REPORT

Report A: Final rehabilitation, decommissioning and mine closure plan for Leeuwpan Coal Mine, as Aligned to the NEMA Financial Provisioning Regulations

Exxaro Resources Limited

Submitted to:

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Distribution List

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Executive Summary

STRUCTURE OF THE CLOSURE PLANNING DOCUMENTS

This set of documents consolidates the necessary closure planning reports for Exxaro Resources Limited's Leeuwpan Coal Mine (Leeuwpan), in terms of the National Environmental Management Act (NEMA, Act 107 of 1998), and specifically the Financial Provisioning Regulations (GN R. 1147 - as amended), gazetted on 20 November 2015, and due to commence in February 2020. The contents of these document are closely aligned with the requirements of GN R. 1147, and although this piece of legislation is being further amended it is unlikely that the next amendment will require significant changes to the contents of the different report/plans:

- Report A: Final rehabilitation, decommissioning and mine closure plan (Appendix 4 of GN. R.1147);
- Report B: Environmental risk assessment (Appendix 5 of GN R. 1147); and
- Report C: Annual rehabilitation plan (Appendix 3 of GN R. 1147).

A regulatory check list detailing what is required in terms of GN R. 1147 is included at the beginning of each Report And provides cross references to the relevant sections of the report(s) where these requirements are addressed.

An overarching introduction and site context description, pertaining to the Leeuwpan operations, is included in the beginning of Report A. The three reports should be read in conjunction as the site context is relevant to each report listed above.

Report A: Final rehabilitation, decommissioning and closure plan

The closure measures set out in the closure plan (Section 16.0 - Report A) are based on a screening level risk assessment undertaken for Leeuwpan (Section 9.0 - Report A), which is informed by relevant biophysical information, available specialist studies, the EMPr, various internal planning documents and a site visit undertaken. The closure measures developed are then costed in Golder's closure costing model to determine the closure costs for Leeuwpan.

The scheduled and unscheduled closure costs were determined using third party/contractor rates and site specific mine rates, where applicable. Quantities used to determine the closure cost estimates were taken from available plans, maps and information provided by Leeuwpan. In addition, a dedicated site visit was conducted to confirm site-specific information. Unit rates were obtained from Golder's data base and/or in consultation with demolition and rehabilitation practitioners.

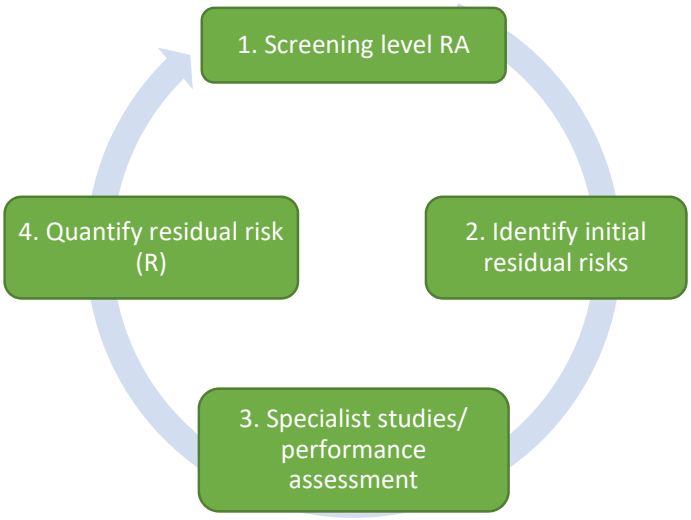
The estimated unscheduled and scheduled closure costs for Leeuwpan, as at the end of December 2018, amount to approximately **R 694.7 million** and **R 273.9 million** respectively (including P&Gs at 12%, and excluding contingencies and VAT). The cost include the water treatment cost for the 10% recharge scenario (Report B), as is reflected in Section 24.0 (Report A).

Report B: Environmental Risk Assessment

This report relates to the identification and costing of residual environmental risks. The preliminary residual risks were identified in the screening level risk assessment undertaken for the closure plan, and the significant residual risks and mitigation measures resulting from the screening level risk assessment were summarised in Section 4.0 Report B.

Preliminary costs have been determined to address the ground water residual risks identified for Leeuwpan, although additional studies are required to improve the understanding of the residual risks. The work required to address the identified knowledge gaps to further inform the necessary mitigation measures for the risks is detailed in Section 7.0 (Report B).

The understanding of the residual risks will gradually improve with annual iterative updates of this document, as more information becomes available. The figure below illustrates the planned approach for costing residual risks:



Report C: Annual Rehabilitation Plan

Report C assesses planned rehabilitation at Leeuwpan for the next 12 months, and considers rehabilitation objectives and envisaged land uses for the various mining areas to be rehabilitated (Section 6 and 7 – Report A).

The Annual Rehabilitation Plan was distilled from the 5 year rehabilitation plan and April 2018 survey information provided by the mine. Costs associated with the planned annual rehabilitation were estimated by Golder. This is the first time an ARP has been prepared for Leeuwpan, it is anticipated that the resolution of the planning and costing will improve with subsequent annual updates.

TERMS AND ABBREVIATIONS	
Terms	
Care and maintenance	This involves the maintenance and corrective action conducted on rehabilitated areas, and the inspection and monitoring required to demonstrate that the closure measures implemented have successfully achieved their intended purpose
Closure	This involves the application for a closure certificate and initiation of the transfer of ongoing care and maintenance to third parties
Contingencies	This allows for making reasonable provision for possible oversights/omissions and possible work not foreseen at the time of compilation of the closure costs. Allowance of between 10 percent and 20 percent would usually be made based on the accuracy of the estimations. The South African Department of Minerals and Energy Guideline (January 2005) requires an allowance of 10 percent
Decommissioning	This relates to the situation after cessation of operations involving the deconstruction/removal and/or transfer of surface infrastructure and the initiation of general site rehabilitation
Post-closure	The period of on-going care and maintenance, as per arrangement with third parties
Preliminary and Generals (P&Gs)	This is a key cost item that is directly related to whether or not third-party contractors are used for site rehabilitation. This cost item comprises both fixed and time-related charges. The former makes allowance for the establishment (and de-establishment) of contractors on site, as well as covering their operational requirements (electricity/water/communications) for their offices, workshops, etc. Time-related items make allowance for the running costs of the fixed charged items for the contract period
Remediation	Work done to assist in the rehabilitation process by enhancing the quality of an area through specific actions to improve especially bio-physical site conditions
Rehabilitation	The return of a disturbed area to its original state, or as close as possible to this state
Scheduled closure	Closure that happens at the planned date and/or time horizon
Unscheduled closure	Immediate closure of a site, representing decommissioning and rehabilitation of the site in its present state
Site relinquishment	Immediate closure of a site, representing decommissioning and rehabilitation of the site in its present state

Abbreviations	
ARD	Acid rock drainage
DMR	Department of Mineral Resources
DWA	Department of Water Affairs
DWS	Department of Water and Sanitation
EC	Electrical conductivity
EIA	Environmental impact assessment
EMPr	Environmental management programme
ERA	Environmental risk assessment
FRDMCP	Final rehabilitation, decommissioning and mine closure plan
GDP	Gross domestic product
IDP	Integrated development plan
IWWMP	Integrated water and wastewater management plan
I&APs	Interested and affected parties
FLFD	Final landform design – Exxaro developed post mining landform
LRA	Labour relations act
LoM	Life of mine
LED	Local economic development
MAP	Mean annual precipitation
MPRDA	Mineral and petroleum resources development act
MRA	Mining rights area
NEMA	National environmental management act
NEMWA	National environmental management waste act
NDM	Nkangala district municipality
RDP	Regional development plan
SLP	Social and labour plan
SDF	Spatial development framework
TDS	Total dissolved solids

WTP	Water treatment plant
WUL	Water use licence
Units of measurement	
ha	Hectares
mg/l	Milligrams per litre
Ml	Mega litres
Ml/d	Mega litres per day

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PROJECT INFORMATION

Proponent's contact details

Name of company	Exxaro Coal Mpumalanga (Pty) Ltd
Name of Mine	Leeuwpan Coal Mine
Name of project	Closure planning and closure cost determination
Physical address	R50, Delmas, Mpumalanga
Contact	Sthembiso Hinani
Telephone number	Sthembiso.hinani@exxaro.com
Email address	+27 (0) 13 665 7621

Details of specialists who prepared the decommissioning, rehabilitation and closure plan, environmental risk assessment and annual rehabilitation plan

Golder was appointed by Leeupan as the specialist closure team to compile this closure planning document for the mine, as aligned to GN R. 1147 (as amended).

The specialists who contributed to the closure planning report and associated closure costing, including their relevant professional registrations and experience are listed below.

Name of company	Golder Associates Africa (Pty) Ltd	
Drawing compilation, measurements and costing	Mbalenhle Baloyi	Civil Technician 3 years' experience
Review	Jennifer Botha, and Johan Bothma	PrLArch (SACLAP, BSc(LArch), BL(Hons), ML(Prof), ML 14 years' experience PrLArch (SACLAP) BL, ML(Prof) 15 years' experience
Costing, report compilation and technical inputs	Anthony Lamb	BSc Hons (Environmental management) 22 years' experience
Postal address	Building 1 Maxwell Office Park Magwa Crescent West Waterfall City Midrand 1685 Gauteng	

Name of company	Golder Associates Africa (Pty) Ltd
Telephone number	+27 (0) 11 254 4800
Email address	anlamb@golder.co.za

Report sign-off

Position	Name	Signature	Date
Snr Rehabilitation and Closure consultant	Anthony Lamb		2019-07-05
Snr Rehabilitation and Closure consultant	Johan Bothma		2019-07-05

1.0 INTRODUCTION

Leeuwpan Coal Mine (Leeuwpan) is owned and operated by Exxaro Resources Limited (Exxaro) and is located 3 - 6 km southeast of Delmas in the Mpumalanga province. Leeuwpan falls within the Victor Khanye Local Municipality and the Nkangala District Municipality.

Opencast mining started at Leeuwpan in 1992 by Kumba Resources Limited (then Iscor) and the mining right was originally owned by Kumba Coal Proprietary limited. The mining right was ceded to Exxaro following the unbundling of Kumba Resources in 2006. The life of mine (LoM) for Leeuwpan has been extended to 2029 based on the expansion project, and the mining right expiry date is 2040. Leeuwpan supplies both the domestic and export market, with most coal leaving the mine via a rapid rail load out station (Exxaro corporate website).

The closure costing provision for Leeuwpan has previously been determined according to the Guideline Document for the Evaluation of the Quantum of Closure-Related Financial Provision Provided by a Mine, prepared by the Department of Minerals and Energy (now Department of Mineral Resources (DMR)) in 2005. The previous DMR-based cost review and update was conducted internally in 2018.

Golder Associates (Golder) was appointed to assist Exxaro to develop closure costing and closure planning documentation aligned with the requirements of the Financial Provisioning Regulations, 2015 (GN R. 1147 of 20 November 2015) (as amended) published under the National Environmental Management Act (Act 107 of 1998) (NEMA).

The contents of this document are closely aligned with the requirements of GN R. 1147, and although this piece of legislation is being further amended it is unlikely that the next amendment will require significant changes to the contents of the different report/plans. This closure-planning document will be updated to align with the revised regulations, once promulgated.

2.0 PROJECT APPROACH

The approach followed to update the preliminary mine closure plan for Leeuwpan is as follows:

- Conduct a dedicated site assessment at Leeuwpan, on 9 September 2018, to gain site context and confirm battery limits for closure;
- Undertake a screening-level Environmental Risk Assessment (ERA), including residual risks, for closure of Leeuwpan and develop closure measures to mitigate the risks identified;
- Reassess closure measures previously developed, and confirm closure measures to be implemented with Leeuwpan personnel;
- Update the recommended studies to improve/further inform the closure plan in future iterative updates of the plan, as informed by the ERA undertaken;
- Measure all areas of infrastructure based on survey information provided by the mine using AutoCAD and populating Golder's closure costing model (APPENDIX D);
- Measure and confirm the areas the mine plans to rehabilitated in their five-year plan based on survey and planning information provided;
- Calculate the closure liability for immediate and planned closure at Leeuwpan, by including the confirmed closure measures in Golder's costing model (including demolition of all infrastructure, discard dump rehabilitation, general surface rehabilitation, and post-closure monitoring and estimated discounted water treatment costs);

- Review the previously determined next land use, and confirm with the mine whether amendments are necessary;
- Develop preliminary site-specific site relinquishment criteria and an associated monitoring plan, to ensure the mine is able to prove that the implemented closure measures will adequately achieve Leeuwpan closure objectives and vision;
- Complete the residual risk assessment report, presented in Report B of this document, and develop mitigation measures to inform the residual closure costs; and
- Review Leeuwpan's 2019 rehabilitation planning, provided as a survey drawing (Figure 1) and compile an ARP substantially in compliance with the requirements of the NEMA Financial Provisioning Regulations. Report C of this document presents an overview of the mine's Annual Rehabilitation Plan, a summary of rehabilitation and monitoring completed (not necessarily signed-off), proposed operational management measures and proposed monitoring and relinquishment criteria. Further recommendations for improving future updates of the plan are also included. Golder did not provide independent assurance, although future updates provided in a report format with accompanying survey plans will be signed off internally and externally in Report C to ensure that mine-generated ARP's meet the requirements of GN R. 1147.

3.0 SUPPORTING INFORMATION

The information summarised in Table 1, was used to inform the current update of the closure plan.

Table 1: Key supporting information used to inform the closure plan update

Report Title	Author	Date
Invasive species monitoring, control and eradication plan	Exxaro	October, 2015
Consolidation and OI Expansion Project Environmental Impact Assessment (EIA)/Environmental Management Plan (EMP)	GCS	December, 2013
Biomonitoring and environmental toxicity programme (Wet season survey)	Clean Stream	June, 2018
Alien and invasive species/threatened or protected species compliance	EOH	October, 2015
Social Impact Assessment Report	GCS	October, 2013
Hydrological Investigation (Draft 3)	GCS	October, 2013
Soil, Land use and land capability report for soil, land use and land capability consolidation study for the Leeuwpan Mining Right area.	GCS	June, 2013
Environmental Impact assessment: Ground vibration and air dust study	GCS	July, 2012
Wetland Delineation and Assessment	Wetland Consulting Services (Pty) Ltd	October, 2012

Report Title	Author	Date
Environmental Management programme Performance Assessment Report	EOH	December, 2017
Safety, health and environmental legal compliance Assessment	Golder	September, 2016
SLP-LP-ENV.008 Ongoing and final rehabilitation	Exxaro	May, 2018
Rehabilitation strategy and implementation programme (RSIP)	Exxaro	June, 2017
Leeuwpan Social and Labour Plan March 2015 – March 2020	Exxaro	March 2015
Leeuwpan Coal Mine Quarterly Water Monitoring Report June 2018	Golder	June 2018
Leeuwpan Coal Mine Wetland Offset Strategy Update	Digby Wells	January 2019

The following data and electronic files and drawings were provided by the mine survey department (Table 2)

Table 2: Available information - drawings

Surveys and Drawings	Author	Date
Final landform design FLFD (Excel spreadsheet with XYZ coordinates)	Exxaro	Unknown
Aerial Image (individual ECW files)	Exxaro	June, 2017
North Pit Image	Exxaro	August, 2018
South Pit Image	Exxaro	August, 2018
North Pit (Digital terrain Model - DTM)	Exxaro	August, 2018
South Pit Image (DTM)	Exxaro	August, 2018
Life of Mine Plan (.DWG drawing file format)	Exxaro	Unknown
LPN CC Review Current Operations (Excel spreadsheet)	Exxaro	October 2018
5 (2019-2023) Year Rehabilitation Plan (.DWG drawing file format)	Exxaro	Unknown

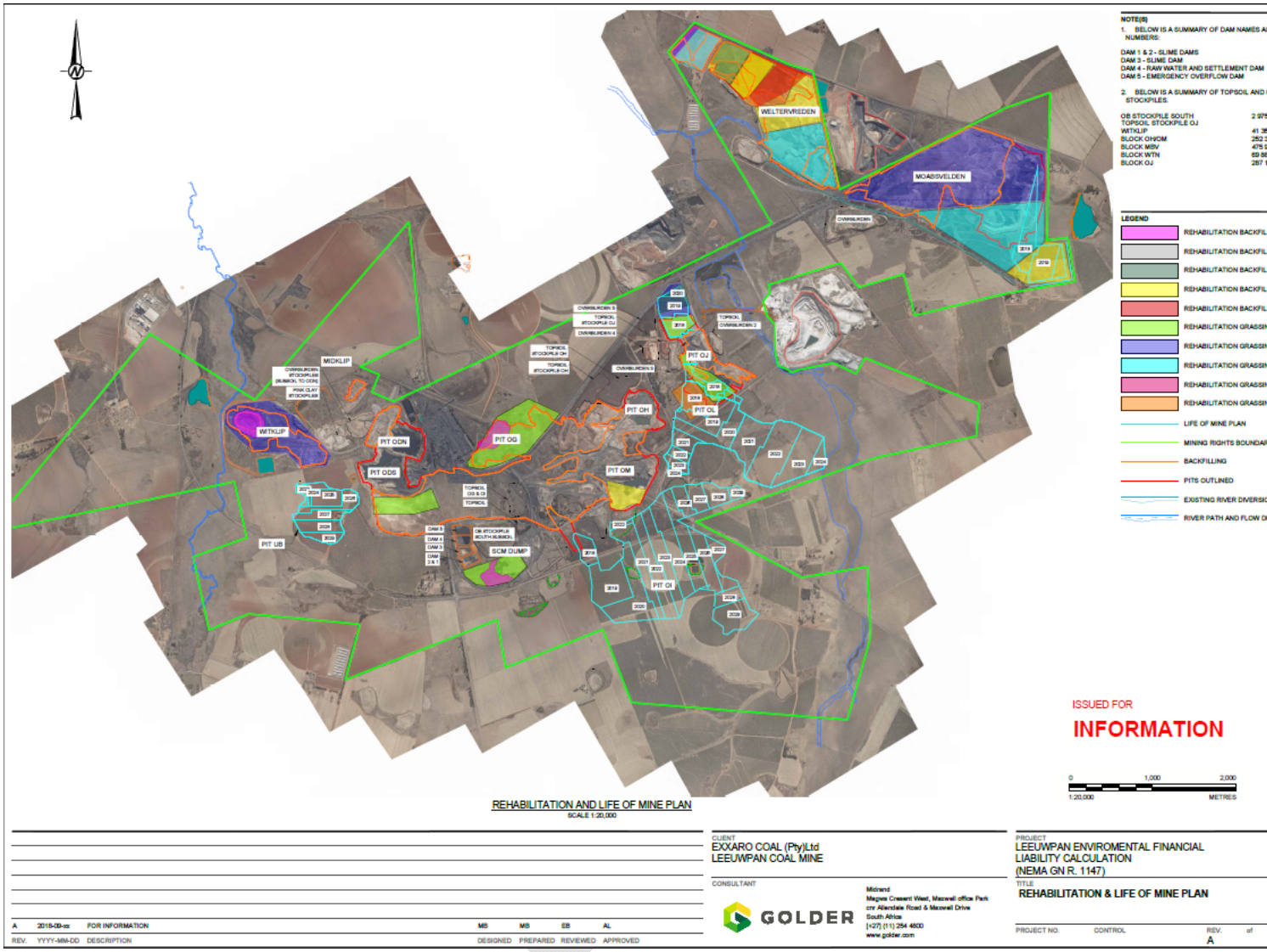


Figure 1: Leeuwpan layout plan: Mining right boundary, mining plan and 5-year rehabilitation plan

4.0 LEGISLATION AND STANDARDS

The NEMA financial provisioning regulations (GN R.1147, Regulations Pertaining to the Financial Provision for Prospecting, Exploration, Mining or Production Operations), promulgated on 20 November 2015, are planned to be repealed and superseded by revised regulations. The contents of this document are closely aligned with the requirements of GN R. 1147, and although this piece of legislation is being further amended it is unlikely that the next amendment will require significant changes to the contents of the different report/plans

Apart from the requirements of the GN R. 1147 regulations, which are summarised at the beginning of each Part of this document, mine closure planning is also required to be compliant with additional legislation, which is summarised in APPENDIX B.

5.0 MINE DESCRIPTION AND CONTEXT

Leeuwpan is owned and operated by Exxaro and is located 3 - 6 km southeast of Delmas in the Mpumalanga province, adjacent to Thaba Chueu Silica Mine and Stuart Coal. Leeuwpan falls within the Victor Khanye Local Municipality and the Nkangala District Municipality.

Opencast mining started at Leeuwpan in 1992 by Kumba Resources Limited (then Iscor) and the mining right were originally owned by Kumba Coal Proprietary limited. The mining right was ceded to Exxaro following the unbundling of Kumba Resources in 2006. The current mine became known as Exxaro Leeuwpan Coal Mine in 2007. Leeuwpan supplies both the domestic and export market, with most coal leaving the mine via a rapid rail load out station (Exxaro corporate website).

The following site related content is based on information received and discussions with mine personnel during the site visit (IWWMP, 2017; EMP 2013 and the Exxaro corporate website).

5.1 Legal status

Leeuwpan is an opencast coal mine operating legally under a mining right (refer to

Table 3 for farm names) and various EMPs authorised by the DMR in terms of the Mineral and Resources Development Act (Act No. 28 of 2002) (MPRDA). According to the Integrated Water and Waste Management Plan (GCS, 2017) the following authorisations are in place in terms of the National Water Act (Act No. 36 of 1998) (NWA):

- Integrated Water Use Licence (IWUL) issued to Leeuwpan (Licence No. 04/B21A/ABCGIJ/429) by the Department of Water and Sanitation (DWS) on the 25th March 2011;
- An amendment to the IWUL for Leeuwpan issued in terms of Section 50 and Section 158 of the NWA on the 18 December 2015 to amend / correct water uses licensed as part of the IWUL issued on the 25 March 2011;
- An IWUL was issued for various water uses proposed to be undertaken on site in terms of Section 21 of the NWA (Licence No. 04/B20A/CIJ/4032) for the proposed Block OI Expansion (applied for as a separate application); and
- Permits for the river diversions were obtained in accordance with article 20 of the Water Act, 1956, (Permit nr B 187\1\220\6) to construct a river diversion for the purpose of preventing water flowing from the Bronkhorstspruit into the open pit on farm Kenbar 257 IR. Another river diversion was constructed to divert the tributary of the Bronkhorstspruit from flowing into the Block OWM Pit. A Water Use License in terms of Chapter 4 of the NWA was obtained in April 2011 (Ref: 16/2/7/B100/C27).

Applications for proposed expansions to the Leeuwpan operations have been issued to the following authorities:

- Mpumalanga Department of Agriculture, Rural Development, Land & Environmental Affairs (MDARDLEA) (reference number: 17/2/3N-180); and
- The DMR [reference number: MP 30/5/1/2/3/2/1 (171) EM].

Approval for the EMP from the DMR was granted on the 25th of April 2017 (including OL and OI). An updated IWWMP has been compiled as per the IWUL conditions of Licence No. 04/B21A/ABCGIJ/429 and its associated amendment, in terms of condition 11.2 of Appendix IV of the IWUL issued for the existing operations at Leeuwpan (does not include the proposed OI expansion). A Rehabilitation Strategy Implementation Plan (RSIP) included in the IWWMP (Appendix B) was compiled by Leeuwpan.

Table 3: Farm names related to the Leeuwpan Mining Right

SG Number	Farm	Portion	Owner detail
T0IR00000000025700000	KENBAR 257	Portion 0	Exxaro Coal Pty Ltd
T0IR00000000024600003	LEEUWPAN 246	Portion 3	Exxaro Coal Pty Ltd
T0IR00000000024800001	MOABSVELDEN 248	Portion 01	Gouws Louis
T0IR00000000024800002	MOABSVELDEN 248	Portion 02	Exxaro Coal Pty Ltd
T0IR00000000024800003	MOABSVELDEN 248	Portion 03	Exxaro Coal Pty Ltd
T0IR00000000024800004	MOABSVELDEN 248	Portion 04	Phillem Beleggings Pty Ltd
T0IR00000000024800005	MOABSVELDEN 248	Portion 05	Exxaro Coal Pty Ltd
T0IR00000000024800006	MOABSVELDEN 248	Portion 06	Exxaro Coal Pty Ltd
T0IR00000000024800010	MOABSVELDEN 248	Portion 10	Exxaro Coal Pty Ltd
T0IR00000000024800012	MOABSVELDEN 248	Portion 12	Exxaro Coal Pty Ltd
T0IR00000000024800013	MOABSVELDEN 248	Portion 13	Exxaro Coal Pty Ltd
T0IR00000000024800016	MOABSVELDEN 248	Portion 16	Exxaro Coal Pty Ltd
T0IR00000000024800027	MOABSVELDEN 248	Portion 27	Transnet Ltd
T0IR00000000024800030	MOABSVELDEN 248	Portion 30	Transnet Ltd
T0IR00000000024800032	MOABSVELDEN 248	Portion 32	Transnet Ltd
T0IR00000000022700007	WELTEVREDEN 227	Portion 07	Exxaro Coal Pty Ltd
T0IR00000000022700037	WELTEVREDEN 227	Portion 37	Transnet Ltd
T0IR00000000022900004	WITKLIP 229	Portion 04	Exxaro Coal Pty Ltd
T0IR00000000022900006	WITKLIP 229	Portion 06	Hendrik Schoeman & Seuns Pty Ltd
T0IR00000000023200113	WITKLIP 232	Portion 113	Eskom Holdings Ltd
T0IR00000000023200016	WITKLIP 232	Portion 16	Hendrik Schoeman & Seuns Pty Ltd
T0IR00000000024400003	WOLVENFONTEIN 244	Portion 03	Endorsement: Exxaro Coal Pty Ltd

5.2 Life of mine

The life of mine for Leeuwpan has been extended to 2029 based on the expansion project, and the mining right expiry date is 2040. Pit OI is currently being initiated and will be the last pit to be mined out. Leeuwpan produced 3.36 million tons of coal in 2017, produced about 4.1 million tons in 2018 and the planned production for 2019 is about 5.3 million tons.

5.3 Mining reserves

The coal reserves exploited by Leeuwpan form part of the Witbank Coalfield, occurring within the Vryheid Formation of the Ecca Group (Karoo Supergroup) (GCS, 2017), Coal has been mined by Exxaro at Leeuwpan since 2007.

An EMP was granted for opencast mining for reserve block OI/OL/UB (originally submitted for underground mining, but resubmitted). The UB reserve represents 3,25 Mt of Leeuwpan's reserves, and the UB reserve will remain in the probable category (although not included in this assessment). To access the OI reserve block the R50 road will have to be rerouted as it overlies the planned mining area (Exxaro corporate website). The planning for this is included in the Leeuwpan life-extension project (LPN LIFEX).

5.4 Battery limits

The mining right area of Leeuwpan is situated adjacent to SamQuarz Mine and Stuart Coal Mine (Figure 1). The mining right area comprises eight Farms, namely Kenbar 257 IR, Leeuwpan 246 IR, Moabsvelden 248 IR, Weltervreden 227 IR, Witklip 232 IR, Wolvenfontein 244 IR and Rietkuil 249 IR. Battery limits for the closure planning of Leeuwpan Coal Mine are shown in Table 4.

Refer to Figure 2 for plant and related infrastructure, Figure 3 for the main office infrastructure, Figure 4 for portions of the mine engineering and workshop infrastructure and Figure 1 for the open pits and water impoundments.

Table 4: Battery limits for closure planning of Leeuwpan Coal Mine

Costing ref	Closure component
1.2	**Plant and related infrastructure**
1.2.1	**Control Room Offices**
1.2.2	**Plant maintenance and planning offices**
1.2.3	**Fraser Alexandra Plant**
1.2.4	**JIG Plant Area**
1.2.5	**DMS Plant**
1.2.6	**Load out station**
1.2.7	**Filter press area**
1.2.8	**Leeuwpan Lab**
1.2.9	**Weigh bridge**
1.2	**Other buildings and support infrastructure**
1.2.10	**Main offices**
1.2.11	**Leeuwkuil**
1.2.12	**Training Centre**
1.2.13	**Lydia's House**
1.2.14	**P&O Building**
1.2.15	**She centre, Project office. Etc.**
1.2	**Mining Engineering Workshops and main entrance**
1.2.16	**Supply Chain area**

Costing ref	Closure component
1.2.17	Gas Cylinder stores
1.2.18	Stores
1.2.19	Parking
1.2.20	Truck tyre bay
1.2.21	Hazardous waste disposal area
1.2.22	Total Diesel Tanks
1.2.23	Servicing Workshop
1.2.24	Mining Workshops
1.2.25	Purification plant (Sewage treatment facility)
1.2.26	Mining green area
1.2.27	Blasting offices
1.2.28	Wash bay
1.2.29	Diesel storage drum area
1.2.30	Main Entrance
1.2.31	Witklip Substation
1.2.32	Witklip Dam
1.2.33	Liviero Yard
1.2.34	Explosive magazine
1.2.35	Emergency overflow dam
1.3	Conveyors
1.4 - 1.5	Demolish roads, pipelines, powerlines and railways
1.4.1	Rehabilitation of roads and paved surfaces
1.4.2	Rehabilitation of powerlines and pipelines
1.5	Demolition and rehabilitation of railway lines
2.1	Open pits including final voids and ramps
2.1.1	Witklip and Midklip
2.1.4	Block OG
2.1.5	Block OH/OM
2.1.2	Block ODN
2.1.3	Block ODS
2.1.6	Block OJ
2.1.7	Block OL
2.1.8	Weltervreden
2.1.9	Moabsvelden
2.1.10	Block OI

Costing ref	Closure component
2.3	Overburden and topsoil stockpiles
2.3.1	Witklip Topsoil and Overburden stockpile
2.3.2	Block OG stockpile
2.3.3	Block OH/OM Topsoil stockpile
2.3.4	Block ODN Overburden stockpile
2.3.4	Block ODS Topsoil stockpile
2.3.5	Block MBV Topsoil and Overburden stockpile
2.3.6	Block WTN Topsoil and Overburden stockpile
2.3.7	Block OJ Topsoil and Overburden stockpile
2.3.7	Block OI Topsoil and Overburden stockpile
2.3.8	Dispatch Topsoil stockpile
2.3.9	Watertank Overburden stockpile
2.5	Water impoundments
2.5.1	Slurry dams 1,2 and 3
2.5.2	Emergency overflow dam
2.5.3	Settling dam
2.5.4	Witklip pollution control dam
2.5.5	Drying Pan (Leeuwpan lab)
2.5.6	Evaporation Dam (PCD)

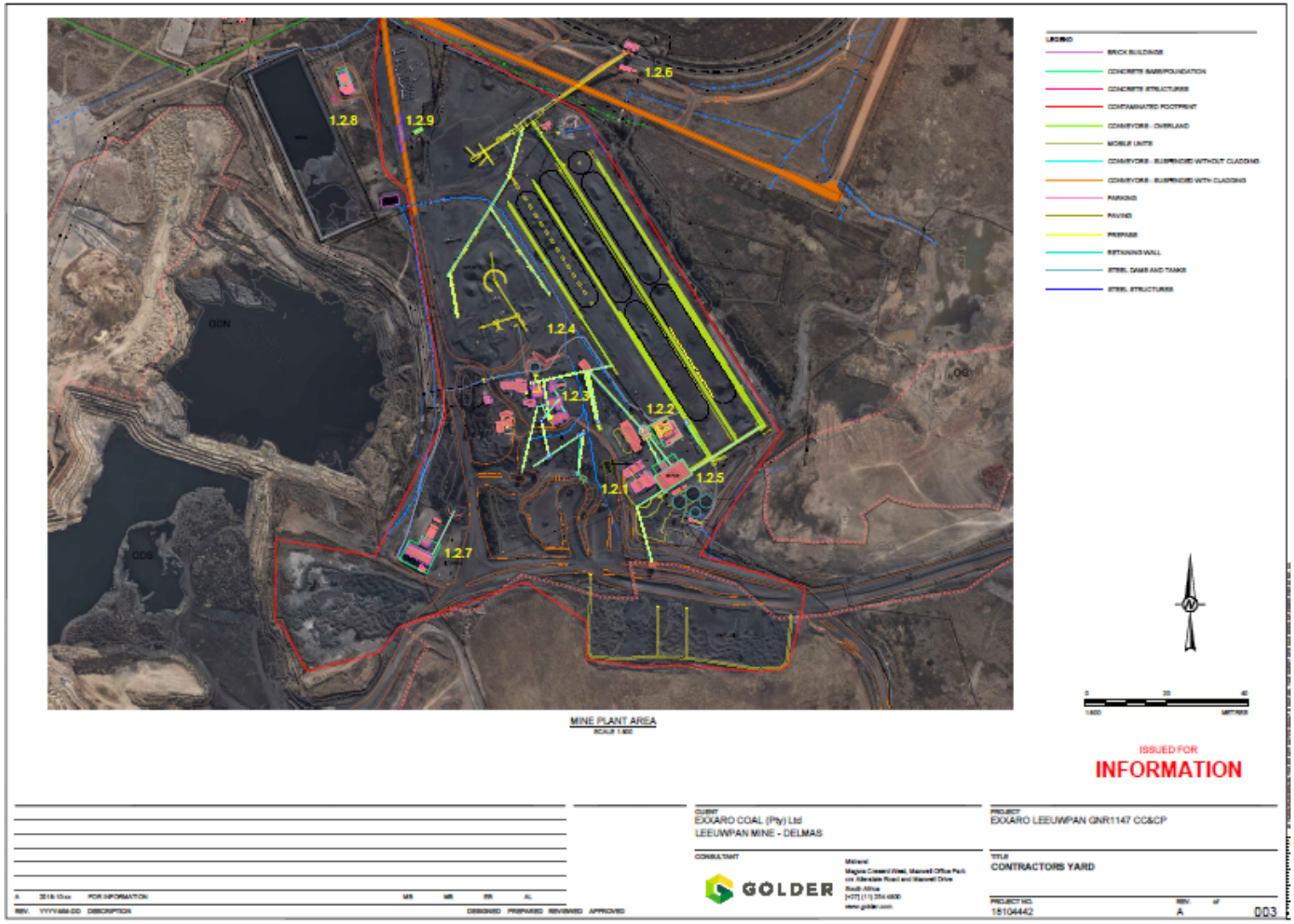


Figure 2: Battery limits: Plant infrastructure and footprint

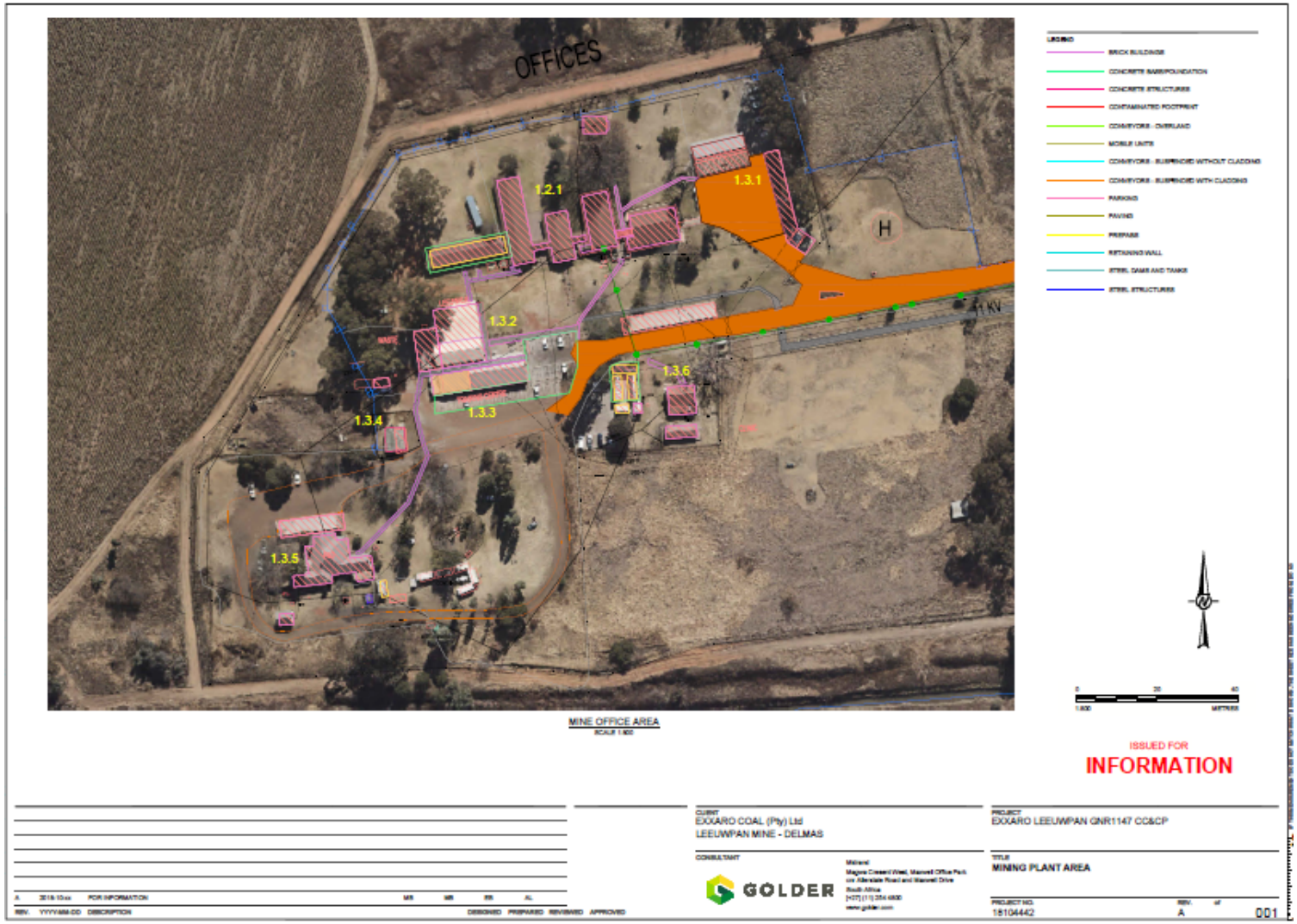


Figure 3: Battery limits: main offices

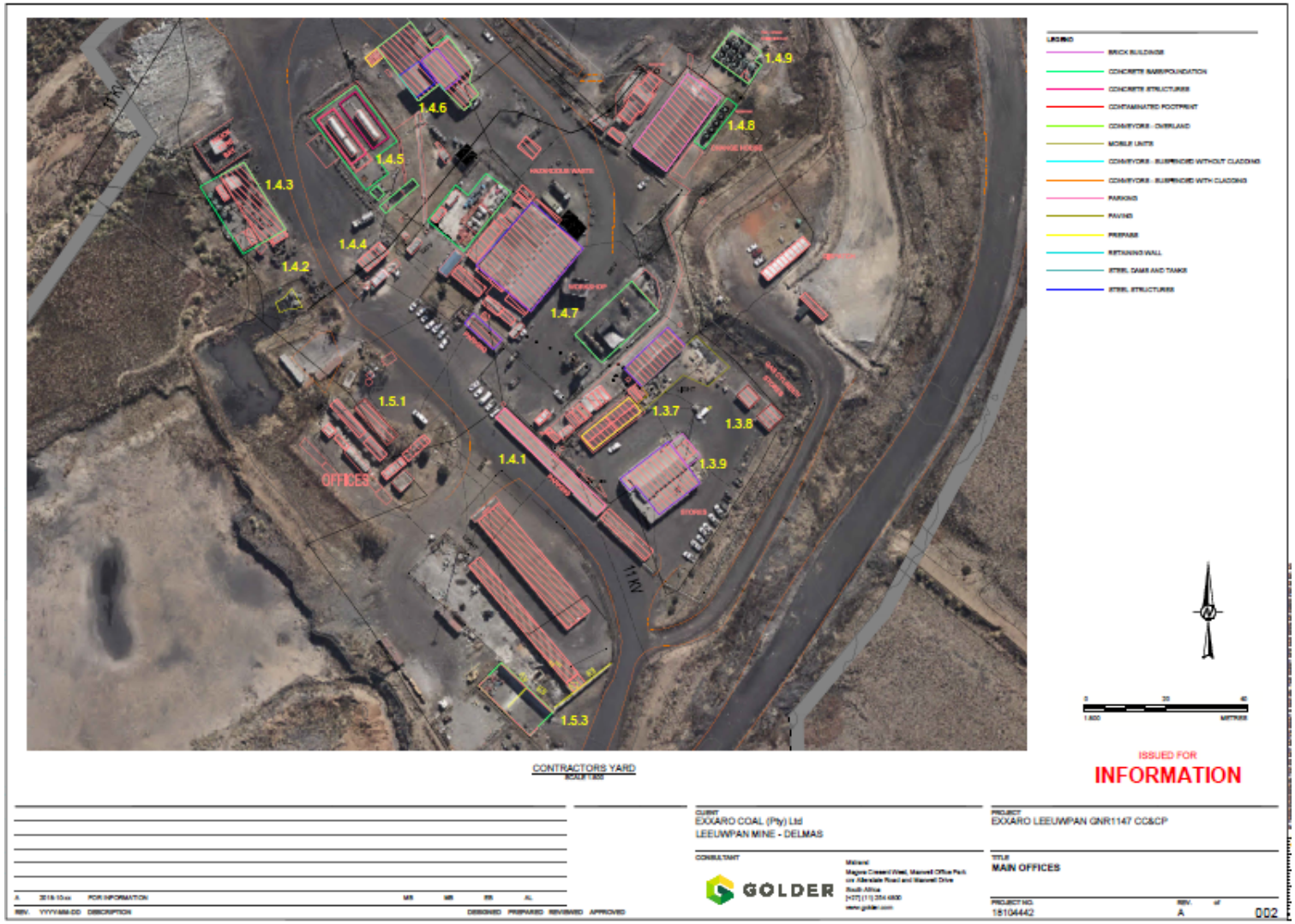


Figure 4: Battery limits: portions of the mine engineering and workshops

REPORT A: FINAL REHABILITATION, DECOMMISSIONING AND MINE CLOSURE PLAN

6.0 NEMA GN R. 1147 (AS AMENDED) CHECKLIST

The required content of the final rehabilitation, decommissioning and mine closure plan is detailed in Table 5, which also provides cross references to the relevant sections of the report where these requirements are addressed.

