mineral resources

Department:
Mineral Resources
REPUBLIC OF SOUTH AFRICA

PART B

ENVIRONMENTAL MANAGEMENT PROGRAMME REPORT

THE DUEL COAL PROJECT

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

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IMPORTANT NOTICE

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

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

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

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

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

OBJECTIVES OF THE ENVIRONMENTAL IMPACT ASSESSMENT PROCESS

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

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

(b) describe the need and desirability of the proposed activity, including the need and desirability of the activity in the context of the preferred location;

(c) identify the location of the development footprint within the preferred site based on an impact and risk assessment process inclusive of cumulative impacts and a ranking process of all the identified development footprint alternatives focusing on the geographical, biophysical, biological, social, economic, heritage and cultural aspects of the environment;

(d) determine the -

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

    ii) degree to which these impacts -

        a. can be reversed;

        b. may cause irreplaceable loss of resources; and

        c. can be avoided, managed or mitigated;

(e) identify the most ideal location for the activity within the preferred site based on the lowest level of environmental sensitivity identified during the assessment;

(f) identify, assess, and rank the impacts the activity will impose on the preferred location through the life of the activity;

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

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

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In terms of the NEMA 2014 EIA Regulations contained in GN R982 of 04 December 2014 (as amended in 2017) the Environmental Management Programme (EMPr) must comply with Appendix 4 of the NEMA 2014 EIA Regulations (GN R982 of 04 December 2014).

Legal Requirement		Relevant Section in EMPr
(1)	An EMPr must comply with section 24N of the Act and include–	
(a)	details of- (i) the EAP who prepared the EMPr; and (ii) the expertise of that EAP to prepare an EMPr, including a curriculum vitae;	Section 1
(b)	a detailed description of the aspects of the activity that are covered by the EMPr as identified by the project description;	Section 2
(c)	a map at an appropriate scale which superimposes the proposed activity, its associated structures, and infrastructure on the environmental sensitivities of the preferred site, indicating any areas that any areas that should be avoided, including buffers;	Section 3 Appendix 15
(d)	a description of the impact management objectives outcomes, including management statements, identifying the impacts and risks that need to be avoided, managed and mitigated as identified through the environmental impact assessment process for all phases of the development including– (i) planning and design; (ii) pre-construction activities; (iii) construction activities; (iv) rehabilitation of the environment after construction and where applicable post closure; and (v) where relevant, operation activities;	Section 4
(e)	The description and identification of impact management outcome required for the aspects contemplated in paragraph (d);	Section 4 Table 4
(f)	a description of proposed impact management actions, identifying the manner in which the impact management objectives and outcomes contemplated in paragraph (d) and (e) will be achieved, and must, where applicable, include actions to (i) avoid, modify, remedy, control or stop any action, activity or process which causes pollution or environmental degradation; (ii) comply with any prescribed environmental management standards or practices; (iii) comply with any applicable provisions of the Act regarding closure, where applicable; and (iv) comply with any provisions of the Act regarding financial provision for rehabilitation, where applicable;	Section 5 Table 4
(g)	the method of monitoring the implementation of the impact management actions contemplated in paragraph (f);	Section 8 Table 8
(h)	the frequency of monitoring the implementation of the impact management actions contemplated in paragraph (f);	Section 8 Table 8
(i)	an indication of the persons who will be responsible for the implementation of the impact management actions;	Section 8 Table 8
(j)	the time periods within which the impact management actions contemplated in paragraph (f) must be implemented;	Section 8 Table 8
(k)	the mechanism for monitoring compliance with the impact management actions contemplated in paragraph (f);	Section 8 Table 8
(l)	a program for reporting on compliance, taking into account the requirements as prescribed by the Regulations;	Section 8
(m)	an environmental awareness plan describing the manner in which— (i) the applicant intends to inform his or her employees of any environmental risk which may result from their work; and (ii) risks must be dealt with in order to avoid pollution or the degradation of the environment; and	Section 9
(n)	any specific information that may be required by the competent authority.	Section 6 Section 10

TABLE OF CONTENT

LIST OF TABLES

LIST OF FIGURES

1 ENVIRONMENTAL ASSESSMENT PRACTITIONER

Information provided in Part A – Environmental Impact Assessment Report, Section 2.

2 DESCRIPTION OF THE ASPECTS OF THE ACTIVITY

Information provided in Part A – Environmental Impact Assessment Report, Section 5.

3 COMPOSITE MAP

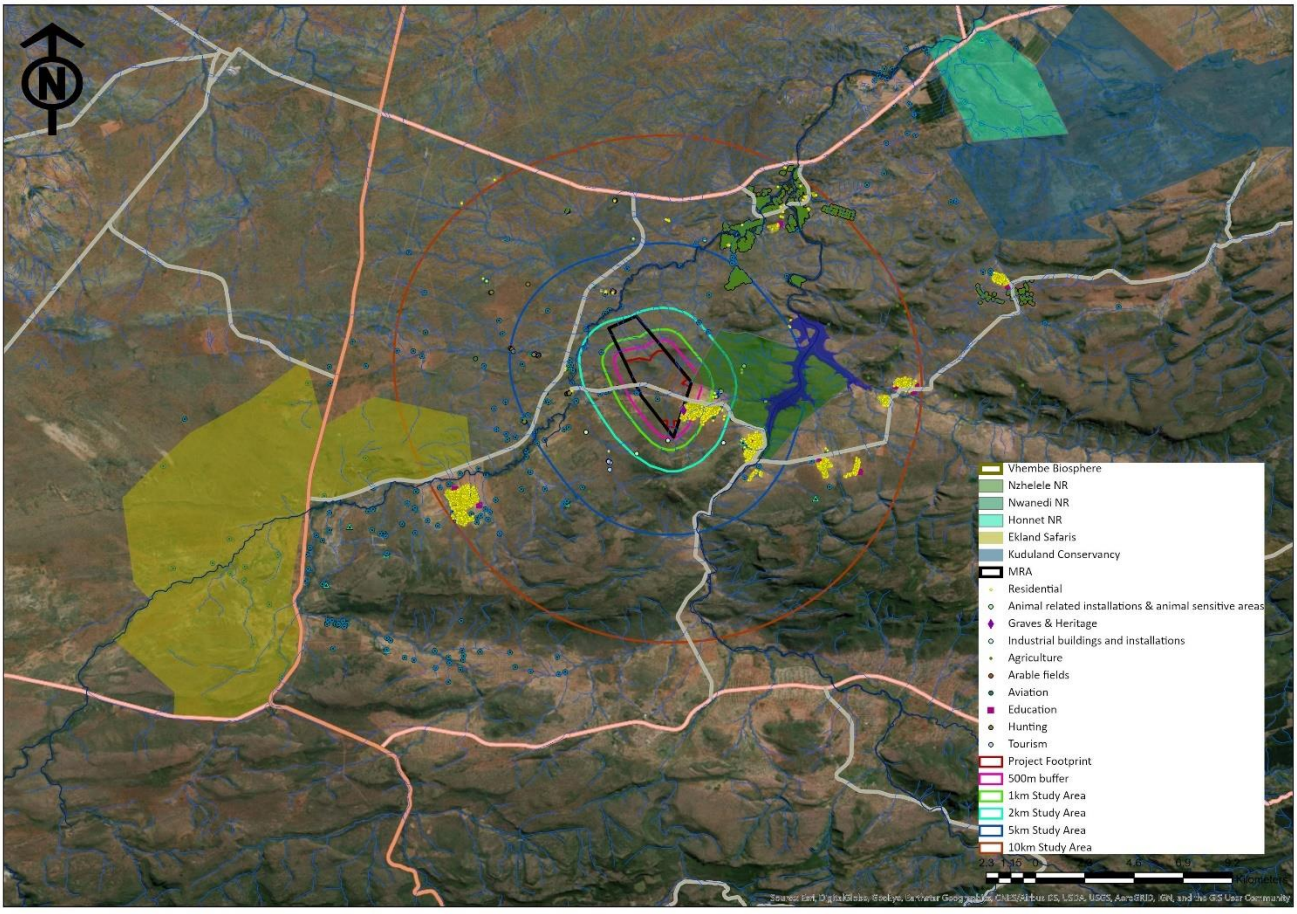

Figure 1: Composite Map inclusive of sensitive receptors

A large-scale Composite Map (Master Plan) is attached in Appendix 15.

4 DESCRIPTION OF IMPACT MANAGEMENT OBJECTIVES

4.1 DETERMINATION OF CLOSURE OBJECTIVES

4.1.1 OBJECTIVES FOR MINE REHABILITATION

Objective 1:

To rehabilitate the disturbed mining and infrastructure areas to a final landform that is sustainable, free-draining and non-erosive.

Objective 2:

To establish a post-mining land use that will sustain rural agricultural activities and/or conservation initiatives once mining activities have been concluded.

Objective 3:

To ensure a sustainable, functional ecosystem post-mining.

Objective 4:

To identify and implement a sustainable post-closure decant management system to prevent the contamination of sensitive water resources.

4.1.2 OBJECTIVES FOR LIVELIHOOD RETENTION

Objective 5:

To empower local communities through Local Economic Development Initiatives, i.e. identify and establish livelihood retention projects that can create off-mine livelihoods during and post-mining.

Objective 6:

To equip employees with portable skills that can be utilised in other sectors post-mining.

4.1.3 OPERATIONAL OBJECTIVES TO FACILITATE CLOSURE

Apart from the short-term objectives and strategies that will require implementation and monitoring over the full life of mine, the following objectives have been set in order to address post-closure issues early on during the operational phase:

4.1.3.1 Verify and manage post-closure decant

- Dedicated monitoring programme and modelling to quantify and verify post-closure water balance and decant water quality. The model will be revised at least every 5 years.
- Ongoing evaluation and reassessment of alternative options for the final water use and required associated water quality, together with the technologies required to achieve the required quality.
- The final land use will also be used to evaluate the post closure water management.
- Active involvement in any regional integrated water management plans developed in the area.

4.1.3.2 Develop final land use plan

- Define, in consultation with all IAPs, the final (post-closure) land use for the mining area, including mining areas, surface and water management infrastructure, mine residue facilities, etc.
- Develop a final land use plan and implementation programme as part of the closure plan, considering important issues such as ongoing operational and maintenance requirements and long-term responsibilities and ownership.
- Set final closure objectives and standards to ensure conformance to the final land use plan and the requirements of the IAPs and relevant environmental legislation.
- Develop a detailed closure plan for The Duel Coal Project five years prior to closure and obtain approval from the relevant authorities.

4.1.3.3 Stability impact management

The Duel Coal Project is aiming at developing rehabilitation and pollution control measures that will be sustainable post-closure.

Key issues and objectives relate to:

- All rehabilitated spoils placed within the open pits will be made free draining as far as practically possible. Grassing will be undertaken on a seasonal basis, to ensure germination of the grass species. This will to ensure maximum drainage from these areas of clean water back into the catchment system without excessive erosion or suspended solids.
- Preventing and managing erosion of rehabilitated surfaces, such as post-mining landforms. The transition to natural systems considered sustainable in the long-term taking account of possible exposure to fire and drought is important.
- Ensuring stability of remaining (if required) stockpiles.
- Ensuring that where activities have affected streams, these areas are not prone to erosion or deterioration in the future. In particular, the stability of the river diversions is a key issue.

4.1.4 REHABILITATION PLAN

The successful rehabilitation of impacted areas (soil, land capability and potential land use perspective) is determined by a few critically important factors, as follows:

- Soil compaction, organic carbon, fertility, suitable topsoiling material and topsoiling depth;
- Sequence of horizons;
- Slope – must not exceed critical erosion slopes;
- Pollution – soluble pollutants, acid mine drainage and dust;
- Re-vegetation; and
- Climate.

These factors interact and have a large bearing on the ease with which roots colonise the soil. In areas where plants thrive, there will consequently be a higher level of vegetative basal cover, and lower levels of run-off and soil erosion. Any one of the aforementioned factors (either singly or in combination) may jeopardize the

successful rehabilitation of mine related facilities/features and will be taken into consideration during the final rehabilitation planning.

4.1.4.1 Post Mining Land Capability

It is doubtful that the area affected by opencast mining will ever function in the same manner as is presently the case from a hydropedological perspective. If traditional approaches are followed, one can assume that the rehabilitated land in the opencast pit area will exhibit a much higher infiltration and percolation rate than is presently the case for the high-lying soils. Rehabilitated land tends to be rather permeable and large volumes of water that currently manifests as surface runoff will end up in the opencast pits – even after infilling. In addition, large sections of the deeper Hutton and Augrabies soils, as well as section of the alluvial deposits will be disturbed and their hydropedological and chemical nature will be changed. Hard-setting and crusting are significant concerns and the post-mining landscape could exhibit a much different soil environment than is now the case. The arable and temporary wetland (riparian) areas to be impacted by opencast mining will probably only be restored to grazing land during rehabilitation while the grazing land will probably only be restored to wilderness land.

In the area where subsidence owing to underground mining could occur, the hydropedological characteristics could be negatively impacted, resulting in areas of water ponding or higher levels of internal drainage. Surface cracking and erosion is a further concern. With the correct mitigation measures these areas can retain their land capability class in the post-mining landscape.

4.1.4.2 Rehabilitation Strategy

The following preliminary strategies have been set for the successful rehabilitation of the disturbed areas associated with the proposed The Duel Coal Project:

- Reclamation: To reclaim all mining related infrastructure from underground and seal the underground operations when production ceases.
- Demolition: To demolish the surface structures where alternative use is not possible (agreed with community) and rehabilitate the areas where required.
- Rehabilitation: To rehabilitate the open pit, remaining surface stockpiles and other disturbed areas to a post-mining grazing capability class.

To achieve the objectives, the following actions will be implemented when mining cease:

- Reclamation

- Reclaim all usable infrastructure from underground for recycling with the surface infrastructure.
- Adits will be filled with non-combustible inert building rubble and terrace material.

