected parties are aware of the procedure for complaints.	0.6	0.42
	Noise	Increase in ambient noise levels due to crushing activities and materials handling.	O	3	4	3.5	2	2.75	0.8	2.2	All vehicles and machinery must be kept in a high level of maintenance. Regular maintenance of access and site roads. Noise monitoring to be undertaken annually or in response to complaints. Continue to implement Kolomela Complaints Procedure and ensure that all affected parties are aware of the procedure for complaints.	0.8	1.76
	Soils	Loss of available soils due to improper handling during construction.	C	1	5	3	1	2	0.6	1.2	Minimise footprint of disturbance to that needed for construction of the road. Strip available topsoil for use in construction rehabilitation. Protect stockpiles from erosion.	0.6	0.72
	Soils	Compaction of soils due to movement of machinery and vehicles.	C	1	5	3	1	2	0.8	1.6	Minimise footprint areas of disturbance. Movement of machinery and vehicles to be restricted to work areas and access routes. Compacted areas to be ripped to reduce compaction.	0.4	0.64

ASPECT	ACTIVITY	POTENTIAL IMPACT	PHASE	INTENSITY	DURATION	CONSEQUENCE	EXTENT	SEVERITY	PROBABILITY	SIGNIFICANCE WITHOUT MITIGATION	MITIGATION	MITIGATION CONFIDENCE	SIGNIFICANCE WITH MITIGATION
	Soils	Soil contamination due to spillages of hydrocarbons and other chemicals used in construction.	C	1	3	2	1	1.5	0.8	1.2	Hydrocarbons and other chemicals used in construction are to be stored within bunded areas at workshops and stores. Should maintenance and repairs be required in the field this is to be done over impervious surfaces. Implement spill response and management procedure. Contaminated soils are to be bioremediated on site.	0.6	0.72
	Land Capability and Land Use	Loss of agricultural land for livestock farming.	C	1	5	3	1	2	1	2	Implement measures to protect soil in order that these can be used in rehabilitation, restoring the land to that suitable for livestock grazing. Remove infrastructure and rehabilitate footprint to resemble pre-mining environment on completion of operations.	0.6	1.2
	Biodiversity	Disturbance of vegetation and habitats in drainage lines due to construction of primary & secondary crushers, ROM stockpile and conveyors.	C	4	5	4.5	1	2.75	1	2.75	Conveyor crossing to be lifted and disturbance of vegetation within drainage lines to be minimised.	1	2.75
	Biodiversity	Damage to drainage lines due to contamination from spillages and run-off from primary & secondary crushers, ROM stockpile and conveyors.	O	4	5	4.5	1	2.75	1	2.75	Protection of drainage lines from spillages and contaminated run-off from crushers, stockpiles and conveyors by diversion of clean water from dirty areas and containment of dirty water run-off from such areas.	0.8	2.2
	Biodiversity	Disturbance of floral species of conservation concern.	C	3	5	4	2	3	0.8	2.4	All protected species within the footprint area of disturbance are to be demarcated during a site walkover. Where the disturbance of protected plants and trees cannot be avoided, the necessary permits are to be in place pior to disturbance. Relocation of protected plants to be undertaken where possible.	0.4	0.96
	Surface Water Resources	Disturbance of drainage areas and interception of drainage channels due to development of infrastructure.	C	4	5	4.5	2	3.25	0.8	2.6	Implement measures as described for the protection of biodiversity and sensitive habitats.	0.6	1.56
	Surface Water Resources	Contaminated run-off and spillages from conveyors, crushers and stockpile areas entering into natural drainage.	O	4	4	4	2	3	0.8	2.4	Implement measures as described for the protection of biodiversity and sensitive habitats.	0.6	1.44
	Cultural Heritage	Disturbance of heritage sites in footprint area of the crushers and associated infrastructure.	C	3	5	4	1	2.5	0.2	0.5	There are no heritage sites known to occur in the footprint area.	0.2	0.1
	Palaeontology	Disturbance of fossils due to excavations for the development of the crushers and associated infrastructure.	C	3	5	4	1	2.5	0.6	1.5	It is possible that fossils will be unearthed during the development of the construction of infrastructure. Implement Chance Find Protocol	0.6	0.9
	Visual Environment	Visual intrusion and loss of scenic quality.	O	2	4	3	2	2.5	0.8	2	Screening of lines of site from visual receptor points. Remove infrastructure and rehabilitate footprint to resemble pre-mining environment on completion of construction.	1	2
	Visual Environment	Lighting of the crushers and associated infrastructure.	O	3	4	3.5	2	2.75	0.8	2.2	Implement measures to reduce light trespass, glare and sky glow.	0.6	1.32

UHDMS & PRODUCT STOCKPILES

ASPECT	ACTIVITY	POTENTIAL IMPACT	PHASE	INTENSITY	DURATION	CONSEQUENCE	EXTENT	SEVERITY	PROBABILITY	SIGNIFICANCE WITHOUT MITIGATION	MITIGATION	MITIGATION CONFIDENCE	SIGNIFICANCE WITH MITIGATION
UHDMS & PRODUCT STOCKPILES	Topography	Levelling of topography for the development of plant, product stockpiles and associated infrastructure.	C	1	5	3	1	2	1	2	Minimise footprint area required for infrastructure development. Infrastructure to be removed at end of life and topography rehabilitated to pre-construction landform.	0.8	1.6
	Groundwater	Contamination of underlying aquifers due to storage and handling of potential pollutants.	O	2	4	3	1	2	0.6	1.2	Protection of groundwater resources from seepage that may originate from the storage and handling of hazardous substances (incl. fuels, oils, greases, lubricants, solvents) by the implementation of bunding and impervious surfaces. Dirty water run-off to be contained and prevented from spilling into surface water resources. Implement spill prevention and emergency response procedure.	0.6	0.72
	Air Quality	Increase in ambient dust levels due to earth moving activities and entrainment due to the movement of vehicles associated with construction.	C	2	2	2	2	2	0.6	1.2	Dust suppression (wet suppression) in main construction areas. Speed limit on site to be restricted to 40 km/hr. Monitoring of fallout dust, PM_{10} and $PM_{2.5}$. Additional mitigation to be identified and implemented should dust monitoring indicate dust levels at receptor points exceed limits.	0.6	0.72
	Air Quality	Increase in ambient dust emissions due to tertiary crushing and screening and materials handling.	O	4	2	3	2	2.5	0.6	1.5	Dust extraction to be in place at crushers. Wet suppression to be in place at all handling points.	0.6	0.9
	Noise	Increase in ambient noise levels due operation of equipment and machinery used in the construction of infrastructure.	C	1	2	1.5	2	1.75	0.4	0.7	All vehicles, machinery and equipment must be kept in a high level of maintenance. Regular maintenance of access and site roads. Noise monitoring to be undertaken annually or in response to complaints. Continue to implement Kolomela Complaints Procedure and ensure that all affected parties are aware of the procedure for complaints.	0.6	0.42
	Noise	Increase in ambient noise levels due to crushing activities and materials handling.	O	2	4	3	2	2.5	0.8	2	All vehicles and machinery must be kept in a high level of maintenance. Regular maintenance of access and site roads. Noise monitoring to be undertaken annually or in response to complaints. Continue to implement Kolomela Complaints Procedure and ensure that all affected parties are aware of the procedure for complaints.	0.8	1.6
	Soils	Loss of available soils due to improper handling during construction.	C	1	5	3	1	2	0.6	1.2	Minimise footprint of disturbance to that needed for construction of the road. Strip available topsoil for use in construction rehabilitation. Protect stockpiles from erosion.	0.6	0.72
	Soils	Compaction of soils due to movement of machinery and vehicles.	C	1	5	3	1	2	0.8	1.6	Minimise footprint areas of disturbance. Movement of machinery and vehicles to be restricted to work areas and access routes. Compacted areas to be ripped to reduce compaction.	0.4	0.64

ASPECT	ACTIVITY	POTENTIAL IMPACT	PHASE	INTENSITY	DURATION	CONSEQUENCE	EXTENT	SEVERITY	PROBABILITY	SIGNIFICANCE WITHOUT MITIGATION	MITIGATION	MITIGATION CONFIDENCE	SIGNIFICANCE WITH MITIGATION
	Soils	Soil contamination due to spillages of hydrocarbons and other chemicals used in construction.	C	1	3	2	1	1.5	0.8	1.2	Hydrocarbons and other chemicals used in construction are to be stored within bunded areas at workshops and stores. Should maintenance and repairs be required in the field this is to be done over impervious surfaces. Implement spill response and management procedure. Contaminated soils are to be bioremediated on site.	0.6	0.72
	Land Capability and Land Use	Loss of agricultural land for livestock farming.	C	1	5	3	1	2	1	2	Implement measures to protect soil in order that these can be used in rehabilitation, restoring the land to that suitable for livestock grazing. Remove infrastructure and rehabilitate footprint to resemble pre-mining environment on completion of operations.	0.6	1.2
	Biodiversity	Disturbance of sensitive sites in footprint area used for plant, product stockpiles and associated infrastructure.	C	3	5	4	1	2.5	0.4	1	Protection of drainage lines from unnecessary disturbance and damage due contaminated run-off from construction activities.	1	1
	Biodiversity	Damage to drainage lines due to contamination from run-off from plant and product stockpile areas.	O	3	5	4	1	2.5	0.6	1.5	Diversion of clean water around plant and stockpile area. Containment of dirty water run-off from plant and stockpile area.	0.8	1.2
	Biodiversity	Disturbance of floral species of conservation concern.	C	3	5	4	2	3	0.8	2.4	All protected species within the footprint area of disturbance are to be demarcated during a site walkover. Where the disturbance of protected plants and trees cannot be avoided, the necessary permits are to be in place pior to disturbance. Relocation of protected plants to be undertaken where possible.	0.4	0.96
	Surface Water Resources	Disturbance of drainage channels as a result of construction of plant, product stockpiles and associated infrastructure.	C	3	5	4	2	3	0.6	1.8	Implement measures as described for the protection of biodiversity and sensitive habitats.	0.6	1.08
	Surface Water Resources	Contaminated run-off and spillages entering into natural drainage.	O	3	4	3.5	2	2.75	0.6	1.65	Implement measures as described for the protection of biodiversity and sensitive habitats.	0.6	0.99
	Cultural Heritage	Disturbance of heritage sites in footprint area of plant, product stockpiles and associated infrastructure.	C	3	5	4	1	2.5	0.2	0.5	There are no heritage sites known to occur in the footprint area.	0.2	0.1
	Palaeontology	Disturbance of fossils due to excavations for the development of the plant, product stockpiles and associated infrastructure.	C	3	5	4	1	2.5	0.6	1.5	It is possible that fossils will be unearthed during the development of the construction of infrastructure. Implement Chance Find Protocol	0.6	0.9
	Visual Environment	Visual intrusion and loss of scenic quality.	O	2	4	3	2	2.5	0.6	1.5	Screening of lines of site from visual receptor points. Remove infrastructure and rehabilitate footprint to resemble pre-mining environment on completion of construction.	1	1.5
	Visual Environment	Lighting of the plant and associated infrastructure.	O	3	4	3.5	2	2.75	0.8	2.2	Implement measures to reduce light trespass, glare and sky glow.	0.6	1.32