Table 5: Content of final rehabilitation, decommissioning and mine closure plan (GN R. 1147, Appendix 4)

Content of rehabilitation, decommissioning and mine closure plan	Reference to section
The final rehabilitation, decommissioning and mine closure plan must be measurable and auditable and must include-	
a) Details of- (i) The person or persons who prepared the plan (i) The professional registrations and experience of the preparers	Included in Project information Section in the beginning of this document (Page 1)
b) The context of the project, including- (i) Material information and issues that have guided the development of the plan	The information used to compile this closure plan is included in Section 3.0 (Report A)
(ii) An overview of- (aa) The environmental context, including but not limited to air quality, quantity and quality of surface and groundwater, land, soils and biodiversity (bb) The social context that may influence closure activities and post-mining land use or be influenced by closure activities and post-mining land use	Refer to Section 7.0 (Report A) for environmental context and social context
(iii) Stakeholder issues and comments that have informed the plan	Stakeholder engagement was not undertaken as part of this closure plan. The issues register from the EMPr process is included in Section 7.10.3
(iv) The mine plan and schedule for the full approved operations, must include- (aa) Appropriate description of the mine plan (bb) Drawings and figures to indicate how the mine develops; (cc) What areas are disturbed (dd) How infrastructure and structures (including ponds, residue stockpiles etc.) develops during operations	Refer to Section 5.0 (beginning section of the report)
c) Findings of an environmental risk assessment leading to the most appropriate closure strategy, including-	Refer to Section 9.0 (Report A) for the environmental risk assessment

Content of rehabilitation, decommissioning and mine closure plan	Reference to section
(i) A description of the risk assessment methodology, including risk identification and quantification, to be undertaken for all areas of infrastructure or activity or aspects for which a holder of a right or permit has a responsibility to mitigate an impact or risk at closure (ii) An identification of indicators that are most sensitive to potential risks and the monitoring of such risks with a view to informing rehabilitation and remediation activities (iii) An identification of conceptual closure strategies to avoid, manage and mitigate the impacts and risks (iv) A reassessment of the risks to determine whether, after the implementation of the closure strategy, the residual risk has been avoided and / or how it has resulted in avoidance, rehabilitation and management of impacts and whether this is acceptable to the mining operation and stakeholders (v) An explanation of changes to the risk assessment results, as applicable in annual updates to the plan	
d) Design principles, including- (i) The legal and governance framework and interpretation of these requirements for the closure design principles	Refer to Section 4.0 (beginning section of report) for legal and framework guiding compilation of this closure plan
(ii) Closure vision, objectives and targets, which objectives and targets must reflect the local environmental and socio-economic context and reflect regulatory and corporate requirements and stakeholder expectations	Refer to Section 11.0 (Report A) for the closure vision, targets and objectives
(iii) A description and evaluation of alternative closure and post closure options where these exist that are practicable within the socio-economic and environmental opportunities and constraints in which the operation is located	Alternative closure and post closure options are included in Section 18.0 (Report A)
(iv) A motivation for the preferred closure action within the context of the risks and impacts that are being mitigated	Refer to Section 17.0 (Report A) for the preferred closure option
(v) A definition and motivation of the closure and post closure period, taking cognisance of the probable need to implement post closure monitoring and maintenance for a period sufficient to demonstrate that relinquishment criteria have been achieved	Refer to Section 21.0 (Report A) for the description of the closure and post closure period. Refer to Section 20.2 (Report A) for monitoring requirements
(vi) Details associated with any on-going research on closure options	Refer to Section 19.0 (Report A) for ongoing research to inform closure options

Content of rehabilitation, decommissioning and mine closure plan	Reference to section
(vii) A detailed description of the assumptions made to develop closure actions in the absence of detailed knowledge on site conditions, potential impacts, material availability, stakeholder requirements and other factors for which information is lacking	A description of the assumptions made to develop the closure plan is included in Section 10.0 (Report A)
e) A planned final post-mining land use which is appropriate, feasible and possible of implementation, including- (i) Descriptions of appropriate and feasible final post-mining land use for the overall project and per infrastructure or activity and a description of the methodology used to identify final post-mining land use, including the requirements of the operations stakeholders (ii) A map of the planned final post-mining land use	Refer to Section 13.1 for the next land use options
f) Closure actions, including- (i) The development and documenting of a description of specific technical solutions related to infrastructure and facilities for the preferred closure option or options, which must include all areas, infrastructure, activities and aspects both within the mine lease area and off of the mine lease area associated with mining for which the mine has the responsibility to implement closure actions	Refer to Section 16.0 for the closure actions to be implemented at closure
(ii) The development and maintenance of a list and assessment of threats and opportunities and any uncertainties associated with the preferred closure option, which list will be used to identify and define any additional work that is needed to reduce the level of uncertainty	Refer to Section 17.0 for the initial opportunity and threat identification
g) A schedule of actions for final rehabilitation, decommissioning and closure which will ensure avoidance, rehabilitation, management of impacts including pumping and treatment of extraneous water- (i) Linked to the mine works programme, if green fields, or to the current mine plan, if brownfields (ii) Including assumptions and schedule drivers (iii) Including a spatial map or schedule, showing planned spatial progression throughout operations	Refer to Section 21.0 (Report A) for the closure schedule of actions providing a schedule for decommissioning, rehabilitation and closure as well as the post closure period
h) An indication of the organisational capacity that will be put in place to implement the plan, including- (i) Organisational structure as it pertains to the plan; (ii) Responsibilities (iii) Training and capacity building that may be required to build closure competence	Refer to Section 22.0 (Report A) the organisational capacity and structure
i) An indication of gaps in the plan, including an auditable action plan and schedule to address the gaps	Refer to Section 19.0 (Report A) for identified knowledge gaps

Content of rehabilitation, decommissioning and mine closure plan	Reference to section
j) Relinquishment criteria for each activity or infrastructure in relation to environmental aspects with auditable indicators	Refer to Section 20.2 for relinquishment criteria
k) Closure cost estimation procedure, which ensures that identified rehabilitation, decommissioning, closure and post-closure costs, whether on-going or once-off, are realistically estimated and incorporated into the estimate, on condition that- (i) Cost estimates for operations, or components of operations that are more than 30 years from closure will be prepared as conceptual estimates with an accuracy of ± 50 per cent. Cost estimates will have an accuracy of ± 70 per cent for operations, or components of operations, 30 or less years (but more than ten years) from closure and ± 80 per cent for operations, or components of operations ten or less years (but more than five years) from closure. Operations with 5 or less years will have an accuracy of ± 90 per cent. Motivation must be provided to indicate the accuracy in the reported number and as accuracy improves, what actions resulted in an improvement in accuracy (ii) The closure costs estimation must include— (aa) An explanation of the closure cost methodology (bb) Auditable calculations of costs per activity or infrastructure (cc) Cost assumptions (iii) The closure costs must be updated annually during the operation's life to reflect known developments, including changes from the annual review of the closure strategy assumptions and inputs, scope changes, the effect of a further year's inflation, new regulatory requirements and any other material developments	Refer to Section 24.0 (Report A) for the closure cost and methodology undertaken to determine the closure costs
l) Monitoring, auditing and reporting requirements which relate to the risk assessment, legal requirements and knowledge gaps as a minimum and must include- (i) A schedule outlining internal, external and legislated audits of the plan for the year, including- (aa) The person responsible for undertaking the audit(s) (bb) The planned date of audit and frequency of audit (cc) An explanation of the approach that will be taken to address and close out audit results and schedule (ii) schedule of reporting requirements providing an outline of internal and external reporting, including disclosure of updates of the plan to stakeholders	Refer to Section 0 (Report A) for the internal and external auditing of this closure plan
(iii) A monitoring plan which outlines- (aa) Parameters to be monitored, frequency of monitoring and period of monitoring (bb) An explanation of the approach that will be taken to analyse monitoring results and how these results will be used to inform adaptive or corrective management and/or risk reduction activities	Refer to Section 20.1 for the monitoring plan to be implemented

Content of rehabilitation, decommissioning and mine closure plan	Reference to section
m) Motivations for any amendments made to the final rehabilitation, decommissioning and mine closure plan, given the monitoring results in the previous auditing period and the identification of gaps as per 2(i)	Refer to Section 25.0 (Report A) for any amendments made to this plan

PART A1: REHABILITATION AND CLOSURE RELATED KNOWLEDGE BASE

7.0 ENVIRONMENTAL KNOWLEDGE BASE

The following information is consolidated from the following source documents: *Invasive species monitoring, control and eradication plan (Exxaro, October 2015); Consolidation and OI Expansion Project Environmental Impact Assessment (EIA)/Environmental Management Plan (EMP) (GCS, December 2013); Hydrological Investigation (Draft 3) (GCS, October 2013); SLP-LP-ENV.008 Ongoing and final rehabilitation (Exxaro, May 2018); Rehabilitation strategy and implementation programme (RSIP) (Exxaro, June 2017); Leeuwpan Social and Labour Plan March 2015 – March 2020 (Exxaro, March 2015); Leeuwpan Coal Mine Quarterly Water Monitoring Report June 2018 (Golder, June 2018) and Leeuwpan Coal Mine Wetland Offset Strategy Update (Digby Wells, January 2019).*

7.1 Climate, rainfall and evaporation

The climate at Leeuwpan is typical for the Mpumalanga Highveld region, with a wet summer and dry winter season, with rainfall mainly occurring in the form of thunderstorms. In summer, the average temperatures range between 13°C and 24°C while in winter the average temperatures range between 1°C and 16°C. The Mean Annual Precipitation (MAP) for the area is 668 mm. The mean annual evaporation is 1 677 mm, with higher rates of evaporation in the summer than in the winter. Winds are light except for short periods during thunderstorms. Very occasionally tornados do occur and can cause tremendous damage in populates areas.

Implications for closure:

- The hot wet summers offer a good growing season for rehabilitated areas, coupled with good soil management practices, quality and depth, effective rehabilitation could be promoted;
- Comparatively high evaporation rates may hamper rehabilitation efforts; and
- Extreme climatic events (e.g. intense rainfall, droughts) could severely increase the risk of erosion and affect long term landform viability.

7.2 Topography

The study area is located in the Olifants Water Management Area 4 and quaternary catchment area B20A. The Bronkhorstspruit flows through the area in the eastern, central and western sections of the mining area, with drainage occurring locally towards the river, and on a larger scale in a general northerly direction. The area can be described as plains with moderate relief, within a larger context of moderately undulating plains and pans. More than 80% of the area has slopes of less than 5%. A number of natural pans and tributaries of the river exist on the site. Additionally, artificial features are also included on the site, such as small pans, farm dams, old void areas, pollution control dams, water in open cast pits and river diversion channels.

Implications for closure:

- No material will remain in the stockpiles post closure, all overburden will be returned to the pit in construction of the post mining landform;
- No surface mine waste facilities are planned for Leeuwpan with the discard returned to the opencast pits prior to backfilling; and
- Due to expected bulking of overburden and the discard volume stream, it is expected that the post mining landform will generally align with the surrounding topography. Localised deficits will result in two remaining final voids shaped as a pan-like structure.

7.3 Geology

Leeuwpan is underlain by the Vryheid Formation of the Ecca Group which forms part of the Karoo supergroup. In the Leeuwpan area, the coal measures overly tillite of the Dwyka Group, of which the latter forms the lower-most stratigraphic unit of the Karoo Supergroup. Chert and dolomite of the Malmani Subgroup of the Transvaal Supergroup underlie the tillite. The coal measures in the mining area are abnormally thick due to the paleo-karst landscape that was present during peat formation. The Karoo Supergroup is also intruded by dolerite dykes and sills, and has a highly weathered top portion, which extends into the coal seam.

Within the site, there is significant variation in seam thickness due to an undulating tillite floor. The overburden thickness varies from 35 m to 90 m, with coal measures of up to 16 m thick, divided into a bottom coal seam (±5 m thick) and a top coal zone (±5 m thick). The bottom coal seam is correlated with Number 2 Seam of the Witbank Coalfield. The top coal zone is correlated with the Number 4 Lower Seam, Number 4 Upper Seam and Number 5 Seam of the Witbank Coalfield. These seams are separated by a sandstone layer (Exxaro, 2014).

The bottom seam has an average thickness of 8 m, of which the lowest 2 m consists mainly of vitriol-rich lustrous coal. The division between the lower and middle seam is mostly shale. In the central part of the Witklip Section, a trough-like structure (graben) is evident, which reaches a maximum thickness of 18 m. The base of the coal is very uneven, possibly as a result of sinkholes in the dolomite, before and after coal deposition. At the Witklip Section of the Leeuwpan Coal, the capping is 10 m thick on average and consists mostly of clay (Exxaro, 2014). The upper seam is 5 m thick on average and consists mostly of dull and lustrous coal with alternative bands of shale.

7.3.1 Current groundwater context

The coal seams, which are situated at a depth between 20 and 40 m between layers of hard rock sedimentary units, are associated with higher hydraulic conductivities. A dolerite sill or dyke is known to sub-outcrop immediately to the south of the mining area. These types of intrusions can serve as both aquifers and aquicludes. Thick unbroken dykes will inhibit the flow of water, while the baked and cracked contact zones can be highly conductive. These structures thus tend to dominate the flow of groundwater.

According to GCS (2014), groundwater occurs in three aquifer systems at Leeuwpan that are reported to be interconnected by faults and fractures:

- A shallow weathered zone (5-12 metre below ground level (mbgl)), locally perched and low yielding (0,01- 0.14 l/s) aquifer;

- A deeper aquifer associated with fractures in Karoo rocks and associated intrusive rocks as well as fractured contact zones. This aquifer is reported to be approximately 40 m thick, has variable yields (0.1-5.0 l/s) and water quality, and is classified as a minor aquifer; and
- A fractured and karst aquifer hosted in the Transvaal dolomites, which is a major aquifer in the area with high yields (>5 l/s) and good quality water. This aquifer is abstracted mainly for large scale irrigation in the area.

Groundwater sampling locations are sampled on a quarterly basis and are situated both on the mine as well as boreholes in surrounding farms. 18 borehole water samples were collected as part of the June 2018 Quarterly Monitoring Report.

The groundwater classifies mainly as either Calcium/Magnesium Bicarbonate water (dominant signature defined for water chemistry from 8 boreholes), which indicates that it is not affected by mining activities; or calcium/magnesium chloride water typical of ground water affected by mining activities (2 boreholes), calcium/magnesium sulphate water, also indicative of ground water affected by mining activities (6 boreholes). The plant/stockpile 1 borehole (KENMB3-D) had a sodium chloride signature, which is typical of saline water.

Shallow groundwater flow generally followed topography, from the central watershed toward the two main watercourses, modified by low water levels in the area around the main pits and abstraction in the area for irrigation purposes (Figure 5).

Groundwater uses other than Leeuwpan have been identified to include the following:

- Domestic use;
- Surrounding mines in the area;
- Livestock watering;
- Garden;
- Maize milling; and
- Crop irrigation.

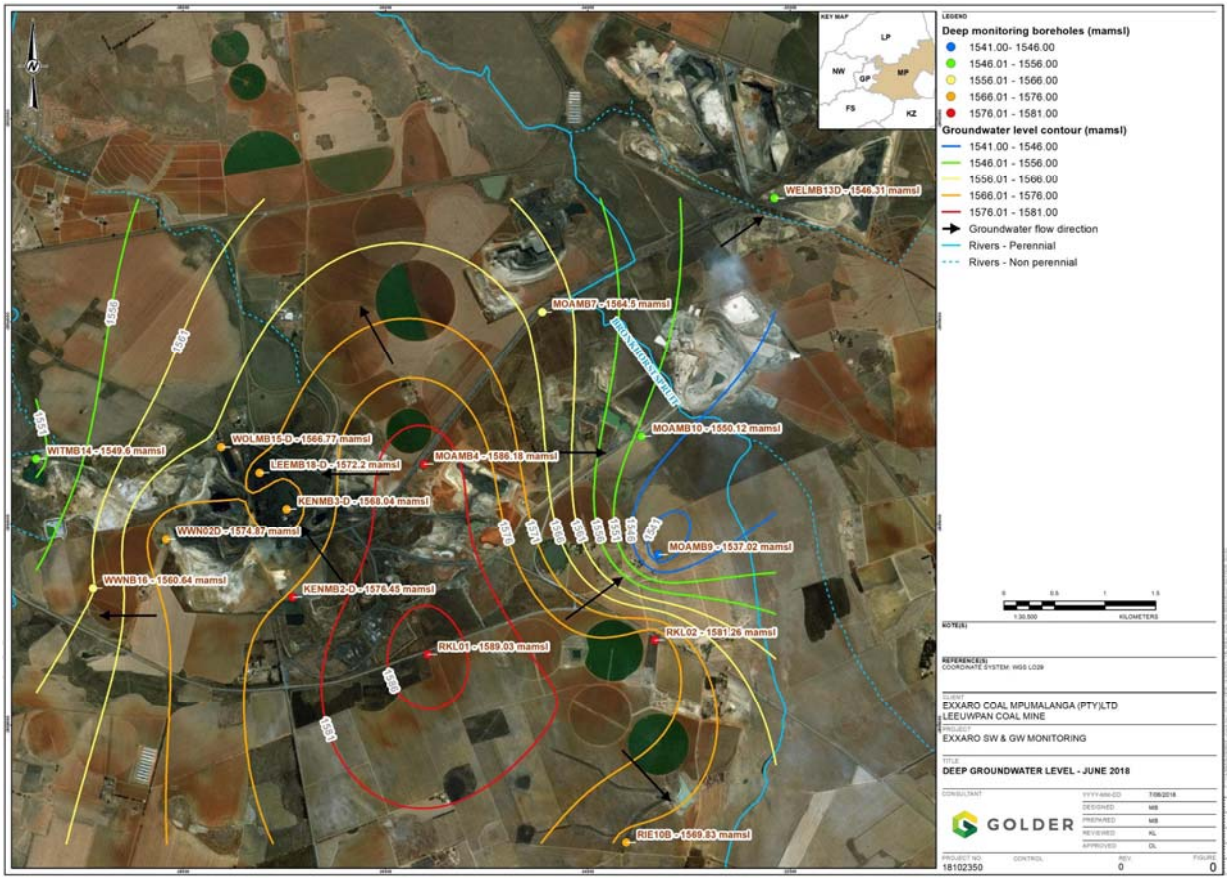


Figure 5: Ground water level and flow direction based on June 2018 sampling data for Leeuwpan

7.3.2 Acid mine drainage potential

A geochemical assessment has been conducted on the mine by GCS in 2014. The following was found:

- Kaolinite is the dominant mineral in the shale (88.71wt%) and discard (69.31wt%) and as a major mineral in the sandstone;
- Quartz is the dominant mineral in the sandstone and a minor mineral in the shale and discard;
- Microcline (K-feldspar) is a minor mineral in the sandstone in the sandstone and discard;
- Plagioclase and muscovite are minor minerals in the sandstone; and
- Calcite, gypsum and pyrite were detected but were only found to be present in trace amounts.

Acid Base Accounting (ABA) and Net Acid Generation (NAG) tests were done on the samples. It was found that the coal and discard have a much higher acidification potential than neutralisation potential, indicating that they have a very high potential to generate long-term acidic drainage. The sandstone and soft overburden have a low %S and low AP with no neutralization potential. These samples have no potential for acid mine generation but also no significant potential to neutralise acidity.

No surface discard facilities are planned for Leeuwpan, the discard waste stream is returned to the pit as part of the mining operations.

Implications for closure:

- Indications are that the in-pit water quality could deteriorate due to AMD. A geochemical model regularly updated and calibrated with sampling data is required to understand the long-term ground water impacts associated with the backfilled opencast pits. Active mitigation measures will be required to protect the surrounding ground water and surface water resources post closure;
- The water qualities of the deeper aquifer have not been affected and does not seem to be linked to the shallower aquifer.
- The additional backfill volume provided by the discard will help offset the thick coal seam removal in attaining a free-draining post mining landform. Specific measures to ensure flooding of this material and reduced oxygen ingress have been devised by the mine and will require accurate implementation.

7.4 Soils and land types

According to the EMPr, the Agricultural Research Council identified three land types across the mining right area. The land types are indicated in Table 6 and Figure 6.

Table 6: Land types determine by the Agricultural research Council prior to mining (EMPr, 2015)

Land Type	Area	geology	Broad soil description	Topography
Land Type Ba2	145 ha	Underlain by shale and sandstone of the Ecca Group, Karoo Sequence as well dolerite, granite and gneiss.	Combination of deep Huttons soil forms (between 900 mm and 1 200 mm) and deep (800 – 1 000 mm) yellow-brown apedal soils of the Glencoe and Avalon forms. Kroonstad, Wasbank and Westleigh forms also occur in this land type but in much smaller areas. The topography is flat to slightly undulating and slopes can range between 0% and 6%.	Flat to slightly undulating and slopes can range between 0% and 6%.
Land Type Bb3	2 542 ha	Combination of shale, sandstone, clay, conglomerate, limestone and marl of the Ecca Group; shale and tillite of the Dwyka Formation, Karoo Sequence; dolerite; occasional Ventersdorp lava, Witwatersrand quartzite and slate; dolomite	Mixture of deep to medium deep sandy clay-loam soil of the Avalon, Glencoe, Wasbank and Westleigh forms. A smaller group of more strongly structured clay-loam soils of the Swartland, Rensburg and Arcadia forms are also found in this land type.	
Land Type Ea15	830 ha	alluvium, dolerite, sandstone and shale of the Ecca Group, Karoo Sequence.	medium to strongly structured soils with vertic (Arcadia and Rensburg forms) or melanic A-horizons (Bonheim, Inhoek and	This land type occurs on flat to slightly undulating plains (slope range

Land Type	Area	geology	Broad soil description	Topography
			Willowbrook forms). These soil forms have clay-loam texture with clay content ranging between 25% and 70%.	between 0% and 1%)

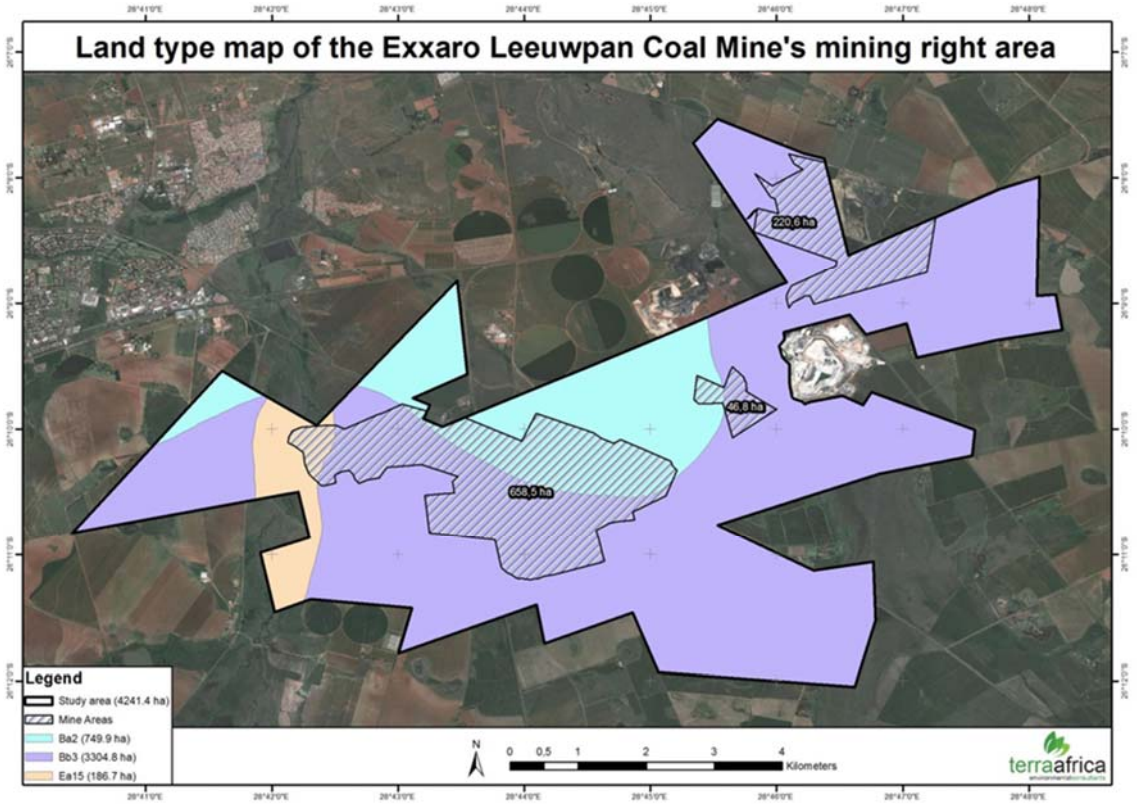


Figure 6: Pre-mining land type map of the Leeuwpan Mining Right area compiled by the Agricultural Research Council (EMPr, 2015)

The summary of the detailed Soil and Land Use Assessment conducted (TerraAfrica 2013) included in the EMPr (2015) provides the following details relating to the soils within the Leeuwpan Mining Right. The current soil forms as well as disturbed profiles were classified into sixteen mapping units. Areas currently being actively mined, or not rehabilitated successfully yet, has been classified as mine areas while a small section where stripping and stockpiling activities have resulted in red soil overlying a vertic A-horizon has been classified as the Witbank form, interestingly (refer to Table 7 and Figure 7):

- Mine areas form the largest portion of the entire Leeuwpan Mining Right area (925.9 ha or 21.8%);
- While productive soil profiles not disturbed by mining activities are dominated by soil forms with either a yellow-brown or red apedal horizon; and
- Approximately 873 ha or 20.6% of land consist of hydromorphic soil forms with wetland land capability.

Table 7: Summary of soil forms and land capabilities as determined by TerraAfrica (EMPr, 2015)

SUMMARY OF SOIL FORMS AND ASSOCIATED LAND CAPABILES IDENTIFIED FOR THE LEEUWIPAN STUDY AREA					
Soils	**Map Code**	**Area (ha)**	**% of study area (%)**	**Average soil depth (cm)**	**Land capability class**
Yellow-brown apedal	AY1	822.9	19.4	100 - 150 cm	Arable
	AY2	46.8	1.1	40 – 70 cm	Arable
	AY3	13.9	0.3	20 – 40 cm	Arable
Red apedal	AR1	549.6	13.0	100 - 150 cm	Arable
	AR2	95.1	2.2	70 - 100 cm	Arable
	AR3	10.4	0.2	40 – 70 cm	Arable
	AR4	5.7	0.1	20 – 40 cm	Arable
	SY	64.9	1.5	70 - 100 cm	Arable
Longlands, Dresden and Wasbank	E1	506.6	11.9	70 - 100 cm	Grazing
	E2	119.9	2.8	20 – 40	Grazing
Lithic	R1	158.3	3.7	20 – 40 cm	Grazing
	R2	45.2	1.1	0 – 10 cm	Grazing
Hydromorphic	W1	581.6	13.7	50 – 70 cm	Wetland
	W2	91.1	2.1	30 - 50 cm	Wetland
	W3	200.3	4.7	0 - 30 cm	Wetland
	Mine Areas	925.9	21.8	N/A	Active Mining
Anthropogenic	Witbank	4.7	0.1	N/A	Industrial/wilderness
	Totals	**4 242.9**	**100.0**		

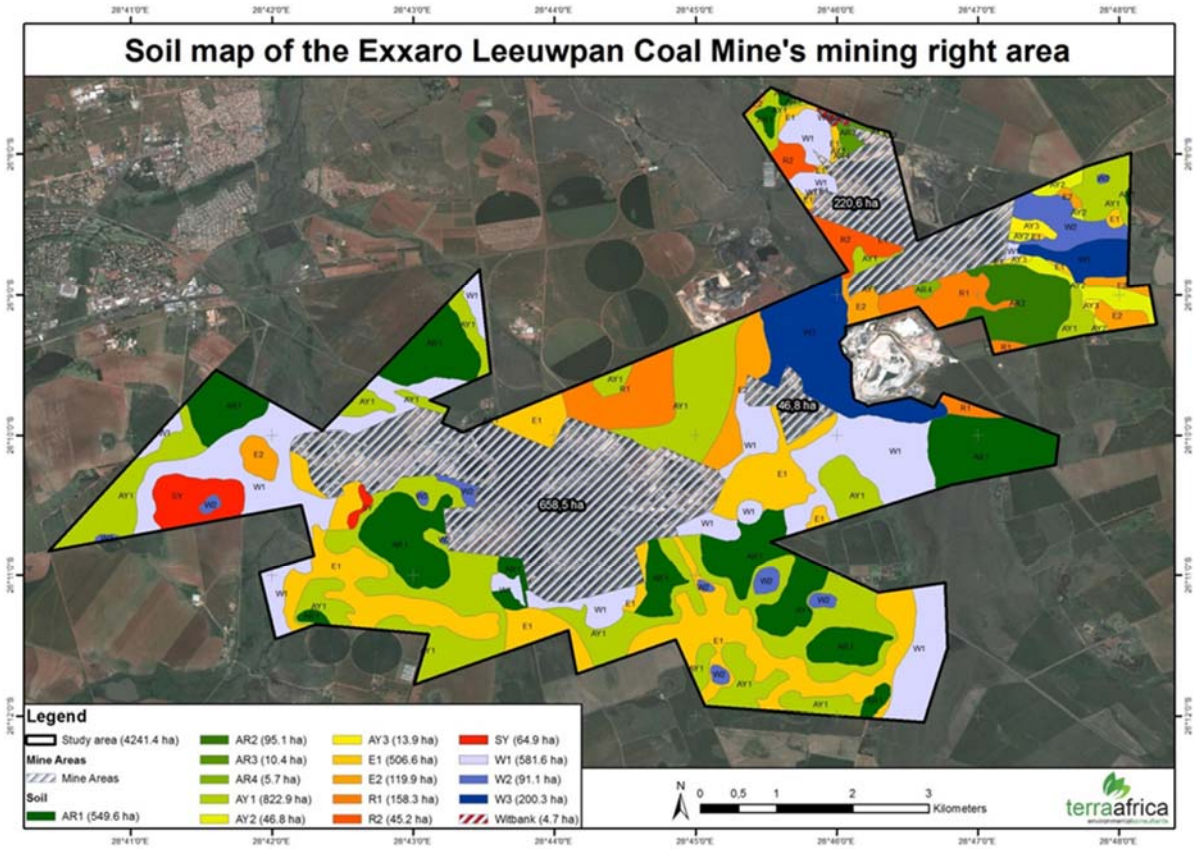


Figure 7: Soil map of the Leeuwpan Mining Right area as determined by TerraAfrica (EMPr, 2015)

The area has a high agricultural potential. Outside of actively mined areas, the land is used for irrigated crop production, dryland crop production, grazing and farming infrastructure. (refer Figure 12 and Figure 13 for the land use and land capability maps).

Implications for closure:

- Conserving soil resources and limiting the damage to the chemical and physical quality throughout the life of mine is a crucial component in achieving successful rehabilitation and the defined end land use and capability post closure.
- Surrounding land uses are predominantly agricultural for grazing and crop production;
- Land disturbed by surface mining generally leads to reduced land capabilities. Implementing effective soil management principles strictly managed through the operations will aid in establishing a post mining land use that can be gainfully employed within the surrounding land use context; and
- Soils should be stripped according the pre-mining soil survey and specifically according to soil types and depth indicated.

7.5 Fauna and flora

Leeuwpan is situated within the Grassland Biome and is located across two regional vegetation units, namely the Eastern Temperate Freshwater Wetlands and the Eastern Highveld Grassland. The latter of these is classified as Endangered and covers the largest portion of the mine site.

The Eastern Highveld Grassland consists of short, dense grassland, dominated by the usual highveld grass composition (*Aristidia, Digitaria, Eragrostis, Themeda, Tristachya*) with small, scattered rocky outcrops with wiry, sour grasses and some woody species. These include *Acacia caffra, Celtis Africana, Diospyros lycioides lycioides, Parinary capensis, Protea caffra* and *Rhus magalismontana.*

According to the Mpumalanga Parks Board Biodiversity Assessment, no habitat which is of conservation priority to the province is present within the study area. 34% of the Exxaro Leeuwpan Coal Mine's surface area is classified as natural and 66% is transformed (Exxaro, 2014). Therefore, it can be concluded that the Leeuwpan surface area does not represent an intact portion of an overall natural landscape. The remaining natural flora and fauna reflect a disturbed and transformed state.

Site-specific vegetation has been recorded (Exxaro, 2014). Due to the high transformation as a result of existing mining and agricultural activities, four clusters or dominant vegetation communities were identified, located on small sections of the site (Figure 8). Grazing pressure on these natural areas has resulted in species associated with exploitation displacing species associated with climax conditions, and variation in environmental attributes such as aspect.

The following vegetation communities were identified:

- Sourveld climax grassland associated with large boulders on crests with very coarse textured soils;
- Climax grassland close to the crests on very shallow, well-drained, coarse textured soils;
- Temporary and seasonally coarse textured, moist grassland on mid slopes and food slopes; and
- Seasonally and permanently fine textured, wet grassland on foot-slopes and valley bottoms.

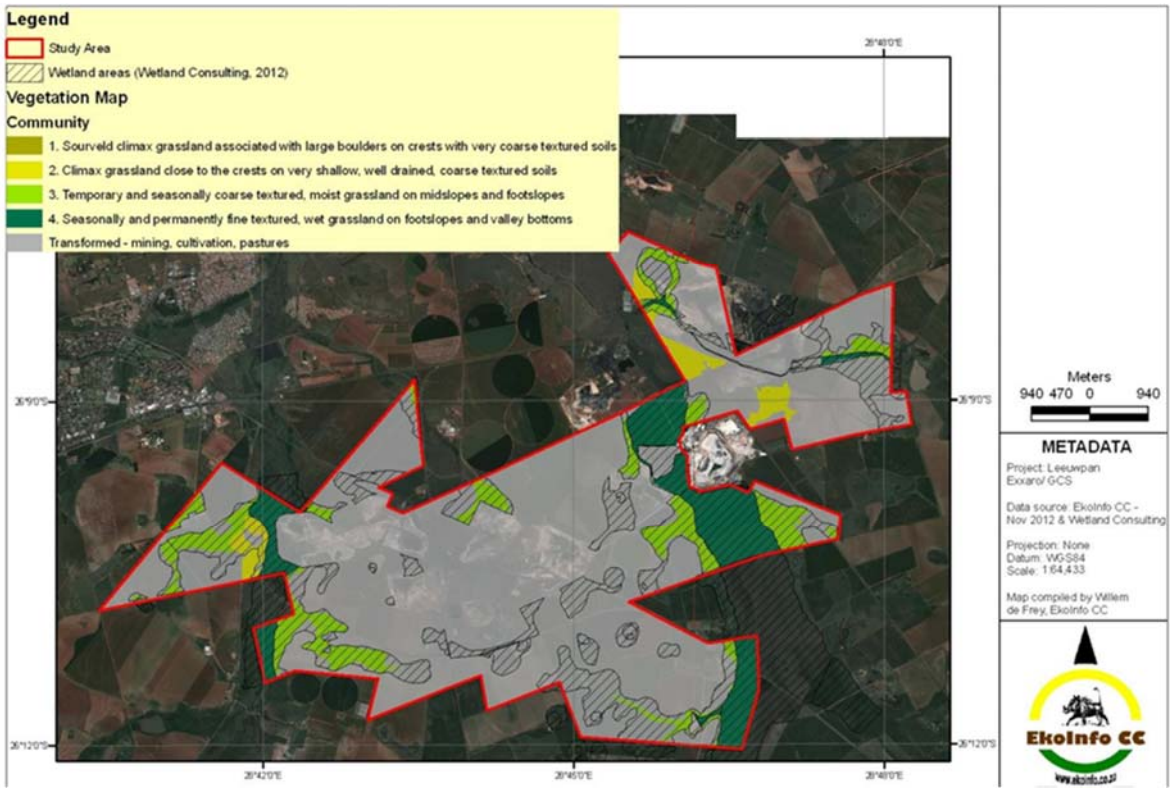


Figure 8: Vegetation map for the Leeuwpan Mining Right area (EMPr, 2015)

Implications for closure:

- Rehabilitation planning, as well as end land use planning, is to take account of the site-specific vegetation, along with the soils required to reintroduce appropriate species;
- Endemic vegetation species should, as far as possible, be utilised with rehabilitation, thereby facilitating the achievement of biodiversity and visual/aesthetic objectives for mine closure where practical;
- Biodiversity objectives, aligned to a Biodiversity Action Plan (BAP), are to be established with closure planning and appropriate measures formulated to facilitate achievement of performance criteria; and
- The disturbance caused to the natural vegetation by mining activities results in an increase in invasive species which will require eradication and control during operations and post closure.