- Demolition

- All buildings and steel structures will be demolished in a safe and environmentally responsible manner.
- Material will be recycled as far as possible and use will be made of contractors specialising in this field to dismantle the surface infrastructure and recycle the building material as far as possible.
- Inert building rubble that cannot be recycled will be used to seal the underground adits.
- Other non-recyclable building material will be disposed of at a registered landfill site.

- All contaminated and carbonaceous material within the Infrastructure Area will be removed and disposed of at an appropriate registered landfill site.

- Rehabilitation

- As far as practically possible, all areas will be designed to be free draining as far as practically possible and all clean surface runoff to be discharged into the natural environment.
- Final destination scheduling will be developed during the Feasibility Phase. This schedule will indicate the removal of materials from the open pit and utilize this material to ensure an overall compliance of the rehabilitation objectives.
- In-pit waste dumping will be utilised as far as practically possible, and the remaining waste to be accommodated on surface near pit exit.
- All disturbed areas will be ripped to a minimum depth of 1m.
- Levelling, sloping and landscaping of the disturbed area.
- Topsoiling and re-vegetation according to the rehabilitation plan.

- Rehabilitation of remaining surface infrastructure

- Final sloping and landscaping of remaining surface dumps.
- Engineered capping of the remaining surface dumps to minimize water ingress and spontaneous combustion.
- Stabilisation of any erosion in and around the remaining surface dumps.
- Construction of energy dissipating structures along steep slopes.
- Final topsoiling and re-vegetation of the remaining surface dumps according to the rehabilitation plan.

Refer to Figure 2 for the envisaged final waste dump arrangements and rehabilitation topography after mining.

4.1.4.3 Topsoil Handling and Stockpiling

Topsoil handling is critical to the whole rehabilitation effort and guidelines should be followed earnestly. Detail instructions for soil stripping and stockpile placement should be formulated within the context of the mine plan (individual strips) and distinguishing differences in soil types should be pointed out for accurate identification.

The Soil Specialist Report (Appendix 3, Table 13) contains a section on soil utilisation and topsoil handling where preliminary proposals are provided in respect of topsoil stripping depths and approximate volumes of soil stockpiles for the opencast areas. Stripping and stockpiling are mainly associated with opencast mining.

Separate stockpiling of the different soil forms that comprise the Mispah-Glenrosa complex, the Mispah/rocky Augrabies complex, the Mispah/rocky Hutton complex and alluvial soil complex of polygon 1 is not practical. The A-horizons of these soils can therefore be stockpiled together. For the purposes of this document, this stockpile is referred to as Stockpile A1 in Appendix 3, Table 13. The B-horizons of these soils should be stored as Stockpile B1.

The A-horizons of the deeper soils must be stockpiled separately from stockpile A1. The A-horizons of the Augrabies and Hutton soil forms can be stored together as Stockpile A2. The A-horizon of the Augrabies soil form does not differ much in terms of chemical and physical characteristics from that of the soils of the Augrabies soil form. The subsoil horizons of these soil forms must be stockpiled separately as the B-horizon of the Hutton soil form differ substantially from that of the soils of the Augrabies soil form. These stockpiles are

referred to as Stockpile B2 and B3 in Appendix 3, Table 13. Mixing of these materials will lead to large scale erosion of the stockpiled material and the post rehabilitation landscape, as well as a decrease in soil fertility levels.

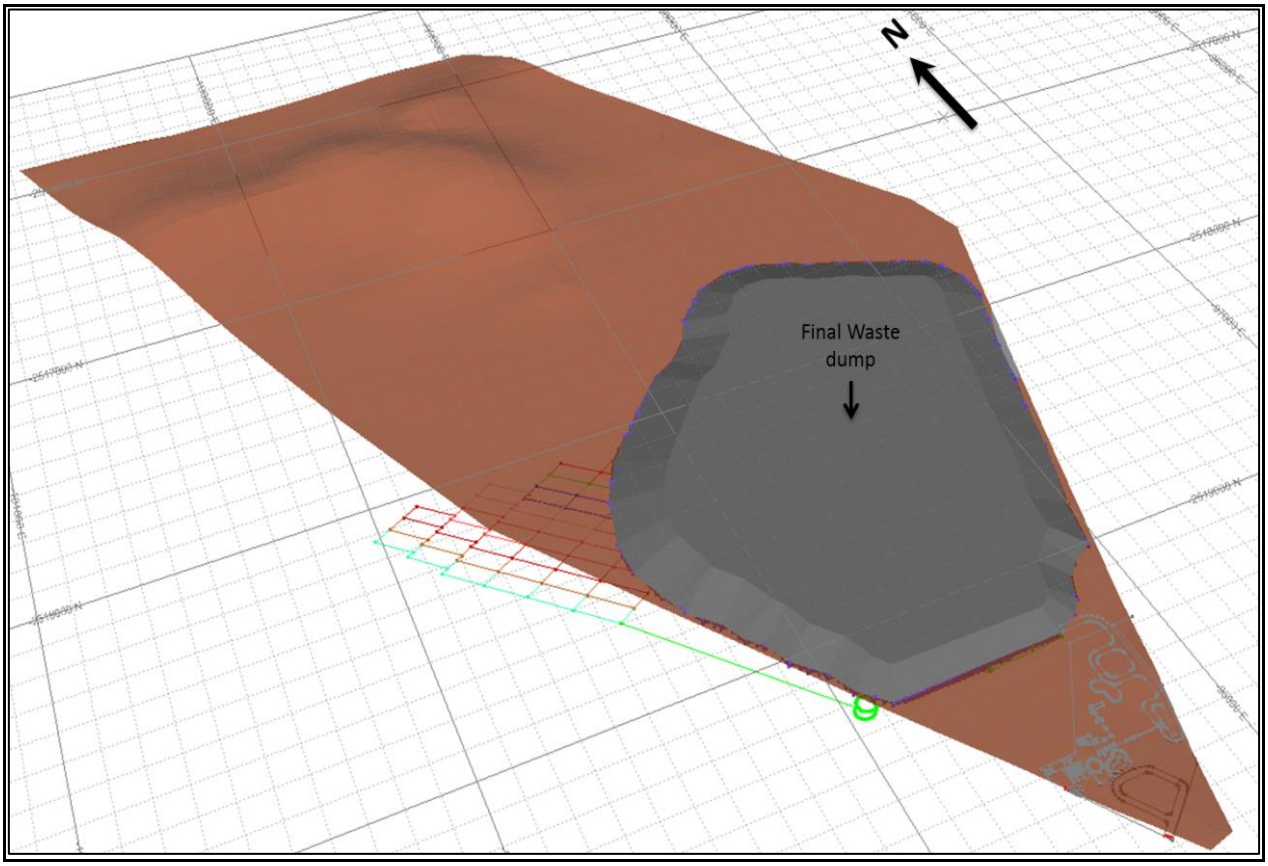

Figure 2: Final waste dump arrangement

It is impractical to separate the rocky Hutton, rocky Augrabies and rocky Brandvlei soil forms as these occur as complexes. These soils can be stripped to bedrock and stockpiled as Stockpile A3. The soils of the soil-rock complex can be stockpiled as Stockpile A4.

During stockpiling the organic matter in the soil decompose, microbial activity decreases and plant seeds and microbial survival structures lose viability with time. It is therefore recommended that stockpiles are utilised as soon as possible, and that erosion of stockpile material be managed (slope and orientation of stockpile, movement of surface water, etc.).

Management and promotion of soil fertility with fertilizer and amendments is an important aspect of rehabilitation and specifically revegetation. Plant nutrient deficiencies and mineral disorders in soil must be detected and rectified. Movement and mixing of soil may result in contamination by coaliferous spoil and coal waste, making soil nutrient and acidity levels unpredictable. Soil analysis provides the best guide and a sound monitoring programme is regarded as mandatory for proper rehabilitation. Management of soil organic matter through organic amendments and the use of mulches should receive attention with the aim of improving functional microbial diversity, nutrient cycling and revegetation.

4.1.4.4 Mitigation Measures in Areas that have undergone Subsidence

Surface ponds or artificial wetlands often form in areas where subsidence has occurred. The following can be done to mitigate the effect of subsidence on land capability and land use:

- Re-contour the surface or install waterways to carry away water collected in depressions;
- Cut and fill operations can be conducted to help restore surface drainage;
- Subsurface drains can be installed to aid drainage; or
- A combination of the above.

Tension ground cracks often form in areas that have undergone subsidence. These cracks can vary from a few millimetres to approximately 25 cm in width. To mitigate these, the following can be done:

- In cultivated fields, ploughing can be used to close the cracks. This is not an option for the area under investigation as no cultivated land will be impacted.
- Wide cracks can be filled with soil material and mulched to combat erosion.

Repair to the impacted land can only be done once subsidence has ceased and the soil surface has become stable. Otherwise any mitigation measures will have to be repeated later. In addition, cracks often close as the soils settle.

4.2 PROCESS FOR MANAGING ANY ENVIRONMENTAL DAMAGE, POLLUTION, PUMPING AND TREATMENT OF EXTRANEOUS WATER OR ECOLOGICAL DEGRADATION

4.2.1 ECOLOGICAL AND BIODIVERSITY MANAGEMENT

The following points highlight the key latent impacts that have been identified:

- Destruction of ecologically intact, irreplaceable floral habitat;
- Loss of ecologically important faunal habitat;
- Loss of faunal and floral habitat diversity;
- Permanent loss of floral habitat and species diversity earmarked for conservation;
- Loss of and altered faunal species diversity;
- Loss of SCC/protected species and associated suitable habitat.
- Alien floral invasion;
- Reduced availability of refugia for aquatic biota;
- Altered riparian vegetation structures;
- Impacts on water quality in local watercourses due to runoff from the impacted mine area;
- Impacts on dissolved oxygen concentration and saturation;
- Silted up refuge pools are unlikely to be naturally rehabilitated by the mine and loss of refugia in the system is deemed likely;
- Loss of some flow dependent species is likely on a localised scale; and
- Loss of some species less tolerant of water quality changes is likely on a localised scale.

Disturbed areas are highly unlikely to be rehabilitated to pre-development conditions of ecological functioning and significant loss of floral habitat, species diversity and SCC/protected floral species will most likely be permanent.

The study area is located in the Soutpansberg IBA, as well as bordering the Nzhelele Nature Reserve, and is likely to provide primary, secondary and temporary habitat to a number of important faunal species. Large raptors known to occur in the region are likely to utilise the study area for both foraging and breeding, similarly for other faunal species. The latent impacts of the mining activities in the study area will likely result in a decrease of these species, as the overall regional carrying capacity and breeding habitat potential of the region will be decreased, compounded with increased threats from poaching and wood harvesting.

4.2.1.1 Ecological and Biodiversity Management Objectives

The proposed ecological and biodiversity management objectives for The Duel Coal Project are to:

- Minimise the loss of ecological and riparian habitats.
- Limit the increase of erosion and downstream sedimentation.
- Minimise the impacts on threatened and/or protected fauna and flora species and species of conservation concern.
- Prevent surface and groundwater pollution.
- Re-establish indigenous vegetation in disturbed and rehabilitated areas.
- Prevent any impact on identified and unidentified heritage and cultural resources.

The end land use management outcome proposed for The Duel Coal Project is Rangeland grazing and browsing with low production potential, medium erosion risk and high biodiversity:

Class	Production Potential	Erosion Risk	Biodiversity (Expected)
Permanent pasture (Productive Grazing)	med-high	med	low
Rangeland (Grazing / browsing)	**low**	**med**	**high**
Sensitive rangeland (Minimum grazing/browsing)	Low-none	high	high

The recommended ecological category for the aquatic systems is:

Feature	VEGRAI Ecostatus	PES Classes	EIS Class	REC Class
Mutamba River	B/C	C	Moderate	C
Smaller drainage lines	B/C	B	Low	B

Appropriate monitoring should be implemented to ensure compliance to the management objectives and outcome as proposed.

4.2.1.2 Biodiversity Action Plan

In order to ensure that impact mitigation takes place to an adequate level, a Biodiversity Action Plan (BAP) must be developed which contains details on all actions that need to be undertaken to manage impacts on the ecology of the region. In addition, the BAP and its implementation should be overseen by an Environmental Management Committee (EMC) which should include representatives from the mine, the local communities and the local farmers' association. The BAP should be a living document and must be continuously updated based on the findings of management and the ecological monitoring program.

4.2.1.3 Reclamation Plan

A detailed Reclamation Plan must be developed for The Duel Project, inclusive of the following aspects:

- Rescue and Relocation Strategy: Protected plants must be removed or transplanted before any mining or construction activities start. The necessary permits to remove and/or destroy protected transplantable and non-transplantable plants must be obtained.
- Collection of local seeds for reproduction in a nursery: Seed from as many of these species as possible will be collected for the re-vegetation programme.
- Establishment of an on-site nursery.
- Re-vegetation trials.
- Maintenance: The maintenance plan must address challenges experienced for both the soil and vegetation resource to achieve sustainable reclamation and improved agricultural potential and final land-use, which is important for mine closure planning.
- Monitoring: The following parameters can be used to establish the condition of the vegetation with other landscape function parameters: basal cover; biomass production; and botanical composition.

4.2.1.4 Ecological offset

Since effective mitigation through avoidance, impact minimisation and rehabilitation is unlikely to adequately limit the impact on the receiving ecology, an ecological offset initiative must be initiated to contribute to the conservation of the area. In particular, initiatives focused on the involvement of surrounding landowners and management of land to create the ecological corridors linking the various areas currently functioning as conservation areas.

In addition, Subiflex must contribute to Strategic Environmental tools, programmes and projects within the province. The method of contribution must be agreed with LEDET.