DISCARD DUMP AND DISCARD CONVEYOR

ASPECT	ACTIVITY	POTENTIAL IMPACT	PHASE	INTENSITY	DURATION	CONSEQUENCE	EXTENT	SEVERITY	PROBABILITY	SIGNIFICANCE WITHOUT MITIGATION	MITIGATION	MITIGATION CONFIDENCE	SIGNIFICANCE WITH MITIGATION
DISCARD DUMP AND DISCARD CONVEYOR	Topography	Change in topography due to the development of the discard dump.	O	3	5	4	1	2.5	1	2.5	Rehabilitate at end of life of operation to a landform that resembles the surrounding environment.	0.8	2
	Groundwater	Contamination of underlying aquifers due to seepage from discard dump.	O	3	5	4	1	2.5	0.6	1.5	Divert clean water run-off to reduce potential for leachate development. Dirty water run-off to be contained and prevented from entering any watercourse or wetland pan. Downstream monitoring of groundwater quality.	0.8	1.2
	Air Quality	Increase in ambient dust levels due handling of discard material and windblown dust.	O	3	2	2.5	2	2.25	0.6	1.35	Wet suppression and material handling points for discard.	0.8	1.08
	Noise	Increase in ambient noise levels due to materials handling	O	1	4	2.5	2	2.25	0.4	0.9	All machinery and equipment must be kept in a high level of maintenance.	0.8	0.72
	Soils	Loss of available soils due to improper handling during construction.	C	2	5	3.5	1	2.25	0.6	1.35	Minimise footprint of disturbance to that needed for construction of the road. Strip available topsoil for use in construction rehabilitation. Protect stockpiles from erosion.	0.6	0.81
	Soils	Compaction of soils due to movement of machinery and vehicles.	C	1	5	3	1	2	0.8	1.6	Minimise footprint areas of disturbance. Movement of machinery and vehicles to be restricted to work areas and access routes. Compacted areas to be ripped to reduce compaction.	0.4	0.64
	Land Capability and Land Use	Loss of agricultural land for livestock farming	C	3	5	4	2	3	1	3	Implement measures to protect soil in order that these can be used in rehabilitation, restoring the land to that suitable for livestock grazing. Remove infrastructure and rehabilitate footprint to resemble pre-mining environment on completion of operations.	0.6	1.8
		Loss of access route to farms to the north.	C	1	5	3	2	2.5	0.6	1.5	Ensure continued safe access to Lynput along western boundary of farm.	0.4	0.6
	Biodiversity	Disturbance of sensitive habitats due to discard dump footprint over wetland pan. Conveyor crossing drainage lines.	C	5	5	5	2	3.5	1	3.5	Alter footprint to avoid destruction of wetland pan including catchment of pan. Conveyor crossing is to be lifted above drainage lines and disturbance of vegetation within drainage kept to a minimum.	0.6	2.1
	Biodiversity	Disturbance of sensitive habitats due to contaminants entering drainage channels or pan catchments due to run-off from discard dump area or spillage from conveyor	O	4	5	4.5	1	2.75	1	2.75	Contain spillages from conveyors and prevent from entering drainage. Contain contaminated run-off from discard dump area and prevent from entering drainage or pan catchment areas.	0.6	1.65
	Biodiversity	Disturbance of floral species of conservation concern.	C	3	5	4	2	3	0.8	2.4	All protected species within the footprint area of disturbance are to be demarcated during a site walkover. Where the disturbance of protected plants and trees cannot be avoided, the necessary permits are to be in place prior to disturbance. Relocation of protected plants to be undertaken where possible.	0.4	0.96
	Surface Water Resources	Destruction of wetland pan within footprint area of discard dump. Development of conveyor crossing of drainage channels.	C	5	5	5	2	3.5	1	3.5	See mitigation measures for protection of biodiversity.	0.4	1.4
	Surface Water Resources	Contaminated run-off entering into natural drainage lines or pan catchments. Spillages from conveyor.	O	4	2	3	2	2.5	0.8	2	Diversion of clean water around dirty water areas. Containment of contaminated run-off and prevention from entering into drainage channels or catchment of wetland pan.	0.6	1.2

ASPECT	ACTIVITY	POTENTIAL IMPACT	PHASE	INTENSITY	DURATION	CONSEQUENCE	EXTENT	SEVERITY	PROBABILITY	SIGNIFICANCE WITHOUT MITIGATION	MITIGATION	MITIGATION CONFIDENCE	SIGNIFICANCE WITH MITIGATION
	Cultural Heritage	Disturbance of heritage sites due to development of discard dump.	C	3	5	4	1	2.5	0.8	2	Phase 2 assessment of MSA and LSA lithics located along the western boundary of the discard dump.	0.2	0.4
	Palaeontology	Disturbance of fossils due to excavations for the development of the discard dump.	C	3	5	4	1	2.5	0.4	1	It is unlikely that fossils will be unearthed during the development of the construction of infrastructure.	1	1
	Visual Environment	Visual intrusion and loss of scenic quality	O	5	4	4.5	2	3.25	1	3.25	Screening of lines of site from visual receptor points. Implement measures to restore topography at the end of the life of the operations.	0.8	2.6
	Visual Environment	Lighting of the discard dump and associated infrastructure.	O	2	4	3	2	2.5	0.8	2	Implement measures to reduce light trespass, glare and sky glow.	0.6	1.2

SLIMES DAM, RWD AND PIPELINES

ASPECT	ACTIVITY	POTENTIAL IMPACT	PHASE	INTENSITY	DURATION	CONSEQUENCE	EXTENT	SEVERITY	PROBABILITY	SIGNIFICANCE WITHOUT MITIGATION	MITIGATION	MITIGATION CONFIDENCE	SIGNIFICANCE WITH MITIGATION
SLIMES DAM, RWD AND PIPELINES	Topography	Change in topography due to the development of slimes and return water dam.	C	2	5	3.5	1	2.25	1	2.25	Rehabilitate at end of life of operation to a landform that resembles the surrounding environment.	0.8	1.8
	Groundwater	Contamination of underlying aquifers due to seepage from slimes and return water.	O	3	5	4	1	2.5	0.8	2	Lining of RWD with a Class C barrier. Minimise pooling of water on slimes dam. Re-use of return water in process. Undertake source-pathway-receptor modelling of slimes to determine risk to the environment and confirm the requirement for a Class C barrier. Monitor downstream groundwater quality. Recycling of water for use in the process.	0.8	1.6
	Air Quality	Increase in ambient dust levels and windblown dust from slimes dam.	O	1	2	1.5	2	1.75	0.6	1.05	Vegetate surfaces of slimes dam during operations.	0.8	0.84
	Soils	Loss of available soils due to improper handling during construction.	C	2	5	3.5	1	2.25	0.6	1.35	Minimise footprint of disturbance to that needed for construction of the road. Strip available topsoil for use in construction rehabilitation. Protect stockpiles from erosion.	0.6	0.81
	Soils	Compaction of soils due to movement of machinery and vehicles.	C	1	5	3	1	2	0.8	1.6	Minimise footprint areas of disturbance. Movement of machinery and vehicles to be restricted to work areas and access routes. Compacted areas to be ripped to reduce compaction.	0.4	0.64
	Land Capability and Land Use	Loss of agricultural land for livestock farming.	C	3	5	4	2	3	1	3	Implement measures to protect soil in order that these can be used in rehabilitation, restoring the land to that suitable for livestock grazing. Remove infrastructure and rehabilitate footprint to resemble pre-mining environment on completion of operations.	0.6	1.8
	Biodiversity	Disturbance of sensitive habitats due to construction of slimes dam, RWD and pipelines crossing drainage channels.	C	4	5	4.5	1	2.75	1	2.75	Pipeline crossings are to be above ground and footprints are to ensure that disturbance of vegetation within drainage areas is kept to a minimum.	0.4	1.1
	Biodiversity	Disturbance of sensitive habitats due to contaminants entering drainage lines.	O	4	5	4.5	1	2.75	1	2.75	Protect drainage lines from spillages from tailings and return water pipelines. RWD to be designed to accommodate 1 in 50 year flood event and sufficient free board (minimum of 800 mm) maintained at all times to prevent spillages into the environment.	0.8	2.2
	Biodiversity	Disturbance of floral species of conservation concern.	C	3	5	4	2	3	0.8	2.4	All protected species within the footprint area of disturbance are to be demarcated during a site walkover. Where the disturbance of protected plants and trees cannot be avoided, the necessary permits are to be in place pior to disturbance. Relocation of protected plants to be undertaken where possible.	0.4	0.96
	Surface Water Resources	Development of pipeline crossings over drainage channels.	C	3	2	2.5	3	2.75	1	2.75	See measures to protect biodiversity and sensitive habitats.	0.6	1.65
	Surface Water Resources	Contaminated run-off entering into natural drainage lines due to run-off from slimes dam area or spillages from pipelines or and RWD.	O	4	2	3	2	2.5	0.8	2	See measures to protect biodiversity and sensitive habitats.	0.6	1.2
	Cultural Heritage	Disturbance of heritage sites due to development of slimes dam and RWD	C	3	5	4	1	2.5	0.2	0.5	There are no heritage sites known to occur in the footprint area.	0.2	0.1

ASPECT	ACTIVITY	POTENTIAL IMPACT	PHASE	INTENSITY	DURATION	CONSEQUENCE	EXTENT	SEVERITY	PROBABILITY	SIGNIFICANCE WITHOUT MITIGATION	MITIGATION	MITIGATION CONFIDENCE	SIGNIFICANCE WITH MITIGATION
	Palaeontology	Disturbance of fossils due to excavations for the development of the slimes dam and RWD.	C	3	5	4	1	2.5	0.6	1.5	It is possible that fossils will be unearthed during the development of the construction of infrastructure. Implement Chance Find Protocol	0.6	0.9
	Visual Environment	Visual intrusion and loss of scenic quality	O	2	5	3.5	2	2.75	1	2.75	Screening of lines of site from visual receptor points.	1	2.75
	Visual Environment	Lighting of the slimes dam and RWD.	O	2	4	3	2	2.5	0.8	2	Implement measures to reduce light trespass, glare and sky glow.	0.6	1.2

DEWATERING INFRASTRUCTURE INCLUDING PIPELINES AND RESERVOIR

ASPECT	ACTIVITY	POTENTIAL IMPACT	PHASE	INTENSITY	DURATION	CONSEQUENCE	EXTENT	SEVERITY	PROBABILITY	SIGNIFICANCE WITHOUT MITIGATION	MITIGATION	MITIGATION CONFIDENCE	SIGNIFICANCE WITH MITIGATION
DEWATERING INFRASTRUCTURE INCLUDING PIPELINES AND RESERVOIR	Topography	Change in topography due to the development dewatering infrastructure	C	1	5	3	3	3	0.4	1.2	Rehabilitate at end of life of operation to a landform that resembles the surrounding environment.	0.8	0.96
	Groundwater	Contamination of underlying aquifers due to storage and handling of potential pollutants used in rail construction.	C	1	2	1.5	2	1.75	0.4	0.7	Mobile toilet facilities to be provided for persons involved in construction. Implement spill prevention and emergency response procedure.	0.6	0.42
	Air Quality	Increase in ambient dust levels due to earth moving and blasting activities associated with the development of dewatering infrastructure.	C	1	1	1	3	2	0.6	1.2	Consideration to be given to wind direction and speed when undertaking wind generating activities (e.g. blasting) near to receptors and stop operations if excessive dust will disturb such receptors.	0.4	0.48
	Soils	Loss of available soils due to improper handling during construction.	C	1	5	3	3	3	0.2	0.6	Strip available topsoil for use in rehabilitation of construction activities.	0.6	0.36
	Soils	Compaction of soils due to movement of machinery and vehicles.	C	1	5	3	1	2	0.4	0.8	Minimise footprint areas of disturbance. Movement of machinery and vehicles to be restricted to work areas and access routes. Compacted areas to be ripped to reduce compaction.	0.4	0.32
	Land Capability and Land Use	Loss of agricultural land for livestock farming. Land capability reduced due to isolation of farm areas by the pipeline which restricts the movement of livestock.	C	1	5	3	2	2.5	0.6	1.5	Create overpasses over pipeline for cattle and wildlife.	0.8	1.2
	Biodiversity	Disturbance of sensitive habitats (i.e. rocky ridges and drainage channels) due to development of dewatering infrastructure especially dewatering pipeline link to reservoir.	C	3	5	4	1	2.5	1	2.5	Minimise footprint areas of disturbance of pipeline route and reservoir. Pipeline crossing over drainage channels is to be elevated to minimise disturbance of vegetation within drainage channels.	0.6	1.5
	Biodiversity	Isolation of faunal species due to development of pipelines,	C	2	5	3.5	1	2.25	0.6	1.35	Create overpasses and underpasses (minimum height of 30 cm above surface) to promote movement of faunal species.	0.8	1.08
	Surface Water Resources	Impedance of flow due to crossing of drainage lines.	C	3	5	4	3	3.5	0.6	2.1	Implement measures described for the protection of biodiversity and sensitive habitats.	0.6	1.26
	Cultural Heritage	Disturbance of heritage sites due to pipeline routing around South Pit and to Reservoir.	C	5	5	5	3	4	0.6	2.4	Phase 2 heritage assessment to be undertaken for HKZ2 to be impacted on by infrastructure around the South Pit. Pipeline route to avoid LSA shelters on rocky ridge.	0.4	0.96
	Palaeontology	Disturbance of fossils due to excavations for the development of dewatering infrastructure.	C	3	5	4	1	2.5	0.4	1	It is unlikely that fossils will be unearthed during the development of the construction of infrastructure.	0.6	0.6
	Visual Environment	Visual intrusion and loss of scenic quality	O	2	4	3	2	2.5	0.6	1.5	Reservoir will be visible from surrounding access routes. Infrastructure to be removed at the end of operations.	1	1.5
	Visual Environment	Lighting of dewatering infrastructure	O	1	4	2.5	2	2.25	0.2	0.45	No mitigation required.	1	0.45