7.6 Surface water

The project area is located in the Olifants Water Management Area and falls within the B20A quaternary catchment. This drainage region has been classified by DWS as moderate in its Ecological Importance and Sensitivity (EIS), and largely modified or Class D in its Present Ecological State (PES). However, the Bronkhorstspruit river catchment itself falls into the Class C resource class as set out by DWS.

The Bronkhorstspruit River flows in a south-north direction through the site to eventually end in the Bronkhorstspruit Dam downstream of the site area. Natural water features include tributaries of the Bronkhorstspruit River and pans. Artificial water features on site include farm dams, old void areas, Pollution Control Dams, rainwater accumulated in open cast pits and river diversion channels.

7.6.1 Surface water quality

Surface water sample locations are sampled on a monthly basis. The water analyses results are measured against the IWUL 2015 limits (Licence no. 04/B21A/ABCGIJ/429 amendment). 19 sites were sampled in June 2018 as part of the Quarterly Water Monitoring Report conducted by Golder Associates. These sites include 8 process water sites, 2 sewage discharge points, 5 receiving environment sites and 4 drinking water sources. It is noted that many receiving environment sites were dry and could not be sampled at the time, and some of the opencast pits have been backfilled.

The surface water samples were taken at two sites on the Bronkhorstspruit tributary, upstream and downstream, and three sites on the Bronkhorstspruit, upstream, downstream and upstream of Block OI (Figure 9).

The surface water samples did not meet many of the water quality limits specified in the IWUL during the second quarter of 2018, with the following exceedances mine water parameters in **bold** being recorded in June 2018:

- WP01 in Bronkhorstspruit tributary upstream of the mine: **electrical conductivity**, ammonia, calcium, magnesium, alkalinity and chlorophyll a;
- WP02 in Bronkhorstspruit tributary downstream of the mine: **total dissolved solids**, **electrical conductivity**, ammonia, calcium, magnesium, manganese, alkalinity, *E.coli*. and chlorophyll a;
- LSW08 in Bronkhorstspruit, far upstream of Leeuwpan mine: **total dissolved solids**, **electrical conductivity**, ammonia, sodium, calcium, magnesium, **manganese**, potassium, alkalinity, dissolved oxygen and dissolved organic carbon;
- LSW07 in Bronkhorstspruit upstream of Leeuwpan mine: **fluoride** (marginally), ammonia, potassium and dissolved organic carbon;

- LSW03 in Bronkhorstspruit adjacent to Delmas Silica: **electrical conductivity**, **sulphate**, ammonia, calcium, magnesium, alkalinity, dissolved oxygen and chlorophyll a;
- RD1 in Bronkhorstspruit at haul road: **electrical conductivity**, **sulphate**, ammonia, calcium, magnesium and alkalinity;
- LSW05 in Bronkhorstspruit downstream of Leeuwpan Mine and Stuart Coal **total dissolved solids**, **electrical conductivity**, **sulphate**, ammonia, calcium, magnesium and alkalinity; and
- LSW13: in Bronkhorstspruit tributary in water from Stuart Coal: **sulphate**.

The surface water contamination sources are broader than just the Leeuwpan Coal Mine and could include Delmas Sillica and agricultural activities.

The mine process water was characterised by circum-neutral pH values, high sulphate and TDS except for LSW09 (displaying an alkaline pH values and low levels of sulphate and TDS) – this can be attributed to oxidation of sulphides in coal and pit spoils materials and their subsequent neutralisation by carbonate minerals – and these waters can be classified as follows:

- Saline Drainage: Most sites: Kenbar return water dam, New Witklip return water dam, ODN Pit and OM pit; and
- Neutral mine drainage: LSW09 and KR04.

The operation of the sewage treatment plant has improved significantly (observed in the large decline of *E.coli)*, but still requires urgent attention due to exceedances of IWUL limits for nitrate, ammonia and *E. coli*. Effluent from the “septic tank” treatment plant LWP_SP_P was characterised by very high counts *of E. coli* (despite the huge decrease in level observed in June), orthophosphate and high concentrations of ammonia since mid-2015. The septic tank should continue to be emptied by an accredited waste removal company and disposed of to an authorised wastewater treatment works.

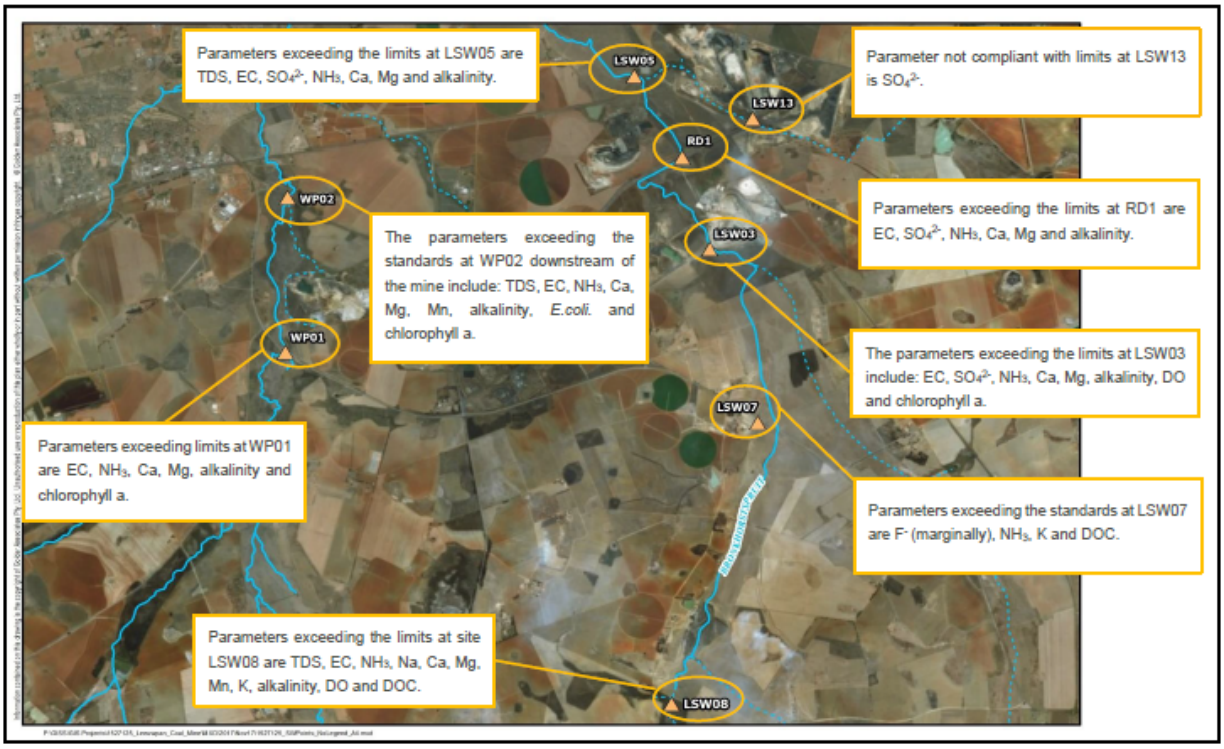


Figure 9: Summary of the surface water samples exceeding the IWUL limit (June 2018)

Implications for closure:

- Operational measures to manage clean and dirty water areas aligned with GN R. 704 of the National Water Act is crucial in protecting surface water resources during operations but also running into closure;
- Leeuwpan operates in an area where surface water bodies are impacted on from various mining operations and agricultural activities. Continual monitoring throughout the LoM to establish a baseline for surface water quality data will be important in setting closure criteria aligned with the mining and water use authorisations in place; and
- Closed pits which cannot be accessed will need boreholes drilling once they have been backfilled. The water quality of rehabilitated pits should be monitored as part of the groundwater monitoring programme and used to calibrate the water balance and geochemical model.

7.6.2 Wetland areas

A wetland study of the mine (Leeuwpan IWWMP, 2017) has shown that a number of wetlands exist on the site, in the form of hillslope seepages, dams, pans, channelled valley bottom wetlands and unchanneled valley bottom wetlands. Towards the east, two small unnamed tributaries of the Bronkhorstpruit exist. One of these valley bottom wetlands passes between Leeuwpan and Stuart East Colliery and has necessitated a river diversion around the mining activities. The other broad valley bottom wetland runs from south to north across the study area and is characterised mostly by vertic soils. Existing mining activities extend into this wetland system and have required the construction of a large berm to divert flows around the mine activities. This activity has been authorized under the WULA that was submitted and approved for the mining of the OWM reserves.

Eight pans occur within the study area. Seven of these are seasonal and characterised by *Leersa hexandra* across the pan width. The eighth pan is a permanent pan but is used for irrigation and is therefore a highly

modified system. A number of the seasonal pans have also been significantly impacted by roads and irrigation dams constructed within the pan basins.

Wetland monitoring at the site has shown the wetlands to range between “Moderately Modified” to “Seriously Modified”. (Leeuwpan IWWMP, 2017).

7.6.2.1 Wetland offset strategy

The Integrated Water Use License (IWUL; no.: 04/B20A/CIJ/4032) for the Leeuwpan OI and OL Expansion was granted on provision that the wetland offset areas were identified to compensate for the loss of wetlands. Mining at OI already commenced based on a 2016 report (LRI) while the mining at OL will commence based on the approval of the 2018 updated report (Digby Wells). The following is notable:

- Block OI mining is expected to impact on at least 134.62 ha of wetlands (68.4 ha directly by opencast mining); and
- 120.3 ha of wetland will be impacted by mining of Block OL.

The hectare equivalents determined for the functional and conservation offset targets for the expansion indicated:

- 87.23 ha of wetland equivalents would be lost;
- An additional 10.51 ha of wetland equivalents would be lost due to the additional Block OI west; and
- The functional offset target was calculated as 97.7 ha equivalents and the conservation offset target as 561.4 ha equivalents.

A total of 660.17 ha have been identified towards achieving the wetland conservation target of 561.4 ha. In terms of functional offset targets, the direct gains in hectare equivalents total 368.95 ha. The gains are essentially due to (accounting for the 10.51 ha Block OI west losses):

- The assumption that the remaining wetlands on site can be rehabilitated (increasing their present ecological state category by one level) to a gain about 202.48 ha equivalents; and
- Rehabilitating three identified potential sites with the aim of restoring stream connectivity of previously fragmented areas. Assuming the wetland portions can be rehabilitated to a category D, 166.47 ha wetland equivalents could be realized.

The proposed gains are subject to the following prerequisites:

- An estimated 204.1 ha of the surrounding catchment areas need to be rehabilitated; and
- Buffer areas covering approximately 87.12 ha selected within the mining right area are recommended to protect existing wetland areas and prevent further losses.

The proposed wetland rehabilitation cannot recreate hillslope seep zones. The recommendation has been made to consider this “out-of-kind” offset as it provides the following benefits:

- Improvements to the present ecological state of the systems as a whole; and
- Improvements to ecological importance and service provision within the greater catchment.

Implications for closure:

- A comprehensive end land use plan must be developed, incorporating the existing wetland areas and the components of the offset strategy, to ensure alignment of end land use and wetland commitments;
- The FLFD must be revisited to ensure the drainage framework is aligned with the objectives of the offset strategy;
- Implementation of all rehabilitation activities must have specific criteria, implementation standards and sign-off criteria; and
- Regular monitoring of riparian zones and surface water quality must be continued throughout the LoM to determine a base line for developing realistic and achievable post closure relinquishment criteria.

7.7 Air quality

According to the Highveld Priority Area (HPA) Baseline Assessment of 2007, The Delmas region is considered a hotspot for PM_{10}, where the ambient PM10 generally exceeds air quality standards. The HPA dispersion modelling results showed that the study site does not fall within an area where more than the allowable 4 exceedances of the PM_{10} air quality standard were predicted per annum.

Implications for closure:

- The active mining footprint limited during the operational phase and disturbed areas rehabilitated as soon as possible; and
- Monitoring and maintenance of rehabilitated areas should include a follow-up soil amelioration and seeding program to ensure the long-term viability of vegetation.

7.8 Cultural aspects

The Mpumalanga Province is associated early farmers that conducted various activities such as mining between AD 400 and AD 1100. Furthermore, Early Iron Age settlements, homesteads and Bushmen drawings are widespread in this region. Within the site boundaries, a Heritage Assessment conducted by Archaetnos found 17 sites of cultural significance. Thirteen of these are grave sites, and the rest are farm buildings.

Implications for closure:

- Cultural aspects have been considered during the mine plan development and are well documented; and
- A heritage and archeological assessment and action plan should form part of the specialist studies as required for the closure authorisations and application process.

7.9 Socio-economic context

The following sections are summarised from the EMPr (2015) and SLP (March 2015 – March 2020).

7.9.1 Regional socio-economic context

The mine is located within the Mpumalanga Province, within the Victor Khanye Local Municipality, which is within the larger Nkangala District Municipality. The Victor Khanye LM (formerly Delmas LM) is located in the Western Highveld of the district municipality, and boasts a growing economy within the trade sector, agriculture and mining sector. Mining activities within the LM are concentrated on coal and silica. Agriculture is, however, the main source of employment and is growing constantly. In terms of land area, farming is the most dominant, taking up 60% of the physical area, while the trade sector is the most dominant in its contribution to the economy.

The total population of the local municipality is 75 452 persons which amounts to 1.8% if the Mpumalanga province population. The average household size is 3.6. The population is comprised of mostly Black African persons (82.3%) followed by White persons (16%). Both the percentage of Black Africans and Whites have increased while the percentage of Coloured people residing in the area have decreased since 2010.

Victor Khanye LM has a large adolescent population (28.2%) younger than 15 years of age. More than two thirds of the population are between 16 and 64 years of age, which is the working population. It further has a very small elderly population (65 years and older) at 4.7%. The education in the area is relatively poor, with the largest percentage of people having some primary education (41.6%), followed by people with some secondary education (32.8%). The unemployment rate in the area is high, at 28.2%.

7.9.2 Mine-related socio-economic context

The mine employs 510 permanent employees and 499 long-term contractors. Permanent employees are sourced locally from Mpumalanga and Gauteng, and the vast majority live in local communities. Contractors, although mostly from Mpumalanga and Gauteng, also include workers from other provinces such as Limpopo and North West. The education levels of the permanent workforce ranges from “No schooling” to “Master’s degrees”, with most of them having completed Grade 10 – Grade 12. The contractors have generally completed a lower level of education, with many of them having an undefined education level or having reached a Grade 7 / Grade 8 level of schooling.

A number of initiatives exist at the mine to improve the labour education levels, equity and improve local economic development. The following social investment initiatives exist in terms of the mine workforce:

- Skills development – An ABET program exists to provide schooling to individual. A further training program makes use of accredited MQA providers to develop workers towards various disciplines of engineering, mining and plant learnerships. These include training towards becoming electricians, fitters, millwrights and diesel mechanics, as well as supervisory skills training. The mine additionally provides portable skills training for employees to allow them to find employment in case of retrenchment. These include agricultural skills (e.g.: cattle farming, crop production, etc), civil skills (e.g. building, carpentry, etc), licencing and technical skills (e.g.: vehicle servicing, etc).
- Career progression and mentorship – Leeuwpan creates generic career paths for all career fields. The career progression is managed via each employee’s individual development plan in conjunction with the Skills Development Plan. A mentorship plan is provided for each step of each career path.
- Talent pool fast tracking – accelerated development is provided to employees with potential, particularly historically disadvantaged South Africans. Discussions with employees in this pool occur quarterly and mentorship is provided.
- Scholarships, bursaries and internships – Bursaries are provided in engineering-specific fields. The bursaries are then placed in a mine as according to manpower requirements. Internships are also provided for youth in the community with a diploma.
- Employment equity – Leeuwpan Coal is committed to working towards employment equity and to adhering to the Mining Charter targets and objectives. A large portion of this plan is related to women in mining, and historically disadvantages South Africans in management.

Outside of the mine itself, Leeuwpan contributes to a number of local economic development initiatives, mainly focussed on Victor Khanye local municipality:

- Enterprise and supplier development;
- Education intervention program;

- Establishment of TVET College;
- Housing allowance for homeowners and buyers, first-time home ownership scheme and living out allowance for employees not staying in company accommodation; and
- Training and development of HDSA SMME suppliers in terms of financial management, business skills, human resources management, safety, legislative compliance, life skills and entrepreneurial skills.

7.10 Stakeholder engagement

7.10.1 Approach

The approach to the stakeholder engagement process is based on the requirements as per Regulation 50 (f) of the MPRDA Regulation R527. Exxaro embraces a philosophy of building stakeholder relationships. Exxaro recognises the positive benefits of early identification of stakeholder needs, along with associated risks and opportunities. Its stakeholder engagement activities are guided by the AccountAbility 1000 Stakeholder Engagement Standard (AA1000SES), its values, and stakeholder management and reputation philosophy.

Exxaro's objectives for stakeholder engagement are:

- Proactively and continuously seek to understand stakeholders and their expectations;
- Engage respectfully and uphold the dignity of stakeholders;
- Respond timeously to stakeholder issues;
- Collaborate and co-create appropriate solutions;
- Identify opportunities to leverage relationships and engagement platforms; and
- Report transparently on the extent and outcomes of engagements with stakeholders.

7.10.2 Method of engagement

The following stakeholder groups were identified and informed of the projects:

- Landowners;
- Lawful occupiers of land;
- Relevant authorities;
- Utilities; and
- Members of the public within the Delmas area.

Various methods were utilised to inform the interested and affected parties (I&APs) as part of the EMPr process:

- Site notices were placed at six locations on the proposed project area;
- A media advertisement, according to Regulation 54 of NEMA, was placed in the Citizen and Streeknuus newspapers on 9 and 16 November 2012 during the scoping phase. The process to initiate advertisements regarding the EIA phase was initiated in January 2014;
- Background information documents (BIDs) were distributed via email, fax and post to:
  - Landowners within the proposed Project Area;
  - Local, provincial and national authorities;

- All I&APs who contacted GCS following the placement of the advertisements; and
- BIDs were placed on the table at the library.

- An introductory public meeting was held on 27 November 2012 at the Agri Lapa, Delmas. An authority consultation meeting was to be held after submission of the draft EIA/EMP for authority review; and
- A stakeholder database was developed containing contact details of all I&APs as well as people who requested registration.

7.10.3 Summary of key issues raised

The issues raised during the public consultation period thus far are summarised in Table 8. This table includes comments directly related or relevant to the project. Some broader comments not directly related to the project can be found in the Appendix. Many of these broader issues are related to the economic and social impact in the region, damage to property from blasting, impacts on groundwater quality and flow, and air pollution. These impacts are ongoing for the mine. Of the issues related to the project, many are related to impacts on wetlands, soil and surface water, as well as legal/regulatory compliance and authorisations.

Table 8: Basic comments and response register

Issue / comment	Commentator	Reference	Response
General			
Will the whole area become Leeuwpan?	Peet Bezuidenhout - Farmer	Open Day – 27/11/2012	It is not a consolidation of farms. Rietkuil will be an extension of the existing mine, no additional mining rights are required
Is the underground mine now going to be an opencast mine?	Elise Tempelhoff – Journalist	Open Day – 27/11/2012	Yes, and this is part of the current EMP. OI replaces UI as resource for opencast.
Wants to know why they are not receiving any notification regarding the project?	Peet Bezuidenhout - Farmer	Phone call – 24/10/2013	Project back in Pre-Feasibility Phase, infrastructure being investigated, delayed the project. EIA will commence again as soon as decisions have been made by Exxaro
Social			
Stakeholders were not informed	Peet Bezuidenhout – Farmer; Residents at Delmas Settlement	Open Day – 27/11/2012	Peet Bezuidenhout - An email was sent to your email address on the 9th of November 2012. Delmas Settlement residents - Leeuwpan to reinstate annual stakeholder meetings
Concern regarding displacement / relocation of people	Residents at Delmas Settlement; Xolisile Nkosi – Victor Khanye Local Municipality	Open Day – 27/11/2012; Telephone conversation – 08/03/2013	A relocation programme for residents on the farm Rietkuil will be negotiated with all stakeholders involved.
Will I lose farmland that I've been renting, will there be other areas to rent for farming?	Willie Joubert - Farmer	Open Day – 27/11/2012	Current lessee's will not be asked to vacate land in near future
Air quality			
Air pollution is a concern, this includes black powder from blasting	Residents at Delmas Settlement	Open Day – 27/11/2012; Fax received – 18/04/2013	New PM10 monitoring programme suggested as part of Air Quality Assessment

Issue / comment	Commentator	Reference	Response
	JHP Snyman - Farmer		Blasting impacts are addressed and detailed in the blasting and vibration report done by Blast Management (MPRDA, 2015). Mitigation measures for the Air quality impacts are addressed in the Air Quality report done by Airshed Planning Professionals (MPRDA, 2015)
Wetlands and Ecology			
Concern regarding wetlands that may be destroyed	Residents at Delmas Settlement	Open Day – 27/11/2012	Impacts identified as part of Wetland Assessment. Exxaro intends to continue with mining but will investigate in conjunction with DWA wetland offsets
How far are you from the river? No mining is allowed 100m from the river	Elise Tempelhoff – Journalist	Open Day – 27/11/2012	No mining will take place within any rivers. The proximity to wetlands will be applied for with the DWA under Section 21(c) and (i).
The tar road caused changes to wetland and flow of water. The water floods the road at two places. Topsoil erosion at entrance to farm road makes road impassable	JHP Snyman - Farmer	Fax received – 18/04/2013	Addressed in the surface water and wetland assessment done by GCS and Wetland Consulting Services respectively (MPRDA, 2015). Soil erosion addressed in the Soils Assessment done by TerraAfrica, (MPRDA, 2015)
Rehabilitation			
Part of this project is the rehabilitation; will we get the rehabilitation plan?	Elise Tempelhoff – Journalist	Open Day – 27/11/2012	The mine works with concurrent rehab. The berm at the channel in front of the offices will be permanent. Excess clay is sold
What will happen to the land after it has been mined?	Elise Tempelhoff – Journalist	Open Day – 27/11/2012	Mine will be rehabilitated back to grazing with agriculture potential

Issue / comment	Commentator	Reference	Response
Related to mining method			
How will they get the coal from Rietpan to the main plant?	Elise Tempelhoff – Journalist	Open Day – 27/11/2012	Overland conveyors that will go through under the R50 at present, other options are still being investigated
Where will the overburden be placed?	Willie Joubert - Farmer	Open Day – 27/11/2012	Overburden will be backfilled, and will be located close to the backfill area
Blasting and vibration			
Property contains cracks and leaks that seem to originate from blasting activities. Submersible pump and borehole lost due to shaft that moved	Jaco Oosterhuis – Neighbouring farmer JHP Snyman - Farmer	Reply to mail notification – 04/03/2013; Fax received – 18/04/2013	Blasting impacts are addressed and detailed in the blasting and vibration report done by Blast Management, see MPRDA 2015
Groundwater			
Concern over drop in quality and groundwater level, and treatment costs to drink water. Farmer would like water quality results from samples	Willie Joubert; JHP Snyman – Farmers; Jaco Oosterhuis – Neighbouring farmer	Open Day – 27/11/2012; Fax received – 18/04/2013; Reply to mail notification – 04/03/2013	Groundwater study not completed yet, impact cannot be determined. Monitoring reports are available from Exxaro. Water Quality results presented in MPRDA 2015
Traffic			
The danger of heavy vehicle movement is a threat to slow moving farming vehicles	JHP Snyman - Farmer	Fax received – 18/04/2013	This is addressed in the Traffic Assessment done by ITS engineers

7.11 Social closure considerations for closure

- Prior to any downscaling process, it will be required to provide the DMR with measurable indicators and timeframes for its mechanisms to mitigate the impacts of job losses, as specified in the SLP Guidelines. The proposed plan should be in line with the terms of Section 52 (1) of the MPRDA and Section 189 of the Labour Relations Act (LRA);
- The mine must ensure that it provides the following information in accordance with the SLP Guidelines, 24-months prior to commencement of a downscaling process:
  - Comprehensive self-employment training programmes;
  - Comprehensive training and re-employment programmes;
  - Comprehensive portable skills development plan;
  - Outline projects earmarked for absorbing the retrenches; and
  - Sustainable mechanisms need to be put in place, such as reskilling for post-closure employment.
- Financial provision for the downscaling and retrenchment has been made available in the SLP;
- Current employees should as far as possible complete all training interventions by the time of mine closure. Education levels of employees should be improved where possible as this could improve their chances of re-employment elsewhere post-closure;
- Pro-active management and capacity building within mining communities and local governments is needed to:
  - Enable and empower communities to take ownership of community projects;
  - Develop capacity to manage social services after closure;
  - Social services may have to be transferred from Leeuwpan to other management structures as a simple handover to government rarely works; and
  - Develop both non-mining activities and other productive assets that will last beyond the life of mine.
- Mine closure planning should be aligned with local and regional municipal planning through integration with the latest IDP documents. In particular, main employment sectors, industries and areas of need should be identified. Where necessary, training interventions should be re-aligned in order to meet the needs of the local economy;
- Post closure land use that will positively contribute to the local municipal macroeconomics and GDP should be identified. This could include:
  - Identification of post-mining uses of skills and infrastructure established by the operation; and
  - Conduct a community needs analysis to identify land use options post-closure.
- Aligning expectations of stakeholders through communications strategies that ensure:
  - Participation in closure planning;
  - Consultation before, during and after mine closure;
  - Initiation of a two-way dialogue to achieve agreement on potential closure objectives and plans; and
  - Development of a realistic post-mining vision for the local area.

7.12 Stakeholder engagement

In terms of the MPRDA, engagement for mine closure is prescribed as follows:

62. *A closure plan contemplated in terms of section 43(3)(d) of the Act, forms part of the environmental management programme or environmental management plan, as the case may be, and must include – (j) a record of interested and affected persons consulted.*

8.0 MINING OPERATIONS AND REHABILITATION PLANNING

8.1 Mining

Coal is mined from various pits simultaneously via conventional opencast methods. The list of existing pits is indicated in Table 9. Topsoil, overburden and interburden have traditionally been stripped ahead of mining and stockpiled separately to access 2 coal seams (upper and lower). An extensive haul road network has been developed to link the pits and the plant. A railway loop provides ease of access to Leeuwpan and the trains are loaded via a rapid load out terminal. The pits are further discussed under rehabilitation.

Several pits have been mined at Leeuwpan since inception, their location in relation to each other and existing mining infrastructure is indicated in Figure 1. The rehabilitation process for Leeuwpan is outlined in Table 10. The mine has no above ground mine waste facilities and is authorised to return discard back into the pit with specific requirements. It is envisaged that the mining and rehabilitation activities will be integrated with stripped overburden and topsoil either live placed or stockpiled in defined locations for future use.

8.2 Pit status and post mining land use

The current status of each pit is highlighted in Table 9, the desired end land use defined in the EMP and RSIP. The mine has recently developed an initial LoM FLFD to guide rehabilitation planning and implementation. The modelled post mining drainage framework is alluded to in Table 9, most backfilled pits will be free draining although three voids are planned due an anticipated materials shortage and will be shaped as pan like structures to remain in the post mining landscape. The configuration of the voids will be refined to provide suitable evaporative capacity as one component of the long-term ground water management strategy.

Table 9: Leeuwpan opencast pits, current status and end land use

PIT	Current status	EMPR Land Use	Void
OD South	Inactive	Agriculture Production/Crops	No – PML free draining
Weltevreden	Active	Grazing	No – PML free draining
Moabsvelden	Active	Grazing	No – PML free draining
OH/OM	Inactive	Agriculture Production/Crops	No – PML free draining
OJ	Active	Agriculture Production/Crops	No – PML free draining
OD North	Inactive	Agriculture Production/Crops	No – PML free draining
OG	Inactive – partially rehabilitated	Agriculture Production/Crops	No – PML free draining
Witklip	Mined out	Grazing	Yes – mostly free draining, void in eastern portion

PIT	Current status	EMPR Land Use	Void
Kenbar	Top soiled and vegetated	Grazing	No – rehabilitation complete (no void)
Midklip	Backfilled and topsoil placed in heaps	Grazing	Yes
OI and OL	Future planned pits	Grazing?	OI – pan shape planned, OL - free draining
OLD Plant Discard Slurry	No	Grazing	No

8.3 Rehabilitation process

The mine has authorisation to return all mine residue back into the open pits. To minimise the long-term ground water impacts in particular, the rehabilitation sequence set out in Table 10 as defined in the EMP and operational rehabilitation planning documents. The key aspects that will require management and measurement during implementation include:

- Stripping similar soil types to the correct depths based on the pre-mining soil survey (stripping plan);
- Direct placement of similar soils to the correct depths on backfilled areas or creating temporary soil stockpiles when suitable areas are not available for live placement;
- Placement of discard back into the pit at the correct locations in the deepest portions of the pit below the carbonaceous layer and expected rebounded water table;
- Covering the discard with selected suitable overburden with high clay content and ensuring compaction as part of the covering process via traversing load and haul equipment;
- Effective survey measurements to calibrate the FLFD with actual bulking factors encountered in the field;
- Refining the FLFD during the operations to optimise material movement and integrate the long-term ground water management requirements into the model; and
- Developing and managing a LoM materials balance including discard, overburden, and topsoil volumes from concurrent mining and existing stockpiles.

Table 10: Summary of the Leeuwpan rehabilitation process

Leeuwpan rehabilitation process summary	Soil stripping	Soil stockpiling	Backfilling	Topsoil placement	Vege
	Strip seedbank separately – defined as the first 100 mm of topsoil	Stockpile soils with similar physical characteristics together – stockpile overburden separately.	Place discard (carbonaceous material) in the deepest portions of the pit below the carbonaceous layer	Replace soils in the same sequence (as far as possible), the sequence is indicated as: ■ Subsoils; ■ Topsoil stripped at 100 – 400 mm depths; and ■ Seedbed – first 100 mm stripped separately.	Ameli and fe fertilis interv
	Strip according to a detailed soil stripping plan	Optimise stockpile locations to limit re-handling and water logging	Place overburden with a high clay content over the discard and compact with trucks as part of the placement		Seed speci mix o speci
	Strip ahead of mining (and pit edges) to avoid losses and contamination	Limit the height to 4 – 5 meters to combat compaction	Backfill with overburden from stockpile or as part of the mining sequence	Place in the dry season as far as possible to limit compaction	Do no climax regula alien invasi
	All stripping to be supervised	Vegetate stockpile side slopes to limit erosion	No placement of discard allowed for the OJ pit	Replace soils in similar slope locations, red/yellow soils on the crest and upper slopes and grey hydromorphic soils in lower lying areas	Use e reputa a high land u
	Strip in dry conditions to limit compaction	Use topsoil only for rehabilitation purposes	Back fill to design levels FLFD		

8.4 Rehabilitation status

Due to historic factors, the mine currently has a rehabilitation backlog. The data provided by the mine has been separated into backfill areas and volumes (Table 14 discussed in section 13.1.1) and topsoil/vegetation areas and volumes (Table 11) for discussion and costing purposes. The present rehabilitation status of each pit is summarised as:

- Total disturbed area by opencast mining is about 960 hectares (ha);
- 55 ha have been rehabilitated in the Kendar Block south of the plant and block ODS (reported with ODS);
- Areas that have been backfilled already account for about 407 ha. Topsoil has been placed in heaps over most of these areas but levelling prior to vegetation establishment is still required;
- Areas that are available for backfilling include 365 ha. Topsoil will be placed over this area once backfilling is complete;
- The remainder of the 960 ha consists of overburden stockpile footprints (89 ha) and the topsoil stockpile footprints (42.7 ha);
- The total opencast area requiring vegetation establishment is 904 ha; and
- Subsequent monitoring and care and maintenance is required over 960 ha.

Table 11: Unscheduled closure: areas requiring topsoil and vegetation establishment

Pit	Area Rehabilitated-Kenbar (ha)	Area backfilled already - (ha)	Area to be backfilled/ top soiled (ha)	Overburden stockpile footprint (ha)	Topsoil stockpile footprints (ha)	Total vegetation establishment (ha)
Witklip/Midklip		25.60	17.41	2.14	1.56	46.71
Block OG		17.50	15.80			33.30
Block OH/OM		104.00	76.70		15.57	196.27
Block ODN		11.60	14.89	10.20		36.69
Block ODS	55.60	40.70	27.40			68.10
Block MBV		97.10	91.00	20.39	5.45	213.94
Block WTN		78.60	65.10	3.59	1.63	148.92
Block OJ		32.10	40.49	14.09	6.57	93.26
Block OI		0.00	16.40	19.70	9.76	45.86
Dispatch					2.15	2.15
WaterTank				19.18		19.18
Total	**55.60**	**407.20**	**365.19**	**89.28**	**42.70**	**904.38**

8.5 Landform modelling and volumetric assessment

To address the current rehabilitation backlog and to better integrate mining and rehabilitation activities at Leeuwpan, the mine survey department have developed a conceptual post mining landform (PML) referred to at the mine as the FLFD. The model is developed for the LoM and aims to provide design elevations for the backfilling operation and guidance for the extent and location of the final voids that will remain post closure.

Designed PMLs are routinely developed for opencast operations as a management tool for the following:

- Integrate mining and rehabilitation activities to reduce expensive re-handle;
- Design a PML that is stable in the long term and based on geomorphic principles to limit the risk of erosion;
- Accurately predict the post mining landform to guide materials movement including the final void configuration;
- Bring implementation accuracy to rehabilitation projects traditionally only measured on production (cubic meters moved, and hectares achieved); and
- Align the PML with the governing elevations for each pit, long term ground water management and the surrounding natural drainage framework for the area.

The Leeuwpan FLFD is the first step in integrating the mining and rehabilitation activities. The design will help address the current backlog over the next 5 years as part of operational planning and implementation. Care should be taken not to only address easy hectares (levelling and vegetation establishment) in the next 5 years, this would leave a large volume of backfill for years 2024 – 2029 when the mine has reduced production.

PART A2: ENVIRONMENTAL RISK ASSESSMENT FOR REHABILITATION, DECOMMISSIONING AND CLOSURE

9.0 SCREENING LEVEL RISK ASSESSMENT

A screening level Environmental Risk Assessment (ERA) was undertaken as part of this closure plan compilation, specifically aimed at informing the closure measures required to be implemented to ensure a meaningful and sustainable post-closure legacy for the mine. Key risks were identified based on available information followed by a dedicated risk assessment workshop held at the mine and augmented from observations made during a dedicated site visit.

The risk assessment process followed is described below:

- For each risk identified, Current Residual Risk (the inherent risk exposure less the current mitigating controls in place) risk rating and Planned Residual Risk (the inherent risk exposure less the mitigating controls in place) risk rating was determined;
- A worst-case scenario has been assumed with the Current Planned Risk as if the existing controls are not implemented accurately;
- As an operational mine, Leeuwpan have operational controls in place already. The specific controls are mentioned in the risk assessment as the current control measures. The treatment plan aims to highlight the next steps required (if any) to effectively address the risk;
- Measures to mitigate the current residual risks distilled from available information and/or developed to reduce the probability/likelihood and/or impact of the risk. The risk was then reassessed with the proposed mitigation measures in place and the Residual Risk (RR) determined, assuming reasonable effectiveness of the conceptualised mitigation measures; and
- The Exxaro Project Risk Register was used for the above risk assessment.

The specific methodology, Risk criteria including the impact scale and treatment effectiveness rating scale detailed along with the ERA spreadsheet can be found in APPENDIX C.

9.1 Key environmental and social risks and mitigation measures

The significant environmental and social risks identified in the screening level risk assessment are outlined in Table 12, and have been listed along with the:

- Risk ID and Risk name;
- Risk description set out in the prescribed format;
- Causes of the risk and the Impacts or effects; and
- The existing controls with the treatment plan as discussed.

Socio-economic risks related to closure have also been included as closure measures will need to be developed to address these risks. It is noted that residual risks are addressed in Report B and are not addressed in this section.

Table 12: Key environmental and social risks

RISK ID*	RISK NAME*	RISK DESCRIPTION	CAUSES	IMPACTS/EFFECTS	EXISTING CONT
1. Biodiversity Aspects					
1.20	Biophysical - Biodiversity / wetland / riparian functionality	As a result of reduced surface water runoff back into the natural catchment it is possible that the interconnectivity and functionality of the existing riparian / wetland systems will be negatively affected	wetland/riparian systems not considered in developing and constructing the post mining landform and related drainage framework	Reduced connectivity and functionality of wetland / riparian systems and wetland offset commitments not met.	FLFD is designed to surface water runoff catchment and direc from the planned vo Concurrent backfillin implemented to crea areas aligned with t drainage framework Clean and dirty wate defined and manage GN R. 704.
2. Infrastructural aspects					
2.20	Infrastructure - general rehabilitation	As a result of the depth of carbonaceous material across the plant not being quantified, it is possible that the volume estimate informing the closure cost is incorrect, which could lead to an increased post mining financial liability	The depth of the carbonaceous material used to construct the pad for entire plant area has not been determined	Uncertain financial liability of removal as volume is not quantified (depth unknown)	Volume estimate on costing purposes. M excavated and depo open pits at closure

RISK ID*	RISK NAME*	RISK DESCRIPTION	CAUSES	IMPACTS/EFFECTS	EXISTING CONTROLS	TREATMENT PLAN
2.90	Infrastructure - waste management	As a result of uncontrolled transport and disposal of demolition and hazardous wastes, it is possible that there will be unwanted environmental impacts and regulatory non-conformance, which could lead to an increased rehabilitation financial liability, reputational damage and legal penalties	Unsuitable offsite transport and/or inappropriate disposal of demolition waste/contaminated liquids/sediments/soils or sludges	Regulatory non-compliances and/or unwanted environmental impacts on soils, ground and surface water	Compile a site-specific waste inventory detailing the quantities of general and hazardous wastes requiring disposal. Compile a waste manifest for the handling and disposal of demolition waste	Address in the closure EMP through the closure Basic Assessment and effective contracting with service providers
3. Mining aspects						
3.10	Mining - Financial / ground water / land capability	As a result of the lack of concurrent rehabilitation, it is possible that backlog areas will increase, which could lead to increased scheduled and unscheduled financial liability	Not implementing concurrent rehabilitation	Increased backlog areas, increased unscheduled and scheduled closure liability and expensive re-handling of material	Integrate mine planning and rehabilitation planning, optimise materials movement to reduce haul distances and re-handling material and adherence to the DWA BPG guidelines - FLFD, RSIP and SLI-LP-ENV.008 (Standard Practice Instruction: Ongoing and Final Rehabilitation)	Optimise the FLFD in terms of final void positions and mass earth works; develop standards for all aspects of backfilling and manage the implementation to reduce the backlog areas.