4.2.1.5 Utilisation of natural resources

The relatively dense vegetation within the proposed mining and infrastructure areas will produce a large volume of biomass that has to be removed and stockpiled before mining commences. A large percentage of the removed plant material will be stored and used to protect newly established plants, prevent soil erosion and serve as seed catchers. A further portion will be chipped for compost, mulching and stabilising berms in the mine. This organic material will be mixed into the top 0.3 m of the rehabilitated topsoiled areas.

Excess wood will be stockpiled and distributed to the local communities, for building purpose or as firewood, as required. It may even offer entrepreneurs the opportunity to start a small business.

4.2.2 WATER MANAGEMENT

Water management on the mine involves all the actions required to ensure that the available water use is maximised, and imported water required are minimised by:

- Re-use of internal water
- Management of clean storm water run-off
- Management of dirty storm water run-off
- Ensuring closed looped system with zero discharge of contaminated water

4.2.2.1 Volumes and rate of water required for mining

4.2.2.1.1 Water Balance

The total water usage for the project is expected to vary between 1225 m^3/day and 2150 m^3/day. Inflows into the mine are expected to vary between 650 m^3/day and 2000 m^3/day. The external water requirement is expected to peak at about 1550 m^3/day. The preliminary water balance is shown in Table 1.

Considering the high level of certainty (98%) required for the mine water supply a safety factor of 1.2 has been applied to the volume required from outside resources (1 550 m^3/day) to give a volume of 1860 m^3/day or 0.679 Mm^3 / annum.

The options or combination of options considered in this study therefore all need to deliver at least 1860 m^3/day of raw water to The Duel Coal Project.

4.2.2.1.2 Bulk Water Supply Options

Alternative options for Bulk Water Supply to The Duel Coal Project are still under investigation. A preliminary investigation was undertaken to determine potential sources for the bulk water requirement, which is attached as Appendix 16. Further work will be required, which will be initiated during the Feasibility Study for the project

4.2.2.1.3 Water Use Licence Application

The approach for The Duel Coal Project is to first apply for the mining right and associated Environmental Authorisation in terms of the NEMA: 2014 regulations. Once this process is completed and the applicant has conducted further feasibility studies and detail designs in respect of its development, the applications for the Water Use Licence in terms of the NWA will be submitted to the Competent Authority (Department of Human Settlements, Water and Sanitation (DHWS)).

Table 1: Water balance for The Duel Coal Project over LOM

Description	Unit	Year																						
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
On-Mine Water Inflow																									
Local Groundwater	m³/day	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pit Dewatering	0	0	750	2 000	1 200	1 800	900	800	900	1 250	750	700	650	700	750	700	600	800	750	700	700	650	650	650	650
Total Inflows	m³/day	0	750	2 000	1 200	1 800	900	800	900	1 250	750	700	650	700	750	700	600	800	750	700	700	650	650	650	650
Water Demand																									
Dust Suppression	m³/day	-164	-590	-790	-790	-790	-790	-790	-790	-790	-790	-790	-790	-790	-790	-790	-790	-790	-790	-790	-790	-790	-790	-790	-790
CHPP	m³/day	-164	-590	-790	-790	-790	-790	-790	-790	-1 180	-1 180	-1 180	-1 180	-1 180	-1 180	-1 180	-1 180	-1 180	-1 180	-1 180	-1 180	-1 180	-1 180	-1 180	65
Water to Water Treatment Plant	m³/day	-75	-90	-90	-90	-90	-90	-90	-90	-120	-120	-120	-120	-120	-120	-120	-120	-120	-120	-120	-120	-120	-120	-120	-120
Washbay and Washdown Water	m³/day	-20	-25	-25	-25	-25	-25	-25	-25	-30	-30	-30	-30	-30	-30	-30	-30	-30	-30	-30	-30	-30	-30	-30	-10
Evaporation	m³/day	0	-30	-30	-30	-30	-30	-30	-30	-30	-30	-30	-30	-30	-30	-30	-30	-30	-30	-30	-30	-30	-30	-30	-30
Construction Water	m³/day	-800	-750	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Outflows	m³/day	-1 223	-2 075	-1 725	-1 725	-1 725	-1 725	-1 725	-1 725	-2 150	-2 150	-2 150	-2 150	-2 150	-2 150	-2 150	-2 150	-2 150	-2 150	-2 150	-2 150	-2 150	-2 150	-2 150	-885
Make-up Water Required from Outside Sources																	Max Demand								
Outside Make Requirment	m³/day	-1 223	-1 325	275	-525	75	-825	-925	-825	-900	-1 400	-1 450	-1 500	-1 450	-1 400	-1 450	-1 550	-1 350	-1 400	-1 450	-1 450	-1 500	-1 500	-1 500	-235
Rouded Balance+10% Contingency	m³/day	-1 345	-1 458	303	-578	83	-908	-1 018	-908	-990	-1 540	-1 595	-1 650	-1 595	-1 540	-1 595	-1 705	-1 485	-1 540	-1 595	-1 595	-1 650	-1 650	-1 650	-259

4.2.2.2 Water Conservation and Demand Management

The key principles of water conservation and demand management (WCDM) are based on the hierarchy of water management as detailed in the various WCDM Best Practise Manual developed for the mining industry (Department of Water Affairs and Forestry, 2008) and include:

- Avoid water use: this principle seeks to reduce, wherever possible, the use of water where waterless options exist.
- Reduce water use: this principle seeks to reduce the amount of water used through measures such as efficient water use and cleaner production.
- Reuse and recycle: this principle seeks to reuse and recycle water as far as possible, in accordance to applicable rules and regulations.
- Disposal of water: this principle seeks to ensure that the disposal of water, or treated wastewater that is not recycled or reused, does not cause degradation to the receiving environment.
- Feedback and adaptive management: feedback and adaptive management involve modifying water use habits to achieve more efficient use of water, thus reducing overall water consumption.

4.2.2.3 Storm Water Management Plan

A conceptual layout of the required Storm Water Management Plan (SWMP) system has been done, based on the requirements in the Best Practice Guideline G1: Stormwater Management, DWAF, August 2006, using the available mining layouts as provided by the company.

Several non-perennial stream and drainage lines will be impacted by the proposed mining development, and clean water runoff will need to be diverted around the dirty water areas to convey unpolluted water to its nearest outfall.

Note that the conceptual layouts do not take the timeline into account. Over the life of the pit, intermediate systems may be installed to shorten flow paths. It was assumed that no drainage structures may cross over the rehabilitated zone and therefore relatively long diversion structures around the pit and dump areas are required. Furthermore, only the major systems required to contain dirty water and divert clean water around sensitive areas are indicated. In the operational phase, more nominal sized conduits and ponds may be required which are not indicated in the conceptual, small-scale layout.

As a general mitigation measure, it is proposed that all access and haul roads be constructed to also act as diversion berms and canals, where required. It is also proposed that runoff at all dirty areas be contained by dirty water berms and excess water be drained by canals (if no access road or haul road can fulfil this function) to discharge dirty storm water to the proposed dirty water ponds.

Table 2: Storm Water Management Measures (Figure 3)

Item Number	Project Component	Description of Impact
PR01	Plant 2h Site	It is proposed to construct dirty water berms around the Plant 2ha Site to retain any pollutant surface water runoff.
		A clean water cut-off canal is proposed to convey unpolluted water from just upstream of the Plant 2 ha site around the Interim Inpit Backfill Dump, Final Waste Dump and Interim Discard Dump and discharge into the nearest downstream release point.
		Dirty water runoff retained in the Plant 2 ha site should drain to a properly designed and constructed pollution control dam.
PR02	Interim Inpit Backfill Dump	Appropriate infrastructure addressed in PR01 and PR05.
PR03	Final Waste Dump	Appropriate infrastructure addressed in PR01 and PR05.
PR04	Interim Discard Dump	It is proposed to construct dirty water berms around the Interim Discard Dump to retain any polluted surface water runoff.
		Dirty water runoff retained in the Interim Discard Dump should drain to a properly designed and constructed pollution control dam.
PR05	Interim Surface Waste Dump	A clean water cut-off canal is proposed just north of the Final Waste Dump footprint to convey unpolluted water from the Surface Waste Dump away from the Interim Inpit Backfill Dump, Final Waste Dump and Interim Discard Dump to the nearest downstream release point.

4.2.2.4 Impact on Groundwater Levels

To address issues on groundwater level lowering, the mining plan proposes to:

- Embark on property specific investigations to determine the baseline of water use, yield and quality of all known boreholes in the area. This will enable the borehole owner(s) and the Company to monitor against these baselines.
- These external boreholes will be included in the groundwater monitoring programme and monitored on a six-monthly basis.
- If an impact is detected, further investigation will be done to determine the origin of the impact. If the impact is proved to have been caused by The Duel Coal Project, the Company will enter into discussions with the borehole owners impacted regarding:

- Compensation; and/or
- Alternative water supply

4.2.2.5 Management of post-closure decant

The current impact modelling predicts a low probability for decant as the opencast pit is situated on a groundwater divide with deep groundwater levels. This prediction needs to be refined as more site-specific data becomes available. Groundwater and geochemical models must be updated on a regular basis (every 5 years) to verify potential for decant.

In the event of decant, the decant water needs to be intercepted and treated to acceptable levels prior to discharge into the natural environment. Appropriate management options need to be investigated during the operational phase of the mine in conjunction with the relevant authorities and IAPs. Given the probable duration between mine closure and the time of decant, as well as the small volume, emphasis will be placed on passive treatment options such as artificial wetlands.

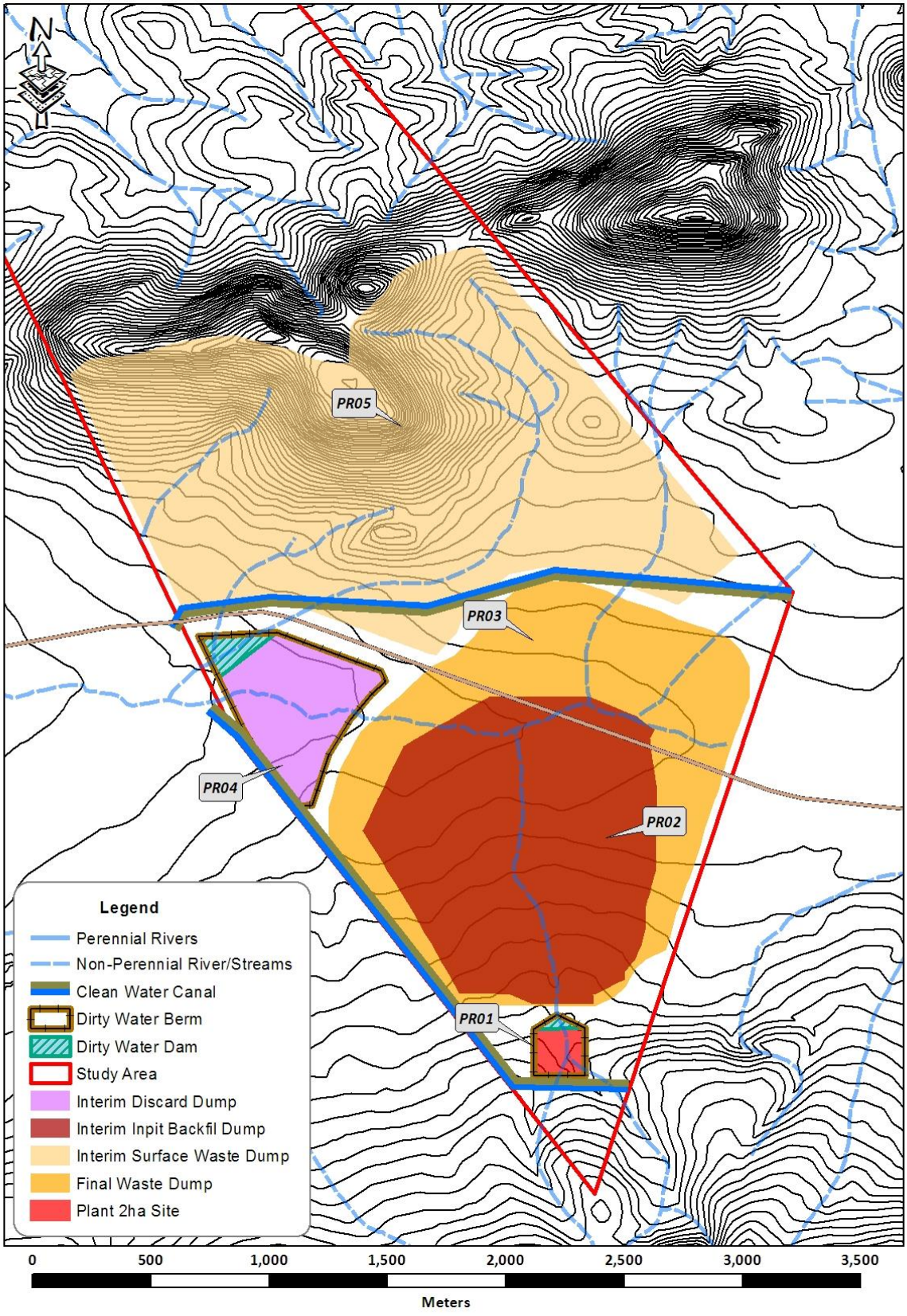

Figure 3: Conceptual storm water management plan

4.2.2.6 Potential risk of acid mine drainage

The coal at The Duel is generally below 2% sulphur and pyrite can be 15% by weight. ABA tests indicate sulphur is less than 1% in the waste rock, including carbonaceous material and the % sulphur can rise to 0.18-0.28% at depths below 150 m. Two core samples indicate a nett positive and a nett negative NNP, however the acid generating rock all occurs at below 150 m, hence if this waste rock is deposited at the bottom of the pit after Life of Mine, where it will be submerged, AMD will be mitigated.