NORTH AND SOUTH PITS

ASPECT	ACTIVITY	POTENTIAL IMPACT	PHASE	INTENSITY	DURATION	CONSEQUENCE	EXTENT	SEVERITY	PROBABILITY	SIGNIFICANCE WITHOUT MITIGATION	MITIGATION	MITIGATION CONFIDENCE	SIGNIFICANCE WITH MITIGATION
NORTH AND SOUTH PITS	Topography	Change in topography due to creating of mine voids.	C	5	5	5	1	3	1	3	Maximise opportunities for in-pit dumping.	0.8	2.40
	Groundwater	Lowering of groundwater levels due to dewatering for mining.	O	5	5	5	2	3.5	1	3.5	Monitoring (including installation of groundwater level date loggers) of groundwater levels at site and neighbouring properties. Ongoing collation of additional information on aquifer characteristics. Regular update of the model and revision of dewatering requirements and impacts as more information becomes available. Memorandum of Understanding applicable to Kolomela to be implemented at Heuningkranz. Investigation into opportunities for aquifer recharge and implementation of such measures in accordance with water use licence, once issued	1	3.5
	Groundwater	Contamination of groundwater due to seepage from pit areas.	O	3	5	4	1	2.5	0.6	1.5	Removing of rainwater from pit areas, as required for safe operations, will reduce potential for leach development. Investigate the need for an evaporation pond to manage this water.	0.8	1.20
	Air Quality	Increase in ambient dust levels due to the excavation and haulage of waste rock and ore from pit areas.	C&O	5	4	4.5	2	3.25	0.6	1.95	Wet suppression on all temporary roads. Chemical suppression on all main haul roads.	0.8	1.56
	Noise	Increase in ambient noise levels due mining activities.	C&O	4	4	4	2	3	0.6	1.8	All vehicles and machinery must be kept in a high level of maintenance. Regular maintenance of access and site roads. Noise monitoring to be undertaken annually or in response to complaints. Continue to implement Kolomela Complaints Procedure and ensure that all affected parties are aware of the procedure for complaints.	0.6	1.08
	Soils	Compaction of soils due to movement of machinery and vehicles.	C	4	5	4.5	1	2.75	0.6	1.65	Minimise footprint areas of disturbance. Movement of machinery and vehicles to be restricted to work areas and access routes. Compacted areas to be ripped to reduce compaction.	0.4	0.66
	Land Capability and Land Use	Loss of land capability due development of pit areas.	C&O	5	5	5	1	3	1	3	Minimise footprint areas to that required for pit areas. Maximise opportunities for in-pit dumping and minimisation of final voids.	0.8	2.40
	Biodiversity	Disturbance of catchments of wetland pans and drainage channels due to the development of pits.	C&O	5	5	5	3	4	1	4	Drainage is to be diverted around pits and redirected back into the catchment in order to minimise downstream impacts. Biomonitoring is to be undertaken downstream of mining operations prior to development and ongoing to assess impacts and identify mitigation should impacts warrant it.	0.6	2.40
	Biodiversity	Loss of biodiversity due to lowering of groundwater levels.	O	4	5	4.5	1	2.75	0.4	1.1	Biomonitoring of biodiversity impacts.	1	1.10
	Biodiversity	Disturbance of floral species of conservation concern.	C&O	3	5	4	2	3	0.6	1.8	All protected species within the footprint area of disturbance are to be demarcated during a site walkover. Where the disturbance of protected plants and trees cannot be avoided, the necessary permits are to be in place prior to disturbance. Relocation of protected plants to be undertaken where possible.	1	1.80

ASPECT	ACTIVITY	POTENTIAL IMPACT	PHASE	INTENSITY	DURATION	CONSEQUENCE	EXTENT	SEVERITY	PROBABILITY	SIGNIFICANCE WITHOUT MITIGATION	MITIGATION	MITIGATION CONFIDENCE	SIGNIFICANCE WITH MITIGATION
	Surface Water Resources	Impedance of flow from upstream catchment and loss of catchment in pit area.	C&O	5	5	5	3	4	1	4	Drainage is to be diverted around pits and redirected back into the catchment in order to minimise downstream impacts. Restore current impedance due to rail and boundary road.	0.8	3.20
	Cultural Heritage	Disturbance of heritage sites due to development of pits including blasting resulting in damage to sensitive sites.	C&O	5	5	5	5	5	0.8	4	Phase 2 heritage assessment to be undertaken for HKZ2 to be impacted on by infrastructure around the South Pit. Phase 2 heritage assessment to be undertaken at LSA Shelters in valley (specifically HKZ9) as blasting will take place within close proximity to this significant site causing damage to the site.	0.4	1.60
	Palaeontology	Disturbance of fossils due to excavations for the development of pits.	C	4	5	4.5	3	3.75	0.6	2.25	Implement Chance Find Protocol recommended by specialist.	0.6	1.35
	Visual Environment	Visual intrusion and loss of scenic quality	C&O	3	5	4	2	3	0.8	2.4	Maximise opportunities for in-pit dumping.	0.8	1.92
	Visual Environment	Lighting of mining operations	C&O	3	4	3.5	2	2.75	0.8	2.2	Implement measures to reduce light trespass, glare and sky glow.	0.6	1.32

WASTE ROCK DUMPS - NORTH EASTERN WRD, SOUTH EASTERN WRD AND SOUTH WESTERN WRD

ASPECT	ACTIVITY	POTENTIAL IMPACT	PHASE	INTENSITY	DURATION	CONSEQUENCE	EXTENT	SEVERITY	PROBABILITY	SIGNIFICANCE WITHOUT MITIGATION	MITIGATION	MITIGATION CONFIDENCE	SIGNIFICANCE WITH MITIGATION
WASTE ROCK DUMPS - NORTH EASTERN WRD, SOUTH EASTERN WRD AND SOUTH WESTERN WRD	Topography	Change in topography due to the creation of WRDs	C	5	5	5	1	3	1	3	Maximise opportunities for in-pit dumping. Reshaping of WRDs during rehabilitation to resemble natural landform.	0.8	2.40
	Groundwater	Contamination of underlying aquifers due to seepage of waste rock material.	O	3	5	4	1	2.5	0.6	1.5	Monitoring of groundwater quality in the vicinity of the pit areas.	1	1.50
	Air Quality	Increase in ambient dust levels due to the excavation and haulage of waste rock and ore to WRDs.	C&O	5	4	4.5	2	3.25	0.6	1.95	Wet suppression on all temporary roads. Chemical suppression on all main haul roads.	0.8	1.56
	Noise	Increase in ambient noise levels due dumping of WRD.	C&O	4	4	4	2	3	0.6	1.8	All vehicles and machinery must be kept in a high level of maintenance. Regular maintenance of access and site roads. Noise monitoring to be undertaken annually or in response to complaints. Continue to implement Kolomela Complaints Procedure and ensure that all affected parties are aware of the procedure for complaints.	0.6	1.08
	Soils	Compaction of soils due to movement of machinery and vehicles.	C	4	5	4.5	1	2.75	0.6	1.65	Minimise footprint areas of disturbance. Movement of machinery and vehicles to be restricted to work areas and access routes. Compacted areas to be ripped to reduce compaction.	0.4	0.66
	Land Capability and Land Use	Loss of agricultural land for livestock farming.	C&O	5	5	5	1	3	1	3	Minimise footprint areas to that required for WRDs areas. Maximise opportunities for in-pit dumping and minimisation of final voids. Rehabilitation of WRDs (including change of slopes) to allow for livestock grazing.	0.8	2.40
	Biodiversity	Disturbance of catchments of wetland pans and drainage channels due to the development of WRDs.	C&O	5	5	5	3	4	1	4	Move North Eastern WRDs so as to avoid wetland pans.	0.4	1.60
	Biodiversity	Disturbance of floral species of conservation concern.	C&O	3	5	4	2	3	0.6	1.8	All protected species within the footprint area of disturbance are to be demarcated during a site walkover. Where the disturbance of protected plants and trees cannot be avoided, the necessary permits are to be in place prior to disturbance. Relocation of protected plants to be undertaken where possible.	1	1.80
	Surface Water Resources	Contamination of drainage channels due to run-off from WRDs.	C&O	5	4	4.5	3	3.75	0.6	2.25	Containment of dirty water run-off from WRDs. Ongoing rehabilitation of slopes converting dirty water areas into clean areas.	0.6	1.35
	Surface Water Resources	Impedance of flow from upstream catchment and loss of catchment WRD footprint areas.	C&O	5	5	5	3	4	1	4	Drainage is to be diverted around dumps and redirected back into the catchment in order to minimise downstream impacts. Restore current impedance due to rail and boundary road.	0.8	3.20
	Cultural Heritage	Disturbance of heritage sites due to development of WRDs.	C	5	5	5	3	4	0.8	3.2	Relocate NE WRD to ensure protection of LVW1 of LVW2.	0.4	1.28
	Palaeontology	Disturbance of fossils due to development of WRDs	C	3	5	4	1	2.5	0.4	1	It is unlikely that fossils will be unearthed during the development of the construction of infrastructure	1	1.00

ASPECT	ACTIVITY	POTENTIAL IMPACT	PHASE	INTENSITY	DURATION	CONSEQUENCE	EXTENT	SEVERITY	PROBABILITY	SIGNIFICANCE WITHOUT MITIGATION	MITIGATION	MITIGATION CONFIDENCE	SIGNIFICANCE WITH MITIGATION
	Visual Environment	Visual intrusion and loss of scenic quality.	O	5	5	5	3	4	1	4	Maximise opportunities for in-pit dumping. Combine NE WRD and SE WRD to allow assimilation of all WRDs into surrounding topography. Ongoing rehabilitation of WRDs including reshaping of slopes to resemble surrounding landforms.	0.8	3.20
	Visual Environment	Lighting of operations on WRDs	C&O	3	4	3.5	2	2.75	0.8	2.2	Implement measures to reduce light trespass, glare and sky glow.	0.6	1.32