RISK ID*	RISK NAME*	RISK DESCRIPTION	CAUSES	IMPACTS/EFFECTS	EXISTING CONTROLS	TREATMENT PLAN
3.20	Mining - Land use / land capability	As a result of having to address backlogs, it is possible that rehabilitation measures will only be measured against production criteria, which could lead to ineffective implementation of detailed design specifications and an increased financial liability	Addressing backlogs - Rehabilitation measured against production criteria of cubic meters moved and hectares achieved only and not the quality and accuracy of construction.	5-year plan to address backlog may increase the liability if not constructed accurately and according to plan, particularly the placement, compaction and covering of carbonaceous material.	Initial FLFD developed to plan mass earthworks and integrate rehabilitation and production activities more closely - Internal 5-year plan developed to address backlog areas and reduce the closure liability. (EMPr, FLFD, RSIP and SLI-LP-ENV.008 (Standard Practice Instruction: Ongoing and Final Rehabilitation).	Existing goals, objectives and strategy documents must be developed into detailed action plans with standards / procedures and sign-off protocols to manage the effective implementation over the LoM. Consider initiating a rehabilitation and closure steering committee to ensure alignment of all departments and manage the accuracy and quality of implementation.
3.30	Mining - Land use / land capability / soils	As a result of the lack of an integrated soil management plan and/or effective implementation, it is possible that soil chemical and physical properties will be reduced, which could lead to post mining land use/capability commitments will not be met, site relinquishment not being achieved and an	Lack of integrated soil management plan and/or effective implementation	Reduced soil quality relating to physical and chemical properties	Strip/place/stockpile according to soil type; Directly place where possible and stockpile on dedicated soil stockpile areas no higher than 4 meters; Strip and place soils in winter months; utilize correct equipment to reduce compaction and limit traffic over rehabilitated areas; Rip to alleviate	Develop a LoM materials balance; develop current commitments / policies into implementation standards with sign-off criteria; Develop a soils management plan to integrate soil stripping

RISK ID*	RISK NAME*	RISK DESCRIPTION	CAUSES	IMPACTS/EFFECTS	EXISTING CONTROLS	TREATMENT PLAN
		increased post mining financial liability			compaction; Apply soil amelioration based on sampling/analysis to meet soil fertility targets; Implement ongoing monitoring, maintenance based on soil analysis; (as per EMPr; RSIP, SLI-LP-ENV.008)	and placement as part of the mining schedule.
3.50	Mining - land use and land capability	As a result of inaccurate construction of the FLFD and /or FLFD volumetric assessment not calibrated/accurate, it is possible that internal blind catchments will be constructed on mined out areas; reducing catchment yield and increased water make, which could lead to post mining land use/capability commitments not being met, site relinquishment not being achieved and an increased post mining financial liability	Inaccurate construction of the FLFD and /or FLFD volumetric assessment not calibrated/accurate	Increased internal blind catchments (ponding) on mined out areas; reduced catchment yield, increased ground water make, reduced pasture viability.	Construct the post mining landform according to the FLFD. Rehabilitation status must be measured and reported on for all disturbed areas by the survey department (RSIP and SLI-LP-ENV.008).	Develop, maintain and calibrate the LoM materials balance to reduce the risk of unexpected backfill deficits. Develop the current rehabilitation guideline documents into implementation standards with sign-off criteria.
3.60	Mining - rehabilitation and closure planning	As a result of no clearly defined rehabilitation and closure goals and objectives, it is possible that planning and operations are not geared towards understanding, managing and reducing the closure liability over time, which could increase financial liability	Lack of clearly defined closure and rehabilitation goals and objectives and standards/procedures	Increased uncertainty and closure liability, agreed to end land use and land capabilities not achieved.	Initial objectives set out and incorporated into planning / strategy documents and expanded on in the Closure Plan - EMPr, Closure Plan, closure provision and SLI-LP-ENV.008 (Standard Practice Instruction: Ongoing and Final Rehabilitation)	Existing goals, objectives and strategy documents must be developed into detailed action plans with standards / procedures to manage the effective

RISK ID*	RISK NAME*	RISK DESCRIPTION	CAUSES	IMPACTS/EFFECTS	EXISTING CONTROLS	TREATMENT PLAN
						implementation over the LoM. Objectives and goals should be revisited once a detailed end land use plan has been developed.
3.80	Mining - soils, land use / land capability	As a result of the lack of an integrated soil management plan and/or effective implementation, it is possible that soil resources will be lost, which could lead to post mining land use/capability commitments not being met, site relinquishment not being achieved and an increased post mining financial liability	Lack of integrated soil management plan and/or effective implementation	Loss of soil resource during operations and reduced land capabilities of rehabilitated areas.	Strip/place/stockpile according to soil type; Directly place where possible and stockpile on dedicated soil stockpile areas no higher than 4 meters; Strip and place soils in winter months; utilize correct equipment to reduce compaction and limit traffic over rehabilitated areas; Rip to alleviate compaction; Apply soil amelioration based on sampling/analysis to meet soil fertility targets; Implement ongoing monitoring, maintenance based on soil analysis; (as per EMPr; RSIP, SLI-LP-ENV.008)	Develop a soil stripping and management plan, include stripping a window ahead of all mining to reduce losses around pit edges (5 m). Develop the current rehabilitation guideline documents into implementation standards with sign-off criteria to align all departments on the mine. Provide training to operational personnel.

RISK ID*	RISK NAME*	RISK DESCRIPTION	CAUSES	IMPACTS/EFFECTS	EXISTING CONTROLS	TREATMENT PLAN
3.90	Mining - Surface and ground water	As a result of specified rehabilitation measures not implemented accurately, it is possible that increased volumes and decreased water qualities will have to be actively managed post closure, which could lead to impacts on riparian habitats, instream qualities and increased post closure financial liability	All specified rehabilitation measures not implemented accurately	increased volumes and decreased water qualities to be actively managed post closure,	Construct the FLFD to free drain water away from final voids; Preferential materials handling including: returning discard/slurry to deepest portions of the pit below expected rebounded ground water elevations; covering and compacting the discard; The final layer (just below the topsoil cover) should be as clayey as possible and compacted with traversing load and haul equipment (methodology aims to bar oxygen from reacting with remaining pyrite). establishing vegetation. (as per EMPr, RSIP, SLI-LP-ENV.008, 5-year plan, annual rehabilitation plan.	Develop standards with sign-off protocols for accurate implementation, conduct a planning workshop involving all departments and train operational personnel in the correct implementation.
4. Residual risks						
Refer to the Environmental Risk Report B						
5. Socio-economic						
5.10	Socio-economic - Land use / land capability	As a result of a lack of post closure access control and pasture management, it is possible that there will be overgrazing, erosion and failed rehabilitation, which could lead to reduced land capability, increased rehabilitation	lack of post mining access control and pasture management	Overgrazing, failure of rehabilitation, increased erosion and reduced land capability	Mine will be rehabilitated and made suitable for agricultural projects; Mine farm will be offered for sale to farmers occupying it on first-right-of-refusal basis; Projects set up in partnership with local municipality prior to closure to ensure optimal,	Develop rehabilitation guidelines and policy documents into detailed implementation plans with sign-off protocols. Ensure effective pasture management of

RISK ID*	RISK NAME*	RISK DESCRIPTION	CAUSES	IMPACTS/EFFECTS	EXISTING CONTROLS	TREATMENT PLAN
		financial liability and reputational damage			sustainable land use. conclude lease / management agreements for rehabilitated land up front prior to closure. SLP section 4.4.2	rehabilitated areas during operations and implement the monitoring and care and maintenance activities; Continual compliance with regulatory framework and engagement with stakeholders.
5.30	Socio-economic: internal	As a result of mine closure it is possible that loss of income may occur, which could lead to poverty and reduced opportunities for employment and reputational damage	Mine closure not effectively planned for.	Poverty and reduced opportunities	Provide transferable skills and development opportunities, particularly for unskilled and semi-skilled workers during the operational period of the mine; Provide voluntary training courses for a limited period for retrenched employees; Allow employees to engage in a clearly defined redeployment process; Ensure clear understanding of the Employee Share Option Scheme rules. (SLP section 4 and table 34)	Continual updates and implementation of the SLP and communication with all stakeholders running into closure.

RISK ID*	RISK NAME*	RISK DESCRIPTION	CAUSES	IMPACTS/EFFECTS	EXISTING CONTROLS	TREATMENT PLAN
5.40	Socio-economic: external	As a result of mine closure it is possible that there is a reduced nett contribution to the local economy, which could lead to reduced income and economic opportunities in the region	Mine closure	loss of income and opportunities for suppliers	Capacity building initiatives and training for SMME suppliers; Implement mentorship programme to ensure sustainability/diversification of SMMEs. (SLP section 3.8.1)	Continual updates and implementation of the SLP and communication with stakeholders running into closure.
5.50	Socio-economic: external	As a result of mine closure it is possible that there is a reduced nett contribution to the local economy, which could lead to reduced income and economic opportunities in the region	Mine closure	Reduced nett contribution to the local/regional economy	Engage actively in District Municipality Local Economic Development planning through relevant forums; Focus on LED efforts in Victor Khanye local municipality, particularly: Establishment of SMME /business incubator, establishment of TVET college and the Education intervention Programmed. (SLP section 3.4 - 3.6)	Continual updates and implementation of the SLP and communication with stakeholders running into closure.
5.60	Socio-economic: external	As a result of not concluding agreements with third parties regarding post mining land use, it is possible that there will be a gradual deterioration of rehabilitated land through mismanagement, illegal occupation, vandalism and overgrazing may occur, which could lead to reduced land capability,	Not concluding agreements with third parties regarding post mining land use	Gradual deterioration of the rehabilitated land though mismanagement, illegal occupation vandalism, overgrazing and no access control	Mine will be rehabilitated and made suitable for agricultural projects; Mine farm will be offered for sale to farmers occupying it on first-right-of-refusal basis; Projects set up in partnership with local municipality prior to closure to ensure optimal, sustainable land use. conclude lease/management agreements for rehabilitated land up front prior to	Continual updates and implementation of the SLP and communication with stakeholders running into closure.

RISK ID*	RISK NAME*	RISK DESCRIPTION	CAUSES	IMPACTS/EFFECTS	EXISTING CONTROLS	TREATMENT PLAN
		increased financial liabilities and reputational damage			closure. SLP section 4.4.2 and SLI-LP-ENV.008 (Standard Practice Instruction: Ongoing and Final Rehabilitation)	
5.90	Socio-economic: internal/external	As a result of misaligned expectations of communities/employees at closure, it is possible that unrest may occur, which could lead to increased financial liabilities and reputational damage	Misalignment of expectations of local communities/employees at closure regarding post closure aspects (land use / water management / economic opportunities).	Unrest/discontentment	Build on PP conducted throughout the operation, SLP implementation and Legacy/Closure projects; Compile Social Impact Assessment and conduct PP to identify and address issues/risks pro-actively	SLP implementation and PP process' throughout the LoM to ensure alignment of all stakeholder expectations

PART A3: CLOSURE PLANNING

10.0 ASSUMPTIONS APPLIED IN THE CLOSURE PLAN

The following assumptions have been made in the compilation of this closure plan:

- The closure plan has been compiled without input from external stakeholders. Stakeholder consultation will be undertaken by the mine during operations, using a suitable implementation vehicle, to obtain stakeholder views and opinions, and these will be considered and incorporated in future updates of the closure plan;
- Dedicated effort will be spent on the alignment of operational social commitments, captured in the SLP, to include a longer-term vision of the social closure planning requirements, so that these aspects can be addressed in more detail in closure planning going forward;
- Successful closure of the mine will require buy-in from, and collaboration with district municipalities, regulators, mine employees and surrounding landowners and communities. This closure plan assumes that the working relationship required with these stakeholders for successful mine closure, will be well established at the onset of closure;
- The closure plan is based on available information supplied by the mine. No additional technical work was done to support the compilation of the plan, however going forward closure-related knowledge gaps will be addressed based on priority, during the remaining life of the mine;
- Decommissioning and rehabilitation activities will follow directly on the cessation of mining (for scheduled closure); and
- Closure planning will be a progressive/iterative process where new information, as it becomes available, will be assimilated and incorporated into the closure planning to achieve an appropriate, up-to-date and implementable closure plan at the time of actual closure.

11.0 CLOSURE VISION

A proposed closure vision, summarised below, provides an overarching guide for all rehabilitation and closure activities and defines the end state to be aimed at.

To agree with local and regional stakeholders on a suitable post-mining landscape that is safe, stable and non-polluting over the long-term, and which leaves behind a positive post-mining legacy that maximizes socio-economic opportunities by maintaining essential ecosystem services and by supporting sustainable agricultural production.

11.1 Closure Goal

The Closure Goal that will guide the development of closure objectives to ensure a practical, achievable and implementable closure plan, as stated in the EMPr, is:

"The overall closure goal for the proposed Leeuwpan mine area is to return the disturbed areas to a state that is as close as possible to the natural conditions. Leeuwpan aims to progressively re-instate an area that is safe, stable, and non-polluting to be integrated into the current land uses (cattle and game farming).

12.0 CLOSURE OBJECTIVES

The closure philosophy and objectives below have been proposed to guide the closure measures to be implemented on site towards achieving the above closure goal and vision:

- **Physical stability:** to remove and/or stabilise surface infrastructure, unavoidable mining residue and open pits that are present on the mine to facilitate the implementation of the planned next land use, by ensuring that:
  - Mining-related remnants/features are stable and as such will not pose a safety risk;
  - The stability of remaining mining-related remnants/features will display longevity with slow landform evolution when exposed to expected natural forces;
  - The stability of remaining mining-related remnants/features will be such that these do not detract from the surrounding next land use;
  - If long term stability cannot be ensured, the measures adopted will take account of this and any instability mitigated as far as possible;
  - All rehabilitated disturbed areas that have the potential for wind and/or water erosion will be provided with a suitable vegetation cover to combat these aspects/forces;
  - Open pits are free-draining where possible with final voids will be backfilled to be free-draining. Where localised material deficits occur, voids will be backfilled and shaped as pan like structures so that beneficial land uses can be implemented; and
  - Monitoring is undertaken to demonstrate the success of the closure and rehabilitation measures implemented.
- **Environmental quality:** to ensure that local environmental quality is not adversely affected by possible physical impacts and chemical contamination arising from the rehabilitated areas and that catchment yield is sustained as far as possible after closure, by ensuring that:
  - Rehabilitated mining areas do not present any unacceptable environmental risks;
  - Environmental impacts will be investigated and addressed at source. If not possible, the required intervention/mitigation measures will be implemented, and preferably during operations to limit the intervention required at closure; and
  - Ongoing monitoring will be undertaken to ensure the quality of the surface and groundwater, specifically in terms of acidity and salinity, remains within acceptable threshold levels.
- **Health and safety:** to limit the possible health and safety threats to humans and animals using the rehabilitated mine site as it becomes available, by ensuring that:
  - Health and safety threats are prevented as far as possible. If not, to limit these to acceptable risks that can be reasonably/realistically achieved.
- **Land capability/land-use:** to re-instate suitable land capabilities over the rehabilitated portions of the mine site, by ensuring that:
  - Where possible land capability will be reinstated to match the pre-mining land capabilities as far as possible. If not, effort will be put into achieving the next best land capability;
  - A functional post-mining landscape is achieved that enables self-sustaining agricultural practices where possible;

- Invasive vegetation species will be eradicated to further enable achievement of the desired land capability on rehabilitated areas, and functioning of riparian zones; and
- Landforms are mostly free-draining to maximise the surface water return into the catchment to reduce recharge and ensure connectivity of wetlands and functioning of riparian zones;

- **Aesthetic quality:** to leave behind a rehabilitated mine site that, in general, is not only neat and tidy with an acceptable overall aesthetic appearance, but which is also aligned to the respective land uses, by ensuring that:
  - Recognition is given to the local/natural analogues and these be repeated as far as practically possible; and
  - Rehabilitation measures that appear unnatural/visually intrusive will be avoided as far as possible;
- **Biodiversity:** to encourage, where appropriate (for example in corridors), the re-establishment of native vegetation on the rehabilitated mine site such that the terrestrial biodiversity is largely re-instated over time, by ensuring that:
  - Viable self-sustaining vegetation communities are established; and
  - Invasive species that could threaten the reinstatement of the desired vegetation communities are actively eradicated.
- **Social:** to ensure that the infrastructure transfers (if any), and measures and/or contributions made by the mine towards the long-term socio-economic benefit of the local communities are sustainable, and aligned to the detailed socio-economic mine closure plan, by ensuring that:
  - Local communities are adequately informed about mine closure (next land use planning, scheduled closure and reskilling initiatives linked to the next land use, where possible);
  - Obsolete/dormant mine infrastructure that could be beneficially reused is identified; and
  - Receiving communities are empowered to take over and maintain ceded infrastructure for their ongoing benefit (e.g. boreholes to remain at closure for local communities).

13.0 CLOSURE SCENARIO

The likely closure scenario has been defined in terms of the following:

- **Remaining operational period until cessation of operations** that allows for the execution of routine closure-related work as part of operations as far as possible to limit the remaining closure costs at LoM; and
- **Closure period and beyond** that allows for the mine site to be handed over to the closure contractor(s), once most operational personnel have left the site, to implement the closure measures and related engineering in terms of the final closure plan

The unscheduled and scheduled closure scenarios for infrastructure are largely similar but vary considerably for the mining areas. A separate discussion is presented in terms of the various scenarios for the mining areas.

The closure scenario is detailed in Table 13, in terms of the following key aspects:

- Infrastructure and plant areas;
- Coal residue and discard;
- Ponds and impoundments;
- Open pits;
- Waste and contaminated land;
- General surface rehabilitation; and
- Water management.

Table 13: Closure scenario for Leeuwpan

Remaining operational period until cessation of operations	Closure a
Infrastructure and plant areas	
■ Surface infrastructure considered redundant / defunct during operations (i.e. obsolete plant, roads no longer needed to support operations and redundant buildings) would have been appropriately decommissioned and footprint areas rehabilitated ■ Suitable transfer agreements would be in place for infrastructure identified for third party beneficial reuse (e.g. offices, access roads, etc.)	■ Final dismantling, removal and demo steel prepared for salvage. Excess m be safely disposed of ■ Concrete would have been crushed t space requirements for disposal for i infrastructure has been removed and ■ Surface contamination due to the rer collected and removed for safe dispo ■ Most of the haul roads and access ro closure activities, will be rehabilitated ■ Disturbed footprint areas will be suita a succession trajectory that will even and desired ecological state
Coal residues and discard	
■ Remaining stockpiles would have been processed with only footprint areas remaining for rehabilitation ■ No permanent disposal facilities exist, all discard would have been deposited within the pits below the carbonaceous layer and covered with compacted high clay content soils	■ Remaining stockpile footprint areas w ■ Disturbed footprint areas will be suita a succession trajectory that will even and desired ecological state
Ponds and impoundments	
■ Any potential spillages or contamination from the pollution control dams or other impoundments will be cleaned-up during the operations	■ Remaining pollution control dams an appropriately cleaned-up by removin of this into the remaining void prior to ■ Remaining liner systems will be clea open pits prior to backfilling and final ■ Dam walls will be breached, shaped re-established using a suitable seed

Remaining operational period until cessation of operations	Closure and beyond
Open pits	
■ The respective open pits have already been rehabilitated during operations, with only minimal additional shaping, levelling and re-vegetation required which would have been undertaken during operations	■ The mining of all other pits will cease in 2024, only block OI (potentially UB excluded for this assessment) will remain active after this period ■ All remaining pits will be rehabilitated between 2014 and 2029 including the concurrent rehabilitation of block OI with material deficits supplemented with volumes from remaining stockpiles ■ The operational window (final void) of OI will be addressed during final rehabilitation at closure. It is assumed that 60% of the initial OI box cut (1.4 million of 2.35 million m3) will be returned to the pit to design levels. A load and haul distance of 2.5 km was estimated for the backfill and topsoil placement based on the mining block plan provided and the current location of the OI overburden and topsoil stockpiles ■ Backfill of the final void will include the carbonaceous veneer recovered from the plant and workshop areas, sediments from the dams, inert building rubble and decontaminated crushed and screened concrete ■ Topsoil will be placed from the box cut topsoil stockpile to a depth of 0.5 m and an allowance is made to rehabilitate 16 ha ■ The stockpile footprints will be ripped to alleviate compaction, scarified and Hydroseeded with an approved seed mix and ameliorants based on dedicated soil fertility sampling and analysis
Waste and contaminated land	
■ Inventories of reagents/chemicals would have largely been run down and no notable quantities would remain on-site ■ A contaminated land assessment will be undertaken to delineate areas of contamination requiring clean up at closure	■ Remaining steel and related wastes that can be salvaged will be sold and removed off-site ■ Uncontaminated/decontaminated demolition waste will be disposed of into the final void ■ Asphalt will be crushed and stockpiled in a central location on site for re-sale to third parties ■ Hydrocarbon-contaminated soils will be treated onsite based on the outcomes of trials conducted during the operational phase

Remaining operational period until cessation of operations	Closure and beyond
General surface rehabilitation	
■ Areas from which redundant surface infrastructure has been removed during operations will be rehabilitated, with a free draining topography ■ Open pits rehabilitated during the operational period would have been rehabilitated aligned to end land use ■ Any subsided areas would have been rehabilitated to be free draining during operations ■ Exotic vegetation would have been removed and eradicated during operations as required	■ Final shaping and levelling of areas from which infrastructure was removed and/or disturbed during operations will be undertaken ■ The above shaping and levelling will be in accordance with the agreed post-closure surface drainage regime aligned to next land use ■ Shaped and levelled areas will be ripped to alleviate compaction, scarified, fertilised and vegetated towards achieving the desired end/next land use ■ Corrective action over already rehabilitated areas will be undertaken as required ■ Ongoing eradication of exotic vegetation will be undertaken post-closure
Water management	
■ Operational mine water management will continue for the remaining LoM	■ Site drainage lines will be reinstated / developed on the rehabilitated surface areas ■ Surface water and groundwater monitoring will be conducted to confirm trends documented with operational monitoring and to demonstrate success of implemented closure measures

13.1 Closure scenarios for the mining areas

The scheduled closure scenario is included in Table 13, the unscheduled closure scenario is summarised below. Option two is the candidate option and forms the basis of the unscheduled closure costs, option 1 is also discussed here for comparative purposes and not as an alternative in section 18.0.

13.1.1 Unscheduled closure

The FLFD is developed for the scheduled closure scenario and to guide materials movement during the operational period. Although not specifically designed for the unscheduled closure scenario, it has provided a basis for high level planning for costing purposes. The materials balance from the volumetric assessment provides insight into the challenges of implementing such a scenario. If the exiting open pits were to be closed in this current state, to achieve the FLFD elevations would require an additional 26 million m^3 of material (Table 14). Should immediate closure be a reality a separate PML would be developed to optimise the mass earth works and design a best fit solution. For costing requirements, two options were considered (Option 2 is the candidate costing scenario):

- Option 1 provides land potentially suitable for grazing across about 595 ha, 166 ha of potentially arable land and voids remaining as open water bodies covering approximately 198 ha (costs equate to about R 409 million); and
- Option 2 provides 595 ha of potentially grazing land use and 365 ha of usable land with localised low points and voids (costs about R 393 million).

Option 1 is the preferred option based on the following:

- The carbonaceous material disposed of in the open pits will all be covered with overburden and compacted as specified followed by topsoil as specified; and
- Open water bodies and remaining highwalls will be limited to smaller areas.

13.1.1.1 Option 1

The following assumptions were made:

Due to the backfill volume deficit across the mine of 26 million^3, an allowance was made for the following:

- Level and shape the topsoil heaps placed on the backfilled areas in preparation of vegetation establishment;
- Backfill and rehabilitate five open pits to achieve an agricultural land use, specific actions include:
  - Utilise the available overburden material in all stockpiles to backfill Witklip, OG, WTN, OJ and OI to the elevations specified in the FLFD (9.2 million m^3);
  - Assuming the backfilling is done to specifications a nominal allowance has been made to level and shape 10% of the area prior to topsoil placement;
  - Place topsoil from all available stockpiles to a depth of about 1 m across the backfilled areas only (about 1.7 million m^3 across 166 ha), previously backfilled areas are indicated as top soiled already;
  - Establish surface water cut-off berms as required for Witklip to reroute storm water around the shaped void; and
  - Rip the placed topsoil and stockpile footprint to alleviate compaction.

- Hydroseed all areas with an approved seed mix and ameliorants based on dedicated soil fertility sampling and analysis; and
- Four open pits will remain as final voids, rehabilitation measures include:
  - Leave pits OH/OM, ODN, ODS and MBV as final voids (combined surface area 198 ha);
  - Allow for levelling and shaping to ensure that carbonaceous material is in the deepest portion of the pit, below the carbonaceous layer and the expected rebounded water table;
  - Maintain and reinforce the existing safety berms around the final voids to limit access to the final voids; and
  - Establish a vegetative barrier around the perimeter of the remaining highwalls to further limit access to the final voids.

13.1.1.2 Option 2

The candidate option includes the following assumptions:

- Level and shape the topsoil heaps placed on the backfilled areas in preparation for vegetation establishment;
- Backfill the remaining pit areas with all available overburden spread across the surface area (filling approximately 26% of the void volume – 9.2 million m^3) ensuring that all carbonaceous material is covered;
- Plan the backfilling to ensure that the overburden cover is compacted by load and haul equipment as part of the process;
- Place topsoil over all backfilled areas to a depth of 0.47 m (1.7 million m^3 across 365 ha), limit the compaction by tipping heaps at specified distances and utilising suitably sized dozers (D6 or equivalent) to spread the topsoil;
- Rip all topsoil areas and stockpile footprints to alleviate compaction; and
- Hydroseed all areas with a mixture of approved seeds and ameliorants based on dedicated soil fertility sampling and analysis.

Table 14: Leeuwpan unscheduled closure volumes (based on information provided)

PIT	Area to be Backfilled and top soiled (Ha)	Volume required (m^2)	Volume available (m^3)	Overburden stockpile footprint (m^2)	Balance (m^3)
Witklip/Midklip	17.41	327,657.00	160,417.00	21,382.00	-167,240.00
Block OG	15.80	135,271.00			-135,271.00
Block OH/OM	76.70	4,521,722.00			-4,521,722.00
Block ODN	14.89	2,667,402.00	551,314.00	101,966.00	-2,116,088.00
Block ODS	27.40	4,898,969.00			-4,898,969.00
Block MBV	91.00	11,326,612.00	3,326,196.00	203,855.00	-8,000,416.00

PIT	Area to be Backfilled and top soiled (Ha)	Volume required (m^2)	Volume available (m^3)	Overburden stockpile footprint (m^2)	Balance (m^3)
Block WTN	65.10	5,771,363.00	126,043.00	35,850.00	-5,645,320.00
Block OJ	40.49	3,556,255.00	1,317,915.00	140,935.00	-2,238,340.00
Block OI	16.40	2,354,041.00	795,643.00	197,029.00	-1,558,398.00
Dispatch					
WaterTank			2,954,232.00	191,813.00	2,954,232.00
Total	**365.19**	**35,559,292.00**	**9,231,760.00**	**892,830.00**	**-26,327,532.00**

14.0 ADDRESSING CURRENT BACKLOGS: 5-YEAR REHABILITATION PLANNING

The mine plan to address the rehabilitation backlog status over the long term is presented in this section. It is important to note that information is based on The April 2018 survey consolidation provided. The Annual Rehabilitation Plan, also based on April 2018 figures, for the current 12-month period is discussed in Report C.

Leeuwpan has a five-year rehabilitation plan on the table to address the current backlogs. The areas indicated in Table 15 and depicted in Figure 10 (annual values) and Figure 11 (cumulative values) have been measured off the mine and rehabilitation planning block plan provided by the mine (refer to Figure 1). The five-year plan (2019 – 2023) reflected here must be seen in relation to the overall backlog status of the mine, the following is noteworthy:

- The total disturbed area will increase from 960 ha to 1 092 ha as an additional 135 ha is mined between 2019 and 2023;
- The **backfilling backlog** will increase slightly from 407 ha to 439 ha in the 5-year period, as 100 ha will be backfilled against the 135 ha mined out;
- The vegetation establishment backlog will decrease by 318 ha by implementing vegetation measures across 450 ha between 2019 and 2023. The vegetation backlog will stand at 586 ha at the end of the 5-year period;
- The total area rehabilitated will improve from 55.6 (Kenbar pit only) in 2018 to 506 ha, leaving the difference between disturbed areas and areas vegetated at 587 ha – mostly requiring backfilling and topsoil placement; and
- The period between 2024 when all other pits are mined out and 2029 when OI is mined out will require the rehabilitation of about 562 ha of backlog and the planned 16 ha related to the OI final void.

The following aspects require further attention to improve the resolution of the rehabilitation planning:

- Backfill volume from concurrent operations vs backfill volumes from existing stockpiles, particularly relating to the 587 ha to be completed between 2024 and 2029 which includes 439 ha of backfilling;

- Predictive modelling of the final void configuration to confirm the volumes required for the closure of OI; and
- Topsoil balance including in-situ material to be stripped and live placed, placement from existing stockpiles and additional stockpiling if required.

Table 15: Summary of the Leeuwpan 5-year rehabilitation plan

Year	Area to be mined (ha)	Cumulative area to be mined (ha)	Area to be backfilled (ha)	Cumulative backfill area (ha)	Total area to be grassed (ha)	Cumulative area to be grassed (ha)
2019	34	34	20	20	84	84
2020	17	51	28	48	223	307
2021	24	75	21	70	0	307
2022	30	106	14	84	95	402
2023	27	132	16	100	48	450
Totals	**132**		**100**		**450**	

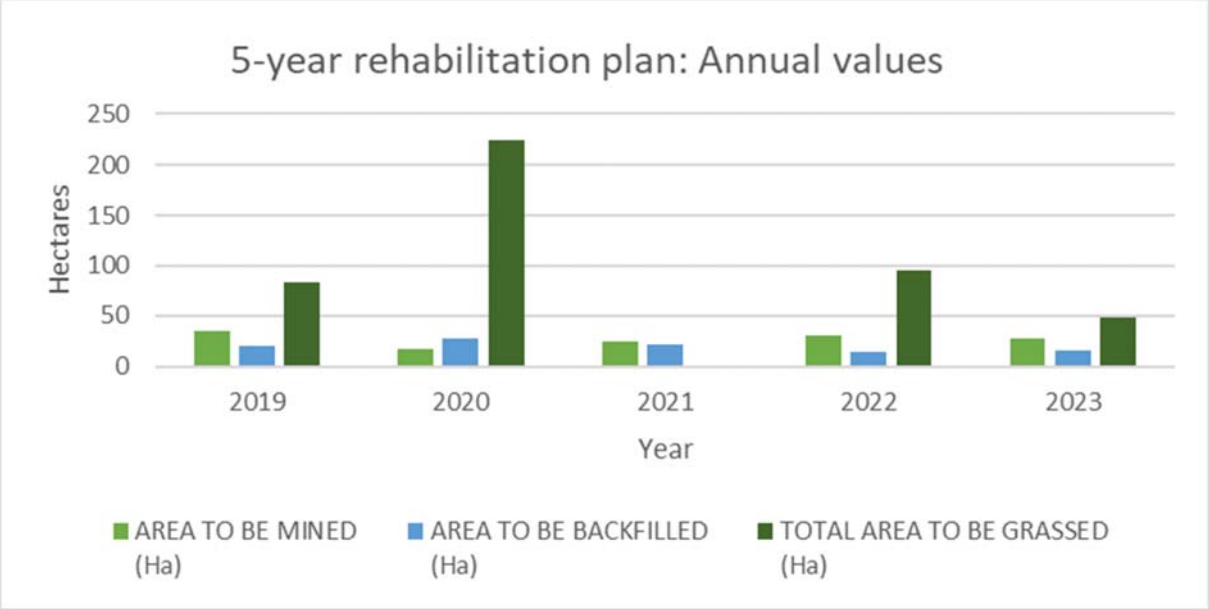


Figure 10: Leeuwpan five-year rehabilitation plan - annual values

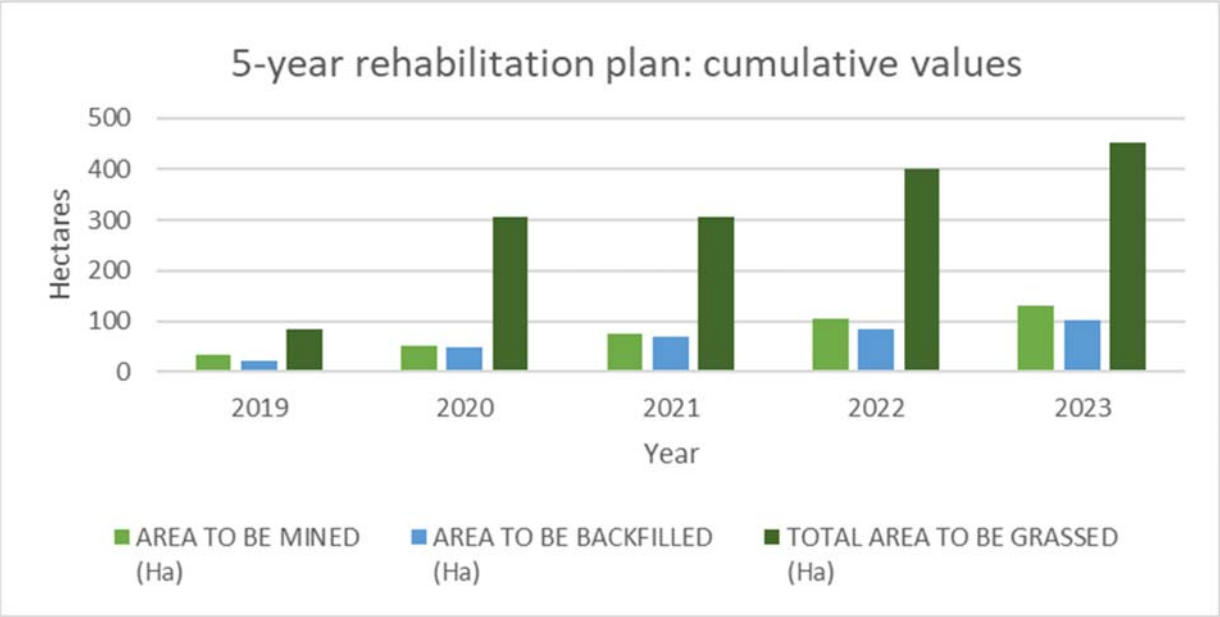


Figure 11: Leeuwpan five-year rehabilitation plan - cumulative values

15.0 NEXT LAND USE PLAN

The development of a comprehensive next land use plan has been highlighted as a current gap. The mine has initiated a process to develop such a land use plan and the outcomes should be incorporated into the required annual updates of this closure plan as information becomes available. The land capability and land uses determined during the EMPr development in 2013 is summarised below.

15.1 Land capability and land uses (2013)

The land uses within the mining right boundary (4 241.4 ha) defined in the EMPr (approved in 2015) were compiled by TerraAfrica (2013). Mining activities had already taken place across a large portion of the area and no pre-mining land uses/capability data is available for these areas. The following is notable:

- Land use of the proposed Leeuwpan Coal Mine Block OI and OL study area consists of mainly of crop production and cattle farming;
- Arable areas are typically under centre pivot irrigation due to the availability of underground water and the high crop production potential of soils (and some fields for dryland crop production (approximately 295.3 ha);
- Dryland crop production accounts for approximately 1 241.9 ha;
- Cattle farming (grazing) is practiced across an estimated area of 1 740.7 ha; and
- Areas with restricted soil depth and temporary water saturation are used grazing, the average grazing capacity for the area is 5 ha/LSU (large stock unit).
- Areas where wetlands occur are also being used for grazing purposes resulting in disturbance of wetland vegetation.

The farm Rietkuil is operated as an independent farming unit producing of maize, sunflowers and soya beans as well as cattle and sheep farming. The town of Delmas is in close proximity to the study site and the larger region is dominated by a mix of land uses including increasing mining activities, crop production and town development.

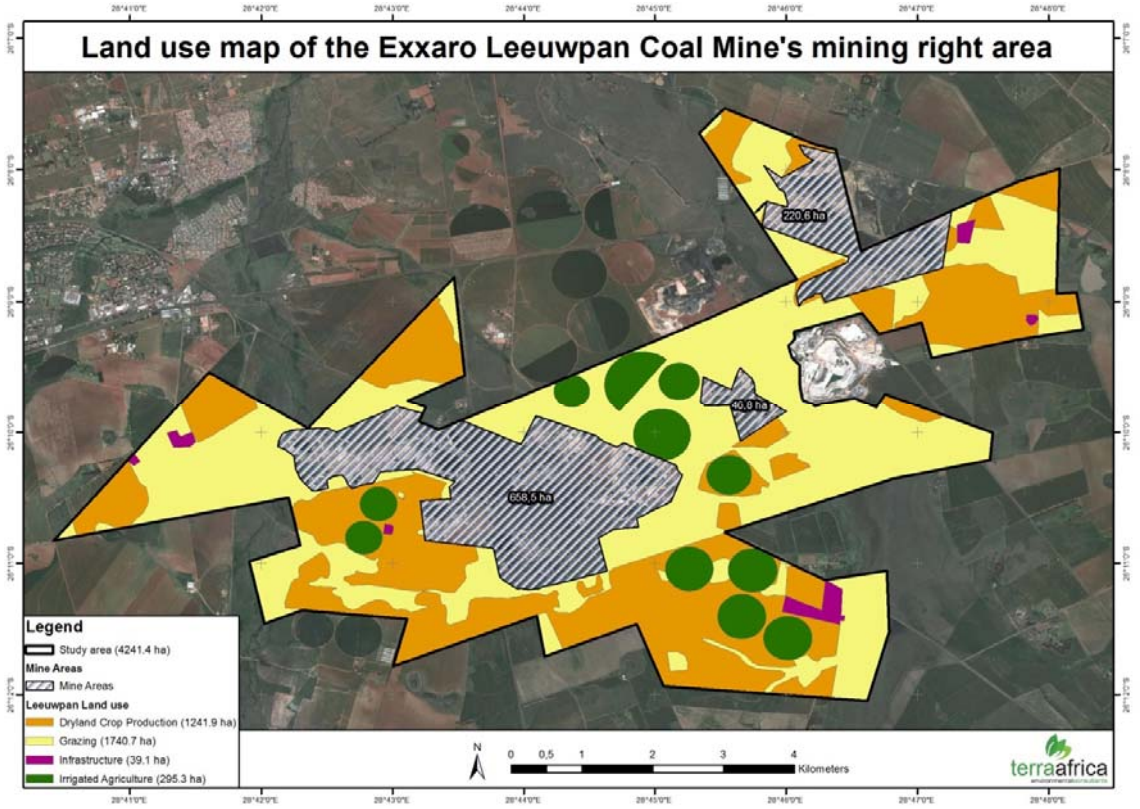


Figure 12: Land use map for Leeuwpan's mining right area (EMPr 2015)

Land capability classes were determined by TerraAfrica aligned with the guidelines outlined in Section 7 of The Chamber of Mines Handbook of Guidelines for Environmental Protection (Volume 3, 1981). The land capability is based on evaluating and categorizing soil properties such as effective soil depth, mechanical limitation, internal drainage, soil texture, soil structure, erosion susceptibility and slope percentage, with the following outcomes:

- Arable land capability (1 609.3 ha or 37.9% of the total area) consisting of deep to medium deep sandy clay-loam and clay-loam soils suited to both dryland and irrigated crop production;
- A total area of 830.1 ha (or 19.6% of the total mining right area) has grazing land capability on shallower soils with a tendency to get water saturated during the rainy season;
- Soil with wetland land capability has been identified on 873 ha (20.6% of the entire study site) of soil with hydromorphic soil and these are directly associated with permanent and seasonal wetlands identified on site by the wetland specialist;
- The area where soil profiles show significant anthropogenic activities (the Witbank soil form) has industrial or wilderness land capability (4.7 ha or 0.11% of the study area);
- The areas where mining activities are currently active and land has not been rehabilitated can technically be classified as having wilderness land capability but as the land is still targeted for rehabilitation which will change the land capability, this is excluded from the areas of wilderness land capability.