The migration of the contaminant plume from the interim waste dumps is shown in Figure 4. The migration of the contaminant plume from the discards, which is the dump containing carbonaceous material and which poses the most risk of contaminants is directed towards the pit, hence does not pose a risk to surrounding properties. The plume from the waste rock, containing the low sulphur rock from the overburden migrates towards the pit and westwards towards Martha. Westward and eastward migration is curtailed by the cone of depression created by the pit.

25 years after LOM, the contaminant plume from The Duel Coal Project is oriented towards the Makhado Project East Pit due to the residual cone of depression remaining in the pit (Figure 5).

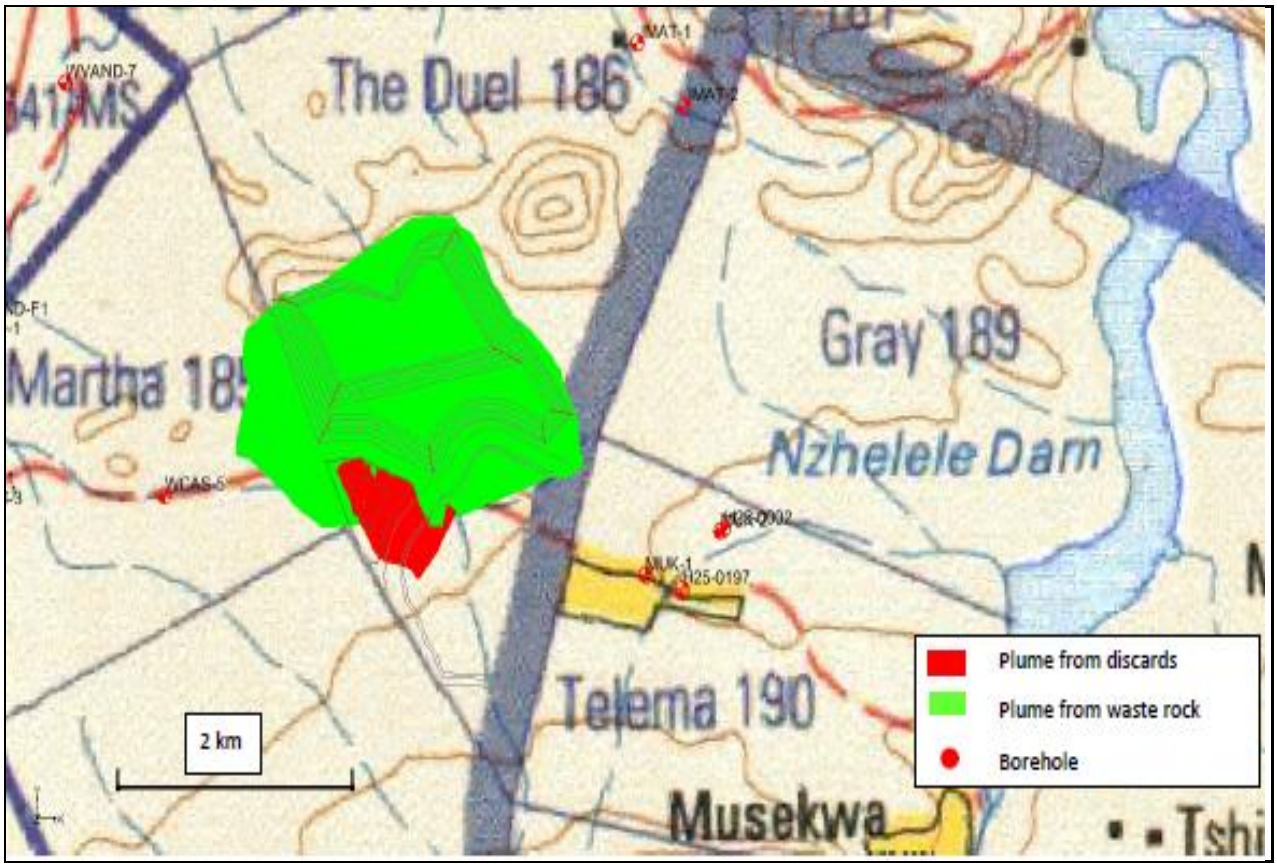

Figure 4: Contaminant plume 16 years after start of mine

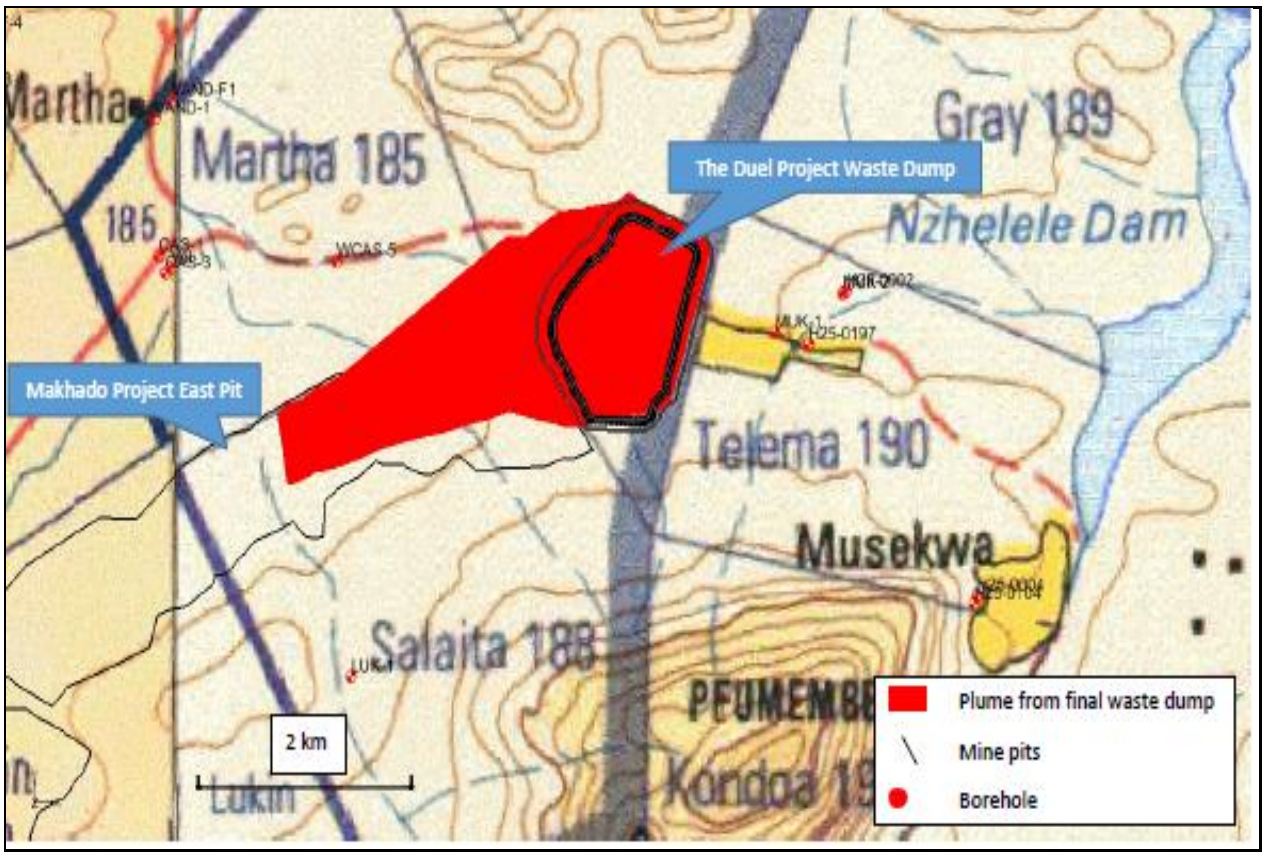

Figure 5: Contaminant plume from final waste dump 25 years after LOM

4.2.2.6.1 Steps taken to investigate, assess and evaluate the impact of AMD

Core analysis and leach tests from cores located in the vicinity of the Duel were undertaken during the Makhado investigation (CoAL, 2011). This geochemical investigation included:

- Alkalinity, paste pH and paste EC determinations;
- Acid Base Accounting, to determine whether the materials are acid producing;
- Na/Cl leach testing for readily available metals;
- Acid Rain leach testing, to determine the medium to long term leaching behaviour of the materials in an aqueous environment; and
- TCLP leach testing, to determine the total leachable fraction for inorganic analyses.

Alkalinity was determined using the USEPA Standard Operating Procedure for GLNPO Total Alkalinity (1992). The pH and EC methods were derived from MEND (1991).

The acid base accounting protocol of MEND (1991) was used in this study.

Total carbon and sulphur concentrations were determined by Eltra CS 800 Carbon and Sulphur Analyser.

The Distilled water leach test was undertaken to determine the presence and concentrations of chemicals of concern that are weakly bound to the sediment, and which would thus be more likely to report to the environment should the chemistry of the sediments be disturbed. The procedure utilises 1 g of sediment extracted at room temperature for one hour with 8 mℓ sodium chloride solution (95 g/ℓ NaCl, pH 7).

The Acid rain and TCLP leach solutions were analysed by ICP-MS (MerckVI) by Perkin Elmer ELAN 6000 ICP-MS, Perkin Ekmer ELAN 9000 ICP-MS and Perkin Elmer ELAN DRC II ICP-MS and by ion chromatography by Dionex QIC Ion Chromatograph. The Acid Base accounting, XRD and XRF analysis was repeated during this investigation from core samples obtained on The Duel. Refer to the Groundwater Specialist Report for a detail description of the methodology and results – Appendix 6.

4.2.2.6.2 Engineering or mine design solutions to be implemented to avoid or remedy AMD

To minimise acid generation and manage leachate the mining plan proposes to:

- Deposit mine wastes in the open pit, controlling the migration of high sulphate leachate.
- The horizons that are potentially acid generating, the coal middlings and carbonaceous mudstones should be placed at the bottom of the pit, where they will be submerged below the water table, preventing oxidation.
- Interim stockpiling of carbonaceous material should be on lined dumps with a leachate collection system.
- Grass cover should be re-established, as soon as possible after top soiling to minimise infiltration of water through residue material.
- Monitoring boreholes should be installed in appropriately selected sites prior to commencement of mining to detect changes in water quality and water levels with time.

4.2.2.6.3 Measures that will be put in place to remedy any residual or cumulative impact that may result from AMD

- Deposit mine residue in the open pits as far as possible, thereby controlling the migration of high sulphate leachate.
- The horizons that are potentially acid generating will be placed at the bottom of the pit, where it will be submerged below the water table, preventing oxidation.
- Open pit areas will be rehabilitated and vegetated as soon as possible to reduce the oxidation and the potential generation of acid-mine drainage.
- Dedicated monitoring programme and modelling to quantify and verify post-closure water balance and decant water quality.
- Ongoing evaluation and reassessment of alternative options for the final water use and required associated water quality, together with the technologies required to achieve the required quality.
- The final land use will also be used to evaluate the post closure water management.
- Active involvement in any regional integrated water management plans developed in the area.

4.2.3 SOCIAL IMPACT MANAGEMENT

The Social Impact Assessment (SIA) has identified and developed several social management and monitoring strategies that should be implemented to ensure that all identified impacts are addressed and managed accordingly. The main aim of the strategies is to minimize negative impacts and maximize positive impacts by means of effective compensation and mitigation measures.

The strategies are listed below and will be developed and implemented as part of this EMPr.

- Communication and Consultation Plan: Ensuring continuous engagement with project affected parties and stakeholders.
- Issue and Grievance Management Strategy: To ensure the appropriate management of issues and grievances.
- Influx Management Strategy: To manage the influx of job seekers.
- Resettlement, Compensation and Mitigation Strategy: To compensate and mitigate for direct and indirect project impacts resulting either a physical or economical loss.
- Employment Strategy:

  - Recruitment Strategy: To maximise employment opportunities for the local communities and reduce the influx of a foreign labour force whilst ensuring an effective construction and operational process.
  - Skills Audit: To capture all project relevant skills in the project area with the aim to enhance local employment figures.
  - Recruitment Manual: To include a list of employment opportunities that will become available during the project planning, construction and operational phases and provide guidelines on procedures to be followed by aspiring employment seekers and employers.
  - Employment Information Desk: To establish an employment information desk to assist with the day to day management of project related labour issues.
  - Human Resource Development and Training Strategy: To identify appropriate training and skills transfer opportunities that will enhance the skills level of the local labour force both during and after project implementation.

- Procurement Policy: To ensure that local business outfits, especially those of HDIs, women and SMMEs get allocated a fair business share of project related business opportunities.
- Housing and Infrastructure Policy: To ensure that project related housing and service delivery are designed and implemented such that it stands to alleviate local housing and service delivery stumbling blocks in the longer-term.
- Education Strategy: To ensure that probable impacts on project area educational facilities are manageable and design applicable mitigation measures where applicable.
- Health and Safety Strategy

  - Occupational Health and Safety Strategy: To ensure that during the project construction process and the operational phase of the project, employees receive adequate health support from the project team for work-related health problems.
  - Community Health and Welfare Strategy: To ensure that the project intervention will not have a negative impact on the health and welfare infrastructure in the project area, and to suggest appropriate measures to enhance the capacity of existing health infrastructure.

- Traffic Safety and Awareness Strategy: To ensure that appropriate traffic management measures are planned and employed, in anticipation of the major increase in both heavy and light vehicle traffic.
- Safety and Security Strategy: To ensure that the project areas as well as the impacted communities are protected adequately through the formal policing system as well as additional safety measures such as additional security at the project sites and community policing in the project area.
- Anti-poaching Collaboration Strategy: To effectively collaborate with stakeholders to determine and minimize any contributing factor the mine development has on poaching activities.

- Social Monitoring and Evaluation Strategy: To ensure that the project intervention process is monitored with the aim of implementing corrective measures if and when required.