EXPLOSIVES MAGAZINE

ASPECT	ACTIVITY	POTENTIAL IMPACT	PHASE	INTENSITY	DURATION	CONSEQUENCE	EXTENT	SEVERITY	PROBABILITY	SIGNIFICANCE WITHOUT MITIGATION	MITIGATION	MITIGATION CONFIDENCE	SIGNIFICANCE WITH MITIGATION
EXPLOSIVES MAGAZINE	Topography	Levelling of topography for infrastructure development.	C	1	5	3	1	2	0.8	1.6	Minimise footprint area required for infrastructure development. Infrastructure to be removed at end of life and topography rehabilitated to pre-construction landform.	0.8	1.28
	Groundwater	Contamination of underlying aquifers	C&O	3	5	4	2	3	0.8	2.4	Protection of groundwater resources from seepage that may originate from the storage and handling of hazardous substances by the implementation of bunding and impervious surfaces. Monitoring of groundwater in the vicinity of the explosives magazine.	0.6	1.44
	Air Quality	Increase in ambient dust levels due to development of explosives magazine.	C&O	2	4	3	3	3	0.2	0.6	None considered necessary.	1	0.60
	Soils	Loss of available soils due to improper handling during construction.	C	2	5	3.5	1	2.25	0.8	1.8	Minimise footprint of disturbance to that needed for operations. Strip available topsoil. Protect stockpiles from erosion.	0.6	1.08
	Soils	Compaction of soils due to movement of machinery and vehicles.	C	1	5	3	1	2	0.8	1.6	Minimise footprint areas of disturbance. Movement of machinery and vehicles to be restricted to work areas and access routes. Compacted areas to be ripped to reduce compaction.	0.4	0.64
	Soils	Contamination of soils	C&O	5	5	5	1	3	0.8	2.4	Contain all spills and prevent them from coming into contact with run-off. Hazardous substances to be handled on impervious surfaces. Hazardous substances to be stored in bunded areas.	0.5	1.2
	Land Capability and Land Use	Loss of land capability due to conversion of grazing land	C	1	5	3	1	2	1	2	Removal of infrastructure and rehabilitation of footprint on closure.	0.2	0.4
	Land Use	Loss of agricultural land for livestock farming.	C	1	5	3	1	2	1	2	See above.	0.4	0.8
	Biodiversity	Disturbance of sensitive habitats	C	1	5	3	1	2	0.4	0.8	No sensitive habitats within areas designated for development.	1	0.80
	Biodiversity	Restriction of faunal movement due to fencing.	O	3	4	3.5	1	2.25	0.6	1.35	Internal fencing to allow for the movement of animals across the properties.	0.4	0.54
	Biodiversity	Disturbance of floral species of conservation concern.	C	1	5	3	2	2.5	0.6	1.5	Site walkover to be undertaken to identify protected species within the footprint area. Avoid species of conservation concern by changing of layout. Where the disturbance of protected plants and trees cannot be avoided, the necessary permits are to be in place pior to disturbance.	1	1.50
	Surface Water Resources	Distrubance of drainage channels.	C	4	5	4.5	3	3.75	0.2	0.75	None considered necessary.	1	0.75
	Cultural Heritage	Disturbance of heritage sites in footprint area used for the development of explosive magazine and associated infrastructure.	C	3	5	4	1	2.5	0.4	1	There are no known heritage sites known to occur in the footprint area.	0.2	0.2
	Palaeontology	Disturbance of fossils due to excavations for the development of the explosives magazine.	C	3	5	4	2	3	0.2	0.6	It is unlikely that fossils will be unearthed during the development of the construction of infrastructure.	0.2	0.12
	Visual Environment	Visual intrusion and loss of scenic quality.	O	1	5	3	3	3	0.2	0.6	None considered necessary.	1	0.60

ASPECT	ACTIVITY	POTENTIAL IMPACT	PHASE	INTENSITY	DURATION	CONSEQUENCE	EXTENT	SEVERITY	PROBABILITY	SIGNIFICANCE WITHOUT MITIGATION	MITIGATION	MITIGATION CONFIDENCE	SIGNIFICANCE WITH MITIGATION
	Visual Environment	Lighting of explosives magazine	O	1	4	2.5	2	2.25	0.6	1.35	Implement measures to reduce light trespass, glare and sky glow.	0.6	0.81

KOLOMELA EXPANSION - SOCIO-ECONOMICS

ACTIVITY	ASPECT	POTENTIAL IMPACT	PHASE	INTENSITY	DURATION	CONSEQUENCE	EXTENT	SEVERITY	PROBABILITY	SIGNIFICANCE WITHOUT MITIGATION	MITIGATION	MITIGATION CONFIDENCE	SIGNIFICANCE WITH MITIGATION
KOLOMELA EXPANSION	SOCIO-ECONOMICS	Local procurement and enterprise development due to construction activities at Heuningkranz	C	2	4	3	4	3.5	1	3.5	Preferential procurement plan for local suppliers. Kumba supplier development programme. Programmes run by the Zimele Business Development Support Centre.	1	3.5
		Local employment of persons involved directly or indirectly in construction	C	2	4	3	4	3.5	1	3.5	Social and Labour Plan commitments and implementation of the mine's local recruitment policy. Collaboration with the municipality's unemployment forum. Local employment commitments from contractors and monitoring thereof.	1	3.5
		Added value to the economy due to capital input	C	4	5	4.5	5	4.75	1	4.75	Participation in the municipal IDP and LED Forums. Collaboration and engagement with local business organisations.	1	4.75
		Sustained employment opportunities due to extension of life of Kolomela Mine	O	2	4	3	4	3.5	1	3.5	Implement local recruitment policy should existing positions become available.	1	3.5
		Sustained Local Economic Development due to extension of LOM of Kolomela	O	4	4	4	3	3.5	1	3.5	Identification of LED needs through participation in IDP and LED Forums.	1	3.5
		Added value to the economy due to operational expenditure.	O	3	5	4	5	4.5	1	4.5	SLP commitments, aligned with the municipal IDP TSASSAMBA Public Private Partnership with Beeshoek mine and Tsantsabane Local Municipality	1	4.5
		Continued support of the local municipality enhances service delivery	O	2	3	2.5	3	2.75	1	2.75	Capacity building programme. Support to the municipality as part of the Operation and Maintenance agreement.	1	2.75
		Continued pressure on municipal services and capacity due to rapidly growing population	O	3	4	3.5	3	3.25	1	3.25	Capacity building and support initiatives to alleviate pressure on the municipality. Guide contractors to communicate and recruit responsibly.	0.8	2.6
		Prolonged shortage of proper and affordable housing due to the demand created by mining (poor living conditions in informal settlements)	C&O	4	3	3.5	3	3.25	1	3.25	Local recruitment prioritised during construction and operation. Temporary housing provided during construction.	0.8	2.6
		Dust, noise and dewatering impacting the farming community's quality of life and livelihoods	C&O	3	5	4	2	3	0.8	2.4	Environmental Forum for engagement. Implement dust suppression initiatives. Monitoring of dust in ambient environment. Monitoring of noise in ambient environment. Monitoring of groundwater surrounding mine. Memorandum of Understanding on addressing impacts on users applicable to Kolomela Mine to be applied to Heuningkranz Effective engagement with affected parties around the project in particular. Continuous communication on plans and feedback on results.	1	2.4
		Increase in social ills (e.g. crime, prostitution, substance abuse, teenage pregnancies) linked to population growth, poor living conditions, and contractors' employment practices	C&O	4	3	3.5	4	3.75	0.8	3	Continued support of, and collaboration with institutions and organisations involved in combatting social ills. Develop a procedure for the management of contractors' social impacts and negotiate the implementation of the procedure with internal role players as well as key contractors.	1	3

ACTIVITY	ASPECT	POTENTIAL IMPACT	PHASE	INTENSITY	DURATION	CONSEQUENCE	EXTENT	SEVERITY	PROBABILITY	SIGNIFICANCE WITHOUT MITIGATION	MITIGATION	MITIGATION CONFIDENCE	SIGNIFICANCE WITH MITIGATION
		Strained relationships with selected stakeholders due to unmet expectations of economic benefits from the mine	O	3	3	3	4	3.5	0.8	2.8	Engagement plan to ensure that stakeholders are being kept up to date with the project and the opportunities for local community members – management of expectations. Effective engagement with key stakeholders. Open door to listen to aggrieved groups. Communicate the mine's performance on socio-economic benefit delivery to the local community	1	2.8
		Increased traffic & consequences on road networks.	C&O	3	4	3.5	4	3.75	1	3.75	Upgrading of all roads to be used during construction and operations R385 and D3326 and implementation of surface wetting to control dust. Ongoing maintenance of access roads. Surfacing of the R385 as soon as practicable.	0.6	2.25

10.SUMMARY OF SPECIALIST REPORTS

LIST OF STUDIES UNDERTAKEN	RECOMMENDATIONS OF SPECIALIST REPORTS	SPECIALIST RECOMMENDATIONS THAT HAVE BEEN INCLUDED IN THE EIA REPORT	REFERENCE TO APPLICABLE SECTION OF REPORT WHERE SPECIALIST RECOMMENDATIONS HAVE BEEN INCLUDED.
Air Quality Specialist Study (Airshed Planning Professionals, February 2018)	The mitigation of sources of emissions. Special attention should be paid to the mitigation of dust from unpaved haul roads; Continued ambient air quality monitoring, including: • Gravimetric sampling of PM_{10} and $PM_{2.5}$ concentrations. • Continued dustfall sampling around operations with an additional 2 locations proposed.	Speed limit on site roads of 40 km/hr. Speed limit on access roads of 60 km/hr. Surface wetting during construction and temporary haul roads. Upgrading and maintenance of access routes, and surface wetting of access routes (including surfacing as soon as practicable) Continued monitoring of PM_{10}, and $PM_{2.5}$ concentrations as well as fallout monitoring at two new locations.	Included as mitigation in Table 9-5. Part B – Section 5 Part B – Section 7.2
Noise Specialist Study (Airshed Planning Professionals, February 2018)	All diesel-powered equipment and plant vehicles should be kept at a high level of maintenance. Equipment with lower sound power levels must be selected. Maintain road surface regularly to avoid corrugations, potholes etc. Avoid unnecessary idling times. Minimising the need for trucks/equipment to reverse.	All equipment to be kept in a high level of maintenance. Noise complaints register to be in place. Access roads to be upgraded and maintained including surfacing as soon as possible. Annual noise monitoring to be implemented from authorisation to establish a comprehensive baseline and then to monitor impacts of construction and operation (more conservative than	Included as mitigation in Table 9-5. Part B – Section 5 Part B – Section 7.3

LIST OF STUDIES UNDERTAKEN	RECOMMENDATIONS OF SPECIALIST REPORTS	SPECIALIST RECOMMENDATIONS THAT HAVE BEEN INCLUDED IN THE EIA REPORT	REFERENCE TO APPLICABLE SECTION OF REPORT WHERE SPECIALIST RECOMMENDATIONS HAVE BEEN INCLUDED.
	Alternatives to the traditional reverse 'beeper' alarm such as a 'self-adjusting' or 'smart' alarm could be considered. Limiting traffic hours to between 06:00 and 18:00. Limiting activities at the rail siding, including train movement, rail car loading etc., to hours between 06:00 and 18:00. Where possible, other non-routine noisy activities such as construction, decommissioning, start-up and maintenance, should be limited to day-time hours. A noise complaints register must be kept. Monitoring programme to be implemented in accordance with the requirements of the IFC: • Once during the construction phase at NSR1, NSR7, NSR10, NSR14 and NSR11; • Annually during the operational phase at NSR1, NSR7, NSR10, NSR14 and NSR11; and • In response to complaints received.	recommendation).	
Economic Impact Assessment (Demacon Market Studies, January 2018).	None.	Recommendations to promote preferential procurement of local suppliers, local economic development initiatives, skills development and local employment.	Included as mitigation in Table 9-5. Part B- Section 5.

LIST OF STUDIES UNDERTAKEN	RECOMMENDATIONS OF SPECIALIST REPORTS	SPECIALIST RECOMMENDATIONS THAT HAVE BEEN INCLUDED IN THE EIA REPORT	REFERENCE TO APPLICABLE SECTION OF REPORT WHERE SPECIALIST RECOMMENDATIONS HAVE BEEN INCLUDED.
Groundwater Investigation (Groundwater Complete, January 2018)	A comprehensive groundwater monitoring programme should be implemented to determine the impact (if any) of the planned mining activities on groundwater quality and water levels. A total of eight source monitoring boreholes are recommended for the mining rights area. Groundwater samples should be analysed at a SANS accredited laboratory for chemical and physical constituents normally associated with iron ore mining and related activities. Groundwater monitoring (i.e. sampling and water level measurements) should be conducted at quarterly intervals.	Groundwater monitoring will be undertaken on site (source monitoring) and within 2 km of boundary, as per recommendations of specialist. Monitoring of quality and levels will be undertaken on an annual basis. The frequency of monitoring will be increased to quarterly 1 year prior to implementation. The groundwater model is to be updated regularly as more information becomes available.	Part B- Section 5 and 7.1.
Heritage Impact Assessment (African Heritage Consultants, September 2013)	The LSA shelters in the valley are the most significant heritage feature. Should any mining or blasting take place within 5 km from the valley, a Phase 2 mitigation is recommended where the shelters should be recorded in more detail. Locality LVW1 at Langverwacht is of high significance. A Phase 2 sampling should be undertaken if this section is impacted by future mining and infrastructural development. The outbuilding at the dam and garden at LVW4 will require a destruction permit if destroyed, as it is older than 60 years.	LSA shelters to be protected and Phase 2 heritage impact assessment is recommended. Mitigated layout plan aims at protecting LVW1. Heritage permit indicated for the destruction of LVW4. Phase 2 Heritage Survey recommended for destruction of HKZ2.	Included as mitigation in Table 9-5. Part B- Section 5. Protection of LVW 1 provided for in mitigated layout plan. Mitigation measures included in Included as mitigation in Table 9-5 and Part B- Section 3.2.