The outcomes of the land capability assessment done for the rehabilitation completed at Kenbar and OM/OH open pits are discussed Report C under the Annual Rehabilitation Plan.

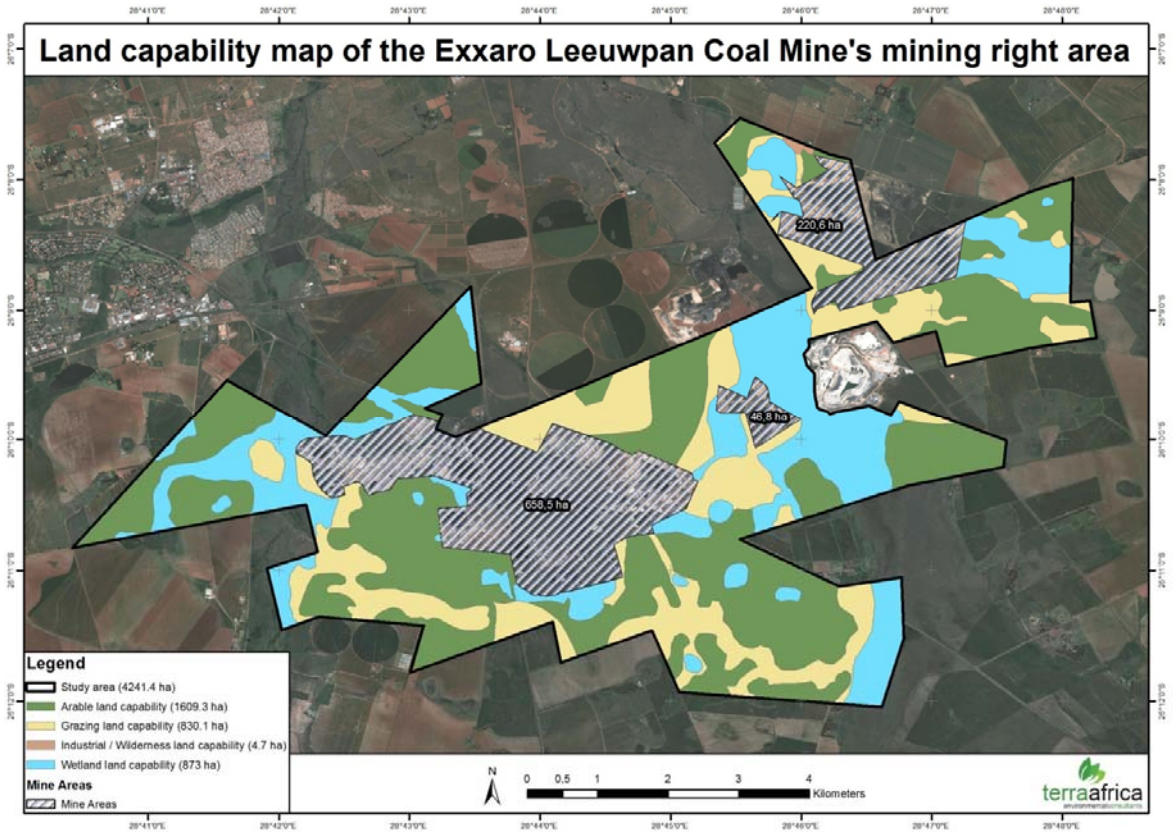


Figure 13: Land capability map for the Leeuwpan mining right area (EMPr 2015)

15.2 Next land use vision

The next land use vision will be defined as part of developing the next land use plan. To realise the land use vision and goals, several key factors need to be taken into consideration that will act as drivers and limitations in terms of post-closure land use of the site. These aspects are broadly alluded to below:

- Identifying and considering the key drivers for planning the next land use for Leeuwpan, which could typically include:
  - Food security;
  - Water availability (considering possible onsite water treatment);
  - Presents or proximity to conservation areas and possible local initiatives; and
  - Proximity to regional urban hubs or agricultural hubs.
- Key limiting factors for next land use planning for Leeuwpan, typically including:
  - Achievable end land use capabilities for rehabilitated land; and
  - Geographic location of the mine; and
- Identifying and evaluating realistic and achievable likely next land use options.

Land capability commitments

The environmental impacts at Leeuwpan are managed through the implementation of the approved EMPr, IWWMP, the RSIP and the rehabilitation specific internal standard practice instruction. The specific commitments to achieving a the post mining land capability of grazing and wilderness (game farming) are summarised in Table 10 section 8.0 of this report.

16.0 CLOSURE ACTIONS AND MEASURES

The closure actions/ measures are largely informed by the EMPr, ERA and next land use objectives. The closure actions detailed in the following tables were developed to implement the next land use, while mitigating environmental risks identified for the mine.

All processing plants and related infrastructure

The following measures are foreseen to reinstate the end land use objectives across these areas:

- Dismantle/demolish all infrastructure until third party agreements have been finalised;
- Demolish and excavate concrete foundations to 1 m below ground level where required for super structures and bunkers; and
- Remove the carbonaceous veneer from the plant footprint and dispose of at the closest final void (assume 300 mm) and dispose of into the final voids below the carbonaceous layer (below the rebounded water table), cover with high clay content soils and compact to limit oxygen ingress;
- Backfill infrastructure footprint where cavities/voids remain after demolition and removal through a cut to fill action to ensure a freedraining surface;
- Manage the various waste streams during the decommissioning and closure process, measures include;
  - Sort and screen waste produced from the dismantling and demolition of infrastructure;
  - Decontaminate steel components and concrete at dedicated decontamination bays utilising exiting infrastructure and dirty water areas;
  - Crush decontaminated concrete, as required, for reuse to infill cavities left by the demolition of surface infrastructure and to take up less airspace during disposal into the open pits;
  - Utilise existing salvage yard or establish a dedicated area for salvaging steel and other equipment;
  - Recycle waste that can be recycled/salvaged (e.g. steel) after decontamination;
  - Transport and dispose of inert demolition waste and decontaminated crushed concrete into the opencast pit; and
  - Transport contaminated demolition waste and asphalt from rehabilitated tar roads to the Holfontein hazardous waste site for safe disposal.
- General level and shape the area to reinstate the surface water flow aligned with the overall site wide drainage framework;
- Recover soils contaminated with hydrocarbons and bio-remediate on-site based on the trials conducted during the operational phase;
- Rip the area to alleviate compaction; and

- Scarify and hydroseed areas with a prescribed seed mix and ameliorants based on dedicated soil sampling and analysis;

Roads and parking areas

The rehabilitation and closure measures for roads and parking areas include:

- Identify and rehabilitate all non-essential roads, except for those required for post-closure monitoring and/or access to infrastructure identified for transfer, aligned to next land use planning (roads to be identified);
- For tar roads onsite, strip asphalt, crush and screen and transport to holfontein hazardous waste site for safe disposal (agreements with third parties should be investigated and concluded prior to closure for safe removal and reuse);
- Rip hardstands and haul roads to alleviate compaction create suitable conditions for vegetation establishment;
- Re-establish natural drainage, including the removal of culverts and/or trenching, to align surface water drainage with the site wide drainage framework;
- Profile the areas to be free draining by levelling and shaping to emulating the natural surface topography; and
- Scarify and hydroseed areas with a prescribed seed mix and ameliorants based on dedicated soil sampling and analysis.

Other services and linear infrastructure

Linear infrastructure requires the following:

- Dismantle and remove the following unless firm agreements are in place with the next land user:
  - all overland and suspended conveyors within the facility;
  - all fencing (especially boundary fencing), including gates, not required to support the next land use;
  - all over head powerlines and transfer to the salvage yard;
  - all above ground pipelines that are not required to be transferred to third parties in the same manner as other non-hazardous material;
  - buried pipelines if required by legislation, and if not, the pipelines will be fully covered with no exposed open ends;
  - remove the railway lines up to the end of the loop
- Further measures for the railway line include:
  - Shape the embankment to align with the surface water drainage framework and bury the ballast in the process;
  - Rip the footprint to alleviate compaction; and
  - Scarify and hydroseed with a combination of an approved seed mix and ameliorants determined through dedicated soil sampling and analysis.

Open pit rehabilitation

The opencast rehabilitation measures are aligned with the summary provided in Table 10, and include the following

- Backfill the OI final void with the following material emanating from the decommissioning and closure activities;
    - carbonaceous veneer recovered from the plant, workshops and haul road footprints, place below the carbonaceous layer and expected rebounded water table;
    - Backfill the pit with decontaminated crushed and screened concrete and inert building rubble from infrastructure demolition.
- To limit possible ground water deterioration the following measures will be implemented to reduce oxygen ingress and water fluctuations over the discard:
    - Place carbonaceous veneer, sediment from dam basins and removed HDPE liners (to be cut up) from the rehabilitation of the constructed water management dams on-site into the pit below the carbonaceous layer and the expected rebounded water table to ensure flooding;
    - Cover the carbonaceous material with overburden material of a high clay content and compact by traversing over the placed clay as part of the covering process.
- Backfill the remainder of the pit with overburden from stockpile to FLFD design elevations, ensuring the surface is freedraining and aligned with the intended end land use and wetland offset strategy;
- The freedraining landform will maximise clean surface water runoff back into the catchment and further reduce in pit water make to be manged post closure;
- Place topsoil to the specified depth of 0.5 m;
- Rip all affected areas to alleviate compaction; and
- Scarify and hydroseed with a combination of an approved seed mix and ameliorants determined through dedicated soil sampling and analysis.

Surface water impoundments

Leeuwpan in in the process of cleaning and lining all surface water impoundments on site, with most of the existing facilities already upgraded, the following closure measures are included:

- Remove all possible sources of contamination from the dam basins including carbonaceous sediment (200mm or as observed), HDPE liners and concrete liners;
- Dispose of the sediment in the final void in the same procedure as the carbonaceous veneer from the plant footprint and coal discard during operations (Table 10);
- Shred HDPE liners and dispose of in the final void below the carbonaceous layer;
- Doze/cut and fill the dam wall material to cover the dam basin and create a free draining landform;
- Rip all affected areas to alleviated compaction;
- Scarify and hydroseed with a combination of an approved seed mix and ameliorants determined through dedicated soil sampling and analysis.

Post closure measures

- Develop infrastructure as required to pump and treat the excess water make from the backfilled opencast pits and prevent them from decanting into the catchment;
- Conduct surface and ground water quality and quantity sampling (10 years from closure) as a continuation of the operational monitoring period. Utilise the results to verify model predictions for the closure scenario;
- Conduct rehabilitation monitoring and continual care and maintenance of rehabilitated land for a period of 10 years to ensure land capability targets and end land use criteria are met;
- Confirm closure objectives and relinquishment criteria have been achieved, or continually use monitoring results to further mitigate and refine approaches as required until relinquishment criteria are proven.

17.0 OPPORTUNITIES AND THREAT ANALYSIS

An initial high-level opportunities and threats analysis has been done for Leeuwpan mine based on available information. This is the first FDRCP compiled for Leeuwpan and the opportunities / threat analysis can be broadened into a Strengths, Weaknesses, Opportunities and Threats (SWOT) analysis in subsequent updates.

17.1 Purpose of the Analysis

Identify possible closure-related opportunities and weaknesses to focus rehabilitation and closure planning to exploiting major opportunities, whilst avoiding/overcoming weaknesses.

17.2 Findings

First order opportunities and weaknesses identified for Leeuwpan are indicated in Table 16. This allows for the identification of strengths that can be capitalised on, and threats that can be minimised, directly by the mine, and threats that need to be addressed through partnerships and joint efforts.

Table 16: Closure analysis for Leeuwpan –Opportunities and Threats

Opportunities and Weaknesses	
Opportunities *(Favourable or unexploited situations that the environment offers regarding development, which can be harnessed for the project's advantage by proactive management)*	Threats *(Unfavourable conditions that the environment imposes on development which, in the absence of proactive management, could lead to the project's under-performance of failure)*
■ Flexibility offered by the remaining LoM to inform effective closure planning and providing flexibility to improve and optimise on closure options, specifically the optimisation of mass earthworks; ■ Environmental team on the mine with corporate assistance driving mine-wide closure planning; ■ Institutional knowledge to guide appropriate mine closure planning; ■ Technical skills in the form of resources as well as supporting studies/investigations that are available to inform planning; ■ Intimate institutional knowledge of water treatment; ■ Planned concurrent rehabilitation – implementation has started with the aim of addressing the current backlog areas; ■ Availability of appropriate closure fund; ■ Comprehensive environmental monitoring – surface water, groundwater, air, rehabilitation; annual EMP performance assessment undertaken to determine effectiveness/appropriateness of monitoring procedures; ■ Availability of of ground (excess) water reserve at closure, provided appropriate treatment is implemented and only the excess water is used (carbonaceous material must be flooded to prevent AMD); ■ Close proximity to regional agricultural hub of Delmas and relative proximity major urban centres in Gauteng and regional urban hubs in Emalahleni; and	■ Inability to reinstate land capability / rehab to arable state; ■ Large backlog areas that need to be rehabilitated resulting in a large unscheduled closure liability; ■ Potential production-only focus on addressing the backlog areas and minimal focus on accuracy of implementation and rehabilitation quality; ■ Potential limited influence of rehabilitation professionals on the day-to-day operational activities; ■ Lack of monitoring of baseline land capability prior to 2013; ■ Losing institutional knowledge through turnover of mine-specific and corporate environmental staff; ■ Short decant time frames; ■ Reduction of wetland / pan functionality, as well as media focus on wetland mitigation; ■ Change in legislation / political focus / turnover of regulators with site-specific involvement / knowledge, resulting in lack of consistency with regulatory decisions; and ■ Managing stakeholder expectations regarding post-closure land uses, capabilities and/or infrastructure/service for beneficial re-use.

Opportunities and Weaknesses	
Opportunities *(Favourable or unexploited situations that the environment offers regarding development, which can be harnessed for the project's advantage by proactive management)*	Threats *(Unfavourable conditions that the environment imposes on development which, in the absence of proactive management, could lead to the project's under-performance of failure)*
■ Alignment of the mine's SLP and related socio-economic frameworks to regional SDFs and IDPs; ■ Home ownership scheme and limited exposure to long term infrastructure liabilities; and ■ Owning the railway siding, linked to national railway route.	

18.0 ALTERNATIVE CLOSURE ACTIONS/MEASURES

18.1 Unscheduled closure

The candidate opencast rehabilitation and alternative to inform the unscheduled closure scenario and costing is presented in section 13.1 of this report.

18.2 Topsoil stripping and placement

Leeuwpan currently has a detailed rehabilitation process (summarised in Table 10). The specific approach to topsoil stripping and placement is the following:

- Strip the A-horizon separately to maintain the seedbed and soil fertility status;
- Strip the remaining good quality soil for use in rehabilitation;
- Replace the soils in the correct sequence prior to amelioration and vegetation establishment; and
- Stockpile soils with similar properties together according to set procedures.

Topsoil management is a key component to successful rehabilitation but is often not implemented correctly. Although the separate stripping and management of the A-horizon could be considered good practice it could lead to increased compaction and reduced quality of the B-Horizon for the following reasons:

- To strip the A horizon the haul equipment used will have to traverse over the good quality B horizon soils, increasing compaction before the in-situ soils have been stripped;
- Placing the soils in the same sequence will require the ADT's to first place the stripped B-horizon in heaps at the correct spacing and levelling off with a dozer. Even if a Caterpillar D6/D7 size dozer (or equivalent) is used, a level of compaction will occur to the placed B horizon soils; and
- Placing the A-horizon soils over the levelled B-horizon soils will require ADT's to traverse the placed B-horizon soils.

Leeuwpan should therefore consider stripping both topsoil horizons together and applying the necessary topsoil management practices accurately rather than managing them separately.

19.0 IDENTIFIED KNOWLEDGE GAPS

The following knowledge gaps, outlined in Table 17, have been identified during the compilation of this closure plan, and should to be addressed during the operational period to inform further updates of this closure plan to ensure that adequate measures are put in place to improve the accuracy of the planning and costing.

Table 17: Identified knowledge gaps and proposed scheduled for addressing the gaps

Identified Gap	Schedule
Rehabilitation planning ■ The backlog areas to be addressed between 2019 and 2023 are mostly related to areas requiring levelling and shaping and vegetation establishment. The backfilling backlog to be addressed between 2014 and 2019 will require large volumes and mass earthworks. Develop a life of mine- rehabilitation plan to ensure the mass earthworks volumes are understood for each time period, particularly year 2024 – 2029 when only OI is operational and the earthworks required at closure for the OI void;	During operations 2019 - 2029

Identified Gap	Schedule
■ Develop implementation standards to manage the accurate implementation of the existing rehabilitation guideline documents with appropriate sign-off criteria; and ■ Develop the rehabilitation reporting to further align with legislative requirements.	
Topsoil balance Develop a life of mine running topsoil balance as management tool to ensure the following: ■ Quantified topsoil resource that include all current stockpiles, placed soils and soil resources to be stripped ahead of future mining for the life of mine at each pit; ■ Detailed stripping plan indicating the soil type boundaries, expected soil depth, placement planning (location the depth) and/or where it will be stockpiled if necessary; ■ Volumetric assessment of surplus or deficits measured in relation to topsoil placement depths at each pit to achieve the planned end land use; and ■ Clear definitions for each category to be measured and updated periodically in the topsoil balance. It is recommended that this is done monthly as part of the pit survey schedule.	During operations 2019 - 2020
Materials balance The FLFD has provided a basis for further development and optimisation of the materials movement planning at Leeuwpan. The following will improve the accuracy and efficiency of mass earthworks: ■ Develop a predictive mined out landform for the life of mine based on the mining plan and indicating the configurations of the final voids in their planned locations; ■ Compile a volumetric assessment for each pit on a cut by cut basis to inform the materials movement planning; ■ Continually improve on the FLFD by applying a shaping model to the predicted mined out surface to optimise materials movement required to achieve a post mining landform that will support the desired end land use in terms of allowable slopes and surface water drainage framework; and ■ Ensure that the design is informed by specific design criteria for each pit, including but not limited to: ▪ Governing elevations including surface water bodies and the site wide drainage framework, predicted decant elevations, flood lines etc.;	During operations 2019 – 2020 and aligned with changes to the mining plan should they occur

Identified Gap	Schedule
▪ Calculated evaporative capacity; ▪ Post mining land use slope specifications; and ▪ Optimised materials movement categories for the closure of each pit including low wall shaping, highwall shaping or infilling and additional measures to ensure free draining.	
End Land use plan ■ Conduct the require specialist work to develop a comprehensive next land use plan for Leeuwpan.	During operations 2019 - 2020
Contaminated land ■ Contaminated land assessments should also be undertaken over the plant and workshop areas.	During remaining operational period
General aspects ■ Optimise the mass earthworks to address the backlog and implement concurrent rehabilitation as an integrated part of the mining process. The placement of all material should be defined and managed to limit potential re-handle and ideally place the stripped overburden and topsoil in its final location; ■ Regularly review and update of the closure costs to ensure that closure costing, on which the financial provisions are based on are up to date. This will also help in limiting last-minute significant changes in closure costs as well as any changes in the closure costing approach; and ■ Regular updates of survey data, infrastructure plans (as required) and aerial images to assist with closure cost determinations.	During operations 2019 – 2020 Annually During operations aligned with the survey programme
Recommended work to inform post-closure water treatment costs ■ Define treated water quality requirements (i.e. end-use for treated water, aligned to the next land use planning/requirements); ■ Define the expected in pit water qualities that will require treatment at decant; ■ Conduct a site-specific study (at PFS/Feasibility level) to determine the optimal water treatment requirements and plant design for Leeuwpan. The plant design should cater for different product streams with different water qualities required to support the next land use plan; ■ Investigate the possibility of establishing a regional water treatment scheme with other mining operations in the area, to potentially optimise collection, distribution and waste management/disposal infrastructure;	■ During the remaining operational period

Identified Gap	Schedule
■ Continue to improve Leeuwpan's water and salt balance by refining the existing geohydrological and geochemical models for the total mine, to inform the selection of the preferred water treatment technology adopted, and to minimise water treatment costs as far as possible.	
Stakeholder engagement ■ Although stakeholder engagement is continuously being undertaken by the mine during the operational period, evidence and minutes of the meetings should be kept, to ensure that expectations and concerns are recorded and addressed appropriately during the operational period so that at closure alignment is obtained; ■ Continue with, and ramp-up, closure-focused stakeholder engagement during the remaining operational period, via the implementation of a closure-specific stakeholder engagement strategy/plan; and ■ Leeuwpan needs to put in place the necessary security and monitoring measures to ensure community invasion of land does not occur. Where possible formal lease agreements could be put in place with farmers/land users, who could provide livelihoods for surrounding communities, until final closure when the land is sold to the end land user.	■ Throughout the operational period

20.0 MONITORING, AUDITING AND REPORTING REQUIREMENTS

20.1 Audit and reporting requirements for the closure plan

A schedule in Table 18 outlines the typical internal, external and legislated audits of the closure plan expected for the year, and includes the required reporting that is usually undertaken to ensure that this closure plan is implemented as required on an annual basis.

Table 18: Schedule outlining internal, external and legislated audits and reporting of the closure plan

Type of audit	Name of audits	Responsibility	Frequency of audits	Approximate schedule	Approach taken to address and close out audit findings
Internal	Water Use Licence audit	Site environmental coordinators	Annual	Q1	Internal audit findings are captured in the site Environmental Management System (EMS) as actions for implementation and close-out. Resources (people and funds), and timeframes, are assigned to all audit findings, and progress
	Legal compliance audit	Permitting specialist	Every 2nd year	Q1	
	Environmental Performance Audit	Site environmental coordinators	Annual	Q2	
	ISO14001 EMS audit	EMS specialist	Annual	Q2	

Type of audit	Name of audits	Responsibility	Frequency of audits	Approximate schedule	Approach taken to address and close out audit findings
	GN704 water audit	Water specialist	Annual or every 2nd year	Q3	is tracked on an EMS platform
	Closure knowledge gap audit (Section 19.0)	Site environmental coordinators	Annually	Throughout the year	
External	Closure cost and closure plan update	External closure and rehabilitation specialist	Annually	As per financial year end	Closure costing report and closure plan to be submitted to external auditors
	Water Use License audit	External water consultant	Annual	Q3	Capture external audit findings in the site Environmental Management System (EMS) as actions for implementation and close out. Resources (people and funds), and timeframes, are assigned to all audit findings, and progress is tracked on an EMS platform
	Legal compliance audit	External legal compliance consultant	Every 2nd year	Q2	
	Environmental audits	External environmental consultant	Annually (comprises of old EMPr PAR and audit of environmental authorizations)	Q4	
	ISO14001 EMS audit	External EMS consultant	Annual	Q3	
	GN704 water audit	Appointed water consultant	Annual or every 2nd year	Q4	

20.2 Monitoring programme and site relinquishment criteria

The rehabilitation performance of all areas rehabilitated after decommissioning and closure, but prior to site relinquishment (i.e. the pre-site relinquishment monitoring period), will be documented in a dedicated biannual rehabilitation performance report until site relinquishment criteria are met. The report should reflect on the findings of the monitoring undertaken, rehabilitation performance and whether corrective action is required.

The rehabilitation monitoring programme and proposed preliminary site relinquishment criteria (including required analysis criteria for surface rehabilitation and surface and groundwater) are presented in Table 19.

The monitoring programme and site relinquishment criteria were developed for the following purposes:

- To establish and create a post-closure knowledge base, that is comparable to the operational phase knowledge base;
- To demonstrate compliance with regulatory requirements (such as instream water quality as per the water use licence); and
- To demonstrate success/performance of the implemented closure measures (i.e. to demonstrate that the site relinquishment criteria have been achieved) in support of a final closure certificate.

21.0 SCHEDULE OF ACTIONS FOR THE CLOSURE AND POST-CLOSURE PERIODS

A schematic illustration of the roll-out of actions to be implemented at closure, and during the post-closure care and maintenance period, as perceived at this stage, is indicated in, is indicated in Table 20.

It is expected that decommissioning and rehabilitation will not exceed a period of two years. This will be followed by an appropriate period for care and maintenance with associated performance monitoring. Provision has been made to conduct care and maintenance for 10 years, however, this care and maintenance will need to continue until site relinquishment.

Notwithstanding the proposed schedule above, the post-closure performance monitoring period will need to be continued until it can be demonstrated that the site relinquishment criteria have been achieved, and/or that the trajectory for success has been clearly established. The performance monitoring and relinquishment criteria developed by Golder is proposed for Leeuwpan, summarized in Table 19, and can be refined as required in subsequent annual updates. An initial operational monitoring plan is proposed in Report B.

The post-site relinquishment period is that period after the mine has been issued a closure certificate, and for which financial provision needs be made to manage all long-term residual risks/impacts identified (particularly water treatment).

Table 19: Proposed monitoring programme and preliminary site relinquishment criteria for Leeuwpan

Monitoring				Site relinquishment criteria		Reporting and corrective action	
Component/aspect	**Monitoring objective**	**Monitoring network**	**Monitoring method and frequency**	**Metrics/target**	**Initial criteria (performance success)**	**Reporting**	**Recommended corrective action**
Surface water							
In-stream surface water quality	To monitor changes (improvement) in surface water quality following final rehabilitation at closure (to determine when water quality objectives and targets are met)	Review operational surface water monitoring and sampling network, to ensure monitoring points are appropriate for the post-closure situation	Collect surface water samples monthly for chemical analysis by an accredited laboratory (monitor parameters stated in WUL). Sample monthly for one year after the final rehabilitation activities, then revaluate frequency of sampling Conduct in-field measurements for pH and EC (as a minimum) when samples are collected – to allow for immediate corrective action if non-compliances are detected Monitoring will continue for at least 10 years post-closure (or until a closure certificate is issued)	In-stream water quality targets set in WUL for samples collected from the monitoring points at the mine site as stipulated in the WUL	Surface water quality has improved to meet the WUL water quality thresholds Or Surface water quality has improved to comply with the Water Quality Management Objectives (WQMO) as defined as the Reserve for the area in the WUL	Surface water monitoring reports and data will be submitted to the DMR on a monthly basis as per the WUL (but amend to six-monthly frequency on closure)	Investigate the cause of any non-compliance in surface water quality leaving the site (using the source – pathway – receptor model) and address the contaminant source with improved rehabilitation and / or appropriate mitigation measures if required
In stream surface water flow	To monitor the recovery of catchment yield after closure rehabilitation has been completed, ensuring the long-term integrity of the surrounding rivers		Measure streamflow on a monthly basis, when doing water quality sampling Continue for 10 years post-closure	No target	Water flow measurements demonstrate that rehabilitation efforts have increased catchment yield as compared with the operational phase	To be included as part of the surface water monitoring report above	If flow decreases – investigate cause and implement corrective action if required
Biomonitoring	To monitor the health and ecological integrity of aquatic life in the surrounding catchment systems, and to track changes over time with the intention of assessing changes in relation to changing water quality and other potential mining impacts	Review operational bio- monitoring and sampling network and revise, as advised by a specialist Include upstream and downstream sampling sites in streams and drainage lines that could potentially be affected by mining operations	Conduct aquatic bio monitoring surveys annually in spring (using SASS5 methodology), and include an assessment of habitat quality using the Integrated Habitat Assessment System (IHAS) Bio monitoring will continue for at least 5 years post-closure (or until a closure certificate is issued)	Biomonitoring target set in WUL. Downstream SASS scores are less than 20% of upstream scores on affected (monitored streams), and the downstream ASPT scores are less than 10% of upstream scores	SASS 5 bio monitoring demonstrates that the ecological integrity and aquatic health of potentially affected streams has either been maintained or improved (PES scores are maintained or improved) Habitat integrity has not deteriorated directly downstream of the operational area	An annual bio-monitoring report will be submitted to the authorities for evaluation and comment based on agreed to timeframes	Investigate the cause of any bio-monitoring anomalies that indicate water quality deterioration and negative aquatic health impacts, and apply appropriate mitigation measures if required

Monitoring				Site relinquishment criteria		Reporting and corrective action	
Component/aspect	**Monitoring objective**	**Monitoring network**	**Monitoring method and frequency**	**Metrics/target**	**Initial criteria (performance success)**	**Reporting**	**Recommended corrective action**
Groundwater							
Groundwater quality	To monitor ground water quality in both natural aquifers and mine workings, to track water quality changes (improvements) over time as a result of closure rehabilitation activities	Review operational groundwater monitoring and sampling network and revise as advised by a specialist	Review the operational groundwater monitoring plan and program, and revise to meet post-mining monitoring needs by: Ensuring that key borehole sampling sites are retained (or new ones introduced as required) to monitor groundwater quality at key points in the mining right area Continuing to monitor the comprehensive suite of water quality parameters that allow an ion balance to be calculated (same as those analysed during operations) - provides assurance on accuracy of lab results, and ensure that all potentially harmful cations and anions are analysed Groundwater samples will be collected quarterly for chemical analysis by an accredited water laboratory Monitoring of boreholes will continue for at least 10 years post-closure (or until a closure certificate is issued)	Water quality analyses show that groundwater at and beyond the mine boundary meets the National Water Quality Standards for potable water at 95th percentile (or as a minimum have a chemistry typical of baseline groundwater quality of the area) The groundwater monitoring plan is able to demonstrate the movement and extent of any contaminated groundwater plumes Offsite borehole water qualities are not impacted by the closed mine, and do not impact neighbours The calculated ion balance for each water sample does not exceed a 5% imbalance (sanity check on lab results)	Groundwater samples show improving water qualities trending towards background levels	Results and findings will be compiled into a quarterly water report, with attached laboratory results An annual compliance report will be compiled and submitted to the authorities for evaluation and comment	Investigate the cause of any non-compliance in borehole water qualities (using the source – pathway – receptor model) and develop appropriate mitigation measures to reduce the generation of contamination at source where possible, or to contain or intercept polluted groundwater movement towards sensitive receptors where this is necessary
Groundwater flows/ levels	To monitor the piezometric (water table) levels in all bore openings to determine the dewatering impacts of mining, and to measure the rate of recharge to underground workings in closed mining areas	Water table heights measured at the same borehole sampling sites as above	Groundwater levels measured quarterly Monitoring will continue for at least 10 years post-closure (or until a closure certificate is issued)	Movements in groundwater level (mamsl/mbgl) to determine groundwater recharge rate	Rate of recharge of mine water corresponds with modelled predictions of the recharge rate Mine water levels stabilise at predicted levels and do not enhance predicted seepage/decant rates	Results and findings will be compiled into a quarterly site groundwater water report	Reassess and revise groundwater management plan for the mine to manage and mitigate possible water contamination

Monitoring				Site relinquishment criteria		Reporting and corrective action	
Component/aspect	**Monitoring objective**	**Monitoring network**	**Monitoring method and frequency**	**Metrics/target**	**Initial criteria (performance success)**	**Reporting**	**Recommended corrective action**
Surface rehabilitation							
Land capability	To measure rehabilitation performance against the land capability objectives committed to as part of next land use planning	All areas disturbed by mining activities and land reinstated by rehabilitation activities	Conduct a post-mining land capability assessment that includes: An assessment of soil depth and soil bulk density on a 100 x 100 m grid Digging of a soil test pit every 9 ha (or similar), to: Collect soil samples for lab analysis of soil properties (bulk density & soil texture), record rooting depth, root density, and bio-perturbation, collect soil samples for lab analysis of soil (pH, resistance, organic carbon, major cations and anions) Create land capability map for rehabilitated sites according to the Chamber of Mines' Rehabilitation Guidelines (2018) or other as defined Land capability assessment is typically a once-off exercise on rehabilitated units within 3 years of completion of the rehabilitation work	Land capability commits are achieved	Site has an accurate post-mining land capability map based on ongoing assessment according to site-wide land capability commitments The areas rehabilitated to different land capability classes in the post-mining landscape do not vary by more than 10% from defined land capability targets		Consult with DMR on any land capability shortfalls that cannot be addressed with available topsoil resources and agree new post-mining land capability targets that will determine the scope of post-mining land uses, that can then be communicated with key stakeholders as part of the mine closure process Use topsoil stockpile reserves, if available, to improve land capability, where possible In-fill areas where differential settling has occurred, and re-shape to be free draining (towards maintaining prescribed land capability soil depths)
Soil fertility	To achieve basal soil fertility levels that will support a self-sustaining vegetation cover (within 5 – 10 years of completion of rehabilitation)	All areas disturbed by mining activities and land reinstated by rehabilitation activities	Sample rehabilitated soils annually for the first 3 years, and every 3 years thereafter until fertility targets met or a closure certificate is issued Analyse samples at a certificated soils laboratory	Soil fertility meets the minimum requirements for maintenance of grassland/pastures. Proposed soil parameters for the soil analyses indicated: ■ pH in range of 5.0 to 8.5 ■ Resistance is >300 Ω, ■ P is >20 mg/kg, and ■ K is >100 mg/ ■ N is in adequate supply so as not to induce yellowing of vegetation	Soil analyses indicate that soils on rehabilitated areas are not salinized, have the correct pH, and have sufficient levels of fertility to support a sustainable vegetation cover.	Findings will be reported in a soil fertility report, after each assessment	Where soil is deficient, ameliorate sufficiently to address the deficiency and to provide a sustainable vegetation cover in support of the next land use
Surface erosion	To monitor rehabilitated areas for soil erosion to	All areas disturbed by mining activities and	Conduct visual inspections for erosion (sheet, rill, and gulley erosion) on an	Visual inspections of rehabilitated areas indicate that erosion has been	No new erosion seen on rehabilitated land after 5 years	Findings will be reported in an internal	Eroded areas will be stabilised by infilling and reshaping, and by

Monitoring				Site relinquishment criteria		Reporting and corrective action	
Component/aspect	**Monitoring objective**	**Monitoring network**	**Monitoring method and frequency**	**Metrics/target**	**Initial criteria (performance success)**	**Reporting**	**Recommended corrective action**
	ensure that a self-sustaining vegetation cover is established that will minimise soil loss through raindrop impact and rainfall runoff erosion	land reinstated by rehabilitation activities	annual basis for the first 3 years (end of wet season), and every 3 years thereafter until landform equilibrium is met	stabilised by rehabilitation activities, and is not significantly higher than surrounding natural areas		rehabilitation report after each assessment	establishing vegetation on the repaired areas/ bare patches, as required
Vegetation establishment	To ensure the successful establishment of suitable perennial grass species on rehabilitated areas, and that these perennial species persist in the rehabilitated landscape	All areas disturbed by mining activities and land reinstated by rehabilitation activities	Monitor the establishment and persistence of vegetation on rehabilitated areas (species composition and basal cover), using standard pasture assessment methods. To be undertaken by a suitably qualified specialist Monitor annually for 3 years, then every 3 years until a sustainable vegetation cover has been established	The vegetation established on rehabilitated areas should comprise at least 4 perennial grass species, one of which is a creeping grass, and which collectively provide a minimum basal cover of 15% after 3 years	Vegetation on rehabilitated areas comprises at least 4 perennial grass species, one of which has a creeping habit, and that these species provide a basal cover of at least 15% after 3 years	Findings will be reported in an annual rehabilitation report	Where the rehabilitation targets for vegetation establishment are not met, re-seed and apply appropriate adaptive management strategies to correct any deterioration in the species composition and cover (e.g. review defoliation/ fertilisation practices and modify accordingly)
Invasive alien species	To eradicate or control declared Category 1, 2 and 3 invader species on both rehabilitated land and on unmined areas within the mining right area. To minimise the threat posed by invasive species to reinstated natural ecosystems and habitats, and biodiversity	All areas disturbed by mining activities and land reinstated by rehabilitation activities	Conduct a visual inspection for invasive species over the site on an annual basis, focussing on rehabilitated and previously disturbed areas, and on areas where invasive species have been eradicated Inspect annually for the first 3 years after closure, and then every 3 years, at least, until closure	The site is free of declared alien invasive plant species (Category 1 – 3 invader species as per CARA, 1983 & Cat 1a, 1b and 2 as per NEM:BA, 2004)	The site is free of declared alien invasive species (CARA Cat. 1 – 3 & NEMBA 1a, 1b and 2) invader species), and if not compliant the control programmes in place are effective and are eradicating alien invasive plant species	Findings will be reported in a rehabilitation report after each assessment	Where measures do not effectively control/eradicate alien invasive plant species, review control measures and modify to improve effectiveness.