4.2.4 ARCHAEOLOGICAL AND HERITAGE MANAGEMENT

4.2.4.1 Management and mitigation of identified heritage sites

The following management measures should be implemented prior to construction:

- Conduct a Phase 1B assessment of the Stone Age material prior to construction activities.
- All identified sites within the development footprint should be clearly demarcated (fenced in) and declared as a no-go area.
- Buffer zones around any of these sites should be at least 20m. Depending on individual circumstances, e.g. blasting and dust pollution, such a buffer may have to be increased.
- Monitoring of heritage sites to determine any damage resulting from blasting or other mining related activities.
- Immediate rectification of damage to any heritage sites.
- A qualified archaeologist shall monitor the development phases during construction and operations to identify any subterranean cultural and heritage resources.
- Construction activities shall cease immediately upon any further discovery of cultural and heritage resources and the required assessment and reporting instituted – refer to Chance Find Protocol below.

4.2.4.2 Chance Find Protocol

Most archaeological and palaeotological remains are subterranean and there is always a chance that archaeological material (including burial sites) may be exposed during earthworks. The Chance Find Protocol below indicates the procedure that need to be followed in such an event.

4.2.4.2.1 Archaeological or historical material

If any unidentified archaeological or historical material are identified and/or exposed during any of the developmental phases of the project, the following steps must be implemented subsequent to those outlined above:

- All work at the affected area must cease and reported to the immediate supervisor and through their supervisor to the senior on-site manager.
- The area should be demarcated to prevent any further work there until an investigation has been completed.

- An archaeologist should be contacted immediately to provide advice on the matter.
- The archaeologist will decide on future action. Depending on the nature of the find, it may include a site visit.
- If needed, the necessary permit will be applied for with SAHRA. This will be done in conjunction with the appointed archaeologist.
- The appropriate action will be determined by the nature of the find and the possibilities given the restriction placed upon it by mining activities.
- Work on site will only continue after the archaeologist/ SAHRA has agreed to such a matter.

4.2.4.2.2 Human remains

If unidentified burial grounds, graves or human remains are identified and/or exposed during any of the developmental phases of the project, the following steps must be implemented subsequent to those outlined above:

- All work at the affected area must cease and reported to the immediate supervisor and through their supervisor to the senior on-site manager.
- The area should be demarcated to prevent any further work there until an investigation has been completed.
- An archaeologist should be contacted immediately to provide advice on the matter.
- The archaeologist must confirm the presence of burial grounds, graves or human remains.
- If this is the case, the archaeologist must inform the local South African Police Services (SAPS) and traditional authority (if applicable). SAHRA's BGG Unit should also be notified in the case of human remains.
- The archaeologist, in conjunction with the SAPS and traditional authority, will inspect the possible graves and make an informed decision whether the remains are of forensic, recent, cultural-historical or archaeological significance.
- Should it be concluded that the find is of heritage significance and therefore protected in terms of heritage legislation, the archaeologist will notify the relevant authorities and institute the grave relocation procedure.

4.2.4.2.3 Palaeontology

If any palaeontological material or fossils are exposed during any of the developmental phases of the project, the following steps must be implemented subsequent to those outlined above:

- All work at the affected area must cease and reported to the immediate supervisor and through their supervisor to the senior on-site manager.
- The area must be fenced-off with a 30 m barrier and the area declared as a no-go area.
- A palaeontologist should be contacted immediately to confirm the presence of palaeontological material and/or fossils.
- If this is the case, SAHRA must be contacted for further investigation and mitigation.
- Three types of permits are available: Mitigation, Destruction and Interpretation. The specialist will apply for the permit at the beginning of the process.
- Mitigation will involve recording, rescue and judicious sampling of the fossil material present and will include a Phase 2 Palaeontological Impact Assessment (PIA).

4.2.4.3 Grave Relocation Procedure

4.2.4.3.1 Graves older than 60 years

- Application for a permit from SAHRA in terms of Section 36 of the NHRA for graves older than 60 years or that of a victim of conflict.
- Known graves: Proof of thorough consultative process:

- Locate next of kin and obtain letter of consent from next of kin.
- Obtain a letter of consent or statement of no objection from the local traditional authority if in a rural area.
- Determine a place for the re-burial of each grave in consultation with next of kin. In addition, also determine the arrangement of reburial, i.e. by the next of kin/community or a funeral undertaker.
- Submit documentation of the above with the permit application to SAHRA.
- Inform the SAPS of intent to relocate the grave/s and submit a copy of the permit to SAPS.
- The graves are to be exhumed by a funeral undertaker under the supervision of an archaeologist. Undertaker would also arrange all the formalities for the reburial.
- The specific requirements regarding ritual and ceremonial practices from next of kin and/or community for both the exhumation and reburial activity must be determined beforehand and facilitated by the developer.

- Unknown graves: Proof of thorough consultative process:

- Place advertisement in a local and national newspaper with description and location of graves and full contact detail of consultant and developer. A waiting period of 60 days applies.
- If no reaction to advertisement follows, then apply for permit from SAHRA after waiting period of 60 days with proof of advertisement and any other consultative process.
- If in rural area obtain a letter of consent or statement of no objection from local traditional authority and submit with permit application.
- If advertisement leads to a claim from next of kin or from a community who by tradition has an interest, then written consent from relevant party must be obtained.
- Determine a place for the reburial of each grave.
- Submit documentation of the above with the permit application to SAHRA.
- Inform SAPS of intent and process of reburial and submit a copy of the permit to SAPS.
- The graves are to be exhumed by a funeral undertaker under the supervision of an archaeologist. Undertaker would also arrange all the formalities for the reburial.
- The specific requirements regarding ritual and ceremonial practices from next of kin and/or community for both the exhumation and reburial activity must be determined beforehand and facilitated by the developer.

4.2.4.3.2 Graves less than 60 years old

- Locate the next of kin of the buried persons and obtain consent from the next of kin for the relocation of the graves.
- Determine a place for the reburial of each grave.
- Obtain a letter of consent or statement of no objection from the local traditional authority if in a rural area.

- Submit above documentation to the Department of Health and obtain permission for the relocation of the graves, which process would most probably be regulated by the District Municipality.
- Inform the SAPS and provide above-mentioned documentation.
- The graves are to be exhumed by a funeral undertaker under the supervision of an archaeologist. Undertaker would also arrange all the formalities for the reburial.
- The specific requirements regarding ritual and ceremonial practices from next of kin and/or community for both the exhumation and reburial activity must be determined beforehand and facilitated by the developer.

4.3 IMPACTS TO BE MITIGATED IN THEIR RESPECTIVE PHASES

The listed activities associated with The Duel Coal Project is listed below together with its aerial extent, where known. The impacts associated with the listed and other activities are provided in Table 4, together with the proposed mitigation measures and time period for implementation.

Table 3: Listed and Specified Activities associated with The Duel Coal Project, 2014 EIA Regulations

ACTIVITY	AERIAL EXTENT[#]	LISTED ACTIVITY	APPLICABLE NOTICE
Mining: open pit and underground (longwall) mining	200 ha	X	GNR 983 – A12 GNR 983 – A19 GNR 984 – A15 GNR 984 – A17 GNR 985 – A12 GNR 985 – A14
Blasting	200 ha	N/A	-
CHPP and related infrastructure (including water management infrastructure)	75 ha	X	GNR 983 – A9 GNR 983 – A10 GNR 983 – A12 GNR 983 – A13 GNR 983 – A19 GNR 984 – A6 GNR 984 – A15 GNR 984 – A16 GNR 984 – A17 GNR 985 – A2 GNR 985 – A12 GNR 985 – A14
Overburden waste dump Interim discard dump	280 ha	X	GNR 983 – A12 GNR 983 – A19 GNR 984 – A6 GNR 984 – A15 GNR 985 – A12 GNR 985 – A14
Access / haul / service roads Deviation of D3672	Width > 8m	X	GNR 983 – A12 GNR 983 – A19 GNR 983 – A24 GNR 985 – A4 GNR 985 – A14
Bulk hydrocarbon facilities	> 80 m^3 < 500 m^3	X	GNR 983 – A14 GNR 985 – A10
Bulk power	> 33 kV < 275 kV	X	GNR 983 – A11

[#]Note: The final extent of the activities will only be confirmed once the further feasibility studies and detail designs in respect of the development are concluded.

5 IMPACT MANAGEMENT ACTIONS AND OUTCOMES

Table 4 lists the proposed mitigation measures that could be applied to reverse, reduce and mitigate the high-risk impacts, together with the proposed standard / level of impact to achieve.

Table 4: Impact Management Actions and Outcomes

No	Activity	Potential Impact	Aspects Affected	Phase	Mitigation Measures	Time Period for Implementation	Standard to Achieve
1	Mining and infrastructure	Loss of soil depth (volume), fertility and organic carbon content	Soils	Construction Operational	• The available topsoil will be stripped prior to mining and placed directly (as far as practicably possible) on levelled spoils. • All available topsoil areas will be seeded prior to the start of the rainy season. • Soil analysis will be performed prior to seeding and the soil fertility rectified (if necessary) to facilitate vigorous growth. • Organic fertilisers will be used as far as possible. • Save topsoil removed at the start of the project and use it to reclaim disturbed areas upon completion of mining activities.	LOM	End land use of grazing capacity
2	Mining	Surface subsidence due to underground mining and/or pit subsidence impacting on the hydropedological functioning of the area	Soils Land use	Post-closure	• Maintain appropriate safety factors to prevent subsidence to surface. • Compaction of overburden and discards placed in the bottom of the pits to limit the potential for subsidence on the rehabilitated open pits. • Re-contour the surface or install waterways to carry away water collected in depressions. • Cut and fill operations can be conducted to help restore surface drainage. • Subsurface drains can be installed to aid drainage.	Decommissioning	Free-draining final profile
3	Excavation and stockpiling	Increased erosion as a result of excavation and stockpiling	Soils Surface water	Construction Operational Decommissioning	• Apply erosion controls relative to possible soil erosion from vehicular traffic and during mining activities (e.g. jute netting, silt fences, and check dams). • Avoid creating excessive slopes during stockpiling of soil and discard material. Stockpiling of different material to adhere to	LOM	Suspended Solids within RWQO for aquatic systems

No	Activity	Potential Impact	Aspects Affected	Phase	Mitigation Measures	Time Period for Implementation	Standard to Achieve
					maximum allowable slopes as proposed by the soil specialist report to prevent erosion. • Dispose of excess excavation materials in approved areas to control erosion and minimize leaching of hazardous materials. • Clean and maintain catch basins, drainage ditches, and culverts regularly. • Re-establish the original grade and drainage pattern to the extent practicable. • Stabilize all areas of disturbed soil using weed-free native shrubs, grasses, and forbs. • Backfill or re-contour strip-mined or contour-mined areas, any foundations, and trenches, preferably with excess excavation material generated during mining.		
4	Mining and infrastructure	Impact on sensitive floral and faunal habitat & diversity	Fauna & Flora	Construction Operational Decommissioning	• Any disturbance of sensitive floral habitat and species of conservation concern must be avoided as far as possible. • The surface footprint of the proposed mine be reduced to the minimum. • Sensitive floral habitat and associated buffer zones beyond the immovable footprint areas must be designated as No-Go areas and no mining vehicles, personnel, or any other mining related activities are to encroach upon these areas. • Development of Biodiversity Action Plan (BAP) prior to construction. • In areas not impacted by the mining activities, the natural vegetation will be maintained by implementing the following: burning programmes; rotational grazing programmes; alien vegetation eradication programme; and restricting vehicle movement to existing roads. • An alien floral control plan must be designed and implemented in order to monitor and control alien floral recruitment in disturbed areas.	LOM	Sustainable, functional ecosystem post-mining

No	Activity	Potential Impact	Aspects Affected	Phase	Mitigation Measures	Time Period for Implementation	Standard to Achieve
					• Concurrent/progressive rehabilitation must be implemented at all times and disturbed areas must be rehabilitated as soon as possible. • A Reclamation Plan will be implemented and updated on a regular basis. • A nursery must be developed in conjunction with a suitably qualified specialist where indigenous/endemic plant species including medicinal plants must be propagated with focus on rehabilitation. • Rehabilitation trials must be continuously undertaken from the commencement of construction in order to determine the efficiency of rehabilitation methods and the suitability of flora propagated in the nursery for rehabilitation. • No collection of firewood, RDL/Protected or medicinal floral species must be allowed by mining personnel. • Illegal access will be limited to prevent illegal hunting and snaring of fauna in the area. • An environmental awareness campaign will be implemented, both internally and externally (local communities). • Initiate an ecological offset initiative together with the relevant stakeholders.		
5	Mining and infrastructure	Impact on species of conservation concern (protected / RDL species)	Fauna & Flora	Construction Operational	• A protected and RDL floral relocation, monitoring and management plan will be designed and implemented by a suitably qualified specialist and should address all species which can be successfully rescued and relocated. • Annual flora rescue operations will be undertaken during the growing season in the areas planned to be mined and/or disturbed within the next year. • Smaller arachnids and species which are suited to relocation such as tortoises can be relocated	LOM	Minimal impact on protected species