LIST OF STUDIES UNDERTAKEN	RECOMMENDATIONS OF SPECIALIST REPORTS	SPECIALIST RECOMMENDATIONS THAT HAVE BEEN INCLUDED IN THE EIA REPORT	REFERENCE TO APPLICABLE SECTION OF REPORT WHERE SPECIALIST RECOMMENDATIONS HAVE BEEN INCLUDED.
Palaeontological Desktop Study (Heritage Impact Consultants, August 2017)	The EAP as well as the ECO for this project must be made aware of the fact that the underlying Koegas Formation as well as the Makganyane Formation is known to contain important remains of stromatolites. These biogenic structures are important indicators of palaeo-environments and a representative sample must be collected during the mining operations. The EAP and ECO for the project must also take note of the rich Palaeontological Heritage preserved in the Quaternary aged sediments on site and any excavation into these units must be inspected by a suitably qualified Palaeontologist. If fossils are observed, the Chance Find Protocol document must be implemented as part of the EMPr of the project. These recommendations must be included in the EMPr of the project and SAHRA must be satisfied that the developer will implement the CFP (included in this report), if applicable	The requirements have been included in the EMPr commitments. This includes the education of the ECO prior to implementation and the use of the Chance Find Protocol throughout the phases of the life of the Heuningkranz Project.	Included as mitigation in Table 9-5. Part B- Section 5.
Soil and Land Capability Assessment (Scientific Aquatic Services, January 2018)	Prevention of soil erosion: • The footprint of the proposed infrastructure area should be clearly demarcated to restrict vegetation clearing activities.	Provision of the minimisation of all footprint areas. Topsoil stockpiles are to be protected from erosional losses. Movement of machinery and vehicles to be restricted to work areas and access routes.	Included as mitigation in Table 9-5 Part B- Section 5.

LIST OF STUDIES UNDERTAKEN	RECOMMENDATIONS OF SPECIALIST REPORTS	SPECIALIST RECOMMENDATIONS THAT HAVE BEEN INCLUDED IN THE EIA REPORT	REFERENCE TO APPLICABLE SECTION OF REPORT WHERE SPECIALIST RECOMMENDATIONS HAVE BEEN INCLUDED.
	• Vegetation clearance and commencement of construction activities can be scheduled to coincide with low rainfall conditions. • Excavation and long-term stockpiling of soil should be avoided as far as practically possible; however, the recovered soils can be re-used to rehabilitate the mine footprint following mine closure. • Soils can be stockpiled as needed according to the required process, as long as adequate measures will be in place to protect the surrounding environmental receptors. • All disturbed areas can be re-vegetated with an indigenous grass to re-establish the protective cover in order to minimize erosion. Soil compaction: • All vehicular traffic should be restricted to the existing service roads as far as practically possible. • Vegetation clearance and commencement of construction activities can be scheduled to coincide with low rainfall conditions when soil moisture is anticipated to be relatively low, such that the soils are less prone to compaction.	Compacted areas to be ripped to reduce compaction. Potentially contaminated stormwater will be contained and prevented from entering any clean water resource. A spill prevention and emergency response plan is to be implemented.	

LIST OF STUDIES UNDERTAKEN	RECOMMENDATIONS OF SPECIALIST REPORTS	SPECIALIST RECOMMENDATIONS THAT HAVE BEEN INCLUDED IN THE EIA REPORT	REFERENCE TO APPLICABLE SECTION OF REPORT WHERE SPECIALIST RECOMMENDATIONS HAVE BEEN INCLUDED.
	• Direct surface disturbance of the identified Hutton soil form can be avoided where possible to minimise the intensity of compaction due their loamy sand texture. Soil Contamination: • Potentially contaminated stormwater must be captured in the vicinity of the mining activity infrastructures areas in compliance with GN704. • Unauthorised discharge of potentially contaminated stormwater should be prohibited. • Contamination prevention measures should be addressed in the EMPr. • The contamination prevention measures should entail demonstration of how the mining process will be conducted in such a manner that limits contaminant migration from the mining areas. • A spill prevention and emergency response plan, as well as dust suppression and fire prevention plans should be compiled to guide the construction works. • An emergency response contingency plan should be put in place to address clean-up measures. • Burying of waste on site is to be strictly prohibited.		

LIST OF STUDIES UNDERTAKEN	RECOMMENDATIONS OF SPECIALIST REPORTS	SPECIALIST RECOMMENDATIONS THAT HAVE BEEN INCLUDED IN THE EIA REPORT	REFERENCE TO APPLICABLE SECTION OF REPORT WHERE SPECIALIST RECOMMENDATIONS HAVE BEEN INCLUDED.
	Loss of Agricultural Land Capability: • Aim to conduct all construction activities during the dry season to avoid unprecedented delays. • Disturbed soils can be lightly ripped to at least 30 cm to alleviate soil compaction, and subsequently revegetated with indigenous grass to alleviate soil compaction and minimise erosion. • The recommended ripping and re-vegetation can be implemented concurrently on the subsections where construction works are complete.		
Terrestrial Ecological Assessment (Scientific Terrestrial Services, February 2018)	Should any floral species of conservation concern be located within the proposed infrastructure areas, the necessary permits need to be obtained. Although Ledebouria coriacea is located outside of the proposed infrastructure areas, it is imperative that no construction or operational activities encroach upon this species and its known locality. It is recommended that the entire population footprint of the species be determined, and the area designed as a no-go area.	Provision of site walkover of footprints prior to construction to identify protected species. Provision for obtaining permits for the destruction or relocation, where possible, of protected species. Buffer of 200 m around L. *coriacea* and further work to determine size and extent of population. Overpasses and underpasses provided for linear infrastructure. Conveyors and pipelines across drainage are to be above the flood level.	Included as mitigation in Table 9-5 Part B- Section 5.

LIST OF STUDIES UNDERTAKEN	RECOMMENDATIONS OF SPECIALIST REPORTS	SPECIALIST RECOMMENDATIONS THAT HAVE BEEN INCLUDED IN THE EIA REPORT	REFERENCE TO APPLICABLE SECTION OF REPORT WHERE SPECIALIST RECOMMENDATIONS HAVE BEEN INCLUDED.
	A walkdown of the various mining footprint areas must be undertaken prior to the vegetation clearing activities in order to locate and mark flora and faunal species of conservation concern earmarked for rescue and relocation plans. Clearing is to take place in a phased manner, in a uniform direction from one site to the other of the study area, ensuring that as far as possible, faunal species can naturally disperse out of the area. The construction and operational footprint must be kept as small as possible in order to minimise the loss of faunal and floral habitat as far as possible. Fence off/demarcate no-go areas to ensure that construction/operational creep does not occur. Educate mine employees about habitat conservation and the risk of continued and unnecessary habitat loss outside of infrastructure areas. Ensure no unnecessary vegetation clearing occurs within the study area and that all vehicles are restricted to designated roads. When constructing new roads and conveyor belts, cognisance must be taken to ensure continued connectivity of habitat with the study area. Conveyor belts and pipelines should ideally have a 30-40 cm gap between the bottom edge to ensure that faunal species are still able to traverse within the area.	Minimisation of footprint areas and areas of disturbance included. Provision of alien invasive control. Internal fencing to allow for free movement of animals. Poaching has been prohibited. Compacted soils to be ripped as part of rehabilitation. Movement of machinery and vehicles to be restricted to work areas and access routes. Provision of waste management facilities. Provision for ongoing rehabilitation of WRDs involving reshaping of slopes and establishment of locally indigenous vegetation.	

LIST OF STUDIES UNDERTAKEN	RECOMMENDATIONS OF SPECIALIST REPORTS	SPECIALIST RECOMMENDATIONS THAT HAVE BEEN INCLUDED IN THE EIA REPORT	REFERENCE TO APPLICABLE SECTION OF REPORT WHERE SPECIALIST RECOMMENDATIONS HAVE BEEN INCLUDED.
	Fences should allow for the free movement of small and medium faunal species within the study area. The lower strands of the fence should be approximately 20 cm from the ground surface. Edge effects of construction and operational activities need to be actively managed to minimise further impacts to the receiving environment, with specific consideration to erosion control and alien floral species management. Restrict vehicles to travelling only on designated roadways. No uncontrolled fires whatsoever should be allowed, as frequent fires will impact the floral and faunal ecology of the study area. Furthermore, this is likely to result in the proliferation of alien and invasive plant species, which will further decrease habitat availability and useability. Appropriate sanitary facilities must be provided during the construction phase and all waste must be moved to an appropriate waste facility. All soils compacted as a result of construction activities that do not form part of the operational footprint of the mine, should be ripped and profiled. Special attention should be paid to alien and invasive plant control within these areas.		

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	No dumping of waste should take place within the surrounding environment during the construction or operational phases. If any spills occur, they should be immediately cleaned up. In the event of a breakdown, maintenance of vehicles must take place with care. Recollection of spillage should be practiced to prevent the ingress of hydrocarbons into the topsoil. No trapping or hunting of any faunal species to take place. Upon completion of construction activities, bare areas not forming part of the operational footprint are to be revegetated with indigenous grassland species. Alien vegetation must be removed from the study area during both the construction and operational phases. Establishment of any revegetated areas must be monitored during the operational phase on a bi-monthly basis for a period of one year. Rehabilitation Plan • Disturbed and cleared areas need to be revegetated with indigenous grass species to help stabilise the soil surface.		

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	• All alien plants within the study area should be cleared, with follow up activities running concurrently for one year. • Soils that have been compacted because of the construction activities must be ripped and rehabilitated in line with the surrounding area.		
Freshwater Resource Ecological Assessment (Scientific Aquatic Services, February 2018)	It is recommended that final mine layout planning takes into consideration the catchment areas of the wetland pans, so as to ensure that the hydrological and ecological functioning of these systems are not impacted upon by the proposed mining activities. Flood berms are to be constructed around the discard and waste rock dumps, so as to ensure that during periods of high rainfall, waste material is not carried into the wetland pans or ephemeral drainage lines. The area around the flood berms must be monitored regularly throughout the life of mine to ensure that no erosion or failure of the berms is/has occurred, which may result in the contamination and sedimentation of the wetland pans and ephemeral drainage lines.	The catchment areas of wetland pans are to be determined with respect to reducing disturbance due to the development of linear infrastructure. Provision for the diversion of clean water and containment of dirty water at residue stockpiles and ROM stockpiles. Placement of pipeline and conveyor crossing above the flood levels of drainage and minimisation of footprint areas where crossings occur. Measures for protection of watercourses from spillages from conveyors and pipelines. Provision for the minimisation of footprint areas to that required for the development infrastructure.	Included as mitigation in Table 9-5 Part B- Section 5.

LIST OF STUDIES UNDERTAKEN	RECOMMENDATIONS OF SPECIALIST REPORTS	SPECIALIST RECOMMENDATIONS THAT HAVE BEEN INCLUDED IN THE EIA REPORT	REFERENCE TO APPLICABLE SECTION OF REPORT WHERE SPECIALIST RECOMMENDATIONS HAVE BEEN INCLUDED.
	Placement of the conveyor belts, roads and power lines within the ephemeral drainage lines is to be done in such a way that these structures do not hinder and cut off the flow of water during high rainfall periods downstream. Loss of downstream recharge will have a negative impact on the ecological functioning of the ephemeral drainage lines which flow into the Soutloop River, as well as negatively impact the biota which are reliant on these systems; The footprint area of the opencast pits must remain as small as possible whilst allowing for economical and optimal extraction of the ore. Throughout the life of mine, non-essential personnel and non-essential vehicles are not to be permitted within the remaining wetland pans and as far as possible within the ephemeral drainage lines. Special care must be taken to ensure that no waste relating to the construction or mining process is disposed of or is designed and managed in such a way as to allow seepage into the wetland pans or ephemeral drainage lines;	Relocation of infrastructure to prevent the destruction of wetland pans. Provision for the recycling of dirty water from stormwater management pond and RWD. Clean water is to be diverted around any potentially polluting area and returned to the natural catchments. Water originating from any dirty water area including residue stockpiles, workshops, fuel storage and handling areas, processing areas, stockpiles and WRDs is to be contained and prevented from entering into any water resource. Excess water abstracted is to be pumped to the Beeshoek Reservoir. Opportunities for aquifer recharge are to be investigated. Dirty water management facilities to be designed to contain 1 in 50-year flood event with sufficient free board available. Adequate sanitation to be provided during construction and priority to be given to the construction of the sewage treatment works during construction phase to allow for the proper management of sewage.	