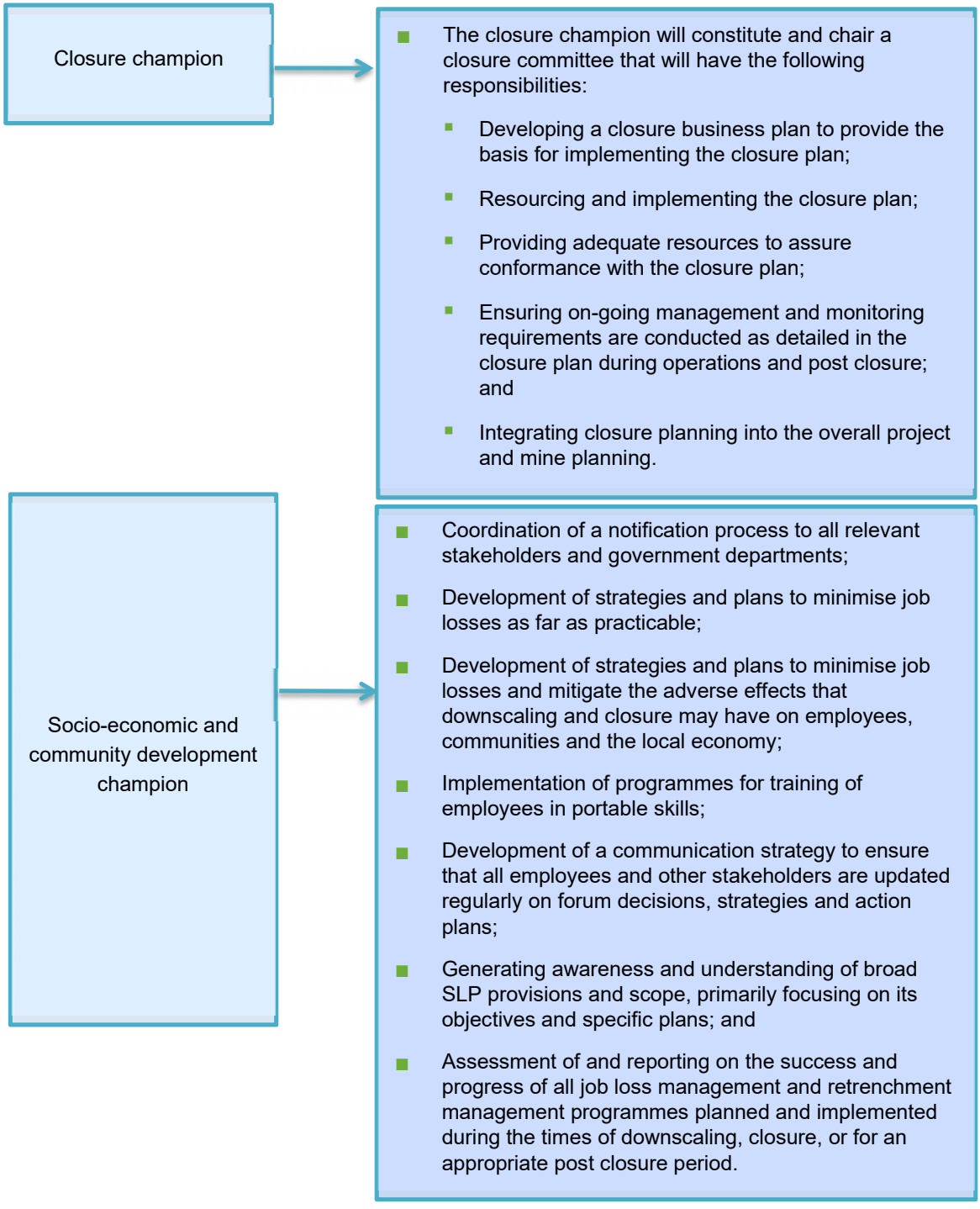
Table 20: Closure action plan and post closure period

ACTION	Remaining operational period	Decommissioning and closure		Post-closure period (Pre-site relinquishment) Post-closure period (Pre-site relinquishment)										Post-closure period (Post-site relinquishment)
		Year 1	Year 2	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11 – onwards (extended as required by the 20-year moving block approach adopted by Exxaro)
Action plan for closure (operational)														
■ Update risk assessment annually to reassess impacts to inform closure measure development/reassessment, and implement closure measures/rehabilitation during operations (concurrently) where possible														
■ Close the knowledge gaps as identified in Section19.0														
■ Update annual closure costs for required financial provisioning														
■ Update closure plan and Annual Rehabilitation Plan														
■ Conduct ongoing operational monitoring (surface and groundwater, rehabilitation performance etc.) to develop an operational monitoring database, which can later be compared to the post-closure monitoring database to demonstrate a success trajectory towards achieving the site relinquishment criteria required for closure														
■ Undertake the necessary stakeholder engagement with relevant I&AP's with respect to closure planning, with emphasis on the planned next land use														
■ Identify possible post-closure business and livelihood opportunities and investigate the feasibility and potential implementation thereof, to inform portable skills offerings to mine employees														
■ Assess and put in place the required agreements for the post-closure transfer of usable/beneficial infrastructure to third parties as/if required														
Decommissioning (closure, pre-site relinquishment and post-site relinquishment)														
■ Decommission and demolish/remove all surface infrastructure														Provision made for a 20-year moving block of water treatment - Current 20 year treatment block extends from 2019 – 2032 and allows for 10 years of treatment for the 10% recharge scenario. Water treatment would occur in the years indicated.
■ Undertake transfer of usable infrastructure to pre-determined third parties														
■ Back fill the void and rehabilitate the remaining 16 ha of pit OI														
■ Implement general surface rehabilitation over disturbed footprint areas once all infrastructure has been demolished, removed and adequately/safely disposed of														
■ Rehabilitate access roads not required for post-closure monitoring														
■ Maintain rehabilitated areas and conduct the required inspections and monitoring to demonstrate that the closure measures implemented have been successful, and that site relinquishment criteria have been achieved														
■ Continue pre-site relinquishment monitoring (if site relinquishment criteria have not yet been achieved)														
■ Implement long term water treatment (once groundwater in the final voids has rebounded)														
■ Continue corrective action and monitoring associated with other residual risks														

22.0 ORGANISATIONAL CAPACITY

22.1 Organisations structure

An initial proposed organisational structure is proposed in Figure 14. This proposes the roles and responsibilities needed to execute the closure plan. The key functional roles within the structure are designated to ensure that the knowledge gaps identified are addressed, and that the actions and measures are implemented for seamless transition from operations to closure. The below organisational structure provides a generic structure that can be adapted as required during the operational period.



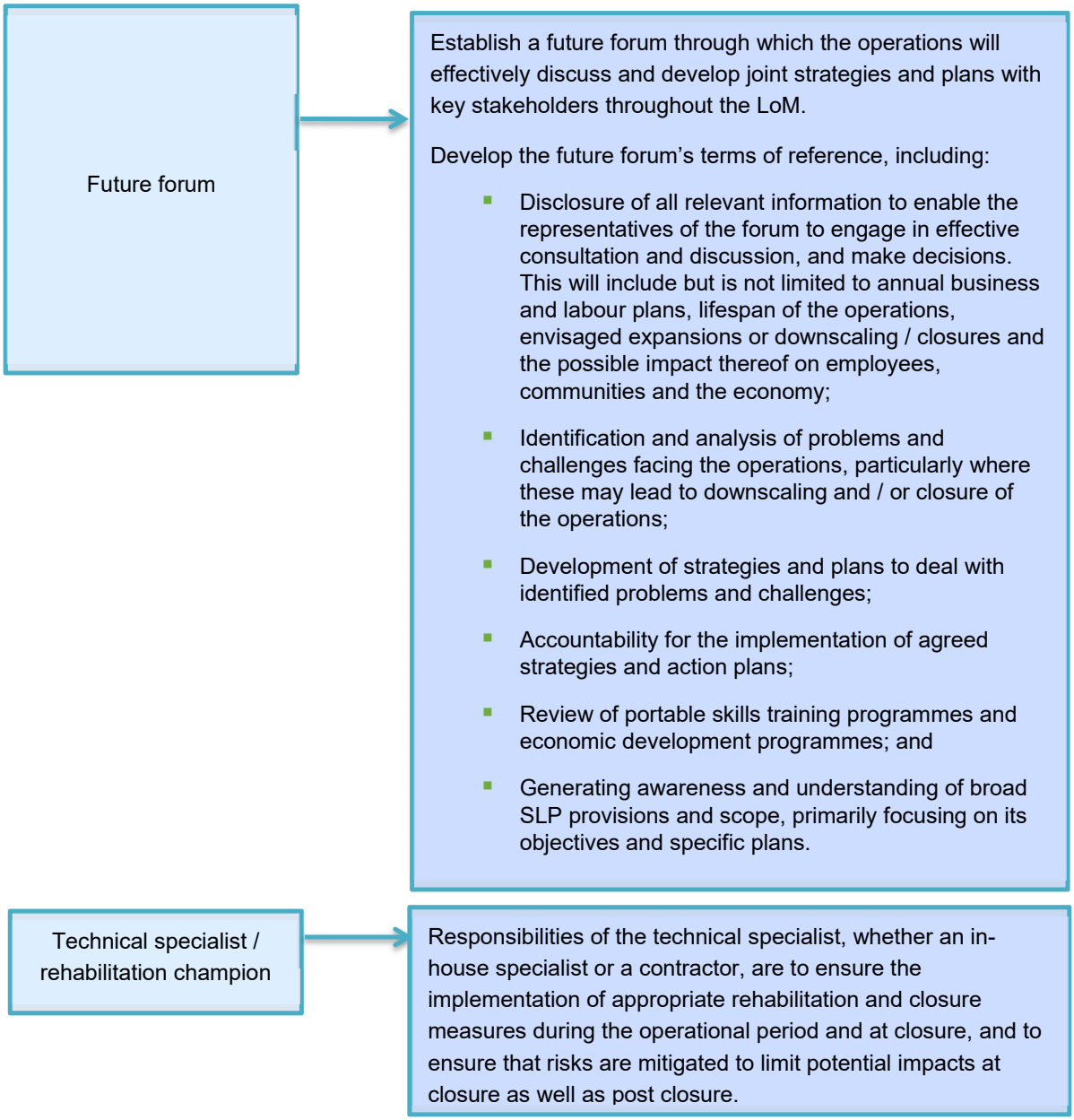


Figure 14: Initial organisational capacity for closure plan implementation

23.0 TRAINING AND CAPACITY BUILDING

As the mine approaches closure, capacity building through training programmes aligned to the above organisational structure must be implemented. This is to ensure that the closure plan is up to date and that the team can implement rehabilitation and closure actions on site. As this closure plan is updated, training programmes are to be developed and implemented as required.

PART A4: CLOSURE COST ASSESSMENT

24.0 CLOSURE COST DETERMINATION

This section details the approach and assumptions applied in the closure cost calculation and summarises the unscheduled and scheduled closure costs estimation. The costs are structured according to the format routinely used for the presentation of closure costs for mine sites as per the following categories:

- Infrastructural areas;
- Mining areas;
- General surface rehabilitation;
- Water management aspects;
- Post-closure aspects:
  - Surface water monitoring;
  - Ground water monitoring;
  - Rehabilitation monitoring and Care and maintenance; and
- Additional allowances:
  - Preliminary and general;
  - Contingencies; and
  - Additional studies.

The summary of the scheduled closure costs as at December 2018 are included in

24.1 Available information

Available information is provided in section 3.0 (Table 1 and Table 2) along with the closure action defined in section

24.2 Approach to determine closure costs

The approach followed to determine the closure costs can be summarised as follows:

- Collect and review background information regarding the site;
- Conduct a site visit to:
  - Hold discussions with site personnel to understand the nature and extent of the operation;
  - Collect further background information, aerial images, layout drawings, surveys and relevant information not yet received;
  - Define the Battery limits for the closure planning and closure cost determination;
  - Understand the status of rehabilitation and remediation activities already implemented on site;

  - View, discuss and Photograph individual aspects related to mining and infrastructure;
  - Determine/identify potential closure-related environmental risks to be considered, and
  - Discuss and understand the scheduled and unscheduled closure scenarios.
- Set-up digital models utilising the relevant survey data and aerial photographs provided;
- Measure all infrastructure based on the aerial photographs and CAD information provided. Quantification and measurement (areas, heights, volumes and load and haul distances) were based on infrastructure general arrangement plans and field observations regarding the construction of each building/component;
- Site orientation and naming of facilities based on discussions during the site visit and limited naming available on associated CAD drawings provided
- Measure future planned mining areas and planned annual rehabilitation areas from the block diagrams provided;
- Verify the volumes for backfill, topsoil placement and stockpiles provided by the mine by recalculating between surfaces within boundaries provided. No dedicated volumetric assessments or landform modelling was conducted;
- Populate the latest Golder costing model which meets the GN1147 requirements with the determined quantities and rates for the full mining area (all areas). The model includes ‘yes/no’ buttons for the toggling of cost items as well as narratives reflecting the assumptions/qualifications made with respect to these cost items; and
- Compilation of this closure costing report reflecting the approach followed, assumptions made with regards to the closure costs, and findings that informed the closure costs.

24.3 Unit rates

The unit rates for general rehabilitation and closure measures and activities were obtained from Golder’s existing database updated in consultation with demolition and earthworks contractors, as well as with rehabilitation practitioners. Golder undertakes a thorough review of its unit rate database, as follows:

- Minor unit rates are adjusted with standard inflation with confirmation less frequent than twice a year;
- Key rates for the dismantling of infrastructure are benchmarked by a specialised demolition contractor, to ensure that they remain market-related and take account of the latest dismantling and demolition techniques. It is noted that as these technologies improve, these rates in real terms are trending downwards;
- Earthworks rates are benchmarked against recent tenders available to Golder as well as benchmarking in discussion with contractors; and
- Aggregated rates dependent on base infrastructure or earthworks-related rates are recalculated given the latest base rates.

24.4 Assumptions and qualifications

24.4.1 General costing assumptions and qualifications

The following general assumptions have been applied:

- The overall closure costs for the site could comprise a number of cost components. This report only addresses surface rehabilitation, decommissioning of infrastructure and the final closure and control of the site that will ensure attainment of the predetermined post mining land use with acceptable environmental and socio-economic effects. This equates to an outside (third party) contractor(s) establishing on-site and conducting the suite of closure related work, ranging from surface rehabilitation to the monitoring/control and corrective action to ensure the desired rehabilitation related outcomes. Other components of the overall costs such as staffing of the site after decommissioning, the maintenance of infrastructure and support services (e.g. power supply, etc.) that may remain and workforce matters such as separation packages, re-training /re-skilling, etc. are outside the scope of this report;
- Based on the above, dedicated contractors would be commissioned to conduct the surface rehabilitation, demolition and closure related work on the site. This would inter alia require establishment costs for the contractors and hence, the allowance for preliminary and general (P&Gs) in the closure costs;
- Allowance has also been made for third party contractors and consultants to conduct post-closure care and maintenance work as well as performance and compliance monitoring;
- Potential handover of infrastructure to third parties at closure will be considered in the closure costing if an agreement is in place with the relevant third party; should no such agreement be in place it has been assumed that the infrastructure will be demolished at closure;
- In accordance with international accounting practices and GN R.1147, no cost off-sets due to possible salvage of dismantled infrastructure has been considered;
- Costs are reflected exclusive of VAT; and
- The costs are presented in present day costs (with no discounting) with longer running costs items, for example the performance monitoring and care and maintenance, etc. reflected as cumulative amounts

24.4.2 Infrastructural aspects

24.4.2.1 Plant infrastructure

Closure Component	Closure cost assessment	
	Unscheduled closure (2018)	Scheduled closure (2029)
Plant infrastructure	Allowances was made for the following: ■ Dismantle/demolish all infrastructure until third party agreements have been finalised ■ Decontaminate steel and concrete at dedicated decontamination bays, making use of existing infrastructure and/or before final dismantling of structures; ■ Demolish and excavate concrete foundations to 1 m below ground level where required for super structures and bunkers; and ■ Remove the carbonaceous veneer from the plant footprint and dispose of at the closest final void (assume 300 mm). Included under General rehabilitation items; ■ Recover soils contaminated with hydrocarbons and bio-remediate on-site; ■ Backfill infrastructure footprint where cavities/voids remain after demolition and removal through a cut to fill action; ■ Rip the area to alleviate compaction; ■ Shape and level the whole area to align with the natural drainage framework; and	As for unscheduled closure

Closure Component	Closure cost assessment	
	Unscheduled closure (2018)	Scheduled closure (2029)
	■ Hydroseed areas with a prescribed seed mix and ameliorants based on dedicated soil sampling and analysis.	

24.4.2.2 Supporting and administrative infrastructure

Closure Component	Closure cost assessment	
	Unscheduled closure (2018)	Scheduled closure (2029)
Workshops, offices and administration buildings, pump stations and parking areas	Allowances was made for the following: ■ Dismantle/demolish all infrastructure until third party agreements have been finalised; ■ Decontaminate steel and concrete at dedicated decontamination bays, making use of existing infrastructure and/or before final dismantling of structures; and ■ Demolish and excavate concrete foundations to 1 m below ground level where deemed appropriate. Included under General rehabilitation items: ■ An allowance is made to bio-remediate soils contaminated with hydrocarbons on-site; ■ Recover the carbonaceous veneer (300 mm) across the whole plant footprint and dispose in the open pit;	As for unscheduled closure

Closure Component	Closure cost assessment	
	Unscheduled closure (2018)	Scheduled closure (2029)
	■ Backfill infrastructure footprint where cavities/voids remain after demolition and removal through a cut to fill action; ■ Rip the area to alleviate compaction; ■ Shape and level the whole area to align with the natural drainage framework; and ■ Hydroseed areas with a prescribed seed mix and ameliorants based on dedicated soil sampling and analysis.	

24.4.2.3 Roads and parking areas

Closure component	Closure cost assessment	
	Unscheduled closure (2018)	Scheduled closure (2029)
Roads	Allowance was made for the following: ■ Identify and rehabilitate all non-essential roads, except for those required for post-closure monitoring and/or access to infrastructure identified for transfer, aligned to next land use planning (roads to be identified); ■ Strip asphalt, crush and screen, remove from site for disposal at Holfontein; ■ Rip hardstands and haul roads to alleviate compaction create suitable conditions for vegetation establishment;	As for unscheduled closure – Other pits mined out in 2024, (excluding proposed UB area) roads would remain for access to rehabilitated areas for monitoring and maintenance.

Closure component	Closure cost assessment	
	Unscheduled closure (2018)	Scheduled closure (2029)
	■ Re-establish natural drainage, including the removal of culverts and/or trenching; ■ Profile to be free draining and emulating the natural surface topography; and ■ Hydroseed areas with a prescribed seed mix and ameliorants based on dedicated soil sampling and analysis.	

24.4.2.4 Services and linear infrastructure

Closure component	Closure cost assessment	
	Unscheduled closure (2018)	Scheduled closure (2029)
Services and linear infrastructure	Conveyors: ■ Dismantle and remove all overland and suspended conveyors within the facility Fences: ■ Remove all fencing (especially boundary fencing), including gates, not required to support the next land use; Power lines: ■ Dismantle and remove all over head powerlines and transfer to the salvage yard;	As for unscheduled closure

Closure component	Closure cost assessment	
	Unscheduled closure (2018)	Scheduled closure (2029)
	■ Remove from the provision as required once agreements for the transfer of useful infrastructure to third parties after operations; Pipelines: ■ Dismantle all aboveground pipelines that are not required to be transferred to third parties in the same manner as other non-hazardous material (provided values used, should be verified during the LoM) ■ Remove buried pipelines if required by legislation, and if not, the pipelines will be fully covered with no exposed open ends (provided values used, should be verified during the LoM) Pipe racks and ducting: ■ Dismantle and remove all pipe racks. Additional 25% was allowed for pipe racks that are not visible on the drawings. (provided values used, should be verified during the LoM) Railways, allowance is made for: ■ Dismantle and remove the railway lines up to the end of the loop; ■ Shape the embankment and bury the ballast in the process; ■ Rip the footprint to alleviate compaction; ■ Hydroseed with a combination of an approved seed mix and ameliorants determined through dedicated soil sampling and analysis.	

24.4.2.5 Demolition waste

Closure component	Closure cost assessment	
	Unscheduled closure (2018)	Scheduled closure (2029)
Demolition waste	Allowance was made for the following: ■ Sort and screen waste produced from the dismantling and demolition of infrastructure; ■ Decontaminate steel components and concrete at dedicated decontamination bays utilising exiting infrastructure and dirty water areas; ■ Crush decontaminated concrete, as required, for reuse to infill cavities left by the demolition of surface infrastructure and to take up less airspace during disposal into the open pits; ■ Utilise existing salvage yard or establish a dedicated area for salvaging steel and other equipment; ■ Recycle waste that can be recycled/salvaged (e.g. steel) after decontamination; ■ Transport and dispose of inert demolition waste and decontaminated crushed concrete into the opencast pit; and ■ Transport and dispose of contaminated building rubble and asphalt at Holfontein.	As for unscheduled closure

24.4.3 Open pit rehabilitation

Closure component	Closure cost assessment	
	Unscheduled closure (2018)	Scheduled closure (2029)
Open pits	Due to the backfill volume deficit across the mine of 26 million cubic meters, an allowance was made for the following (option 2): ■ Level all topsoil heaps previously placed over backfilled areas, allowance is made for shaping a depth of 0.2 m over the footprint; ■ Backfill the closest final void with the following material emanating from the decommissioning and closure activities; ▪ Backfill the open pit with the carbonaceous veneer recovered from the plant footprint, place below the carbonaceous layer and expected rebounded water table; and ▪ Place carbonaceous sediment and removed HDPE liners (to be cut up) from the rehabilitation of the constructed water management dams on-site into the pit. As with the discard/sediment it must be placed below the carbonaceous layer and expected rebounded water table; ■ Utilise all available overburden material in all stockpiles to backfill each pit, allowance is made to backfill about 26% of the void volume to ensure all carbonaceous material is covered; ■ Place topsoil from all available stockpiles to a depth of 0.47 m across the backfilled areas only;	All other mining ceases in 2024 allowing for a 5-year rehabilitation period while OI is still operational. It is assumed that the backlog areas would have been addressed and all pits backfilled and rehabilitated aligned with the FLFD. OI will be the last remaining pit to be mined out in 2029, the following allowance is made for scheduled closure: ■ Backfill the OI final void with the following material emanating from the decommissioning and closure activities; ▪ Backfill the open pit with the carbonaceous veneer recovered from the plant, workshops and haul road footprints, place below the carbonaceous layer and expected rebounded water table; ▪ Place carbonaceous sediment and removed HDPE liners (to be cut up) from the rehabilitation of the constructed water management dams on-site into the pit. As with the discard/sediment it must be placed below the carbonaceous layer and expected rebounded water table, ▪ Cover the carbonaceous material with overburden material of a high clay content and compact by driving over the placed clay as part of the covering process;

Closure component	Closure cost assessment	
	Unscheduled closure (2018)	Scheduled closure (2029)
	■ Establish surface water cut-off berms as required for Witklip to reroute storm water around the shaped void; ■ Rip the footprint to alleviate compaction; ■ Hydroseed with a combination of an approved seed mix and ameliorants determined through dedicated soil sampling and analysis.	■ Backfill the pit with decontaminated crushed and screened concrete and inert building rubble from infrastructure demolition; ■ Backfill the remainder of the pit with overburden from stockpile – assuming 100% of the original OI box cut will remain for this purpose (2.35 million m^3); ■ Place topsoil to the specified depth (0.65 m allowed for), allowance is made to cover 16 ha; and ■ Rip the areas to alleviate compaction; and ■ Hydroseed with a combination of an approved seed mix and ameliorants determined through dedicated soil sampling and analysis.

24.4.4 Impoundments and dams

Closure component	Closure cost assessment	
	Unscheduled closure (2018)	Scheduled closure (2029)
Lined Dams	Allowance has been made for the following: ■ Remove pumps and related equipment; ■ Remove sediment accumulated in the dams to a depth of approximately 200 mm (or as visually observed) and dispose of into the opencast pits;	As for unscheduled closure – assuming all the dams will be dealt with in 2029 for this assessment.

Closure component	Closure cost assessment	
	Unscheduled closure (2018)	**Scheduled closure (2029)**
	■ Remove HDPE liner, cut up and dispose of into the opencast pits; ■ Doze in the dam wall material to cover the dam basin and create a free draining landform; ■ Rip to alleviate compaction; and ■ Establish vegetation on the ripped/scarified areas	
Unlined Dams	Allowance has been made for the following: ■ Remove pumps and related equipment; ■ Remove sediment to a depth of approximately 200 mm and dispose of in pit; ■ Doze/cut and fill the dam wall material to cover the dam basin and create a free draining landform; ■ Rip the area to alleviate compaction; and ■ Establish vegetation on the ripped/scarified areas.	As for unscheduled closure
Concrete Dams	Allowance has been made for the following: ■ Demolish concrete silt trap after the removal of sediment; ■ Remove pumps and related equipment; ■ Remove carbonaceous sediment accumulated in the dams to a depth of approximately 200 mm (or as visually observed) and dispose of into the open pit; ■ Utilise the material in the dam walls to backfill the basin through a combination of dozing and cut and fill; ■ Rip the area to alleviate compaction; and ■ Establish vegetation on the ripped/scarified areas.	As for unscheduled closure

24.4.5 General surface rehabilitation

Closure component	Closure cost assessment	
	Unscheduled closure (2018)	Scheduled closure (2029)
All disturbed areas	Descriptions Included with related infrastructure.	As for unscheduled closure

24.4.6 Water management

Closure component	Closure cost assessment	
	Unscheduled closure (2018)	Scheduled closure (2029)
Stormwater management measures	A nominal allowance has been made to: ■ Establish vegetation/stabilise portions of the river diversions – based on establishing wetland vegetation over 15% of the total surface area.	None, measures would be implemented during the operational period.

24.4.7 Post closure aspects

Closure component	Closure cost assessment	
	Unscheduled closure (2018)	Scheduled closure (2029)
Surface water monitoring	Allowance was made for quarterly monitoring over a 5-year period at six surface water monitoring points	As for unscheduled
Ground water monitoring	Allowance was made for quarterly monitoring over a 10-year period at 20 surface water monitoring points	As for unscheduled

Closure component	Closure cost assessment	
	Unscheduled closure (2018)	Scheduled closure (2029)
Rehabilitation monitoring	An allowance has been included for the rehabilitation monitoring of all rehabilitated areas for a 5-year period	As for unscheduled
Care and maintenance	Care and maintenance of the rehabilitated areas, over a 5-year period, has been assumed	As for unscheduled

24.4.8 Additional allowances

Closure component	Closure cost assessment	
	Unscheduled closure (2018)	Scheduled closure (2029)
Preliminary and general items	An allowance for preliminaries and general amounting to 12% of the total for infrastructural and related aspects (sub-total 1 on summary costing table) has been made	As for unscheduled
Contingencies	A routine allowance of 10% of the total for infrastructural and related aspects (sub-total 1 on summary costing table) has been made	As for unscheduled
Additional studies	An allowance is made for specialist studies and a public participation process in support of relevant applications for closure.	As for unscheduled

24.5 Closure cost summary

The closure cost summaries for scheduled and unscheduled closure for the various scenarios are given below (Table 21).

The estimated unscheduled and scheduled closure costs for Leeuwpan, as at the end of December 2018, amount to approximately **R 694.7 million** and **R 273.9 million** respectively (including P&Gs at 12%, and excluding contingencies and VAT). The costs include the water treatment cost for the 10% recharge scenario (Report B).

Table 21: Scheduled and Unscheduled closure costs for Leeuwpan, as at December 2018

	Closure components	Unscheduled Closure (2018)		Scheduled Closure (2029)	
1	Infrastructural aspects	R	56,998,841.42	R	59,091,033.85
2	Mining aspects	R	402,342,469.13	R	72,749,621.01
3	General surface rehabilitation	R	15,184,182.83	R	16,777,411.07
4	Reinstatement of drainage lines	R	202,814.74	R	-
	Sub-Total 1	**R**	**474,728,308.12**	**R**	**148,618,065.93**
6	**Additional Allowances**				
6.1	Preliminary and general	R	71,209,246.22	R	22,292,709.89
6.2	Contingencies	R	47,472,830.81	R	14,861,806.59
6.3	Additional studies	R	2,800,000.00	R	2,800,000.00
	Sub-Total 2	**R**	**121,482,077.03**	**R**	**39,954,516.48**
5	**Post-Closure Aspects**				
5.1	Surface water monitoring	R	3,686,617.70	R	1,843,308.85
5.2	Groundwater monitoring	R	1,640,743.50	R	1,640,743.50
5.3	Rehabilitation monitoring	R	5,521,679.43	R	2,157,887.79
5.4	Care and maintenance	R	30,492,808.41	R	11,916,674.93
5.6	Contingencies for post-closure aspects	R	4,134,184.90	R	1,755,861.51
	Sub-Total 3	**R**	**45,476,033.95**	**R**	**19,314,476.57**
5	**Water treatment cost**				
7.1.2	10% recharge scenario (capex+2029 to 2039)	R	53,000,000.00	R	66,000,000.00
	Subtotal 4 costs associated with latent and residual risks (subtotal 3 + water treament)	**R**	**98,476,033.95**	**R**	**85,314,476.57**
	Subtotal 5 closure costs (sub total 1 + subtotal 2)	**R**	**596,210,385.15**	**R**	**188,572,582.41**
	Grand Total Excl. VAT. (Sub-total 1 +2 +4)	**R**	**694,686,419.10**	**R**	**273,887,058.98**

PART A5: CONCLUSIONS AND RECOMMENDATIONS

25.0 MATTERS REQUIRING FURTHER ATTENTION

The following recommendations (summarised from Table 14 section 19.0) have been made for improvement of the next update of the ARP:

- Refine the FLFD based on a detailed volumetric assessment;
- Refine the annual rehabilitation plan format and align the survey data with the regulatory requirements in Report C;
- Develop a LoM topsoil balance;
- Implement topsoil stripping controls based on the pre-mining topsoil survey in terms of soil types and depth; and
- Develop implementation standards based on existing guideline documents and the objectives, performance targets and monitoring programme proposed in this first draft.

26.0 CONCLUSIONS

The closure costs as reflected in this report were based on information provided by Leeuwpan. Good practice measures widely adopted by the South African and international coal mining industry were incorporated as deemed necessary.

In those cases where the required information was not available, estimates were made based on Golder's experience in closure cost estimations. For the scheduled and unscheduled closure situations, unit rates for the costing were obtained from Golders' database. Where required, the unit rates were adapted to reflect site-specific conditions.

A number of aspects that require further attention to improve the accuracy of future closure costs have been identified and listed in this report.

Notwithstanding these, the reflected costs provide a good indication of the closure costs as at December 2018, providing a sound basis for making the required financial provision.

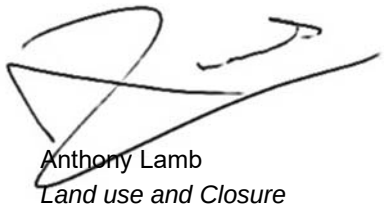
27.0 AMENDMENTS TO CLOSURE PLAN

This is the first closure plan to be developed for Leeuwpan, future updates will consider and document significant amendments and changes material to the planning and costing:

- The closure plan was updated to align to the NEMA (No. 107 of 1998), and specifically the Financial Provisioning Regulations (GN R. 1147 - as amended), gazetted on 20 November 2015. Since the new financial provisioning regulations had not been promulgated at the time of writing this report, the report has been aligned with the GN R. 1147 regulations, as they stand, and the report will be updated to align with the revised regulations, once promulgated;
- As part of the above compliance update, a Residual Environmental Risk Assessment report was compiled (Report B) along with costs to address the residual risk related to pumping and treating ground water;

- An Annual Rehabilitation Plan was compiled by Leeuwpan, reviewed by Golder and included in Report C;
- A preliminary monitoring plan and site relinquishment criteria were proposed for Leeuwpan, to ensure the performance of the rehabilitation undertaken can be assessed and demonstrated when applying for closure; and
- A preliminary operational monitoring plan has been proposed for Leeuwpan. The next step is to develop the existing standards into practical implementation plans. Once this is done the proposed monitoring plans can be revisited as part of the annual updates.

Golder Associates Africa (Pty) Ltd.



Anthony Lamb
Land use and Closure

Johan Botha
Land use and Closure

AL/JB/nbh

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APPENDIX A

Document limitations

DOCUMENT LIMITATIONS

This Document has been provided by Golder Associates Africa Pty Ltd ("Golder") subject to the following limitations:

i) This Document has been prepared for the particular purpose outlined in Golder's proposal and no responsibility is accepted for the use of this Document, in whole or in part, in other contexts or for any other purpose.

ii) The scope and the period of Golder's Services are as described in Golder's proposal, and are subject to restrictions and limitations. Golder did not perform a complete assessment of all possible conditions or circumstances that may exist at the site referenced in the Document. If a service is not expressly indicated, do not assume it has been provided. If a matter is not addressed, do not assume that any determination has been made by Golder in regards to it.

iii) Conditions may exist which were undetectable given the limited nature of the enquiry Golder was retained to undertake with respect to the site. Variations in conditions may occur between investigatory locations, and there may be special conditions pertaining to the site which have not been revealed by the investigation and which have not therefore been taken into account in the Document. Accordingly, additional studies and actions may be required.

iv) In addition, it is recognised that the passage of time affects the information and assessment provided in this Document. Golder's opinions are based upon information that existed at the time of the production of the Document. It is understood that the Services provided allowed Golder to form no more than an opinion of the actual conditions of the site at the time the site was visited and cannot be used to assess the effect of any subsequent changes in the quality of the site, or its surroundings, or any laws or regulations.

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APPENDIX B

Relevant legislation and industry guidelines

LEGISLATION PERTAINING TO MINE CLOSURE

Apart from the GN R. 1147 regulations summarised at the beginning of each Part of the main body of this report, mine closure planning is also required to be compliant with the following legislation:

- Minerals Petroleum and Resources Development Act No. 28 of 2002 (MPRDA). Section 43 states that a holder of a prospecting right, mining right, retention permit or mining permit remains responsible for any environmental liability, pollution or ecological degradation and the management thereof, until the Minister has issued a closure certificate to the holder concerned
- National Environmental Management Act, No. 107 of 1998 (NEMA):
  - If it is determined that a mine, having regard to its known ore reserves, is likely to cease mining operations within a period of five years, the owner of that mine must promptly notify the Minister in writing -
    - of the likely cessation of those mining operations; and
    - of any plans that are in place or in contemplation for the rehabilitation of the area where the mining operations were conducted after mining operations have stopped; and
    - the prevention of pollution of the atmosphere by dust after those operations have stopped.
  - Duty of care to take reasonable measures to prevent significant pollution or degradation of the environment from occurring, continuing or re-occurring or where such pollution or degradation cannot be reasonably stopped or avoided, such person must take reasonable measures to minimize and rectify such pollution or degradation.
- **Environmental Impact Assessment Regulations, 2014.** An application for an environmental authorisation (Basic Assessment) must be submitted for the decommissioning of any activity requiring:
  - A closure certificate in terms of section 43 of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002); or
  - A prospecting right, mining right, mining permit, production right or exploration right, where the throughput of the activity has reduced by 90% or more over a period of 5 years excluding where the competent authority has in writing agreed that such reduction in throughput does not constitute closure.

NEMA Principles

- In terms of section 38 of the MPRDA, holders of reconnaissance permissions, prospecting rights, mining rights, mining permits or retention permits must promote compliance with the principles set out in section 2 of the NEMA, which provide that -
  - The disturbance of ecosystems and loss of biological diversity is avoided, or, wherever it cannot altogether be avoided, is minimised and remedied;
  - Pollution and degradation of the environment is avoided, or where it cannot be altogether avoided, is minimised and remedied;
  - The disturbance of landscapes and sites that constitute a nations cultural heritage is avoided, or where it cannot be altogether avoided, is minimised and remedied;
  - A risk-averse and cautious approach is applied, which takes into account the limits of current knowledge about the consequences of decisions and actions; and
  - Negative impacts on the environment and on people's environmental rights be anticipated and prevented, and when they cannot be altogether prevented, are minimised and remedied.
- **The National Water Act (NWA), Act No. 36 of 1998** requires the following:

- A duty is imposed on the owner of land, a person in control of land or a person who occupies or uses the land to take all reasonable measures to prevent the pollution of a water resource from occurring, continuing or recurring.
- Regulations on the Use of Water for Mining and Related Activities Aimed at the Protection of Water Resources, GN R. 704
- Any person in control of an existing mine must notify the DWA 14 days before the temporary or permanent cessation of the operation of the mine;
- Any person in control of a mine must at temporary or permanent cessation of mining operations, ensure that -
  - Any person in control of a mine or activity must at temporary or permanent cessation of operations ensure that all pollution control measures have been designed, modified, constructed and maintained in accordance with GN R. 704; and
  - Any person in control of a mine or activity must ensure that the in-stream and riparian habitat of any water resource, which may be affected or altered by the mine or activity, is remedied so as to comply with GN R. 704.
- Provision is made for, *inter alia* -
  - Regulation 4: Restrictions on locality regarding infrastructure;
  - Regulation 5: Restrictions on use of material;
  - Regulation 6: Capacity requirements of clean and dirty water systems; and
  - Regulation 7: Protection of water resources.

- **Regulation 7 of GN R. 704:**
  - Every person in control of a mine or activity must take reasonable measures to -
    - Prevent water containing waste or any substance which causes or is likely to cause pollution of a water resource from entering any water resource and must retain or collect such substance or water for use, re-use, evaporation or for purification and disposal in terms of the Act;
    - Cause effective measures to minimise the flow of any surface water or floodwater into mine workings, open cast workings, other workings or subterranean caverns, through cracked or fissured formations, subsided ground, sinkholes, outcrop excavations, audits, entrances or any other openings; and
    - Prevent the erosion or leaching of materials from any residue deposit or stockpile from any area and contain such material or substances so eroded and leached in such area by providing effective suitable barrier dams, evaporative dams or any other effective measures to prevent this material or substance from entering and polluting any water resources.
- **Conservation of Agricultural Resources Act No. 43 of 1983,**
  - Regulation 15 of the Conservation of Agricultural Resources (CARA), Act No. 43 of 1983 provides a list of Category 1 plants (Weeds) and Category 2 and Category 3 plants (invaders) that must be controlled. Category 1, 2 and 3 plants may not occur on any land or inland water surface other than in biological control reserves and must be controlled by means of the methods prescribed in the regulations (unless exemption granted).
- **Constitution of the Republic of South Africa, Act No. 108 of 1996, Section 33:**
  - Everyone has the right to administrative action that is lawful, reasonable and procedurally fair.

- Everyone whose rights have been adversely affected by administrative action has the right to be given written reasons.
- Any application for, for example, a closure certificate or an application for transfer of liabilities and responsibilities in terms of the MPRDA must be considered by the relevant authority according to the criteria contained in Section 33 of the Constitution.
- Where the relevant authority has been given a discretion, that discretion must be exercised in a reasonable manner and without bias, prejudice or any personal agenda.
- Where the state fails to exercise just administration, the decision in question may be set aside by way of an application to court or any internal procedures prescribed by the empowering legislation.

South African good practice

The Department of Water Affairs and Sanitation (DWS) formerly known as the Department of Water Affairs and Forestry (DWAF) – commissioned a series of Best Practice Guidelines (BPG), in partnership with industry, to assist with aspects of DWAF's water management hierarchy. BPG5: Water Management Aspects for Mine Closure, includes the following principles:

- Management measures at closure should primarily be of a passive nature with minimal long-term maintenance and operating costs;
- The final landform must be sustainable, must be free-draining, must minimise erosion and avoid ponding;
- Concurrent rehabilitation must be undertaken in a manner that supports the final closure landform to ensure/avoid that rehabilitation does not need to be redone at a later stage; and
- Land use plan which is directly interlinked with water management issues insofar as water is required to support the intended land use and the land use itself may have an impact on the water.
- Biodiversity plan will address issues that are interrelated with the mine water management plan, particularly regarding the environmental water balance and the effects that mining may have thereon.

The Guidelines for the rehabilitation of mined land developed by the Chamber of Mines (updated 2007) was developed by key industry role players with focus on aspects of opencast mine rehabilitation. Pertinent aspects include:

- Stripping topsoil per a dedicated stripping plan and utilizing the correct equipment to minimise compaction, over stripping and mixing of horizons;
- Implementing concurrent rehabilitation, constructing a post mining landform free of ponding and prioritizing the live stripping and placement of topsoil where possible;
- Limiting topsoil management activities to dry seasons as increased moisture content can also increase the potential for compaction;
- Implementing effective strategies for topsoil stripping, placement and stockpiling to limit compaction; and
- Implementing a soil amelioration and revegetation strategy based on dedicated soil sampling and analysis.

APPENDIX C

Environmental risk assessment

CONTENTS

This workbook contains a number of worksheets that provide templates and tools to help you effectively manage risk for your business. Refer to the Vendor Risk Specification on the frequency in the submission of this Risk Register.