No	Activity	Potential Impact	Aspects Affected	Phase	Mitigation Measures	Time Period for Implementation	Standard to Achieve
					to surrounding natural areas - a rescue and relocation programme for fauna species will be developed and implemented with the assistance of specialists in this field. • An environmental awareness campaign will be launched, both internally and externally (local communities). • All voids, or open pits must be fenced off in order to prevent faunal species falling into such features. • Site clearing should occur within phases, enabling faunal species to naturally move to surrounding natural areas. During this time of clearing it is recommended that fences are removed in the affected sections so as to enable easy movement of faunal species out of the areas being cleared. • Where possible the removal of large established trees must be avoided, as these provide breeding and roosting sites for raptor species occurring within the region. • Lighting pollution and its effect on fauna (with special mention of invertebrates, bats and avifauna) must be effectively mitigated.		
6	ROM and product haulage	Killing of animals and avifauna on the roads, especially nocturnal animals/birds	Fauna & Flora	Construction Operational Decommissioning	• Maintaining vehicle speeds. • Off-site hauling of product should be limited to between the hours of 06h00 to 20h00. • Implementation of an Environmental Awareness Programme for trucking contractor.	LOM	Minimal impact
7	Power lines	Killing of avifauna species of concern	Avifauna	Construction Operational Decommissioning	• Implement bird flappers or other bird deterrents on powerlines, especially where the lines cross sensitive habitat areas such as the Mutamba River and the Soutpansberg Mountain Bushveld.	LOM	Minimal impact
8	Mining and infrastructure	Loss of riparian habitat and ecological and socio-cultural service provision	Aquatic Systems	Construction Operational	• No dumping of waste should take place within the riparian zone. If any spills occur, they should be immediately cleaned up. • Implement alien vegetation control program within riparian areas with special mention of	LOM	REC Class B

No	Activity	Potential Impact	Aspects Affected	Phase	Mitigation Measures	Time Period for Implementation	Standard to Achieve
					water loving tree species such as *Eucalyptus sp.* and *Acacia mearnsii.* • Ongoing aquatic monitoring to determine any deterioration in the Present Ecological State (PES) of the systems. • Biodiversity offset programmes should include riparian offsets where appropriate.		
9	Mining and infrastructure	Loss of aquatic habitat, biodiversity and sensitive taxa	Aquatic Systems	Construction Operational	• Implementation of a biodiversity monitoring programme for early detection of potential impacts. • Water quality and aquatic monitoring to assess the suitability of the water to support aquatic life. • All affected riparian systems must be monitored for moisture stress and monitor all potentially affected riparian zones for changes in riparian vegetation structure.	LOM	REC Class B
10	Mining and infrastructure	Impedance of flood-lines and watercourses by placement of stockpiles, infrastructure and mining pits	Surface Water	Construction Operational	• Diversion of non-perennial streams around the open pits. • Construct bridges, culverts or low-water crossings over drainage lines to minimise disturbance of streams.	LOM	REC Class B
11	Mining and infrastructure	Reduction in clean water runoff to the non-perennial drainage lines and the Mutamba River	Surface Water	Construction Operational	• Implementation of a Storm Water Management Plan (SWMP) as prescribed in GN704 and DHWS's Best Practice Guidelines. • Separation of clean and dirty storm water runoff, where the unaffected flow is routed to the receiving water body while the contaminated flows are contained for re-use and/or evaporation. • Limit the footprint area of the construction activity to what is absolutely essential in order to minimise the loss of clean water runoff areas which recharge the receiving aquatic environment. • Water use will affect the instream flow in the Mutamba River and the associated drainage lines and needs to be very carefully managed.	LOM	REC Class B

No	Activity	Potential Impact	Aspects Affected	Phase	Mitigation Measures	Time Period for Implementation	Standard to Achieve
					Any water abstraction from surface water resources or groundwater resources must take place in such a way as to ensure that impacts on the instream flow of the Mutamba River are avoided and managed. This is particularly important during low flow periods to ensure that instream flow and refugia are maintained. • All affected riparian systems must be monitored for moisture stress and monitor all potentially affected riparian zones for changes in riparian vegetation structure.		
12	Mining and infrastructure, storm water management	Increased sediment loads due to canalization of water, vegetation clearance and compaction	Surface Water	Construction Operational	• Design and install appropriate outlet structures to retard flow velocity. • Construct energy dissipating structures along steep slopes. • Side slopes of earth berms / canals to be designed to 1:3 and protected & vegetated to prevent erosion. • Adequate storm water management must be incorporated into the design of the proposed development in order to prevent erosion and the associated sedimentation of the riparian and instream areas. • All areas affected by stockpiling during the operational phase of the mine should be rehabilitated and stabilised using cladding or a suitable grass mix to prevent sedimentation of the aquatic resources in the area. • Upon closure all haul and access roads as well as all unnecessary mining infrastructure should be removed in order to minimise the impacts on the aquatic resources of the area beyond the life of mine. • Final topsoiling and re-vegetation according to the rehabilitation plan. • All available topsoil areas will be seeded prior to the start of the rainy season.		Suspended Solids within RWQO for aquatic systems, REC Class B

No	Activity	Potential Impact	Aspects Affected	Phase	Mitigation Measures	Time Period for Implementation	Standard to Achieve
13	Mine residue facilities	Pollution as a result of leachate and runoff from stockpiles	Surface Water	Construction Operational	• Appropriate geo-liners to be constructed for the stockpiles, depending on the waste classification of this material. • Provision of berms and/or paddocks at overburden and discards stockpiles to contain runoff. • Reuse of this water for dust suppression on and around the stockpile areas. • If the contaminated flow volumes exceed the capacity that can be re-cycled or evaporated, treatment of the surplus outflow is required.	LOM	RWQO for aquatic systems
14	Mining and infrastructure	Pollution due to uncontrolled releases from the mining footprint and infrastructure areas	Surface Water	Construction Operational	• No dirty water runoff will be permitted to reach the water resources during the entire life of mine. • Separation of clean and dirty water through implementation of the SWMP. • Directing and containment of dirty water runoff to PCDs and providing silt traps. • Design dirty water management infrastructure for the 1:50 year flood event. • HDPE liners to be implemented at PCDs. • No dirty water runoff must be permitted to reach the water resources during the entire life of mine, and clean and dirty water management systems must be put in place to prevent the contaminated runoff (suspended solids and salts and water with low pH) from entering the receiving aquatic environment. Clean and dirty water runoff systems should be constructed before construction of any other infrastructure takes place. • Any area where decant will occur needs to be very carefully managed. If decant will occur all water is to be treated to background water quality values prior to release into the receiving environment.	LOM	RWQO for aquatic systems

No	Activity	Potential Impact	Aspects Affected	Phase	Mitigation Measures	Time Period for Implementation	Standard to Achieve
					• Strict control of sewage water treatment must take place and the sewage system should form part of the mine's closed process water system.		
15	Hazardous chemicals and waste	Pollution as a result of accidental spillages of chemicals and hazardous material	Soils Surface Water	Construction Operational	• Develop and implement a Spill Management Procedure for The Duel. • Implement a waste management programme for the mine. • Strict control of sewage water treatment must take place and the sewage system should form part of the mine's closed process water system. • Develop and implement hydrocarbon management procedure to prevent accidental spillages. • Bulk facilities and chemical stores to be concrete lined and bunded to a capacity of 110%. • Spillages must be cleaned up immediately in line with the Spill Management procedure. • No dumping of waste should take place within the riparian zone. If any spills occur, they should be immediately cleaned up.	LOM	RWQO for aquatic systems
16	Mining	Lowering of groundwater levels, including cumulative drawdown due to other mine plans	Groundwater	Construction Operational Post-closure	• Establishment of monitoring piezometers near where initial mine workings will commence. • Verification of inflows and water levels by monitoring is required to validate model after mining commences. • Verification of abstractions especially from major groundwater users. • Derivation of local more detailed multilayer models at a monthly time scale for each mine once more detailed mining plans become available. • Once the model is complete with all the required information, supported by monitoring data, a sensitivity analysis needs to be undertaken to determine how sensitive the model results are to parameters with some uncertainty.	LOM Post-closure	No reduction in water supply to communities

No	Activity	Potential Impact	Aspects Affected	Phase	Mitigation Measures	Time Period for Implementation	Standard to Achieve
					• Model verification comparing model results against an independent data set from that which the model was calibrated against. • Enter into negotiations with surrounding landowners and communities impacted regarding compensation or alternative water supply. • Coordinate mining with the Makhado Project East Pit to simultaneously mine and benefit from the combined cone of depression, minimising combined inflows, total abstraction volumes and the duration of significant impact.		
17	Infrastructure area	Effect on groundwater quality due to infiltration of poor quality water/effluent from wet sources (PCDs, etc.)	Groundwater	Construction Operational	• Leachate to be captured and pumped to the processing facility for re-use. • Dirty water dams (PCDs) to be plastic lined (HDPE) to prevent groundwater contamination. • Dirty water canals in the infrastructure area to be concrete lined to prevent groundwater contamination. • Monitoring boreholes will be installed in appropriately selected sites prior to commencement of mining to detect changes in water quality and water levels with time.	LOM	RWQO for domestic supply
18	Mine residue facilities	Effect on groundwater quality due to poor quality leachate generated through dry hazardous material / stockpiles	Groundwater	Construction Operational Post-closure	• Appropriate geo-liners to be constructed for the stockpiles, depending on the waste classification of this material. • Discards stockpile and stockpiling of any other carbonaceous material will be designed with a competent liner with a leachate collection system. • Stockpiles will be compacted to minimise infiltration.	LOM Post-closure	RWQO for domestic supply
19	Mining Hauling of ROM	Increased dust levels as a result of construction and on-site hauling of ROM	Air quality	Construction Operational Decommissioning	• The impacts from dust fallout and Particulate Matter must be reduced by implementing dust control measures, i.e. watering or chemical stabilization. • The highest intensity of the construction work should be carried out during the summer	LOM	PM_{10} (annual) < 40 µg/m^3 PM_{10} (daily) < 75 µg/m^3 Dust outfall < 600 mg/m^2/day

No	Activity	Potential Impact	Aspects Affected	Phase	Mitigation Measures	Time Period for Implementation	Standard to Achieve
					months and not over the harsh winter months as this can result in increased dispersion of fugitive dust. • The Duel project should ensure that unpaved roads are continuously watered and treated with chemical stabilisers to reduce the volume of fugitive dust emitted from unpaved roads. • The use of wind screens on open ground surfaces during periods of extreme windy conditions • Re-vegetate disturbed areas as soon as possible to prevent further dispersion of wind-blown dust emissions. • The drop heights when loaders dump soil and coal should be kept at a minimum. • A speed limit of 40 km/hr should be set for all vehicles travelling over exposed areas or near stockpiles. Traffic over exposed areas should be kept to a minimum. • Include speedbumps to control the speed limits. • Implement a program of wet suppression of the unpaved roads with major vehicle activity.		
20	Blasting	Increase of dust level due to blasting events	Air quality	Operational	• Measures should be taken into consideration to limit the dust impact during periods of blasting. • Watering the blast area, following the charging of blast holes with explosives. • Blasting should be delayed in unfavourable wind and atmospheric conditions.	LOM	PM_{10} (annual) < 40 µg/m³ PM_{10} (daily) < 75 µg/m³ Dust outfall < 600 mg/m²/day
21	Mining	Coal bed methane released from the coal bed	Air quality	Operational	• Ongoing methane monitoring to determine levels of methane released to the atmosphere.	LOM	Level below explosive limit (<5%)
22	Mining and associated activities	Potential for noise impact during construction and mining in surrounding communities	Ambient noise	Construction Operational Decommissioning	• Construction to be restricted from 06h00 to 18h00 with no activities (or at least no noisy construction activities) at night. • Use of low-noise generation plant and equipment. • All plant, equipment and vehicles are to be kept in good repair.	LOM	Suburban noise level Day: 50 dBA Night: 40 dBA

No	Activity	Potential Impact	Aspects Affected	Phase	Mitigation Measures	Time Period for Implementation	Standard to Achieve
					• Keep internal hauling roads well maintained and avoid steep gradients. • Where possible, attempt to enclose noise sources, if the sources enclose has a noise directivity ensure the noise is directed away from any communities. • Increase the distance from source to receiver – siting equipment and noisy activities as far as possible from the noise sensitive area or receivers. • Screening of noise sources, if it isn't possible to increase the distance, the alternative measure is to screen the noise source. Screening can make use of the natural environment, existing buildings and/or screens or earth berms. These screens should be placed in the direct line of sight to effectively reduce the noise received and the sensitive location. • Implement an extensive noise-monitoring programme within the community to determine the actual noise levels. • Monitor and investigate all complaints from members of the community regarding irritation, trouble to sleep and lack of rest and calmness.		
23	Mining Blasting	Resettlement of households and relocation of graves within 500 m radius from open pits (blasting)	Land Use Community	Construction	• Resettle directly impacted households in line with the Resettlement, Compensation and Mitigation Strategy.	Prior to mining (blasting)	Voluntary resettlement in line with relevant legislation and guidelines
24	Blasting	Health, safety and nuisance impacts related to blasting, including ground vibration, air blast and fly rock	Community	Operational	• Implementation of Blasting Procedure and blast design guidelines. • Resettle directly impacted households in line with the Resettlement, Compensation and Mitigation Strategy. • All animals and people within 500m of a blast must be evacuated. • All roads within 500m of a blast must be closed.	LOM	Air blast < 120dB GV < 12.5 mm/s No fatal incidents

No	Activity	Potential Impact	Aspects Affected	Phase	Mitigation Measures	Time Period for Implementation	Standard to Achieve
					• Blasting time must be fixed and blasting notice boards setup at various routes around the project area that will inform the community blasting dates and times. A recommended good blasting time will be between 12:00 and 14:00. • Implementation of permanent seismographs to monitor ground vibration and air blast of every blast to ensure adherence to blast designs.		
25	Blasting	Structural damage to houses and other structures	Infrastructure	Operational	• Pre-blasting photographic inspections will be done on all houses and other structures prior to blasting within a distance of 1500m. • Monitoring of Makushu graveyard and community boreholes to determine any damage resulting from blasting. • Ground vibration and air blast monitoring using permanent installed stations. • Monitor and investigate all complaints from members of the community.	LOM	Air blast < 120dB GV < 12.5 mm/s
26	Blasting	Structural damage to community boreholes	Water supply	Operational	• Monitoring of community boreholes to determine any damage resulting from blasting. • Monitor and investigate all complaints from members of the community.	LOM	Air blast < 120dB GV < 12.5 mm/s No reduction in water supply to communities
27	Blasting	Impact on Makushu graveyard as a result of ground vibration and fly rock	Heritage	Operational	• Monitoring of Makushu graveyard and community boreholes to determine any damage resulting from blasting. • Ground vibration and air blast monitoring using permanent installed stations. • Rectification of damage to grave sites. • Relocation of burial sites if impact unacceptable. • Monitor and investigate all complaints from members of the community.	LOM	Air blast < 120dB GV < 12.5 mm/s No damage to graveyard
28	Mining and excavation	Impact on sub-surface heritage artefacts	Heritage	Construction Operational	• Develop and implement a Heritage Management Plan prior to mining. • Conduct Phase 1B assessment of the Stone Age material prior to construction activities. • A qualified archaeologist shall monitor construction activities until completion thereof.	LOM	No damage to heritage / cultural artefacts