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	As far as possible, mining surface infrastructure (including soil stockpiles and any temporary structures during the construction phase) should not encroach into the wetland pans and wetland catchments, as well as the associated zones of regulation nor the demarcated flood lines, in accordance with the requirements of Regulation GN704 of the National Water Act. Any activities which encroach on the wetland pans and within the flood lines must be authorised by the relevant authorities, and such activities must be managed in a responsible manner. Limit the footprint area of the construction activities (including the placement of temporary infrastructure) to what is absolutely essential in order to minimise the loss of clean water runoff areas and loss of catchment yield. Measures to contain and reuse as much water as possible within the mine process water system should be undertaken. Very strict control of water consumption and detailed monitoring must take place, and all water usage must continuously be optimised; The mine's water balance must be strictly controlled at all times to ensure optimal water use, prevent overflow in dirty stormwater management systems and prevent spills to the environment.	Treated sewage effluent will be re-used in the process. All physical infrastructure is to be removed on closure and the landform restored to resemble the pre-mining environment.	

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	It is considered possible that the open cast pits may form a cone of depression which will impact the hydrological cycle of the ephemeral drainage lines, as well as the downstream recharge potential of the wetland pans. Although decant from the open pits is not anticipated, any area where decant points may be determined during operations must be suitably managed. No dirty water runoff (as defined by Regulation GN704) must be permitted to reach the wetland pans or ephemeral drainage lines during the entire life of mine, and clean and dirty water management systems must be maintained and operated efficiently to prevent any contaminated runoff from entering the receiving freshwater environment. Clean and dirty water runoff systems should be implemented in accordance with an approved stormwater management plan. Ground water extracted from boreholes used to dewater the open cast pits is to be pumped out to the local reservoir at Beeshoek. However, if a positive water balance is experienced during operations, the mine should consider using this additional water from the dewatering boreholes to possibly recharge the ground water via the ephemeral drainage lines located to the south-east of the prosed mining areas (with approval from		

LIST OF STUDIES UNDERTAKEN	RECOMMENDATIONS OF SPECIALIST REPORTS	SPECIALIST RECOMMENDATIONS THAT HAVE BEEN INCLUDED IN THE EIA REPORT	REFERENCE TO APPLICABLE SECTION OF REPORT WHERE SPECIALIST RECOMMENDATIONS HAVE BEEN INCLUDED.
	DWS). In this way minimising water stress/impacts to the down gradient ephemeral drainage systems resulting from upgradient catchment loss. All dirty water containment structures should be designed to contain a minimum storm event of a 24 hour 1 in 50-year flood event. These containment facilities must remain outside of the defined wetland pan areas and the respective zone of regulation and the ephemeral drainage lines as a measure to minimise the impact on the receiving environment. All pollution control facilities must be managed in such a way as to ensure that storage and surge capacity is available if a rainfall event occurs. Strict control of sewage water treatment must take place and the sewage system should form part of the mine's closed process water system. Adequate stormwater management must be implemented and maintained in accordance with a stormwater management plan, in order to prevent erosion and the associated sedimentation of the wetland and drainage line areas. In this regard special mention is made of:		

LIST OF STUDIES UNDERTAKEN	RECOMMENDATIONS OF SPECIALIST REPORTS	SPECIALIST RECOMMENDATIONS THAT HAVE BEEN INCLUDED IN THE EIA REPORT	REFERENCE TO APPLICABLE SECTION OF REPORT WHERE SPECIALIST RECOMMENDATIONS HAVE BEEN INCLUDED.
	Sheet runoff from cleared areas, paved surfaces and access roads needs to be curtailed; Runoff from hard surfaces should be slowed down by the strategic placement of berms, swales and other stormwater management structures; and All discard and waste stockpiles must have berms and/or catchment paddocks at their toe to contain runoff from the areas. During construction activities and the operational phase of the proposed mining development, erosion berms should be installed on roadways to prevent gully formation and alteration of the sediment balance of the wetland pans and ephemeral drainage lines. No disposal of any wastes should take place within the wetlands or ephemeral drainage lines. If any spills occur, they should be immediately cleaned up. Implement alien vegetation and bush encroachment control programme in conjunction with construction activities. Alien floral invasion is expected within any disturbed areas, and therefore regular monitoring and control of alien invasive vegetation should take place throughout the operational phase; and		

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	Upon closure, all haul and access roads which are no longer required, as well as all unnecessary mining infrastructure (including temporary structures) should be removed and the area rehabilitated in such a way as to make the area free draining and to minimise the impacts on the ephemeral drainage lines and wetland pans of the study area beyond the life of mine.		
Traffic Impact Assessment (JG Afrika, January 2018)	Mitigation measures should focus on the upgrade and maintaining of the road surface as well as dust suppression. These measures should be to the approval of the Roads Department who do not favour propriety dust suppressants. Regular watering for dust suppression may lead to unsafe conditions of the calcrete gravel road as experienced under similar conditions on the Witsand access to Kolomela. The traffic volumes over this gravel section of the R385 will exceed the accepted threshold for surfacing as used by road authorities. The sensitivity of the traffic and trip generation data was tested, and the traffic volumes confirmed.	Upgrading of access roads and surface wetting for dust control while road is not surfaced. Surfacing of the road as soon as practicably possible is recommended due to traffic volumes.	Included as mitigation in Table 9-5 Part B- Section 5.

LIST OF STUDIES UNDERTAKEN	RECOMMENDATIONS OF SPECIALIST REPORTS	SPECIALIST RECOMMENDATIONS THAT HAVE BEEN INCLUDED IN THE EIA REPORT	REFERENCE TO APPLICABLE SECTION OF REPORT WHERE SPECIALIST RECOMMENDATIONS HAVE BEEN INCLUDED.
	As a fulltime maintenance and dust suppression team may be expensive and come with a long-time safety risk (2031-2048), it is recommended that a lifetime economic option analysis be carried out considering upgrading of the R385 (MR882) to a surfaced road. This will mitigate all the impacts and reduce the safety exposure to 12 months.		
Waste Assessment (Jones & Wagener, January 2018)	Consideration should be given to a formal barrier system for the residue deposits and stockpiles, such as the waste rock and overburden. In the case of the wet tailings disposal facility, a Class C barrier system is recommended unless further refined groundwater source-pathway-receptor modelling work is undertaken to verify that the facility can be developed with an alternative or no barrier system. All residue deposits and stockpile management systems and disposal and stockpiling designs must be approved by DWS.	No liners recommended for stockpile, discard and WRD areas. Class C barrier recommended for slimes RWD. Source-pathway-receptor modelling work recommended to confirm barrier requirements for the slimes dam.	Included as mitigation in Table 9-5 Part B- Section 5.
Visual Impact Assessment (EXM, February 2018)	Final layout planning is to give consideration to the possibility of consolidating of the waste rock dumps and the incorporation of the topographical changes into the existing landscape features.	Mitigated layout provides for the consolidation of the WRDs. Ongoing rehabilitation of WRDs to resemble surrounding landforms recommended.	Included as mitigation in Table 9-5 Part B- Section 5.

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	The reshaping of slopes to mimic those which occur naturally in the area, together with the implementation of a vegetation cover that resembles that of the surrounding natural environment will substantially decrease the change in the scenic quality of the environment. Opportunities for the backfilling of pits as part of the mine planning, thus reducing the volume of waste rock produced is to be investigated. Visual screening e.g. through the use of berms and/or trees can substantially reduce the impact on nearby receptors by enhancing the visual absorption capacity of the environment and intercepting the lines of site from nearby receptor points. It is recommended that consideration be given to relocating the construction village to reduce the impact on the neighbouring homestead. Excessive and unnecessary lighting is to be avoided. Consideration is also to given to the type of light that is provided with orange light resulting in less glare than white light (due to the amount of blue light emitted). In addition, blue light brightens the night sky more than any other colour of light resulting in sky glow.	Recommended that opportunities for in pit dumping to be maximised. Screening of lines of site from visual receptor points included. Need for measures to reduce light trespass, glare and night glow included.	

11. ENVIRONMENTAL IMPACT STATEMENT

11.1 SUMMARY OF KEY FINDINGS OF THE ENVIRONMENTAL IMPACT ASSESSMENT

The following have been identified as the key findings of the impact assessment:

11.1.1 Employment, Local Procurement and Economic Development

- The construction phase of the project will provide for 950 jobs. The predicted indirect job opportunities created due to the capital input will be 13 665.
- The operational phase of the project will provide for sustained job opportunities at Kolomela Mine due the extension of the LOM by 14 years. A total of 813 positions will be retained for the Heuningkranz operations. However, due to the annual operational expenditure associated with the mine, a total of 6 871 employment positions will be sustained due to the Heuningkranz Project.
- The project will have a significant impact on the local and regional economy both during construction (~additional GGP of R6.2 billion) and during the life of the operations (~R3.1 billion per annum).

11.1.2 Influx of Persons

- The sustained life of mine at Kolomela Mine will mean that negative impacts associated with an influx of persons into Tsantsabane will continue. This includes pressure on housing, expansion of informal settlements, increased pressure on municipal services and increased crime levels, in particular theft.

11.1.3 Lowering of Groundwater levels

11.1.4 Lowering of Groundwater levels

- Dewatering will be required for safe mining operations at Heuningkranz to continue to below the groundwater table.
- It is currently anticipated that ~ 416 m^3/hr will need to be pumped from the aquifer to allow for mining at Heuningkranz (Groundwater Complete, January 2018).
- Dewatering is expected to result in a drawdown of the natural groundwater levels up to 200 m below ground level at the site boundary north east of the pit operations.

- Boreholes of private land owners up to 5 km to the north east and 2 km to the south and west may be affected by dewatering with groundwater levels dropping by 5 m. The delivery of boreholes may also be affected.
- The groundwater model is to be updated on a regular basis as more information becomes available.
- Cumulative impact assessment on dewatering impacts to be undertaken prior to the application for water use licensing and result to be communicated with interested and affected parties.

11.1.5 Increased Dust Levels

- The main source of dust at Heuningkranz will be the movement of vehicles on haul roads.
- No non-compliances with the NAAQS are however predicted at any surrounding receptors.
- Dust resulting from increased traffic on public access roads is considered to be a safety risk to persons travelling to Heuningkranz as well other users on the road.
- Access roads are to be upgraded and surface wetting applied to ensure dust levels are controlled.
- The surfacing of the R385 presents the safest option in the long term.

11.1.6 Disturbance of Watercourses

- The North Pit and the North Eastern WRD (if unmitigated) will result in the destruction of sections of the ephemeral drainage of the tributary of the Soutloop River at Heuningkranz.
- The relocation of the North Eastern WRD means that the main drainage system across the site has less impedance and loss to the catchment, although the water will still need to be diverted around the North Pit and returned to the natural drainage system.
- Conveyor and pipelines will cross the drainage lines posing the additional risk of impedance of flow disturbance of beds or contamination due to spillages.

11.1.7 Loss of Wetlands

- The unmitigated layout would result in the destruction of 3 of the 6 wetland pans due the footprint of the North East WRD and the Discard Dump.
- Indirect impacts due to infrastructure being developed within the wetland buffer zones means that the impact would be greater if the layout is not altered.
- The Mitigated Layout allows for the 3 wetland pans to be protected and infrastructure to be moved further from wetland pans.