USING THE RISK REGISTER

General	Source ID	**Free Text Field -** Your unique ID for the risk. When you have allocated a source ID to a new risk, keep the source ID the same for that particular risk. Avoid deleting a risk, rather close the risk.
	Last updated	**Type Date in Correct ISO Format -** Change the date each time the risk is updated. Avoid updating the date when there are no changes to the risk.
Risk Identification	Risk/Unwanted Event	**Free Text Field -** A risk is an unwanted event or condition that, if it occurs, could have a positive or negative effect on a project's objectives. An unwanted event is not a cause to the risk or an impact of a risk, rather the event that you are trying to avoid. Utilise the meta-language provided to assist with the risk description.
	Risk Description	**Free Text Field -** Use the risk meta-language provided to correctly describe the risk.
	Risk Owner	**Free Text Field -** The person who has the accountability to ensure that the risk is managed.
	Causes/Drivers	**Free Text Field -** The fundamental conditions or events which might give rise to an identified Risk.
	Impacts/Consequences	**Free Text Field -** Outcome of an unwanted event affecting objectives.
	Existing Controls	**Free Text Field -** Measure that is modifying the Risk. Controls include any process, policy, device, practice, or other actions which modify Risk (reducing the residual risk)
	Risk Status	**Drop down -** Self-explanatory
Treatment Plan	Treatment Plan	**Free Text Field -** Controls are the result of Risk treatment. Controls include any process, policy, device, practice, or other actions designed to modify Risk.
	TP Target Date	**Type Date in Correct ISO Format -** A date the treatment plan will be in place and modifying the risk.
	TP Feedback	**Free Text Field -** The actions that are put into place to ensure that the treatment plan is in place at the TP target date.
	TP Prog. %	**Free Text Field -** Indicate the percentage achieved to date with the TP. When the TP is in place 100% and working as intended, move this TP to a control for monitoring.
	TP Status	**Drop down -** Self explanatory
Current Residual Risk is the inherent risk exposure less the mitigating controls in place (not treatment plans)		
Current Residual Risk	Probability/Likelihood	**Drop down -** The chance of the unwanted event happening.
	Cost Impact	**Drop down -** The cost should the unwanted event occur.
	Schedule Impact	**Drop down -** The schedule delay should the unwanted event occur.
	Other Impact	**Drop down -** The other impacts it might have on the objectives should the unwanted event occur i.e. quality, stakeholder, environmental, health, safety, IM, operations, legal/compliance and HR. Select from these the impact which will have the highest impact since the calculation of the residual risk is based on the Probability X the highest impact (whether cost, schedule or other impact).
	Control Effectiveness	**Drop down -** You will have the opportunity to list all your existing controls which are in place and working but with only one average control effectives for all of the listed controls.
Planned Residual Risk is the inherent risk exposure less the mitigating controls in place and treatment plans		
Planned Residual Risk	Probability/Likelihood	**Drop down -** The chance of the unwanted event happening
	Cost Impact	**Drop down -** The cost should the unwanted event occur.
	Schedule Impact	**Drop down -** The schedule delay should the unwanted event occur.
	Other Impact	**Drop down -** The other impacts it might have on the objectives should the unwanted event occur i.e. quality, stakeholder, environmental, health, safety, IM, operations, legal/compliance and HR. Select from these the impact which will have the highest impact since the calculation of the residual risk is based on the Probability X the highest impact (whether cost, schedule or other impact).

CONTENTS

This workbook contains a number of worksheets that provide templates and tools to help you effectively manage risk for your business. Refer to the Vendor Risk Specification on the frequency in the submission of this Risk Register.

USING THE RISK REGISTER

Control Effectiveness	**Drop down -** You will have the opportunity to list all your existing controls which are in place and working but with only one average control effectives for all of the listed controls.

The entry in the Risk Rating column will display automatically once the assessment criteria for Probability and Impacts have been selected.
Conditional formatting has been used in the Risk Register to display traffic light colours for all assessment criteria and risk ratings.

RISK CRITERIA

IMPACT SCALE

No	Scale	Financial	Project performance	Operations	Health	Safety	Environment	Stakeholder Relations	Legal / Compliance	Quality	Human Resources
5	Extreme - >80 – 100%	>5% change in core operating margin	>10% variation on remaining project schedule	>10% variation in production	Death or multiple permanent disabilities	One or more fatalities	Level 3 reportable environmental incident, resulting in extreme environmental harm, and/or irreversible ecological damage	Media attention lasting more than one week at international level or more than two weeks at national level, across multiple platforms	Permanent closure of mine / operation due to non-compliance	>10% Client Spec deviation	>5% deviation in clusters with succession planning (i.e. >55% or <45%)
		>2% change in services cost	>10% variation on project costs	>10% variation in productivity	Exposure ≥ 2 x Occupational Exposure Limit (OEL)		Level 2 reportable environmental incident resulting in major environmental harm with long term ecological damage that is remediable post LOM	Permanent change in stakeholder relations (local community, labour, national government)	Change in BBBEE registration by two levels	>10% change in yield	>5% deviation in critical skills sourced internally (i.e. >80% or <70%)
		>10% change in cash generation from operations	>10% change in project scope (critical)	>10% variation from target	>20% variation from plan in people enrolled in HIV/AIDS training			All sell-side analyst recommend the selling of shares as a result of management action/inaction	>5% change from target for compliance with King III and JSE LR	One or more Level 1 audit findings	>2% deviation in turnover (i.e. >8% or <4%)
		>2% change in working capital	>10% variation on project ROI	>2% variation in water intensity	>20% variation from plan in eligible people enrolled in HIV management programme						>1% deviation in managed non-performance (i.e. >4% or <2%)
		>10% change in net cash before expansion capital		>10% variation in growth from coal commodities							
		>10% change in net cash after expansion capital		Loss of critical systems for >5 days, and/or unrecoverable loss of significant data and/or configurable information that is crucial to operations or for compliance							
		>10% change in total asset base									
		Civil liability claims >7.5% of revenue									
4	Major - >60 - 80	2-5% change in core operating margin	5-10% variation on remaining project schedule	5-10% variation in production	Permanent disability resulting in irreversible loss of quality of life	Injury resulting in irreversible loss of	Level 2 reportable environmental incident resulting in major	Media attention lasting 1-5 days at international level or 1-2 weeks at national	Temporary closure of mine / operation due to noncompliance	5-10% Client Spec deviation	[no measures at this level]

RISK CRITERIA

IMPACT SCALE

No	Scale	Financial	Project performance	Operations	Health	Safety	Environment	Stakeholder Relations	Legal / Compliance	Quality	Human Resources
		1-2% change in services cost	5-10% variation on project costs	5-10% variation from target	Exposure 1-2 times Occupational Exposure Limit (OEL)	quality of life	environmental harm with long term ecological damage that is remediable within LOM	level, across multiple platforms	[no separate BBBEE scale at this level]	5-10% change in yield	
		5-10% change in cash generation from operations	5-10% change in project scope (major)	1-2% variation in water intensity	10-20% variation from plan in people enrolled in HIV/AIDS training			Temporary change lasting more than one month in stakeholder relations (local community, labour, national/local government)			
		1-2% change in working capital		5-10% variation in growth from coal commodities							
		5-10% change in net cash before expansion capital	5-10% variation on project ROI	Loss of critical systems for 2-5 days, and/or loss of significant data and/or configurable information requiring a restore from backups	10-20% variation from plan in eligible people enrolled in HIV management programme				2-5% change from target for compliance with King III and JSE LR	Multiple Level 2 audit findings	
		5-10% change in net cash after expansion capital						The majority of sell-side analyst recommend the selling of shares as a result of management action/inaction			
		5-10% change in total asset base									
		Civil liability claims 5-7.5% of revenue									
3	High - >35 - 60	1-2% change in core operating margin	2-5% variation on remaining project schedule	2-5% variation in production	Temporary disability / LTI lasting 4 or more days	Lost time injuries with no irreversible loss of quality of life	Level 2 reportable environmental incident resulting in moderate environmental effect / short term reversible ecological disturbance	Media attention at national level lasting less than one week or at local level lasting 1-2 weeks on single platform	Temporary closure of section of mine / operation due to noncompliance	2-5% Client Spec deviation	2-5% deviation in clusters with succession planning (i.e. 52-55% or 45-48%)
		0.5-1% change in services cost	2-5% variation on project costs	2-5% variation in productivity	Exposure between 50% and 100% of OEL			Temporary change lasting 2-4 weeks in stakeholder relations (local community, labour, national/local government)	Change in BBBEE registration by one level	2-5% change in yield	2-5% deviation in critical skills sourced internally (i.e. 77-80% or 70-73%)
		2-5% change in cash generation from operations	2-5% change in project scope (significant)	2-5% variation from target	5-10% variation from plan in people enrolled in HIV/AIDS training			Some sell-side analyst recommend the selling of shares as a result of management action/inaction	1-2% change from target for compliance with King III and JSE LR	One or more Level 2 Audit findings	1-2% deviation in turnover (i.e. 7-8% or 4-5%)
		0.5-1% change in working capital	2-5% variation on project ROI	0.5-1% variation in water intensity	5-10% variation from plan in eligible people enrolled in HIV management programme						0.5-1% deviation in managed non-performance (i.e. 3.5-4% or 2-2.5%)
		2-5% change in net cash before expansion capital		2-5% variation in growth from coal commodities							
		2-5% change in net cash after expansion capital		Loss of critical systems for 1-2 days, with no data loss							
		2-5% change in total asset base									

RISK CRITERIA

IMPACT SCALE

No	Scale	Financial	Project performance	Operations	Health	Safety	Environment	Stakeholder Relations	Legal / Compliance	Quality	Human Resources
		Civil liability claims 2-5% of revenue									
2	Moderate - >10 - 35	0.5-1% change in core operating margin	1-2% variation on remaining project schedule	1-2% variation in production	Temporary disability/LTI lasting <4 days	Medical treatment case	Level 1 reportable environmental incident resulting in minimal environmental harm	Media attention at local level lasting 1-5 days on single platform	No stoppage directives	1-2% Client Spec deviation	[no measures at this level]
		0.25-0.5% change in services cost	1-2% variation on project costs	1-2% variation in productivity	Exposure between 10% and 50% of OEL			Temporary change lasting 1-2 weeks in stakeholder relations (local community, labour, national/local government)	[no separate BBBEE scale at this level]	1-2% change in yield	
		1-2% change in cash generation from operations	1-2% change in project scope (minor)	1-2% variation from target	2-5% variation from plan in people enrolled in HIV/AIDS training			A moderate deviation from analyst expectations	No change from target for compliance with King III and JSE LR	Multiple Level 1 audit findings	
		0.25-0.5% change in working capital	1-2% variation on project ROI	0.25-0.5% variation in water intensity	2-5% variation from plan in eligible people enrolled in HIV management programme						
		1-2% change in net cash before expansion capital		1-2% variation in growth from coal commodities							
		1-2% change in net cash after expansion capital		Loss of systems for 4-8 hours, with no data loss							
		1-2% change in total asset base									
		Civil liability claims 1-2% of revenue									
1	Negligible -< and = 10	<0.5% change in core operating margin	<1% variation on remaining project schedule	<1% variation in production	Medical monitoring variance	Injury requiring first aid treatment	Non-reportable environmental incident	Media attention at local level lasting 1 day on single platform	No directives	<1% Client Spec deviation	<2% deviation in critical skills sourced internally (i.e. 48-52%)
		<0.25% change in services cost	<1% variation on project costs	<1% variation in productivity	Exposure < 10% of OEL			No change in stakeholder relations (local community, labour, national/local government)	No change in BBBEE level	<1% change in yield	<2% deviation in critical skills sourced internally (i.e. 73-77%)
		<1% change in cash generation from operations	<1% change in project scope (negligible)	<1% variation from target	<2% variation from plan in people enrolled in HIV/AIDS training			A negligible deviation from analyst expectations	No change from target for compliance with King III and JSE LR	Single Level 1 audit findings	<1% deviation in turnover (i.e. 5-7%)
		<0.25% change in working capita	<1% variation on project ROI	<0.25% variation in water intensity	<2% variation from plan in eligible people						<0.5% deviation in managed non-

RISK CRITERIA

IMPACT SCALE

No	Scale	Financial	Project performance	Operations	Health	Safety	Environment	Stakeholder Relations	Legal / Compliance	Quality	Human Resources
		<1% change in net cash before expansion capital		<1% variation in growth from coal commodities	enrolled in HIV management programme						performance (i.e. 2.5-3.5%)
		<1% change in net cash after expansion capital		Loss of systems for <4 hours, with no data loss							
		<1% change in total asset base									
		Civil liability claims <1% of revenue									

TREATMENT EFFECTIVENESS RATING SCALE

Description	Factor	Indicator
Almost non-existent	0% - 5%	The treatment is completely ineffective and does not meet its designed objective(s).
Inadequate	6% -15%	The treatment is mostly ineffective and meets its designed objective(s) inadequately.
Very weak	16% - 25%	The treatment is very weak and meets little of its designed objective(s).
Weak	26% - 35%	The treatment is weak and only meets some of its designed objective(s).
Moderate	36% - 45%	The treatment is moderately effective and meets a reasonable amount of its designed objective(s).
Satisfactory	46% - 55%	The treatment is satisfactory and meets a satisfactory amount of its designed objective(s).
Adequate	56% - 65%	The treatment is adequate and meets an adequate amount of its designed objective(s).
Good	66% - 75%	The treatment is mostly effective and meets a good amount of its designed objective(s).
Very good	76% - 85%	The treatment is highly effective and meets a very good amount of its designed objective(s).
Excellent	86% - 95%	The treatment is extremely effective and meets an excellent amount of its designed objective(s).

RISK IDENTIFICATION								RISK TREATMENT PLAN (TP)	CURRENT RESIDUAL RISK					TARGET RESIDUAL RISK					RESIDUAL RISK CALCULATION			
RISK ID*	LAST UPDATED	RISK NAME*	RISK DESCRIPTION	CAUSES	IMPACTS/EFFECTS	EXISTING CONTROLS	RISK STATUS	TREATMENT PLAN	LIKELIHOOD (current)*	COST IMPACT (current)*	SCHEDULE IMPACT (current)*	OTHER IMPACT (current)*	CONTROL EFFECTIVENESS (current)*	LIKELIHOOD (target)*	COST IMPACT (target)*	SCHEDULE IMPACT (target)*	OTHER IMPACT (target)*	CONTROL EFFECTIVENESS (target)	RR (current)	PRIORITY (current)	RR (target)	PRIORITY (target)
1		Biodiversity Aspects																				
1.10	28 September 2018	Biophysical - Alien invasive control	As a result of poor alien invasive species control, it is possible that the invasives will reduce biodiversity and ecosystem functioning, which could lead to reduced reduce biodiversity and ecosystem functioning	Insufficient control of alien invasive species on mining rights area and surrounding properties	Spread of invasives will reduce biodiversity and ecosystem functioning, reduce natural ecological habitats, reduce options for land use, unnecessarily consume water resources - regulatory non-compliance	Revegetate areas as soon as possible, use an effective nursing crop (teff) to outcompete invasive species allowing pasture grasses time to establish, ameliorate based on soil fertility analysis, conduct follow up sampling and implement suitable additional amelioration as required, conduct care and maintenance across rehabilitated areas including alien invasive identification and removal aligned with the Invasive Species Monitoring, Control and Eradication Plan, EMPr, biodiversity action plan, RSIP and SLI-LP-ENV.008 (Standard Practice Instruction: Ongoing and Final Rehabilitation).	Open	Develop implementation standards and procedures from exiting guideline documents with specific sign-off criteria.	(3) Possible (>35% - 60%)	(2) Minor (1-2% variation on project costs)	(2) Minor (1-2% variation on remaining project schedule)	(3) Moderate	(1) Highly [90% > CE <= 100%]	(2) Unlikely (>10 - 35%)	(0) Not Applicable	(1) Insignificant (<1% variation on remaining project schedule)	(1) Insignificant	(1) Highly [90% > CE <= 100%]	36	Priority II	8	Priority IV
1.20	28 September 2018	Biophysical - Biodiversity / wetland / riparian functionality	As a result of reduced surface water runoff back into the natural catchment it is possible that the interconnectivity and functionality of the existing riparian systems will be negatively affected	wetland/riparian systems not considered in developing and constructing the post mining landform and related drainage framework	Reduced connectivity and functionality of wetland / riparian systems and wetland offset commitments not met.	FLFD is designed to maximise clean surface water runoff back into the catchment and direct water away form the planned voids. Concurrent backfilling is	Open	Integrate outcomes of the wetland specialist study into the FLFD to ensure alignment of the drainage framework with the existing systems.	(3) Possible (>35% - 60%)	(3) Moderate (2-5% variation on project costs)	(2) Minor (1-2% variation on remaining project schedule)	(3) Moderate	(2) Mostly [70% > CE <= 90%]	(1) Rare (< 10%)	(1) Insignificant (<1% variation on project costs)	(1) Insignificant (<1% variation on remaining project schedule)	(1) Insignificant	(1) Highly [90% > CE <= 100%]	36	Priority II	4	Priority IV

						being implemented to create free draining areas. Clean and dirty water areas are defined and managed according to GN R. 704.															
1.30	28 September 2018	Biophysical - post rehabilitation land management	As a result of a lack of operational pasture maintenance, it is possible that the vegetation establishment will be poor, which could lead to reduced species diversity, alien invasive encroachment, erosion and increased rehabilitation financial liability a	Lack of operational maintenance and cutting&baling/slashing/grazing of pastures	encroachment by alien species, followed by poor vegetation establishment and basal cover, resulting in increased erosion and lower land capability and land use potential	Ameliorate and vegetate topsoiled areas aligned with the specifications in the EMPr, biodiversity action plan, RSIP and SLI-LP-ENV.008 (Standard Practice Instruction: Ongoing and Final Rehabilitation). Kenbar, ODN and ODS pits were hydroseeded by a contractor with effective contractual controls in place. Post rehabilitation management only refers to follow up soil amelioration and limiting grassing till after climax species have established.	**Open**	Develop implementation standards and procedures from exiting guideline documents with specific sign-off criteria. Develop and land management standards further and align with accepted good practice aligned with the end land use.	(2) Unlikely (>10 - 35%)	(2) Minor (1-2% variation on project costs)	(2) Minor (1-2% variation on remaining project schedule)	(3) Moderate	(1) Highly [90% > CE <= 100%]	(2) Unlikely (>10 - 35%)	(0) Not Applicable	(1) Insignificant (<1% variation on remaining project schedule)	(1) Insignificant	(1) Highly [90% > CE <= 100%]	**24**	**Priority III**	**8**	**Priority IV**
1.40	28 September 2018	Biophysical - Topography	As a result of constructing unsustainable slopes that are not effectively vegetated, it is possible that post mining loss of soils to erosion will be increased, which could lead to post mining land use/capability commitments not being met, site relinquishment not being achieved and an increased post mining financial liability	Constructing unsustainable slopes and not establishing an effective vegetation cover	Increased erosion and loss of soils post rehabilitation	Post mining landform constructed according to the FLFD; construct contour berms to reroute clean water runoff away from final voids and into the natural catchment; Revegetate replaced soils as soon as possible.	**Open**	Develop implementation standards and procedures from exiting guideline documents with specific sign-off criteria. Consider creating a rehabilitation and closure commitee to ensure alignment of all departments are working to the same goals.Use the FLDF as a basis for Hydrological calculations, define high erosional risk areas and design additional measures as	(3) Possible (>35% - 60%)	(3) Moderate (2-5% variation on project costs)	(3) Moderate (2-5% variation on remaining project schedule)	(3) Moderate	(3) Effective [50% > CE <= 70%]	(1) Rare (< 10%)	(2) Minor (1-2% variation on project costs)	(2) Minor (1-2% variation on remaining project schedule)	(2) Minor	(1) Highly [90% > CE <= 100%]	**36**	**Priority II**	**8**	**Priority IV**

								required. Test the long term stability of the FLDF with erosional/long term stability models and adjust as required.													
1.50	28 September 2018	Biophysical - vegetation establishment	As a result of incorrect seed mix and soil ameliorant application, it is possible that the desired successional trajectory will not be reached, which could lead to reduced species diversity, alien invasive encroachment and increased rehabilitation financial liability.	Seed mix and soil ammeliorants applied to rehabilitated land not meeting desired successional trajectory (i.e. the desired perennial pasture species)	Inadequate vegetation basal coverage and/or species diversity and rehabilitated areas therefore do not have those species at the correct biomass to support economic agricultural activity, increased erosion an loss of soils.	Source a local seed mix from a reputable supplier based on recommendations from an ecologist, Revegetate areas as soon as possible, use an effective nursing crop (teff) to outcompete invasive species allowing pasture grasses time to establish, ameliorate based on soil fertility analysis, conduct follow up sampling and implement suitable additional amelioration as required, conduct care and maintenance across rehabilitated areas including alien invasive identification and removal. EMPr, biodiversity action plan, RSIP and SLI-LP-ENV.008 (Standard Practice Instruction: Ongoing and Final	**Open**	Develop implementation standards and procedures from exiting guideline documents with specific sign-off criteria.	(2) Unlikely (>10 - 35%)	(2) Minor (1-2% variation on project costs)	(2) Minor (1-2% variation on remaining project schedule)	(3) Moderate	(1) Highly [90% > CE <= 100%]	(2) Unlikely (>10 - 35%)	(0) Not Applicable	(1) Insignificant (<1% variation on remaining project schedule)	(1) Insignificant	(1) Highly [90% > CE <= 100%]	**24**	**Priority III**	**8**	**Priority IV**

						Rehabilitation) - ensure effective contractual management as revegetation is outsourced.																
1.60	28 September 2018	Biophysical-surface water and ground water / surface water - regulatory and financial	As a result of implementing a long term water strategy with no buy-in from authorities or stakeholders, it is possible that the strategy will not be authorised,which could lead to planning having to be reworked, expensive materials rehandling and an increased post mining liability for pumping and treating water.	Constructing evaporative capacity as along term water management strategy being implemented prior to regulatory approvals and buy-in (current EMPR allows for 2 final voids only)	No regulatory or Stakeholder buy-in and a change of strategy required to pumping and treating will require remodelling and replanning with an increased post mining liability	FLFD is being developed and presented to the authories and provides a basis for costing mass earthworks but also for improving accuracy of the water balance.	**Open**	Engage with the authorities and all stakeholders to ensure alignment of expectations and update the EMPR to reflect current planning	(3) Possible (>35% - 60%)	(4) Major (5-10% variation on project costs)	(4) Major (5-10% variation on remaining project schedule)	(4) Major	(4) Partially [25% > CE <= 50%]	(3) Possible (>35% - 60%)	(4) Major (5-10% variation on project costs)	(4) Major (5-10% variation on remaining project schedule)	(4) Major	(3) Effective [50% > CE <= 70%]	**48**	**Priority I**	**48**	**Priority I**
2.00		Infrastructural aspects																				
2.10	28 September 2018	Infrastructure - contaminated land	As a result of unquantified/undetected contamination, it is possible that affected plant/infrastructure areas could be defined as contaminated land, which could lead to an increased financial liability	Undetected or unreported contamination from spillages at fueling bays and workshops and processing plant areas	Localised adverse effects on soil properties, surface water and groundwater, and potential to sustain the desired final land use, as well as unplanned costs for additional remediation/ disposal	Allowance has been made to ameliorate hydrocarbon contaminated soils onsite at closure. It is also assumed that chemicals will be run down towards closure and/or removed from site by the relevant contractors.	**Open**	Conduct a visual inspection of the workshops and plant areas to identify potential contamination and initiate further studies if required, include remedial action as part of the annual rehabilitation planning implemented to achieve the closure objectives systematically during operations	(3) Possible (>35% - 60%)	(3) Moderate (2-5% variation on project costs)	(3) Moderate (2-5% variation on remaining project schedule)	(3) Moderate	(0) Not Assessed	(2) Unlikely (>10 - 35%)	(2) Minor (1-2% variation on project costs)	(2) Minor (1-2% variation on remaining project schedule)	(2) Minor	(2) Mostly [70% > CE <= 90%]	**36**	**Priority II**	**16**	**Priority IV**

2.20	27 September 2018	Infrastructure - general rehabilitation	As a result of the depth of carbonaceous material across the plant not being quantified, it is possible that the volume estimate informing the closure cost is incorrect, which could lead to an increased post mining financial liability	The depth of the carbonaceous material used to construct the pad for entire plant area has not been determined	Uncertain financial liability of removal as volume is not quantified (depth unknown)	Volume estimate only for initial costing purposes. Material will be excavated and deposited into the open pits at closure.	**Open**	Quantify the volume of carbonaceous material to be mover at closure, include the volume and deposition planning into the FLFD	(4) Likely (>60% - 80%)	(4) Unknown/Uncontrolled	(1) Insignificant (<1% variation on remaining project schedule)	(3) Moderate	(4) Partially [25% > CE <= 50%]	(1) Rare (< 10%)	(1) Insignificant (<1% variation on project costs)	(1) Insignificant (<1% variation on remaining project schedule)	(1) Insignificant	(1) Highly [90% > CE <= 100%]	**64**	**Priority I**	**4**	**Priority IV**
2.30	28 September 2018	Infrastructure - Land use / land capability	As a result of limited soil resources, it is possible that additional amelioration of subsoils will be required to meet post mining land use/capability commitments across infrastructure footprints	Topsoil and subsoils not stripped and stored for the rehabilitation of the plant and infrastructure footprint rehabilitation	Increased soil amelioration costs due to limited soil resources for rehabilitation	Soil amelioration based on dedicated soil sampling, fertility analysis and interpretation; follow up sampling within 3 months and ongoing monitoring, suitable amelioration and care and maintenance (as per EMPr; RSIP, SLI-LP-ENV.008)	**Open**	Implement planned measures and finalise the site wide materials balance for unscheduled and scheduled closure scenarios.	(4) Likely (>60% - 80%)	(3) Moderate (2-5% variation on project costs)	(3) Moderate (2-5% variation on remaining project schedule)	(3) Moderate	(4) Partially [25% > CE <= 50%]	(2) Unlikely (>10 - 35%)	(2) Minor (1-2% variation on project costs)	(2) Minor (1-2% variation on remaining project schedule)	(2) Minor	(2) Mostly [70% > CE <= 90%]	**48**	**Priority II**	**16**	**Priority IV**
2.40	28 September 2018	Infrastructure - Land use / land capability	As a result of soils not stripped and stored across the plant areas, it is possible that post mining land use/capability commitments will not be met, which could lead to site relinquishment not being achieved and an increased financial liability at closure	Topsoil and subsoils not stripped and stored for the rehabilitation of the plant and infrastructure footprint rehabilitation	Reduced land use and land capability across infrastructure footprints	Remove carbonaceous veneer across affected plant area, shape and level the area to be freedraining, rip, scarify and hydroseed (with amelioration based on dedicated soil sampling and analysis) insitu soils. (as per EMPr; RSIP, SLI-LP-ENV.008)	**Open**	Costing estimate based on estimated carbonaceous veneer depthof 300mm must be verified	(5) Almost Certain (>80% - 100%)	(2) Minor (1-2% variation on project costs)	(2) Minor (1-2% variation on remaining project schedule)	(2) Minor	(2) Mostly [70% > CE <= 90%]	(2) Unlikely (>10 - 35%)	(2) Minor (1-2% variation on project costs)	(1) Insignificant (<1% variation on remaining project schedule)	(2) Minor	(2) Mostly [70% > CE <= 90%]	**40**	**Priority II**	**16**	**Priority IV**
2.50	28 September 2018	Infrastructure - surface water / ground water / air emissions	As a result of inefficient decontamination of plant infrastructure prior to dismantling, it is possible that health risks and releases of contaminants to surface and ground water could be increased during decommissioning, which could lead to an increased financial liability	Failure to decontaminate/hose down plant infrastructure prior to dismantling and demolition	Short term dust generation and associated health risks in terms of inhalation of PM10 and PM2.5 carbonaceous dusts, contamination of surface and groundwater resources from uncontrolled	Fugitive dust to be washed from plant infrastructure prior to dismantling and demolition to reduce the dust exposure to employees and contractors, and to reduce nuisance dust effects. Mitigation to address surface and ground water to	**Open**	Schedule final rehabilitation to ensure alignment with commitments and develop standards for accurate implementation	(4) Likely (>60% - 80%)	(3) Moderate (2-5% variation on project costs)	(2) Minor (1-2% variation on remaining project schedule)	(2) Minor	(3) Effective [50% > CE <= 70%]	(2) Unlikely (>10 - 35%)	(1) Insignificant (<1% variation on project costs)	(1) Insignificant (<1% variation on remaining project schedule)	(1) Insignificant	(2) Mostly [70% > CE <= 90%]	**48**	**Priority II**	**8**	**Priority IV**

					release of contamination during demolition activities	be included also															
2.60	28 September 2018	Infrastructure - Surface water / ground water / health&safety	As a result of the ineffective placement of decontamination bays, it is possible that the disturbed footprint can be increased and surface water bodies impacted, which could lead to an increased rehabilitation financial liability and reduced surface water quality available to downstream users	Ineffective placement and construction of decontamination bays	increased sediment and salt load to surface water bodies and an increased disturbed footprint	Utilise existing dirty water systems and impoundments during the washing down/decontamination of demolished infrastructure	**Open**	Address in the closure EMP through the design of clean dirty water systems for the closure Basic Assessment	(3) Possible (>35% - 60%)	(2) Minor (1-2% variation on project costs)	(2) Minor (1-2% variation on remaining project schedule)	(3) Moderate	(3) Effective [50% > CE <= 70%]	(1) Rare (< 10%)	(1) Insignificant (<1% variation on project costs)	(1) Insignificant (<1% variation on remaining project schedule)	(2) Minor	(1) Highly [90% > CE <= 100%]	**36**	**Priority II**	**8**	**Priority IV**
2.70	28 September 2018	Infrastructure - waste disposal	As a result of delays in planning and permitting on-site demolition waste disposal, it is possible that there will be project delays, which could lead to an increased financial liability	Permitting/licensing and location of demolition waste disposal	Time and financial-related risks (delays in closure process)	Assumed that demolition waste will be decontaminated, crushed and screened for disposal in the remaining voids prior to backfilling and final rehabilitation	**Open**	Ensure communication and alignment with regulatory bodies, confirm quantities and relevant authorisations at closure.	(3) Possible (>35% - 60%)	(2) Minor (1-2% variation on project costs)	(2) Minor (1-2% variation on remaining project schedule)	(3) Moderate	(3) Effective [50% > CE <= 70%]	(2) Unlikely (>10 - 35%)	(1) Insignificant (<1% variation on project costs)	(1) Insignificant (<1% variation on remaining project schedule)	(1) Insignificant	(2) Mostly [70% > CE <= 90%]	**36**	**Priority II**	**8**	**Priority IV**
2.80	28 September 2018	Infrastructure - waste disposal	As a result of underestimating hazardous/demolition waste, it is possible that there will be project delays, which could lead to an increased financial liability	Underestimation of quantities and/or hazardous classification of demolition waste	Time and financial-related risks (delays in closure process)	Assumed that demolition waste will be decontaminated, crushed and screened for disposal in the remaining voids prior to backfilling and final rehabilitation	**Open**	Compile a site-specific waste inventory detailing the quantities of general and hazardous wastes requiring disposal. Quantify the volumes of waste and carbonaceous materials and plan the sequence of backfilling final voids to accommodate demolition waste at closure. Incorporate the volumes that will be returned to the pit into the LoM FLFD.	(4) Likely (>60% - 80%)	(3) Moderate (2-5% variation on project costs)	(3) Moderate (2-5% variation on remaining project schedule)	(3) Moderate	(4) Partially [25% > CE <= 50%]	(2) Unlikely (>10 - 35%)	(2) Minor (1-2% variation on project costs)	(2) Minor (1-2% variation on remaining project schedule)	(2) Minor	(2) Mostly [70% > CE <= 90%]	**48**	**Priority II**	**16**	**Priority IV**

2.90	28 September 2018	Infrastructure - waste management	As a result of uncontrolled transport and disposal of demolition and hazardous wastes, it is possible that there will be unwanted environmental impacts and regulatory non-conformance, which could lead to an increased rehabilitation financial liability, reputational damage and legal penalties	Unsuitable offsite transport and/or inappropriate disposal of demolition waste/contaminated liquids/sediments/ soils or sludges	Regulatory non-compliances and/or unwanted environmental impacts on soils, ground and surface water	Compile a site-specific waste inventory detailing the quantities of general and hazardous wastes requiring disposal. Compile a waste manifest for the handling and disposal of demolition waste	**Open**	Address in the closure EMP through the closure Basic Assessment and effective contracting with service providers	(2) Unlikely (>10 - 35%)	(2) Minor (1-2% variation on project costs)	(1) Insignificant (<1% variation on remaining project schedule)	(3) Moderate	(3) Effective [50% > CE <= 70%]	(1) Rare (< 10%)	(2) Minor (1-2% variation on project costs)	(2) Minor (1-2% variation on remaining project schedule)	(2) Minor	(1) Highly [90% > CE <= 100%]	**24**	**Priority III**	**8**	**Priority IV**
3.00		Mining aspects																		
3.10	28 September 2018	Mining - Financial / ground water / land capability	As a result of the lack of concurrent rehabilitation, it is possible that backlog areas will increase, which could lead to increased scheduled and unscheduled financial liability	Not implementing concurrent rehabilitation	Increased backlog areas, increased unscheduled and scheduled closure liability and expensive rehandling of material	Integrate mine planning and rehabilitation planning, optimise materials movement to reduce haul distances and rehandling material and adherence to the DWA BPG guidelines - FLFD, RSIP and SLI-LP-ENV.008 (Standard Practice Instruction: Ongoing and Final Rehabilitation)	**Open**	Optimise the FLFD in terms of final void positions and mass earth works - develop standards for all aspects of backfilling and manage the implementation to reduce the backlog areas.	(4) Likely (>60% - 80%)	(4) Major (5-10% variation on project costs)	(4) Major (5-10% variation on remaining project schedule)	(4) Major	(4) Partially [25% > CE <= 50%]	(2) Unlikely (>10 - 35%)	(2) Minor (1-2% variation on project costs)	(2) Minor (1-2% variation on remaining project schedule)	(2) Minor	(2) Mostly [70% > CE <= 90%]	**64**	**Priority I**	**16**	**Priority IV**
3.20	28 September 2018	Mining - Land use / land capability	As a result of having to address backlogs, it is possible that rehabilitation measures will only be measured against production criteria, which could lead to ineffective implementation of detailed design specifications and an increased financial liability	Addressing backlogs - Rehabilitation measured against production criteria of cubic meters moved and hectares achieved only	5 year plan to address backlog may increase the liability if not constructed accurately according to plan, particularly the placement, compaction and covering of carbonaceous material.	Initial FLFD developed to plan mass earthworks and integrate rehabilitation and production activities more closely - Internal 5 year plan developed to address backlog areas and reduce the closure liability. (EMPr, FLFD, RSIP and SLI-LP-ENV.008 (Standard Practice Instruction: Ongoing and Final Rehabilitation).	**Open**	Existing goals, objectives and strategy documents must be developed into detailed action plans with standards / procedures/sign-off protocols to manage the effective implementation over the LoM. Consider intiating a rehabilitation and closure steering committee to ensure alignment of all departments and manage the accuracy and quality of implementation.	(4) Likely (>60% - 80%)	(4) Major (5-10% variation on project costs)	(4) Major (5-10% variation on remaining project schedule)	(4) Major	(4) Partially [25% > CE <= 50%]	(3) Possible (>35% - 60%)	(2) Minor (1-2% variation on project costs)	(2) Minor (1-2% variation on remaining project schedule)	(3) Moderate	(2) Mostly [70% > CE <= 90%]	**64**	**Priority I**	**36**	**Priority II**

3.30	28 September 2018	Mining - Land use / land capability / soils	As a result of the lack of an integrated soil management plan and/or effective implementation, it is possible that soil chemical and physical properties will be reduced, which could lead to post mining land use/capability commitments will not be met, site relinquishment not being achieved and an increased post mining financial liability	Lack of integrated soil management plan and/or effective implementation	Reduced soil quality relating to physical and chemical properties	Strip/place/stockpile according to soil type; Directly place where possible and stockpile on dedicated soil stockpile areas no higher than 4 meters; Strip and place soils in winter months; utilize correct equipment to reduce compaction and limit traffic over rehabilitated areas; Rip to alleviate compaction; Apply soil amelioration based on sampling/analysis to meet soil fertility targets; Implement ongoing monitoring, maintenance based on soil analysis; (as per EMPr; RSIP, SLI-LP-ENV.008)	**Open**	Develop a LoM materials balance; develop current commitments / policies into implementation standards and develop a soils management plan to integrate soil stripping and placement as part of the mining schedule.	(4) Likely (>60% - 80%)	(3) Moderate (2-5% variation on project costs)	(3) Moderate (2-5% variation on remaining project schedule)	(4) Major	(4) Partially [25% > CE <= 50%]	(2) Unlikely (>10 - 35%)	(2) Minor (1-2% variation on project costs)	(2) Minor (1-2% variation on remaining project schedule)	(2) Minor	(2) Mostly [70% > CE <= 90%]	**64**	**Priority I**	**16**	**Priority IV**
3.40	28 September 2018	Mining - land use / safety	As a result of constructing unsustainable slopes, it is possible that slopes could be too steep to operate farming equipment, which could lead to post mining land use/capability commitments not being met, site relinquishment not being achieved and an increased post mining financial liability	Constructing unsustainable slopes	dangerous operating conditions for agricultural equipment on steep slopes	Design and construct FLFD to specific design criteria to support the intended post mining land use.	**Open**	Develop FLFD further to include land use / capability criteria	(2) Unlikely (>10 - 35%)	(3) Moderate (2-5% variation on project costs)	(3) Moderate (2-5% variation on remaining project schedule)	(3) Moderate	(3) Effective [50% > CE <= 70%]	(1) Rare (< 10%)	(2) Minor (1-2% variation on project costs)	(2) Minor (1-2% variation on remaining project schedule)	(2) Minor	(1) Highly [90% > CE <= 100%]	**24**	**Priority III**	**8**	**Priority IV**

3.50	28 September 2018	Mining - land use and land capability	As a result of inaccurate construction of the FLFD and /or FLFD volumetric assessment not calibrated/accurate, it is possible that internal blind catchments will be constructed on mined out areas; reducing catchment yield and increased water make, which could lead to post mining land use/capability commitments not being met, site relinquishment not being achieved and an increased post mining financial liability	Inaccurate construction of the FLFD and /or FLFD volumetric assessment not calibrated/accurate	Increased internal blind catchments (ponding) on mined out areas; reduced catchment yield, increased ground water make, reduced pasture viability.	Construct the post mining landform according to the FLFD. Rehabilitation status measured and reported on for all disturbed areas by the survey department (RSIP and SLI-LP-ENV.008).	**Open**	Develop, maintain and calibrate the LoM materials balance to reduce the risk of unexpected backfill deficits. Develop the current rehabilitation guideline documents into implementation standards with sign-off criteria.	(4) Likely (>60% - 80%)	(4) Major (5-10% variation on project costs)	(4) Major (5-10% variation on remaining project schedule)	(4) Major	(3) Effective [50% > CE <= 70%]	(2) Unlikely (>10 - 35%)	(2) Minor (1-2% variation on project costs)	(2) Minor (1-2% variation on remaining project schedule)	(2) Minor	(1) Highly [90% > CE <= 100%]	**64**	**Priority I**	**16**	**Priority IV**
3.60	28 September 2018	Mining - rehabilitation and closure planning	As a result of no clearly defined rehabilitation and closure goals and objectives, it is possible that planning and operations are not geared towards understanding, managing and reducing the closure liability over time, which could increase financial liability (uncertain)	lack of clearly defined closure and rehabilitation goals and objectives and standards/procedures	Increased uncertainty and closure liability, agreed to end land use and land capabilities not achieved.	Initial objectives set out and incorporated into planning / strategy documents and expanded on in the Closure Plan - EMPr, Closure Plan, closure provision and SLI-LP-ENV.008 (Standard Practice Instruction: Ongoing and Final Rehabilitation)	**Open**	Existing goals, objectives and strategy documents must be developed into detailed action plans with standards / procedures to manage the effective implementation over the LoM. Objectives and goals should be revisited once a detailed end land use plan has been developed.	(4) Likely (>60% - 80%)	(4) Major (5-10% variation on project costs)	(4) Major (5-10% variation on remaining project schedule)	(4) Major	(4) Partially [25% > CE <= 50%]	(2) Unlikely (>10 - 35%)	(2) Minor (1-2% variation on project costs)	(2) Minor (1-2% variation on remaining project schedule)	(2) Minor	(2) Mostly [70% > CE <= 90%]	**64**	**Priority I**	**16**	**Priority IV**
3.70	28 September 2018	Mining - soils, Land use / land capability	As a result of the lack of integrated mining, FLFD and soils planning and/or effective implementation, it is possible that fragmented post mining land use units will be created, which could lead to post mining land use/capability commitments will not being met, site relinquishment not being achieved and an increased post mining financial liability	Lack of integrated mining, FLFD and soils planning and/or effective implementation planning	fragmentation of post mining land use units	Construct the post mining landform according to the FLFD (uses the pre-mining natural ground level as a basis of design). Strip, store and place soils aligned with the EMPr; RSIP, SLI-LP-ENV.008.	**Open**	Develop a post mining land use plan. Develop current commitments / policies into implementation standards with sign-off criteria, and develop a soils management plan to integrate soil stripping and placement as part of the mining schedule.	(4) Likely (>60% - 80%)	(2) Minor (1-2% variation on project costs)	(2) Minor (1-2% variation on remaining project schedule)	(3) Moderate	(4) Partially [25% > CE <= 50%]	(2) Unlikely (>10 - 35%)	(1) Insignificant (<1% variation on project costs)	(1) Insignificant (<1% variation on remaining project schedule)	(2) Minor	(2) Mostly [70% > CE <= 90%]	**48**	**Priority II**	**16**	**Priority IV**