No	Activity	Potential Impact	Aspects Affected	Phase	Mitigation Measures	Time Period for Implementation	Standard to Achieve
					• Construction activities shall cease immediately upon any discovery of cultural and heritage resources and a qualified archaeologist informed to do further assessment and reporting. • Identified sites of cultural and heritage significance shall be demarcated until such time that an instruction to resume work is provided to the contractor in writing, following consultation with the regulating authorities.		
29	Mining and excavation	Impact on fossil material	Palaeontology	Construction Operational	• A thorough examination by a palaeontologist is required on the exposures of the Karoo Supergroup strata present within the project area. • Should any fossil materials be identified SAHRA must be informed and a palaeontologist mandated to inspect the fossil materials and ascertain their scientific and cultural importance. • Suitable staff members of the mining company (e.g. the environmental officer) who have the correct training and clearance to access the working mine faces should be trained to recognise the types of fossils that may be encountered during the ongoing mining operations. The mining company should mandate the trained employees to make regular examinations of the working mine faces and determined if fossil materials are present. • If fossil materials are identified, the infrastructure construction or the mining activity in that area should be temporarily halted and a professional palaeontologist contracted to assess the scientific value of the fossils. Should scientifically or culturally significant fossil material exist within the project areas the negative impact upon it would be mitigated by its excavation (under permit from	LOM	No damage to fossil material

No	Activity	Potential Impact	Aspects Affected	Phase	Mitigation Measures	Time Period for Implementation	Standard to Achieve
					SAHRA) by a palaeontologist and the resultant material being lodged with an appropriately permitted institution		
30	Infrastructure Mine residue facilities	Visual intrusion of mining activities, impacting on the sense of place	Visual	Construction Operational Decommissioning	• The construction site must be kept in a neat and orderly condition at all times and all operational facilities should be actively maintained. • Areas for material storage, waste sorting and temporary storage, batching and other potentially intrusive activities must be designated and screened off as far as is considered feasible. • The height of structures should be a low as possible, where this can be achieved without increasing the infrastructure footprint. • As far as possible, infrastructure should not be placed on ridgelines or other locations where they would be silhouetted against the sky. • Waste and discard dumps must be shaped and rounded to blend in with the surrounding undulating landscape, especially the waste dump which will eventually protrude over the mountain crest and alter the skyline. All stockpiles should be shaped to fit in with the surrounding hills and mountains and revegetated to blend with the surroundings and to minimise visual contrast. • Where mining infrastructure is sited within view of visually sensitive areas, it must be placed as far away as possible or within lower-lying areas where it may be screened by topography. Where full screening of infrastructure components is not possible, siting should take advantage of partial screening opportunities. • It must be ensured that all buildings and paved road surfaces fit its surroundings through the appropriate use of colour and material selection in order to lower the visibility of the proposed project.	LOM	N/A

No	Activity	Potential Impact	Aspects Affected	Phase	Mitigation Measures	Time Period for Implementation	Standard to Achieve
					• The use of permanent signs and project construction signs should be minimised and visually unobtrusive. • It must be ensured that existing vegetation is retained during the construction phase to act as visual screens. • Where possible, screening of the mining operations should be implemented through, for example, planting the project boundaries with indigenous vegetation. In this regard planting of additional large trees on the site boundaries should be considered to screen nearby views, with smaller trees or large shrubs utilised as an additional mitigation measure. • An ecological approach to any proposed landscaping is recommended. Should plants be introduced for this purpose, choice should be guided by ecological rather than horticultural principles. • Stockpiles should be placed to screen the opencast mining activities from the potential viewers. • Visually cluttered material storage yards and laydown areas should be screened through the use of material fencing, which will result in a more unified and tidy appearance. • Concurrent/progressive rehabilitation must be implemented, and disturbed areas must be rehabilitated as soon as possible and as soon as areas become available. • The waste dump adjacent to the central mountain within the study area, as well as other dumps and stockpiles should be concurrently revegetated throughout the operational phase to reduce the visual impact.		
31	Lighting	Impact due to night-time lighting	Visual	Construction Operational Decommissioning	• A lighting engineer may be consulted to assist in the planning and placement of light fixtures for the mining facility and all ancillary	LOM	TBD

No	Activity	Potential Impact	Aspects Affected	Phase	Mitigation Measures	Time Period for Implementation	Standard to Achieve
					infrastructures in order to reduce visual impacts associated with glare and light trespass. • Outdoor lighting must be strictly controlled. • High light masts should be avoided. Any high lighting masts should be covered to reduce the glow. • Construction activities should be restricted to daylight hours as far as possible, in order to limit the need to bright floodlighting and the potential for sky glow. • Lighting fixtures must be selected and placed so that they direct their light on the intended area only, to avoid light spill and offsite light trespass. • Light sources must be shielded by physical barriers. • The use of low-pressure sodium lamps, yellow LED lighting, or an equivalent reduces sky glow and wildlife impacts. Bluish-white lighting is more likely to cause glare and attract insects and is associated with other human physiological issues.		
32	Product transport Increase in traffic	Safety of other road users, increase in traffic accidents	Communities	Construction Operational Decommissioning	• All heavy vehicles must be restricted to designated routes and not permitted on other roads. • Low speed limits on access roads with public drop-off / pick-up areas as to not disrupt the flow of traffic. • Include speedbumps to control the speed limits. • As part of the development there will be road geometric improvements made to the road network. These upgrades are focused on improving the safety of the road and will hence have a positive impact on other road users. • Deviation of public road around the mine development rather than cutting through the infrastructure areas. • Traffic minimized through bus and combi services to transport workers to the project site.	LOM	No fatal incidents

No	Activity	Potential Impact	Aspects Affected	Phase	Mitigation Measures	Time Period for Implementation	Standard to Achieve
33	Social aspects	Potential impact on the surrounding communities due to an influx of job seekers on the existing services (i.e. water, electricity, sewerage services, road maintenance, and social services)	Communities	Construction Operational Decommissioning	• Implementation of social mitigation measures (as summarized in the SIA) and Social Management Plans.	LOM	TBD
34	Social aspects	Increase in available employment opportunities locally Increase in skills development programmes and therefore skill levels of the local communities	Social	Construction Operational Decommissioning	• Source the maximum number of employees from the local area, based on a skill matching strategy. • Implement skills development programmes in the areas where most job opportunities will be created. • Make available bursary opportunities to build skill capital in the region. • Establish a database of local people with information on qualifications and skills, utilize this database to develop skills plans and recruit local people. • Implement portable skills development programmes. • Implementation of programmes to minimize and mitigate the impact of downscaling and retrenchment.	LOM	Positive
35	Social aspects	Empowerment of local business through procurement and capacity building	Social	Construction Operational Decommissioning	• Establish a database of local businesses; utilize this database to establish partnerships between local and larger service providers as well as locally preferred work packages. • Consultation and feedback on results on a regular basis. • Implementation of capacity building programmes to minimize and mitigate the impact of mine downscaling and closure.	LOM	Positive
36	Residual Impacts	Impact on ecosystem	Land Use and land capability	Operational Decommissioning Post-closure	• Since effective mitigation through avoidance, impact minimisation and rehabilitation is deemed unlikely to adequately limit the impact	LOM Post-closure	TBD

No	Activity	Potential Impact	Aspects Affected	Phase	Mitigation Measures	Time Period for Implementation	Standard to Achieve
					on the receiving ecology, it is deemed important that an ecological offset initiative be initiated to contribute to the conservation of the area.		
37	Residual Impacts	Post-closure land use and land capability	Land Use and land capability	Operational Decommissioning Post-closure	• Define, in consultation with all IAPs, the final (post-closure) land use for the mining area, including mining areas, surface and water management infrastructure, mine residue facilities, etc. • Develop a final land use plan and implementation programme as part of the closure plan, taking into account important issues such as ongoing operational and maintenance requirements and long-term responsibilities and ownership. • Set final closure objectives and standards to ensure conformance to the final land use plan and the requirements of the IAPs and relevant environmental legislation. • Develop a detailed closure plan five years prior to closure and obtain approval from the relevant authorities.	LOM Post-closure	Sustainable, functional ecosystem post-mining End land use minimum of grazing
38	Residual Impacts	• Deterioration of groundwater quality within the back-filled open pits due to AMD reactions • Decant into the shallow aquifer or on surface at the lowest surface elevations intersected by the pit	Surface and groundwater resources	Operational Decommissioning Post-closure	• Deposit mine wastes in the open pit, controlling the migration of high sulphate leachate. • The horizons that are potentially acid generating, the coal middlings and carbonaceous mudstones should be placed at the bottom of the pit, where they will be submerged below the water table, preventing oxidation. • Interim stockpiling of carbonaceous material should be on lined dumps with a leachate collection system. • Open pit areas will be rehabilitated and vegetated as soon as possible to reduce the oxidation and the potential generation of acid-mine drainage.	LOM Post-closure	RWQO for aquatic systems REC Class B Zero AMD

No	Activity	Potential Impact	Aspects Affected	Phase	Mitigation Measures	Time Period for Implementation	Standard to Achieve
					• Grass cover should be re-established, as soon as possible after top soiling to minimise infiltration of water through residue material. • Monitoring boreholes should be installed in appropriately selected sites prior to commencement of mining to detect changes in water quality and water levels with time. • Dedicated monitoring programme and modelling to quantify and verify post-closure water balance and decant water quality. • Ongoing evaluation and reassessment of alternative options for the final water use and required associated water quality, together with the technologies required to achieve the required quality. • The final land use will also be used to evaluate the post closure water management. • Active involvement in any regional integrated water management plans developed in the area.		

6 FINANCIAL PROVISION

6.1 CLOSURE COST ASSESSMENT

It is firstly important that the various components that need to be part of the closure cost be quantified. The *Guideline Document for the Evaluation of the Quantum of Closure-Related Financial Provision Provided by a Mine* (DMR, 2004) was used as a guideline to identify the various components that would form part of such an assessment. In addition to that, attention was also given to the closure objectives and relinquishment criteria.

A rules-based approach was used and related back to the surface area of the various components included in the closure costs. The unit rate (master rate) for each closure component was taken from the DMR guideline and inflated by the Consumer Price Index (CPI) to account for escalation since January 2005. The CPI rates used in this assessment is listed below.

YEAR	CPI RATE	YEAR	CPI RATE
2005	0.034	2012	0.056
2006	0.046	2013	0.054
2007	0.072	2014	0.054
2008	0.115	2015	0.060
2009	0.071	2016	0.070
2010	0.043	2017	0.053
2011	0.050	2018	0.045

The decommissioning and closure cost estimate for The Duel Coal Project was calculated as R344 million (rounded, including 15% VAT). Refer to Table 5 for detail calculation in line with the *Guideline Document for the Evaluation of the Quantum of Closure-Related Financial Provision Provided by a Mine* (DMR, 2004), as escalated by the annual CPI rate.

This is a high-level estimate for the full LOM implying no concurrent rehabilitation during the operational phase. As the mine is still in the planning stages, a conceptual level of costing (50% accuracy) is adequate. However, when the project is authorised, this will need to be refined to a 70% accuracy level.

Once the Feasibility Study and final designs have been completed, a materials balance and final placement plan will be developed by the mine planners for inclusion in the EMPr, in line with the requirements of Government Notice No. R.1147 (GN R.1147): "*Regulations pertaining to the Financial Provision for Prospecting, Exploration, Mining or Production Operations*" promulgated in November 2015. Financial provision will be updated on an annual basis in line with the requirements of GN R.1147.