11.1.8 Loss of Sensitive Biodiversity

- The wetlands are considered to have high biodiversity importance due to ecological functioning in the dry environmental conditions.
- Ephemeral drainage lines are also considered to be sensitive as they harbour protected species and also support downstream ecological functions.
- The protection of wetlands and watercourses is thus a priority for biodiversity protection at the site.

11.1.9 Heritage Protection

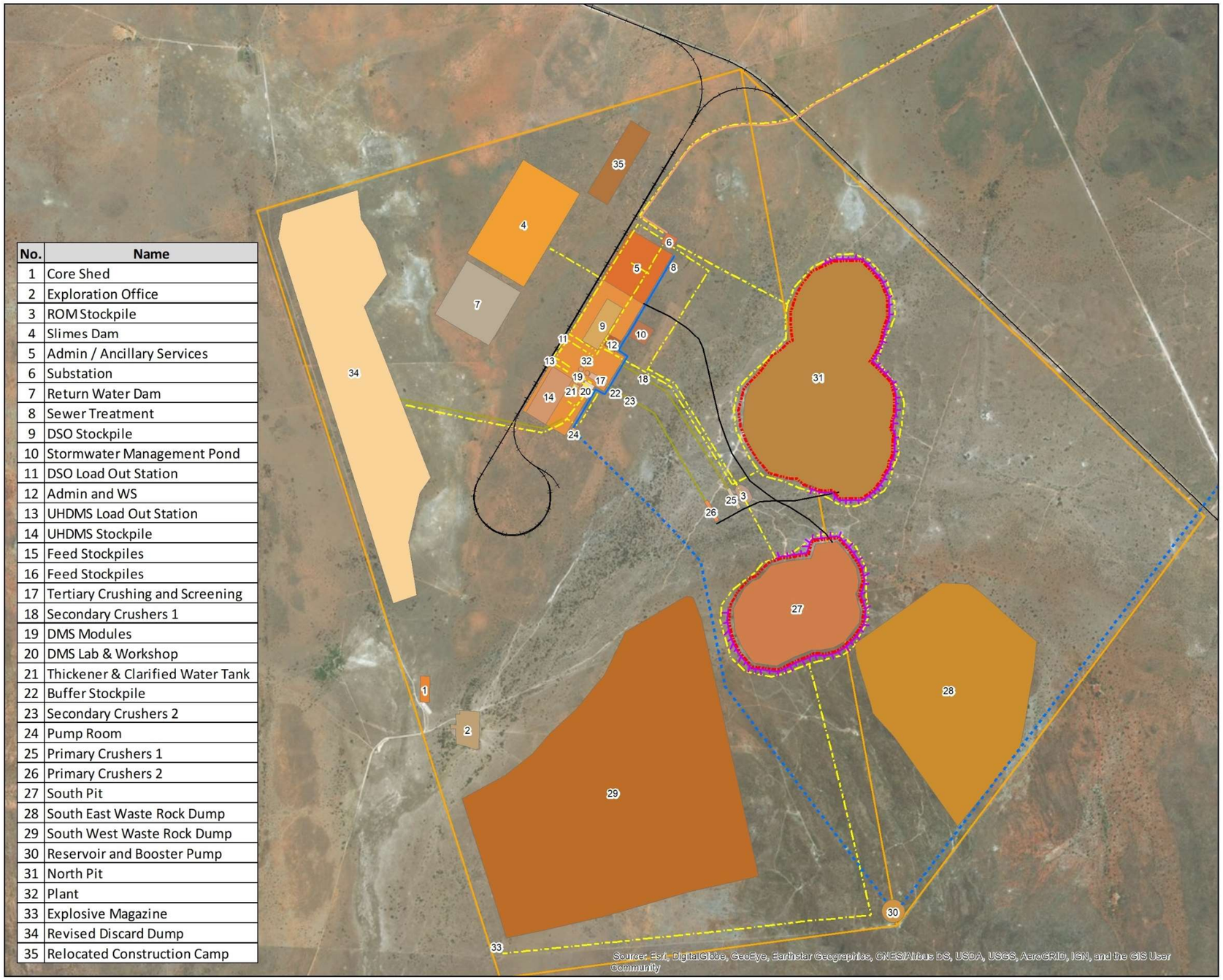
- LSA Site shelters located at the valley within the rocky ridge in the south eastern corner of the site is considered to be of high heritage significance. The site is to be protected but could be damaged due to blasting within pits.
- MSA and LSA lithics of high significance are located within the footprint of the North Eastern WRD (unmitigated). In the mitigated scenario the lithics are protected.

11.1.10 Traffic

- The access roads in their current condition cannot support increased traffic volumes due to the project.
- The access roads used are to be upgraded and maintained to support traffic volumes.
- Surface wetting (note that dust suppressants are not acceptable to the Northern Cape Department of Roads and Public Works) will need to be carried out on roads.
- The surfacing of the R385 should be undertaken as soon as practicable within the life of the project.

11.2 Final site map

The final site layout map (Mitigated Scenario) is provided in Figure 3-1 and also here as Figure 11-1.



No.	Name
1	Core Shed
2	Exploration Office
3	ROM Stockpile
4	Slimes Dam
5	Admin / Ancillary Services
6	Substation
7	Return Water Dam
8	Sewer Treatment
9	DSO Stockpile
10	Stormwater Management Pond
11	DSO Load Out Station
12	Admin and WS
13	UHDMS Load Out Station
14	UHDMS Stockpile
15	Feed Stockpiles
16	Feed Stockpiles
17	Tertiary Crushing and Screening
18	Secondary Crushers 1
19	DMS Modules
20	DMS Lab & Workshop
21	Thickener & Clarified Water Tank
22	Buffer Stockpile
23	Secondary Crushers 2
24	Pump Room
25	Primary Crushers 1
26	Primary Crushers 2
27	South Pit
28	South East Waste Rock Dump
29	South West Waste Rock Dump
30	Reservoir and Booster Pump
31	North Pit
32	Plant
33	Explosive Magazine
34	Revised Discard Dump
35	Relocated Construction Camp

Legend

- Mitigated Access Road
- Conveyor Belt
- Dewatering Network
- Haul Road
- Railway Line
- Stormwater Berm
- Stormwater Channel
- Revised Electrical Line
- Property Boundary

N
W E
S

Kilometers
0 0,75 1,5

Date: 2018/03/13

EXM Advisory Services
SOLUTIONS | PROGRESS | PARTNERS

Coordinate System: DMS	
Spheroid: WGS84	Central Meridian: LO

Heuningkranz Mitigated Layout

FIGURE 11-1: PROPOSED PROJECT LAYOUT HEUNINGKRANZ (MITIGATED)

11.3 Summary of the positive and negative implications and risks of the proposed activity and identified alternatives

TABLE 11-1: SUMMARY OF KEY POSITIVE AND NEGATIVE IMPACTS IDENTIFIED FOR THE MITIGATED AND UNMITIGATED SCENARIOS

ACTIVITY	ASPECT	POTENTIAL IMPACT	SIGNIFICANCE WITHOUT MITIGATION	MITIGATION	SIGNIFICANCE WITH MITIGATION
ACCESS ROAD	Air Quality	Increase in ambient dust levels due to traffic movement on access roads.	HIGH	The R385 is to be upgraded (recommend surfacing of the road as soon as practicable) to handle traffic volumes and control dust. Prior to surfacing of the road, the road is to be upgraded and maintained on a regular basis. Dust suppression is to be ongoing to control dust levels on unsurfaced access roads. Monitoring of fallout dust, PM10 and PM2.5.	LOW
DISCARD DUMP	Biodiversity	Disturbance of sensitive habitats due to discard dump footprint over wetland pan. Conveyor crossing drainage lines.	HIGH	Alter footprint to avoid destruction of wetland pan including catchment of pan. Conveyor crossing is to be lifted above drainage lines and disturbance of vegetation within drainage kept to a minimum.	LOW
	Surface Water Resources	Destruction of wetland pan within footprint area of discard dump. Development of conveyor crossing of drainage channels.	HIGH	See mitigation measures for protection of biodiversity.	HIGH
MINE PITS	Groundwater	Lowering of groundwater levels due to dewatering for mining.	HIGH	Monitoring (including installation of groundwater level date loggers) of groundwater levels at site and neighbouring properties. Ongoing collation of additional information on aquifer characteristics. Regular update of the model and revision of dewatering requirements and impacts as more information becomes available. Memorandum of Understanding applicable to Kolomela to be implemented at Heuningkranz. Investigation into opportunities for aquifer recharge and implementation of such measures in accordance with water use licence, once issued	HIGH
	Biodiversity	Disturbance of catchments of wetland pans and drainage channels due to the development of pits.	HIGH	Drainage is to be diverted around pits and redirected back into the catchment in order to minimise downstream impacts. Biomonitoring to be undertaken downstream of	LOW

ACTIVITY	ASPECT	POTENTIAL IMPACT	SIGNIFICANCE WITHOUT MITIGATION	MITIGATION	SIGNIFICANCE WITH MITIGATION
				mining operations prior to development and ongoing to assess impacts and identify mitigation should impacts warrant it.	
	Surface Water Resources	Impedance of flow from upstream catchment and loss of catchment in pit area.	HIGH	Drainage is to be diverted around pits and redirected back into the catchment in order to minimise downstream impacts. Restore current impedance due to rail and boundary road.	LOW
	Cultural Heritage	Disturbance of heritage sites due to development of pits including blasting resulting in damage to sensitive sites.	HIGH	Phase 2 heritage assessment to be undertaken for HKZ2 to be impacted on by infrastructure around the South Pit. Phase 2 heritage assessment to be undertaken at LSA Shelters in valley (specifically HKZ9) as blasting will take place within close proximity to this significant site causing damage to the site.	LOW
WASTE ROCK DUMPS	Biodiversity	Disturbance of catchments of wetland pans and drainage channels due to the development of WRDs.	HIGH	Move North Eastern WRDs so as to avoid wetland pans.	LOW
	Cultural Heritage	Disturbance of heritage sites due to development of WRDs.	HIGH	Relocate NE WRD to ensure protection of LVW1 and LVW2.	LOW
	Visual Environment	Visual intrusion and loss of scenic quality.	HIGH	Maximise opportunities for in-pit dumping of waste rock. Combine NE WRD and SE WRD to allow assimilation of all WRDs into surrounding topography. Ongoing rehabilitation of WRDs including reshaping of slopes to resemble surrounding landforms.	LOW
HEUNINGKRANZ PROJECT	Social Impacts	Continued pressure on municipal services and capacity due to rapidly growing population	HIGH	Capacity building and support initiatives to alleviate pressure on the municipality. Guide contractors to communicate and recruit responsibly.	LOW
		Prolonged shortage of proper and affordable housing due to the demand created by mining (poor living conditions in informal settlements)	HIGH	Local recruitment prioritised during construction and operation. Temporary housing provided during construction.	LOW
		Increased traffic & consequences on road networks.	HIGH	Upgrading of all roads to be used during construction and operations including R385 and D3326 and implementation of surface wetting to control dust.	LOW

ACTIVITY	ASPECT	POTENTIAL IMPACT	SIGNIFICANCE WITHOUT MITIGATION	MITIGATION	SIGNIFICANCE WITH MITIGATION
				Ongoing maintenance of access roads. Surfacing of the R385 as soon as practicable.	
		Local procurement and enterprise development due to construction activities at Heuningkranz.	HIGH	Preferential procurement plan for local suppliers. Kumba supplier development programme. Programmes run by the Zimele Business Development Support Centre.	HIGH
		Local employment of persons involved directly or indirectly in construction	HIGH	Social and Labour Plan commitments and implementation of the mine's local recruitment policy. Collaboration with the municipality's unemployment forum. Local employment commitments from contractors and monitoring thereof.	HIGH
		Added value to the economy due to capital input	VERY HIGH	Participation in the municipal IDP and LED Forums. Collaboration and engagement with local business organisations.	VERY HIGH
		Sustained employment opportunities due to extension of life of Kolomela Mine	HIGH	Implement local recruitment policy should existing positions become available.	HIGH
		Sustained Local Economic Development due to extension of LOM of Kolomela	HIGH	Identification of LED needs through participation in IDP and LED Forums.	HIGH
		Added value to the economy due to operational expenditure.	VERY HIGH	SLP commitments, aligned with the municipal IDP TSASSAMBA Public Private Partnership with Beeshoek Mine and Tsantsabane Local Municipality	VERY HIGH