3.80	28 September 2018	Mining - soils, land use / land capability	As a result of the lack of an integrated soil management plan and/or effective implementation, it is possible that soil resources will be lost, which could lead to post mining land use/capability commitments not being met, site relinquishment not being achieved and an increased post mining financial liability	Lack of integrated soil management plan and/or effective implementation	Loss of soil resource during operations	Strip/place/stockpile according to soil type; Directly place where possible and stockpile on dedicated soil stockpile areas no higher than 4 meters; Strip and place soils in winter months; utilize correct equipment to reduce compaction and limit traffic over rehabilitated areas; Rip to alleviate compaction; Apply soil amelioration based on sampling/analysis to meet soil fertility targets; Implement ongoing monitoring, maintenance based on soil analysis; (as per EMPr; RSIP, SLI-LP-ENV.008)	**Open**	Develop a soils stripping and managment plan, Include stripping a window ahead of all mining to reduce losses around pit edges (5 m). Develop the current rehabilitation guideline documents into implementation standards with sign-off criteria to align all departments on the mine. Provide training to operational personnel.	(4) Likely (>60% - 80%)	(3) Moderate (2-5% variation on project costs)	(3) Moderate (2-5% variation on remaining project schedule)	(4) Major	(4) Partially [25% > CE <= 50%]	(2) Unlikely (>10 - 35%)	(2) Minor (1-2% variation on project costs)	(2) Minor (1-2% variation on remaining project schedule)	(1) Insignificant	(2) Mostly [70% > CE <= 90%]	**64**	**Priority I**	**16**	**Priority IV**
3.90	28 September 2018	Mining - Surface and ground water	As a result of specified rehabilitation measures not implemented accurately, it is possible that increased volumes and decreased water qualities will have to be actively managed post closure, which could lead to impacts on riparian habitats, instream qualities and increased post closure financial liability	All specified rehabilitation measures not implemented accurately	increased volumes and decreased water qualities to be actively managed post closure,	Construct the FLFD to free drain water away from final voids; preferential materials handling including: returning discard/slurry to deepest portions of the pit below expected rebounded ground water elevations; covering and compacting the discard; The final layer (just below the topsoil cover) should be as clayey as possible and compacted if feasible (methodology aims to bar oxygen from reacting with remaining pyrite). establishing vegetation. (as	Draft	Develop standards with sign-off protocols for accurate implementation, conduct a planning workshop involving all departments and train operational personnel in the correct implementation.	(3) Possible (>35% - 60%)	(4) Major (5-10% variation on project costs)	(4) Major (5-10% variation on remaining project schedule)	(4) Major	(3) Effective [50% > CE <= 70%]	(1) Rare (< 10%)	(2) Minor (1-2% variation on project costs)	(2) Minor (1-2% variation on remaining project schedule)	(2) Minor	(1) Highly [90% > CE <= 100%]	**48**	**Priority I**	**8**	**Priority IV**

						per EMPr, RSIP, SLI-LP-ENV.008, 5 year plan, annual rehabilitation plan,															
3.10	28 September 2018	Mining - Surface Water / ground water	As a result of not implementing discard disposal accurately as part of concurrent rehabilitation , it is possible that ground water make and contamination will increase, which could lead to increased long term water management costs and an increased unscheduled financial liability	Not implementing discard disposal accurately as part of concurrent rehabilitation	increased ground water contamination, long term water management costs	Place discard/slurry into deepest portions of the pits that will be flooded post closure by the rebounded water table, cover with suitable material and compact to specifications to limit oxygen ingress; implement concurrent backfill to FLFD elevations to deliver clean water back into the natural catchment and reduce the dirty water make that requires active management (EMPr, FLFD, RSIP and SLI-LP-ENV.008 (Standard Practice Instruction: Ongoing and Final Rehabilitation).	**Open**	Existing goals, objectives and strategy documents must be developed into detailed action plans with standards / procedures/sign-off protocols to manage the effective implementation over the LoM. Consider intiating a rehabilitation and closure steering committee to ensure alignment of all departments and manage the accuracy and quality of implementation.	(3) Possible (>35% - 60%)	(3) Moderate (2-5% variation on project costs)	(3) Moderate (2-5% variation on remaining project schedule)	(3) Moderate	(2) Mostly [70% > CE <= 90%]	(2) Unlikely (>10 - 35%)	(2) Minor (1-2% variation on project costs)	(1) Insignificant (<1% variation on remaining project schedule)	(1) Insignificant	(2) Mostly [70% > CE <= 90%]	**36**	**Priority II**	**16**	**Priority IV**
3.11	28 September 2018	Mining - Surface water / wetland / riparian functionality	As a result of mining encroachment on the stream diversion, it is possible that instream flow to sustain functional riparian system can be reduced, which could lead to impacts on riparian habitats and water qualities with an increased	Stream diversion not functional due to mining encroachment	Reduced in stream flow to sustain functional riparian system and reduced water quality	Ensure that the placement of stockpiles and other mining activities does not encroach and manage the mining footprint to limit the size of disturbed areas aligned with the mines surface water management plan and GN R. 704	**Open**	Develop the soils stripping plan and ensure stockpiling only occurs in designated areas and manage the mining footprint	(2) Unlikely (>10 - 35%)	(1) Insignificant (<1% variation on project costs)	(1) Insignificant (<1% variation on remaining project schedule)	(2) Minor	(3) Effective [50% > CE <= 70%]	(1) Rare (< 10%)	(1) Insignificant (<1% variation on project costs)	(1) Insignificant (<1% variation on remaining project schedule)	(1) Insignificant	(1) Highly [90% > CE <= 100%]	**16**	**Priority IV**	**4**	**Priority IV**

			rehabilitation financial liability																	
3.12	28 September 2018	Mining - surface water hydrology	As a result of the increased clean storm water runoff from free draining rehabilitation areas, it is possible that the existing culverts/conduits have insufficient capacity, which could lead to site relinquishment not being achieved and an increased post mining financial liability	Insufficient capacity of the existing storm water culverts / conduits to accept or route the flow from the free draining site	Periodic flooding during storm events and subsequent road damage/safety threats	Conduct hydrological modelling to determine peak flows and increase capacity if required	**Open**	Develop a post mining surface water management plan aligned with the hydrological calculations to inform the FLFD drainage framework.	(3) Possible (>35% - 60%)	(3) Moderate (2-5% variation on project costs)	(3) Moderate (2-5% variation on remaining project schedule)	(3) Moderate	(2) Mostly [70% > CE <= 90%]	(2) Unlikely (>10 - 35%)	(1) Insignificant (<1% variation on project costs)	(2) Minor (1-2% variation on remaining project schedule)	(2) Minor	(2) Mostly [70% > CE <= 90%]	**36**	**Priority II**	**16**	**Priority IV**
3.13	28 September 2018	Mining - Topography / land use - mining	As a result of discard disposal into the pit, it is possible that more areas can be backfilled to be free draining, which could lead to an improved post mining land use and coherent land units	Discard/slurry disposed on into the opencast pits	Increased volume of material available for backfilling pits to be free draining - positive impact	Discard volume stream has been considered in the development of the FLFD and ensure correct placement according to the discard deposition strategy. FLFD, RSIP and SLI-LP-ENV.008 (Standard Practice Instruction: Ongoing and Final Rehabilitation).	**Open**	Regularly update the FLFD. Develop and maintain a LoM materials balance including soils, overburden and discard.	(0) Not Assessed	(1) Insignificant (<1% variation on project costs)	(0) Not Assessed	(1) Insignificant	(0) Not Assessed	(1) Rare (< 10%)	(1) Insignificant (<1% variation on project costs)	(1) Insignificant (<1% variation on remaining project schedule)	(1) Insignificant	(1) Highly [90% > CE <= 100%]	**0**	**None**	**4**	**Priority IV**
4.00		Residual																		
4.10	28 September 2018	Residual - body of knowledge informing closure planning and modelling	As a result of a disconnect between the various models being developed for planning purposes, it is possible that the solutions will not be optimised and the closure liability not quantified accurately, which could lead to delays in the project and increased post mining financial liability	Disconnect between various planning models	Solutions not optimised and closure liability not quantified accurately	Ground water numerical modelling, geochemical modelling, FLFD, water balance are regularly revisited and updated based on monitoring results.	**Open**	Consider establish of a rehabilitation and closure steering committee to ensure integration of all planning and implementation - implement a third party review system aligned with DWA BGP on impact prediction for all models. Ensure that the information maturity is understood and improved	(3) Possible (>35% - 60%)	(4) Major (5-10% variation on project costs)	(4) Major (5-10% variation on remaining project schedule)	(4) Major	(2) Mostly [70% > CE <= 90%]	(2) Unlikely (>10 - 35%)	(2) Minor (1-2% variation on project costs)	(2) Minor (1-2% variation on remaining project schedule)	(2) Minor	(1) Highly [90% > CE <= 100%]	**48**	**Priority I**	**16**	**Priority IV**

								throughout the LoM.													
4.20	28 September 2018	Residual - climate change	As a result of not considering the predicted impacts of climate change in closure models, it is possible that rehabilitation of disturbed areas could fail.	Failure to consider predicted climate change impacts in closure models and planning	Failure of rehabilitation and or changing volumes of water requiring treatment	Existing models (water balance, geochemistry, geohydrology and the surface hydrology of the FLFD) should include scenarios for predicted climate change impacts.	**Open**	Investigate and include in regular updates.	(3) Possible (>35% - 60%)	(4) Unknown/Uncontrolled	(4) Unknown/Uncontrolled	(3) Moderate	(4) Partially [25% > CE <= 50%]	(2) Unlikely (>10 - 35%)	(4) Unknown/Uncontrolled	(4) Unknown/Uncontrolled	(2) Minor	(1) Highly [90% > CE <= 100%]	**48**	**Priority I**	**32**	**Priority II**
4.30	28 September 2018	Residual - ground water	As a result of incorrect assumptions inherent in the ground water model, it is possible that decisions requiring large capital expenditure based on limited understanding, which could lead to delays in the project and increased post mining financial liability	incorrect assumptions inherent in the ground water model	decisions requiring large capital expenditure based on limited understanding	Models have been developed and are regularly updated. Systematically address any gaps and improve the resolution of the model during the operations	**Open**	Preliminary water treatment costs developed based on three recharge scenarios - improve resolution based on updated FLFD and updated long term water quality estimates.	(3) Possible (>35% - 60%)	(3) Moderate (2-5% variation on project costs)	(2) Minor (1-2% variation on remaining project schedule)	(3) Moderate	(2) Mostly [70% > CE <= 90%]	(2) Unlikely (>10 - 35%)	(2) Minor (1-2% variation on project costs)	(1) Insignificant (<1% variation on remaining project schedule)	(2) Minor	(1) Highly [90% > CE <= 100%]	**36**	**Priority II**	**16**	**Priority IV**

4.40	28 September 2018	Residual - Surface water and ground water	As a result of post mining pit inflows exceeding evaporation/evapotranspiration, it is possible that active pumping and treatment of extraneous water will be required, which could lead to an increased post mining financial liability	Dynamic balance between post mining pit inflows and constructed inpit evaporative capacity not achieved	Active pumping and treatment of extraneous water will be required to manage decant and seepage from the pits	FLFD is designed to maximise clean surface water runoff back into the catchment and direct water away form the planned voids. Concurrent backfilling is being impolemented to reduce water make further. Preliminary water treatment costs have ben developed based on three recherge scenarios (8%, 10% and 15%). A pit water and salt balance is regularly update along with the geohydrological model for Leeuwpan. An information baseline is being developed through wurface water monitoring of the streams and quarterly groundwater sampling. Rehabilitation is being implemented aligned with the EMPr; RSIP, SLI-LP-ENV.008 (Standard Practice Instruction: Ongoing and Final Rehabilitation)	**Open**	Develop managment standards with sign-off protocols for the construction of the FLFD and implementation of the rehabilitation measures. Determine the expected water qualities at decant and investigate solutions to deal with extraneous water (pump and treat). Continually refine the FLFD and ground water models based on monitoring results.	(5) Almost Certain (>80% - 100%)	(3) Moderate (2-5% variation on project costs)	(4) Major (5-10% variation on remaining project schedule)	(3) Moderate	(5) Ineffective [0% >= CE <= 25%]	(2) Unlikely (>10 - 35%)	(1) Insignificant (<1% variation on project costs)	(1) Insignificant (<1% variation on remaining project schedule)	(2) Minor	(5) Ineffective [0% >= CE <= 25%]	**80**	**Priority I**	**16**	**Priority IV**

4.50	28 September 2018	Residual - surface water and ground water	As a result of changed surface water hydrology due to future rehabilitation done by bordering mines, it is possible that greater volumes will be delivered to final voids than planned for, which could lead to an increased liability	Changed surface water hydrology due to future rehabilitation done by bordering mines	Greater volumes delivered to final voids than planned, flooding of rehabilitation, failure of the long term water management strategy and an increased liability	In-pit monitoring programme in place to detect and quantify changes, results can be used to apportion liability	Draft	Engauge with the authorities and bordering mines, Continue the current monitoring program and develop a water quality and quantity database as a baseline. Insert monitoring boreholes into the backfilled pits and expand the monitoring programme as required during the LoM.	(3) Possible (>35% - 60%)	(4) Unknown/Uncontrolled	(4) Unknown/Uncontrolled	(3) Moderate	(4) Partially [25% > CE <= 50%]	(3) Possible (>35% - 60%)	(2) Minor (1-2% variation on project costs)	(2) Minor (1-2% variation on remaining project schedule)	(2) Minor	(4) Partially [25% > CE <= 50%]	**48**	**Priority I**	**24**	**Priority III**
5.00		Socio-economic																		
5.10	28 September 2018	Socio-economic - Land use / land capability	As a result of a lack of post closure access control and pasture management, it is possible that there will be overgrazing, erosion and failed rehabilitation, which could lead to reduced land capability, increased rehabilitation financial liability and reputational damage	lack of post mining access control and pasture management	Overgrazing, failure of rehabilitation, increased erosion and reduced land capability	Mine will be rehabilitated and made suitable for agricultural projects; Mine farm will be offered for sale to farmers occupying it on first-rights-of-refusal basis; Projects set up in partnership with local municipality prior to closure to ensure optimal, sustainable land use. conclude lease/management agreements for rehabilitated land up front prior to closure. SLP section 4.4.2	**Open**	Develop rehabilitation guidelines and policy documents into detailed implementation plans with sign-off protocols. Continual compliance with regulatory framework and engagement with satkeholders.	(3) Possible (>35% - 60%)	(4) Major (5-10% variation on project costs)	(4) Major (5-10% variation on remaining project schedule)	(3) Moderate	(2) Mostly [70% > CE <= 90%]	(2) Unlikely (>10 - 35%)	(1) Insignificant (<1% variation on project costs)	(1) Insignificant (<1% variation on remaining project schedule)	(1) Insignificant	(1) Highly [90% > CE <= 100%]	**48**	**Priority I**	**8**	**Priority IV**
5.20	#####	Socio-economic - Regulatory	As a result of misaligned expectations of authorities at closure, it is possible that closure and relinquishment could be deferred, which could lead to increased financial liabilities	Misalignment of expectations of authorities at closure regarding post closure aspects (land use / water management / economic opportunities).	Closure and relinquishment deferred and an extended post closure liability for Exxaro	Compile and submit, annually update and resubmit closure planning and costing reports aligned with GN R. 1147. Update and resubmit IWWMP and RSIP, conduct EMPr performance reviews as required.	**Open**	Continuous compliance with regulatory framework, submission of annual updated to the FDRCP, ARP and ERA, and engagement/communication with authorities;	(3) Possible (>35% - 60%)	(3) Moderate (2-5% variation on project costs)	(3) Moderate (2-5% variation on remaining project schedule)	(3) Moderate	(2) Mostly [70% > CE <= 90%]	(3) Possible (>35% - 60%)	(1) Insignificant (<1% variation on project costs)	(2) Minor (1-2% variation on remaining project schedule)	(2) Minor	(2) Mostly [70% > CE <= 90%]	**36**	**Priority II**	**24**	**Priority III**

5.30	28 September 2018	Socio-economic: external	As a result of mine closure it is possible that loss of income may occur, which could lead to poverty and reduced opportunities for employment and reputational damage	Mine closure	loss of income for employees	Provide transferable skills development opportunities, particularly for unskilled and semi-skilled workers during the operational period of the mine; provide voluntary training courses for a limited period for retrenched employees; Allow employees to engage in a clearly defined redeployment process; Ensure clear understanding of the Employee Share Option Scheme rules. SLP section 4 and table 34	**Open**	Continual updates and implementation of the SLP and communication with stakeholders running into closure.	(5) Almost Certain (>80% - 100%)	(3) Moderate (2-5% variation on project costs)	(3) Moderate (2-5% variation on remaining project schedule)	(3) Moderate	(1) Highly [90% > CE <= 100%]	(3) Possible (>35% - 60%)	(1) Insignificant (<1% variation on project costs)	(2) Minor (1-2% variation on remaining project schedule)	(1) Insignificant	(3) Effective [50% > CE <= 70%]	**60**	**Priority I**	**24**	**Priority III**
5.40	28 September 2018	Socio-economic: external	As a result of mine closure it is possible that there is a reduced nett contribution to the local economy, which could lead to reduced income and economic opportunities in the region	Mine closure	loss of income and opportunities for suppliers	Capacity building initiatives and training for SMME suppliers; Implement mentorship programme to ensure sustainability/diversification of SMMEs. SLP section 3.8.1	**Open**	Continual updates and implementation of the SLP and communication with stakeholders running into closure.	(5) Almost Certain (>80% - 100%)	(3) Moderate (2-5% variation on project costs)	(2) Minor (1-2% variation on remaining project schedule)	(2) Minor	(2) Mostly [70% > CE <= 90%]	(3) Possible (>35% - 60%)	(1) Insignificant (<1% variation on project costs)	(1) Insignificant (<1% variation on remaining project schedule)	(1) Insignificant	(2) Mostly [70% > CE <= 90%]	**60**	**Priority I**	**12**	**Priority IV**
5.50	28 September 2018	Socio-economic: external	As a result of mine closure it is possible that there is a reduced nett contribution to the local economy, which could lead to reduced income and economic opportunities in the region	Mine closure	reduced nett contribution to the local/regional economy	Engage actively in District Municipality Local Economic Development planning through relevant forums; Focus on LED efforts in Victor Khanye local municipality, particularly: Establishment of SMME /business incubator, establishment of TVET college and the Education intervention Programmed.	**Open**	Continual updates and implementation of the SLP and communication with stakeholders running into closure.	(5) Almost Certain (>80% - 100%)	(3) Moderate (2-5% variation on project costs)	(2) Minor (1-2% variation on remaining project schedule)	(2) Minor	(2) Mostly [70% > CE <= 90%]	(3) Possible (>35% - 60%)	(1) Insignificant (<1% variation on project costs)	(2) Minor (1-2% variation on remaining project schedule)	(1) Insignificant	(2) Mostly [70% > CE <= 90%]	**60**	**Priority I**	**24**	**Priority III**

						SLP section 3.4 - 3.6														
5.60	28 September 2018	Socio-economic: external	As a result of not concluding agreements with third parties regarding post mining land use, it is possible that there will be a gradual deterioration of rehabilitated land through mismanagement, illegal occupation, vandalism and overgrazing may occur, which could lead to reduced land capability, increased financial liabilities and reputational damage	Not concluding agreements with third parties regarding post mining land use	Gradual deterioration of the rehabilitated land though mismanagement, illegal occupation vandalism, overgrazing and no access control	Mine will be rehabilitated and made suitable for agricultural projects; Mine farm will be offered for sale to farmers occupying it on first-rights-of-refusal basis; Projects set up in partnership with local municipality prior to closure to ensure optimal, sustainable land use. conclude lease/management agreements for rehabilitated land up front prior to closure. SLP section 4.4.2 and SLI-LP-ENV.008 (Standard Practice Instruction: Ongoing and Final Rehabilitation)	**Open**	Continual updates and implementation of the SLP and communication with stakeholders running into closure.	(3) Possible (>35% - 60%)	(4) Major (5-10% variation on project costs)	(4) Major (5-10% variation on remaining project schedule)	(3) Moderate	(2) Mostly [70% > CE <= 90%]	(3) Possible (>35% - 60%)	(1) Insignificant (<1% variation on project costs)	(2) Minor (1-2% variation on remaining project schedule)	(2) Minor	(2) Mostly [70% > CE <= 90%]	**48**	**Priority I**	**24**	**Priority III**
5.70	28 September 2018	Socio-economic: external	As a result of not concluding agreements with third parties regarding post mining land use, it is possible that there will be a gradual deterioration of infrastructure through mismanagement, illegal occupation and vandalism may occur, which could lead to increased financial liabilities and reputational damage	Not concluding agreements with third parties regarding post mining land use	Gradual deterioration of infrastructure though mismanagement, illegal occupation vandalism	Discussions will be held with local municipality to establish best use for infrastructure prior to demolition; Infrastructure will only be left if robust agreements with third parties are in place - closure assumption is that all infrastructure will be demolished to 1 meter below ground level or covered with 1 meter of material. EMPr,	**Open**	Continuous compliance with regulatory framework, submission of annual updated to the FDRCP, ARP and ERA as further details become available closer to closure, and engagement/communication with stakeholders.	(0) Not Applicable	(0) Not Assessed	(0) Not Assessed	(0) Not Assessed	(0) Not Assessed	(0) Not Applicable	(0) Not Assessed	(0) Not Assessed	(0) Not Assessed	(0) Not Assessed	**0**	**None**	**0**	**None**

						SLP section 4.4.2 and SLI-LP-ENV.008 (Standard Practice Instruction: Ongoing and Final Rehabilitation)															
5.80	28 September 2018	Socio-economic: internal/external	As a result of SMME and education initiatives not being self sustaining at closure, it is possible that continued reliance on Exxaro for funding may occur, which could lead to increased post closure liabilities or reputational damage	SMME and education initiatives not yet self sustaining at closure	Continued financial reliance on Exxaro	Capacity building initiatives and training for SMME suppliers; Implement mentorship programme to ensure sustainability/diversification of SMMEs. Engage actively in District Municipality Local Economic Development planning through relevant forums; Focus on LED efforts in Victor Khanye local municipality, particularly: Establishment of SMME /business incubator. SLP section 3.8.1; section 4 and table 34	**Open**	Continual updates and implementation of the SLP and communication with stakeholders running into closure.	(3) Possible (>35% - 60%)	(2) Minor (1-2% variation on project costs)	(3) Moderate (2-5% variation on remaining project schedule)	(2) Minor	(3) Effective [50% > CE <= 70%]	(1) Rare (< 10%)	(1) Insignificant (<1% variation on project costs)	(1) Insignificant (<1% variation on remaining project schedule)	(2) Minor	(2) Mostly [70% > CE <= 90%]	**36**	**Priority II**	**8**	**Priority IV**
5.90	28 September 2018	Socio-economic: internal/external	As a result of misaligned expectations of communities/employees at closure, it is possible that unrest may occur, which could lead to increased financial liabilities and reputational damage	Misalignment of expectations of local communities/employees at closure regarding post closure aspects (land use / water management / economic opportunities).	Unrest/discontentment	Build on PP conducted throughout the operation, SLP implementation and Legacy/Closure project Compile Social Impact Assessment and conduct public participation to identify and address issues/risks pro-actively	**Open**	SLP implementation and PP process' through out LoM	(3) Possible (>35% - 60%)	(4) Major (5-10% variation on project costs)	(4) Major (5-10% variation on remaining project schedule)	(3) Moderate	(3) Effective [50% > CE <= 70%]	(2) Unlikely (>10 - 35%)	(3) Moderate (2-5% variation on project costs)	(3) Moderate (2-5% variation on remaining project schedule)	(2) Minor	(2) Mostly [70% > CE <= 90%]	**48**	**Priority I**	**24**	**Priority III**

5.10	28 September 2018	Surface and ground water - infrastructure	As a result of the removal of carbonaceous veneer from the plant footprint, it is possible that the bare footprint could increase the risk of erosion prior to vegetation establishment.	recovering and clearing carbonaceous veneer from the plant footprint	increased erosion and sediment transport,	Bare areas must be rehabilitated as soon as possible (EMPR, IWUL, IWWMP and RSIP)	**Open**	Develop rehabilitation guidelines and policy documents into detailed implementation plans with sign-off protocols. Ensure effective pasture management of rehabilitated areas during operations and implement the monitoring and care and maintenance activities; Continual compliance with regulatory framework and engagement with stakeholders.	(3) Possible (>35% - 60%)	(3) Moderate (2-5% variation on project costs)	(3) Moderate (2-5% variation on remaining project schedule)	(3) Moderate	(2) Mostly [70% > CE <= 90%]	(2) Unlikely (>10 - 35%)	(1) Insignificant (<1% variation on project costs)	(2) Minor (1-2% variation on remaining project schedule)	(1) Insignificant	(2) Mostly [70% > CE <= 90%]	**36**	**Priority II**	**16**	**Priority IV**
5.11	28 September 2018	Surface and ground water - Infrastructure	As a result of not removing all of the carbonaceous veneer from the plant footprint, it is possible that there will be continued contamination of surface and ground water, which could lead to an increased post closure liability.	Not recovering and clearing all of the carbonaceous veneer from the plant footprint	Continued surface and ground water contamination from the rehabilitated footprint	Contaminated material will be removed across the whole plant area prior to general rehabilitation measures being implemented (EMPR, IWUL, IWWMP and RSIP)	**Open**	Schedule final rehabilitation to ensure alignment with commitments and develop standards for accurate implementation	(3) Possible (>35% - 60%)	(3) Moderate (2-5% variation on project costs)	(3) Moderate (2-5% variation on remaining project schedule)	(3) Moderate	(2) Mostly [70% > CE <= 90%]	(2) Unlikely (>10 - 35%)	(2) Minor (1-2% variation on project costs)	(2) Minor (1-2% variation on remaining project schedule)	(2) Minor	(2) Mostly [70% > CE <= 90%]	**36**	**Priority II**	**16**	**Priority IV**

APPENDIX D

Infrastructure measurements

No	Infrastructure	Area (m^2)	Area (ha)	General rehab area (m2)	Silt Volume (m3)	Shaft area (m2)	Estimated volume(m3)	Mass (t)	Length (m)	Diam (m)	structure type - assumptions
1	**Control Dam offices**	285.74									Double storey brick building
1.1	Single storey brick building	395.99									
2	Shed near control dam offices	400.45					120.14		12.15		2 double brick walls (with metal sheeting)
3	Plant Maintenance & Planning offices	1,999.16									Concrete Foundation (assume 300mm depth)
4	Prefabs	280.36									
5	Mobile Units	102.95									male and female bathrooms and showers (Assets)
6	Containers										
7	Parking	256.99									
8	Concrete Silo	199.45					420.12			15.94	Assumed height of 20m, assume 300mm walls (incl.

No	Infrastructure	Area (m^2)	Area (ha)	General rehab area (m2)	Silt Volume (m3)	Shaft area (m2)	Estimated volume(m3)	Mass (t)	Length (m)	Diam (m)	structure type - assumptions
											top and bottom slab)
9	FA Steel dam										
10	FA Conveyors										heavy steel, suspended, without cladding
11	FA Steel Structures	840.69									
	JIG Plant										
	Structural steel Heavy	346.11									
	Structural steel Medium	401.18									
	Sub-station and building behind FA Plant	659.11									Single storey brick building
12	Retaining Wall								28.71		
13	Steel dam 1	256.89								18.09	at area near FA Plant
14	Steel dam 2	404.37								22.69	DMS Plant
15	Steel dam 3	433.83								23.50	DMS Plant

No	Infrastructure	Area (m^2)	Area (ha)	General rehab area (m2)	Silt Volume (m3)	Shaft area (m2)	Estimated volume(m3)	Mass (t)	Length (m)	Diam (m)	structure type - assumptions
16	Steel dam 4	349.72								21.10	DMS Plant
17	Steel dam 5	220.79								16.77	DMS Plant
18	Steel dam 6	62.61								8.93	DMS Plant
19	**DMS plant**	2,283.14									Concrete foundation
20	Structural steel	1,771.25					17,712.50	139,043.13			Assumed height of 10m
21	Sump 1	264.61							82.20		Concrete (Depth TBC)
22	Tunnel	91.39							40.47		Concrete (Depth TBC)
23	Rail line								6,334.16		
24	Stormwater channel/trench								1,042.77		Concrete channels (at the plant only)
25	Conveyors								1,912.90		heavy steel, suspended, without cladding
26	Conveyors								147.32		heavy steel, suspended, with cladding

No	Infrastructure	Area (m^2)	Area (ha)	General rehab area (m2)	Silt Volume (m3)	Shaft area (m2)	Estimated volume(m3)	Mass (t)	Length (m)	Diam (m)	structure type - assumptions
27	Conveyors								2,556.05		heavy steel, overland, without cladding
28	**Load out station**	128.32									single storey brick building
29	Parking shed/Car port	81.77									Consisting of concrete foundation and metal sheet roof
30	Parameter wall								121.77		Double brick wall
31	Surge bin	63.58									sheavy steel, height TBC
32	Gaurdhouse	12.00									
33	**Filter Press Area**	2,319.21					695.76				Concrete Foundation
34	Warehouse 1	755.79									Large shed type structure on concrete base (assumed height of 13-15m)

No	Infrastructure	Area (m^2)	Area (ha)	General rehab area (m2)	Silt Volume (m3)	Shaft area (m2)	Estimated volume(m3)	Mass (t)	Length (m)	Diam (m)	structure type - assumptions
35	MCC building	67.60									Double storey brick building
36	Warehouse 2	147.39									Shed type structure on concrete base, height TBC
37	Offices	41.64									Prefabs
38	Steel tanks									5.00	(assume 5 diameter, position TBC) x2
39	**Leeuwpan Lab**	406.15					121.85				Concrete Foundation beneath shed structure
40	Lab	272.43									Brick structure (half of lab)
41	Lab	317.70									Shed type structure (half of lab)
42	PCD Evapouration Dam	30,156.28			123,920.00						HDPE Lined
43	Concrete Sump						59.13				
44	Drying pans	462.24			**						Concrete dam

No	Infrastructure	Area (m^2)	Area (ha)	General rehab area (m2)	Silt Volume (m3)	Shaft area (m2)	Estimated volume(m3)	Mass (t)	Length (m)	Diam (m)	structure type - assumptions
45	Contaminated Plant Footprint	479,623.336	47.96				143,887.00				Measured off survey plan, for volume assume 300mm depth
46	way bridge	278.55					41.78				precast concrete slabs (150mm) with (I/C-Beams)
47	Gaurdhouse	9.95									Double bricked single storey brick building
48	Pavement	43.97									
49	Prefabs	43.499									
50	Prefabs foundation	69.62					20.89				Concrete foundation, assume 300m depth
51	Transformers										At Leeuwpan dam and Filter Press Area
52	Equipment										
53	**Offices**										

No	Infrastructure	Area (m^2)	Area (ha)	General rehab area (m2)	Silt Volume (m3)	Shaft area (m2)	Estimated volume(m3)	Mass (t)	Length (m)	Diam (m)	structure type - assumptions
54	Parking 1	250.96		250.96							Metal roof sheeting with concrete base
55	Open area	759.24		759.24							Tar?
56	Paving			0.00							
57	Main office buildings	946.65		946.65							Single storey brick structure
58	Prefabs	192.17		192.17							
59	Prefabs concrete base	308.62		308.62			92.59				concrete
60	Lapa	61.44		61.44							Single storey brick structure
61	**Leeuwkuil**	225.69		225.69							single storey brick structure
62	leeuwkuil	168.29		168.29							double storey brick structure
63	Parking	139.27		139.27							Metal roof sheeting with concrete base
64	Paving			0.00							Concrete Paving

No	Infrastructure	Area (m^2)	Area (ha)	General rehab area (m2)	Silt Volume (m3)	Shaft area (m2)	Estimated volume(m3)	Mass (t)	Length (m)	Diam (m)	structure type - assumptions
65	**Training Centre**	227.15		227.15							Single storey brick structure
66	Parking	695.01		695.01							concrete foundation and track ballast
67	Walkway with shade	62.77		62.77							Concrete Paving
68	Open walkway			0.00							Concrete Paving
69	**White brick building**	67.07		67.07							single storey brick building
70	Perimeter Fencing			0.00					63.04		Steel fencing
71	Pre-cast concrete wall			0.00					18.49		Pre-cast concrete
72	**P&O Building**	359.79		359.79							Single storey brick structure
73	Parking	157.61		157.61							steel sheet roofing with concrete base
74	Paving			0.00							
75	Small building behind P&O	23.52		23.52							brick building
76	Small shed structure	5.48		5.48							1.5-2m high

No	Infrastructure	Area (m^2)	Area (ha)	General rehab area (m2)	Silt Volume (m3)	Shaft area (m2)	Estimated volume(m3)	Mass (t)	Length (m)	Diam (m)	structure type - assumptions
77	Prefabs	15.77		15.77							
78	**Prefabs (SHE centre, Project office…etc.)**	87.00		87.00							(2 x 10m x 3m + 1 x 9m x 3m) Prefab
79	Concrete Base	160.05		160.05							
80	Prefabs			0.00							
81	Leeuwpan Clinic	112.64		112.64							Single storey painted brick buidling
82	Walkway	28.61		28.61							Brick paving
83	shed-like Structure	55.69		55.69							Height TBC
84	**Contractors Yard**			0.00							
85	Office with green carpet	168		168.00							Prefab - without concrete base (7m x 24m)
86	Shed structure near Office	230.00		230.00							
87	Paving around shed structure	364.12		364.12							Brick paving

No	Infrastructure	Area (m^2)	Area (ha)	General rehab area (m2)	Silt Volume (m3)	Shaft area (m2)	Estimated volume(m3)	Mass (t)	Length (m)	Diam (m)	structure type - assumptions
88	Gas cylinder stores	98.00		98.00							(7m x 6m + 7m x 8m) Sheet steel and concrete base
89	Stores (Shed area)	422.90		422.90							
90	Stores (Brick area)	70.23		70.23							
91	Parking	270.00		270.00							Steel sheet roof with Concrete base
92	Area with Jojo tanks			0.00							
93	Concrete foundation (around 4 wooden poled lights)	584.28		584.28							
94	Hazardous waste disposal	55.00		55.00							
95	2 horizontal cylinders	650.60		650.60			229.98				Concrete Base, assume depth of 300mm, concrete walls, assume 300mm thickness
96	Concrete sumps	84.00		84.00							Concrete, assume depth of 1m, with wall thickness of 300mm

No	Infrastructure	Area (m^2)	Area (ha)	General rehab area (m2)	Silt Volume (m3)	Shaft area (m2)	Estimated volume(m3)	Mass (t)	Length (m)	Diam (m)	structure type - assumptions
97	Shed structure	120.00		120.00							10m high
98	Fueling station	99.41		99.41							steel sheet roof with concrete base
99	Concrete base	661.21		661.21							assume depth of 300mm
100	Area behind workshops	460.85		460.85			138.25				Concrete Base, assume depth of 300mm
101	Purification Plant	210.14		210.14			63.04				Concrete Base, assume depth of 300mm
102	Water tanks	101.57		101.57			30.47				Concrete Base, assume depth of 300mm
103	Area behind workshops	460.85		460.85			138.25				Concrete Base, assume depth of 300mm
104	Change House	560.00		560.00							Brick structure

No	Infrastructure	Area (m^2)	Area (ha)	General rehab area (m2)	Silt Volume (m3)	Shaft area (m2)	Estimated volume(m3)	Mass (t)	Length (m)	Diam (m)	structure type - assumptions
105	Mining Workshops	832.00		832.00							about 10m high
106	Mining Workshops concrete foundation	832.00		832.00			249.60				concrete foundation, assume depth of 300mm
107	Truck parking near Mining Workshops	450.15		450.15			135.05				Concrete base (TBC), assume 300mm depth
108	Parking near Mining Workshops	76.42		76.42							
109	Offices			0.00							Prefabs
110	Offices parking	106.89		106.89							
111	Wash Bay	177.61		177.61							Exact Material and position TBC
112	Concrete wall (high)			0.00			49.68		27.60		6m high, assume wall thickness of 300mm

No	Infrastructure	Area (m^2)	Area (ha)	General rehab area (m2)	Silt Volume (m3)	Shaft area (m2)	Estimated volume(m3)	Mass (t)	Length (m)	Diam (m)	structure type - assumptions
113	Concrete wall (short)			0.00			11.16		37.22		1m high, assume a wall thickness of 300mm
114	Concrete area	350.10		350.10			105.03				Concrete base, assume depth of 300mm
115	Pit sizes & Dumps			0.00							
116	Leeupan lab area	67,735.04	6.77	67,735.04							
117	Main gate security building	110.00	0.01	110.00							
118	Main gate large IRB shed/roof	105.00	0.01	105.00							
119	Main gate pedestrian access IRB	150.00	0.02	150.00							
120	Main gate bus shelter / sheeting	70.00	0.01	70.00							
121	Main gate weighbridge	35.32	0.00	35.32			30.00				

No	Infrastructure	Area (m^2)	Area (ha)	General rehab area (m2)	Silt Volume (m3)	Shaft area (m2)	Estimated volume(m3)	Mass (t)	Length (m)	Diam (m)	structure type - assumptions
122	Main gate paving	367.74	0.04	367.74							
123	Main gate hard stand	4,549.53	0.45	4,549.53			909.91				hard stand and carbonaceous veneer (0.20 mm)
	Monitoring and maintenance areas retained from previous costing										
	Between ODN/ODS	13,500.00	1.35								
	Next to witklip substation	52,900.00	5.29								
	Old OE rehab area	347,400.00	34.74								
	Wetland area next to Samquartz and OJ	889,000.00	88.90								
	Totals	1,917,137.26		86,729.44	123,920.00	0.00	164,322.27		12,424.84	132.02	
	Hectares	**191.71**			**12.39**	**0.00**					

APPENDIX E

Detailed costing sheets

Detailed costing sheets are provided separately within an excel workbook.

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