11.4 Proposed management objectives and the impact management outcomes for inclusion in the EMPr

Mitigation measures required to reduce key negative impacts and enhance positive impacts are included in Table 11-1. The key mitigation measures to be included in the EMPr are as follows:

- Implementation of project layout as per Mitigated Scenario.
- Groundwater monitoring of boreholes on site and within 2 km radius of Heuningkranz to be monitored annually and then quarterly basis from at least 1 year prior to the commencement of construction activities.
- The R385 is to be upgraded and maintained. Surface wetting to be carried out while road is unsurfaced.
- The R385 is to be surfaced as soon as practicable within the life of the project.
- The groundwater model is to be updated regularly as more information becomes available with respect to aquifer characteristics and mine planning, prior to commencement of mining and annually thereafter. Findings are to be communicated with potentially affected parties through the Kolomela Environmental Forum.
- A cumulative impact assessment of dewatering impacts in the region including Kolomela, Beeshoek Mine and the Heuningkranz Project is to be undertaken prior to the application for the water use licence.
- Opportunities for aquifer recharge are to be included as part of the Heuningkranz Project.
- The catchments of wetland pans are to be delineated and impedance of flow within these catchments prevented.
- The flow within the ephemeral tributary of the Soutloop River is to be diverted around the North Pit and returned to the catchment. Energy dissipation for erosion is to be implemented if required.
- The opportunity for aquifer recharge for excess water originating from dewatering activities.
- Air quality monitoring is to be expanded in line with specialist recommendations and monitoring to continue to establish pre-construction baseline and then impacts of construction and operations.
- Noise monitoring is to be undertaken annually from authorisation to establish baseline and then impacts of construction and operational phases. This is to include continuous monitoring over longer periods (e.g. 7 days) to allow for a more representative baseline.
- Clean water is to be diverted around any potentially polluting area including workshop areas, processing areas, ore stockpile areas, and residue stockpiles/dumps.

- Potentially polluted run-off is to be contained from any potentially polluting area and prevented from entering into any drainage channel or catchment of any wetland pan.
- The existence of the Critically Endangered plant species *Ledeboria coriacea* is to be confirmed and the magnitude and the extent of the population determined. A buffer of 200 m is to be maintained around the site with no disturbance allowed until the information on the occurrence of the species can be confirmed.
- The LSA Shelters in the valley on the rocky ridge in the south east of the site are to be protected from disturbance prior to construction, during construction and operation. A Phase 2 Assessment is to be carried out at this site prior to construction.
- Conveyor and pipeline crossings across ephemeral drainage to be raised above the flood levels (1 in 100 year).
- Source-pathway receptor modelling to be undertaken to determine the barrier system required for the slimes dam.
- Class C barrier system to be in place for the RWD.
- Wet suppression to be undertaken on all temporary haul roads and areas of work (during construction phase).
- Dust on haul roads and other unsurfaced roads on the site is to be controlled by chemical suppressants.
- Dust extraction systems to be in place at all crushers and dust suppression to be carried out at all material handling points.
- Local employment commitments are to be obtained from contractors and these are to be monitored.
- Contractors to be encouraged (through preferential procurement process) to make use of local suppliers.

11.5 Final proposed alternatives

The proposed final layout alternative is depicted in Section 11.2 (see Figure 3-1 & Figure 11-1).

11.6 Aspects for inclusion as conditions in the authorisation

The authorisation is subject to the implementation of the Mitigated Layout Plan which is required to reduce negative impacts to acceptable levels. The authorisation is also subject to the amendment of the Kolomela Mine Water Use Licence by the Department of Water and Sanitation prior to the commencement of site activities. Key conditions to be included are the need for a cumulative assessment of impacts on groundwater by Kolomela Mine, Beeshoek Mine and the Heuningkranz Project. In addition, the opportunities for aquifer recharge are to be investigated.

11.7 Description of any assumptions, uncertainties and gaps in knowledge

The outcomes of this EIA Report are based on the following assumptions, uncertainties and knowledge gaps:

- The impacts are as for the project description provided by the Sishen Iron Ore Company and as described in Section 4.
- The proposed layout of Heuningkranz as provided in Figure 3-1 and Figure 11-1 are conceptual. Detailed design of such infrastructure is still to be undertaken. The final layout may differ slightly from the conceptual layout plan. The principles as specified in the outcomes of the EIA Report will however be adhered to during final design
- The modelled scenarios for air quality and noise impacts are based on the mine works programme available at the time. The details with respect to the actual implementation of the programme with respect to the production from different pit areas may differ from that used in the modelling. It is however, anticipated that the magnitude and extent of the predicted impacts present a reasonable estimate for the purposes of the EIA.
- The predicted impact on groundwater is based on a 3D hydrogeological model. The model is subject to limitations with respect to available data on aquifer characteristics, hydraulic conductivity and faults which may affect the prediction on the extent on the drawdown cones. The model is to be updated as more information becomes available.
- Abstraction of water at Kolomela Mine will be required to meet at least the process and domestic water needs during the life of Heuningkranz. This impact has not been taken into consideration and should be considered in future planning for Kolomela.
- No detailed pit floor contours/elevations are available as yet, instead only the deepest floor elevation at mine closure was available for each pit. Volume calculations should therefore be updated once more detailed information becomes available in the future.
- Kolomela Mine's available budget to implement management and mitigation measures to enhance positive social impacts and mitigate negative social impacts, especially in view of the cumulative social impacts of mining developments, are dependent on world economic conditions in particular deteriorating iron ore prices and increased iron ore production worldwide.

11.8 Reasoned opinion as to whether the proposed activity should or should not be authorised

It is the opinion of the EAP that the activities at Heuningkranz Project be authorised based on the following reasons:

- There is a significant socio-economic benefit in terms of capital projection and sustained support of local communities due to the implementation of the project and the extension of the life of Kolomela Mine.
- The negative impacts on water resources, biodiversity, heritage resources and neighbouring receptors can be successfully mitigated to acceptable levels by the implementation of the Mitigated Layout Plan and the implementation of the proposed management measures.

11.9 Rehabilitation Objectives

Based on the outcomes of the EIA the following rehabilitation objectives are applicable to the Heuningkranz Project:

- Rehabilitation will be undertaken in accordance with the Kolomela Rehabilitation Strategy as authorised at the time.
- Establish a safe, stable, non-polluting healthy environment with predominantly grazing potential
- Topsoil is to be stripped in all areas of disturbance and conserved for use in rehabilitation activities.
- Spill prevention and response is to be in place, aimed at the protection of soils and water resources. Soils contaminated with hydrocarbons are to be bioremediated and used for the purposes of rehabilitation.
- The opportunity for in-pit dumping of waste rock should be maximised through future mine planning.
- All infrastructure is to be removed at closure and footprint areas to be rehabilitated.
- Waste rock dumps rehabilitation should be maximised during the life of the operation, with the reshaping of benches to resemble natural landforms and slopes not susceptible to erosion. The Kolomela Rehabilitation Strategy provides for a final slope of 18°.
- Mine residue stockpiles including the discard dump and slimes dam should also be reshaped to resemble a natural landform.
- All areas are to be vegetated with an indigenous (to the local area) vegetation mix that is equal or better in terms of grazing potential when compared to pre-mining conditions but suitable to the rehabilitation conditions.

11.10 Period for which the environmental authorisation is required

Construction and mining (pre-stripping) activities are only planned to commence in 2031 and will continue until 2048. The environmental authorisation is to remain applicable for the extended life of the Kolomela Mine.

12. FINANCIAL PROVISION

12.1 Derivation of quantum

12.1.1 Annual (Premature) Closure Provision

The Heuningkranz Project is planned for commencement in 2031. Current activities at the site involve prospecting activities by SIOC under the existing Prospecting Right (File Ref. 10506PR). ABSA Capital submitted a financial guarantee of R 2 486 101.90 (excl VAT) to the DMR for the Heuningkranz prospecting area in 2012. Application has been made in terms of Section 102 for the inclusion of the Heuningkranz Project area into the Kolomela mining right area. The inclusion of Heuningkranz into Kolomela Mine would mean that any closure liability associated with disturbance at Heuningkranz would need to be included in the annual financial provision calculation for rehabilitation at Heuningkranz.

The latest calculation of the financial provision for rehabilitation of activities at Heuningkranz (November, 2017) is included in Part C, Appendix 14 and summarised in Table 12-1. This presents the current liability at Heuningkranz and is estimated at **R 1 797 405**.

TABLE 12-1: CURRENT CLOSURE LIABILITY HEUNINGKRANZ PROJECT

Current Closure Liability Heuningkranz (10506PR)	
Description	**Amount**
Capping & casing of boreholes	R 30,856.00
General surface rehabilitation	R 288,144.00
Removal of sludge and drill chips or residue	R 75,895.00
Placement of drill socks	R 36,120.00
Testing of boreholes for contamination with hydrocarbons	R 68,400.00
Surface Maintenance of rehabilitated sites including:	
Ripping of compacted areas	R 83,022.00
Erosion repair	R 41,511.00
Physical removal of weed and invasive species	R 181,353.75
Flattening of mounds	R 83,022.00
Removal of rocks and calcrete	R 120,902.50
Brushpacking	R 20,755.50
Removal of drill chips or residue	R 208,976.00
Augmentation of growth as required (seeding and fertilization)	R 17,145.55
Remediation of downhole contamination of sites	R 283,042.00
Closure Planning	R 94,860.00

Contingencies (10%)	R 163,400.53
Total	**R 1,797,405.83**

12.1.2 LOM Closure Provision

EXM Advisory Services has conducted a detailed closure estimate for the Heuningkranz Project. The Closure Costing Report is provided as Part C, Appendix 14. The cost has been based on the Kolomela Closure Costing of July 2017 and updated to include the decommissioning and rehabilitation of infrastructure associated with the Heuningkranz Project. An additional **R241 081 229** is required for the final rehabilitation of Heuningkranz. A summary of the LOM Closure Costs for Kolomela Mine and Heuningkranz are provided in Table 12-2.

TABLE 12-2: LOM CLOSURE COSTS FOR PROPOSED KOLOMELA MINE & HEUNINGKRANZ PROJECT

Area	Kolomela LOM (2034)	Heuningkranz LOM (2048)
Buildings & Structures	R 35,330,172.64	R 11,461,435.29
Plant & Related Infrastructure	R 122,267,961.83	R 68,642,636.70
Pits Areas	R 56,570,319.17	R 32,102,168.60
Mine Residue Deposits	R 34,935,580.83	R 58,582,902.41
Overland & General Infrastructure	R 51,680,323.37	R 31,107,086.43
Maintenance & Monitoring	R 57,488,368.48	R 39,185,000.00
Total	**R 358,272,726.32**	**R 241,081,229.43**

12.2 Amount to be provided for from operating expenditure

Kolomela Mine carries out ongoing rehabilitation of the WRDs as part of the operations. The rehabilitation of the waste rock dumps forms the bulk of the rehabilitation costs. Currently ~R40 million is spent per annum on the rehabilitation of WRDS at Kolomela.

13. DEVIATIONS FROM THE APPROVED SCOPING REPORT AND PLAN OF STUDY

13.1 Deviations from the methodology used in determining the significance of the potential environmental impacts and risks

Not applicable

13.2 Motivation for deviation

Not applicable

14. OTHER INFORMATION REQUIRED BY COMPETENT AUTHORITY

Not applicable

15. OTHER MATTERS REQUIRED IN TERMS OF SCETIONS 24(4)(A) AND (B) ON NEMA

Not applicable

16. UNDERTAKING

I, Kerry Colleen Fairley, the Environmental Assessment Practitioner responsible for compiling this report, undertake that:

- the information provided herein is correct;
- the comments and inputs from stakeholders and I&APs has been correctly recorded;
- information and responses provided to stakeholders and I&APs by the EAP is correct; and

the level of agreement with I&APs and stakeholders has been correctly recorded and reported.

17.REFERENCES

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