Table 5: Closure Cost Assessment for The Duel Coal Project

No	Description	Unit	Quantity	Master Rate	Multiplication factor	Weighting factor 1	E=A*B*C*D
1	Dismantling of the plant structures	m^3	60 000	R 15.14	1	1.1	R 999 292.69
2a	Demolition of steel buildings (outside of plant area)	m^2	395	R 210.91	1	1.1	R 91 638.46
2b	Concrete structures (incl. plant foundations)	m^2	6 000	R 310.81	1	1.1	R 2 051 333.96
3	Roads	m^2	270 000	R 37.74	1	1.1	R 11 209 074.86
4a	Demolition and rehabilitation of electrified railway lines	m	0	R 366.31	1	1.1	R 0.00
4b	Demolition and rehabilitation of non-electrified railway lines	m	0	R 199.81	1	1.1	R 0.00
5	Removal of offices and other temporary structures	m^2	1 200	R 421.81	1	1.1	R 556 790.65
6	Opencast rehabilitation (final void and ramps)	ha	200	R 221 117.82	1	1.1	R 48 645 919.65
7	Rehabilitation of underground mining	m^3	0	R 113.22	1	1.1	R 0.00
8a	Rehabilitation of overburden and spoils	ha	280	R 147 411.88	1	1.1	R 45 402 858.34
8b	Rehabilitation of processing waste deposits and evaporations ponds (basic, salt-producing waste)	ha	14	R 183 598.83	1	1.1	R 2 827 421.98
8c	Rehabilitation of processing waste deposits and evaporations ponds (acidic, metal-rich waste)	ha	0	R 533 258.03	1	1.1	R 0.00
9	Rehabilitation of subsided areas	ha	0	R 123 435.25	1	1.1	R 0.00
10	General surface rehabilitation, vegetation	ha	555	R 116 775.07	1	1.1	R 71 291 181.34
11	River diversions	ha	5	R 0.00	1	1.1	R 0.00
12	Fencing	m	12 000	R 133.20	1	1.1	R 1 758 286.25
13	Water management (separating clean and dirty water areas)	ha	555	R 44 401.17	1	1.1	R 27 106 913.06
14	2-3 years of maintenance and aftercare	ha	555	R 15 540.41	1	1.1	R 9 487 419.57
15	Specialist studies (10%)	Sum		R 22 142 813.08	1	1.1	R 24 357 094.39
				Sum of items 1 to 15			R 245 785 225.19
	SUBTOTAL 1 {Multiply by weighting factor 2 = 1.05 (peri-urban)}						**R 258 074 486.45**
	Preliminary and General	6 % of Subtotal 1		Add 6 % to subtotal if 1 >R 100,000,000			
				Add 12 % to subtotal if 1<R 100,000,000			R 15 484 469.19
	Contingency	10% of subtotal 1					R 25 807 448.65

No	Description	Unit	Quantity	Master Rate	Multiplication factor	Weighting factor 1	E=A*B*C*D
	SUBTOTAL 2 {Management}						**R 41 291 917.83**
	SUBTOTAL 3 {Subtotal 1 & 2}						**R 299 366 404.29**
	VAT (15%)						R 44 904 960.64
	GRAND TOTAL {Subtotal 3 plus VAT}						**R 344 271 364.93**

6.2 QUANTIFICATION OF IMPACT DIRECTLY AFFECTED PERSONS

Table 6 provides a high-level monetary quantification of the impacts on directly affected persons and activities. Please note that the values are estimates only, on the conservative side, and may be an over-estimation of the actual costs.

Table 6: Monetary quantification of impact on directly affected persons

Impact	Assumption for Quantification	Estimated Cost	LOM cost (based on 24 years)
Resettlement of households	223 households @ R1m per household, inclusive of services and other livelihood aspects (loss of grazing / arable plots, relocation of graves within households)	R 223 million (once-off)	R 223 million
Lease agreement with Land Claimants	550 ha @ R5,000 per ha per annum (third of value)	R 2.75 million per annum	R 66 million
TOTAL			**R 289 million**

6.3 FINANCIAL CAPACITY

The estimated annual environmental cost required for monitoring and auditing, specialist involvement and biodiversity off-sets are estimated below (in real terms):

Aspect	Amount (Rands)
- Water monitoring	R 350 000
- Dust monitoring	R 120 000
- Biodiversity monitoring	R 250 000
- Heritage / Palaeontology monitoring	R 150 000
- Specialist studies	R 350 000
- Auditing & reporting	R 250 000
- Biodiversity offsets	TBD
TOTAL (per annum)	**R 1 470 000**

Enough funding will be made available in the project cost structure for rehabilitation and environmental aspects.

6.4 RESOURCE CAPACITY

The following resources from Subiflex (Pty) Ltd will be required for the implementation of the environmental and social management plans and associated strategies / policies:

- Human Resources Manager
- Community Engagement Manager
- Rehabilitation Officer
- Environmental Officer

In addition, the following specialists will be appointed as required to assist with the development of the plans and programmes, and to perform the necessary monitoring:

- Qualified archaeologist and/or palaeontologist
- Qualified biodiversity / water specialists
- Qualified social and stakeholder engagement specialist
- Resettlement specialist
- Specialists required to assist with off-set programmes

7 ENVIRONMENTAL MONITORING

A comprehensive monitoring system was developed for The Duel Coal Project in line with the proposals of the specialists – refer to Table 7. The objective of the environmental monitoring system is to:

- Prevent and/or minimise the environmental impact associated with the proposed mining operation;
- Ensure that the environmental management system at The Duel Coal Project performs according to specifications;
- Ensure conformance with the environmental objectives;
- Ensure timeous implementation of the environmental strategies and implementation programme;
- Act as a pollution early-warning system;
- Obtain the necessary data required to address knowledge gaps;
- Check compliance with license requirements; and
- Ensure consistent auditing and reporting protocols.

A proper data management system will be set up to facilitate trend analyses and preparation of reports. All the monitoring data will be collated and analysed on an annual basis and included in HSEC management reports.

It must be noted that the monitoring programme is a dynamic system changing over the different life-cycle phases of the mine. The programme will be reviewed on an annual basis and revised if necessary.

In addition, an Environmental Monitoring Committee (EMC) will be established with representatives from the IAPs, authorities and the mine. Quarterly meetings will be scheduled to review the monitoring results and to identify issues of concern. The EMC will assist in identifying shortcomings in the monitoring programme and to review the programme as mining commences.

Table 7: Environmental Monitoring Programme for The Duel Coal Project

Aspect	Issue	Purpose	Monitoring points	Frequency	Sampling Method	Variables
Climate	Weather station	To obtain detailed weather records for the LOM	MRA area	Continuous	Air quality monitor	Wind speed & direction Temperature & rainfall Humidity and atmospheric pressure
Surface water	Surface water quality	Determine any deterioration in water quality as a result of the mining related activities	Up- and downstream of mining operation	Monthly	Grab sampling	EC, pH, TDS, SS, Cl, SO_4, NO_3, Na, F, Fe, Al, Mn, Zn, Total Alkalinity, Ca, Mg, K, Total Hardness
				Annually	Grab sampling	Analyses to 95% charge balance, including all metals and hydrocarbons
	Potable water	Determine quality of drinking water	Outflow of potable treatment facility	Weekly	Grab sampling	Turbidity and micro-biological constituents
	Sewage effluent	Determine water quality of sewage effluent	Outflow of sewage works	Weekly	Grab sampling	Turbidity and micro-biological constituents
	Water management infrastructure	Monitoring of condition, identifying areas that require maintenance	Along clean & dirty water canals, clean & dirty water dams	Monthly After a big rain event	Visual	Evidence of erosion, cracks, subsidence, overgrowth, etc.
	Dirty water systems	Determine the water quality and long-term chemical changes in the dirty water systems	Dirty water dams	Monthly	Grab sampling	EC, pH, TDS, SS, Cl, SO_4, NO_3, Na, F, Fe, Al, Mn, Zn, Total Alkalinity, Ca, Mg, K, Total Hardness
	Road / conveyor crossings	To identify and mitigate any spillages into the clean water system	All stream crossings	Weekly	Visual inspection	Evidence of spillages
Groundwater	Groundwater quality	To determine any impact on the groundwater quality as a result of mining	Hydro-census / baseline boreholes Community water supply boreholes	Quarterly	High integrity grab sampler (double valve), preferably made from PVC/Teflon	EC, pH, TDS, SS, Cl, SO_4, NO_3, Na, F, Fe, Al, Mn, Zn, Total Alkalinity, Ca, Mg, K, Total Hardness Annually: Analyses to 95% charge balance, including all metals and hydrocarbons
	Groundwater levels	To determine any impact on the groundwater levels as a result of mining	As above	Monthly	Pump samples	Water level
	Geochemical	To collect sufficient geochemical data to verify and quantify the geochemical models during mining	Solid waste materials (all waste rocks, carbonaceous and non-carbonaceous)	Annually	Representative grab samples	ABA and leach tests
			Toe drain leachate of discards stockpile and PCDs	Quarterly	Grab sample (liquid only)	Full chemical analyses (incl. heavy metals)

Aspect	Issue	Purpose	Monitoring points	Frequency	Sampling Method	Variables
Mine water balance	Water levels in dams	To verify water balance and volume of water stored	Clean & dirty water dams	Monthly	Survey	Height (m)
	Dirty water recycled	To determine volume of dirty water abstracted & recycled for processing and dust suppression	Mine dewatering at the dewatering pumps Discharge volumes (excess water)	Monthly reading	Water meters	Volume (m^3)
	Clean water abstraction	To determine volume of clean water abstracted	Water supply abstraction point	Monthly reading	Water meters	Volume (m^3)
	Process flow	To determine accurate process water balance	Inflows & outflows Moisture content of the product & residue	Monthly	Water meters	Volume (m^3)
Biodiversity / Land use management	Soil erosion	To pro-actively identify soil erosion in order to rectify prior to serious degradation	The Duel MRA area Downstream any stream crossings / discharge points	Routinely (monthly)	Field survey	-
	Species diversity	To determine species diversity (fauna & flora)	The Duel MRA area	Annually	Field survey	As per specialist advise – refer section 4.1.4
	Aquatic monitoring	Ongoing monitoring of the aquatic resources in the vicinity of the mining development	The Duel MRA area	Annually Summer	Field survey	As per specialist advise – refer section 4.1.4
	Aquatic monitoring	To determine the impact on the aquatic systems as a result of mining	The Duel MRA area	Annually Summer	Field survey	As per specialist advise – refer section 4.1.4
	Alien vegetation	To monitor conformance with alien vegetation programme	The Duel MRA area	Monthly (during eradication programme)	Survey	Area (hectares)
Air quality	Dust outfall	To determine the levels of dust outfall as a result of the mining activities	As per specialist advise	Continuous	Directional dust outfall buckets	Settleable particles ($mg/m^2/day$)
	PM2.5, PM10	To determine the particular matter levels for PM_{10} and $PM_{2.5}$	Selected points within the affected communities	Continuous	Air Quality monitor	$\mu g/m^3$
Environmental noise	Noise levels	To determine the noise levels within the communities and sensitive areas	Sensitive receptors (communities) within 35dBA noise isopleth	Monthly	To be determined	dBA
Blasting	Ground vibration and air blast	To ensure adherence to blast design guidelines and blasting limits	Refer to proposed monitoring points in Figure 6	Permanent	Seismograph	mm/s dBL
	Structural monitoring	To measure crack changes on sensitive structures	Pre-selected sensitive structures within 1500m radius	Annually	Photographic survey Gauge measurements	Crack changes
Waste	Waste generation & management	To determine volume of waste generated & disposed	Site	Weekly	Contractor report	Waste types
Heritage	Heritage/cultural resources	To capture all heritage/cultural resources exposed by development	Site	As required	Archaeologist site visit	-

7.1 CLIMATIC DATA

The meteorological conditions (Temperature, Humidity, Rainfall, Atmospheric Pressure, Solar Radiation, Wind Speed and Wind Direction) will be measured by an on-site metrological station.

7.2 WATER QUANTITY MONITORING

For efficient management of water on the site, a good understanding of the site water balance is required. To achieve this, the following monitoring is needed:

- Rainfall – to be measured daily on the site
- Evaporation – this is not essential but would be useful for calibration of the water balance model
- Dam water levels – to be measured weekly
- Flows – including the following, to be measured weekly:

  - Mine water make pumped from the opencast pit and underground workings
  - Inflows to the PCDs
  - Water pumped from the PCDs for reuse in the operations
  - Water recycled at the potable water treatment plant

- Leachate volumes

7.3 WATER QUALITY MONITORING

Surface water quality and groundwater levels will be monitored on a monthly basis, whilst groundwater quality will be monitored on a quarterly basis.

Water samples will be analysed for the following constituents:

- pH, Cl, Acidity, EC, SO_4, total hardness, TDS, NO_3, Ca, F, Mg, Fe, Na, Mn, K, Sr, Al, SiO_2, total alkalinity, NH_4, NO_2, PO_4 and turbidity.

The samples will be analysed by an independent SANS approved laboratory.

7.3.1 SURFACE WATER SAMPLING POINTS

Up- and downstream monitoring points in the Mutamba River will be selected. The positions of the monitoring points must still be determined.

7.3.2 GROUNDWATER SAMPLING POINTS

All existing boreholes on the MRA area and adjacent properties, including all community water supply boreholes.

7.4 BIOMONITORING

7.4.1 FLORAL MONITORING

A floral monitoring plan must be designed and implemented throughout all phases of the mining development, should it be approved. The following points aim to guide the design of the monitoring plan, and it must be noted that the monitoring plan must be continually updated and refined for site-specific requirements:

- Permanent monitoring plots must be established in areas surrounding the surface infrastructure and rehabilitated areas. These plots must be designed to accurately monitor the following parameters on an annual basis:

- Measurements of crown and basal cover;
- Species diversity;
- Species abundance;
- Impact of dust on flora;
- Recruitment of indigenous species;
- Alien vs. Indigenous plant ratio;
- Recruitment of alien and invasive species;
- Erosion levels and the efficacy of erosion control measures; and
- Vegetation community structure including species composition and diversity which should be compared to pre-development conditions.

- Monitoring of rehabilitation trials considering the above parameters must also take place throughout all phases of the proposed mining development and for a period of 5 years after decommissioning and closure.
- The rehabilitation plan must be continuously updated in accordance with the monitoring results to ensure that optimal rehabilitation measures are employed.
- Results of the monitoring activities must be considered during all phases of the proposed mining development and action must be taken to mitigate impacts as soon as negative effects from mining-related activities become apparent.
- The method of monitoring must be designed to be subjective and repeatable in order to ensure consistent results.

7.4.2 FAUNAL MONITORING

A faunal monitoring plan must be designed and implemented throughout all phases of the mining development, should it be approved. It is recommended that monitoring activities be conducted on an annual basis. The following points aim to guide the design of the monitoring plan, and it must be noted that the monitoring plan must be continually updated and refined for site-specific requirements:

- It is recommended that monitoring points be established in areas surrounding the mining area. These points must be designed to accurately monitor the following parameters:

- Species diversity (mammal, invertebrate, amphibian, reptile and avifaunal);
- Species abundance; and
- Faunal community structure including species composition and diversity which should be compared to pre-development conditions.

- The following methods aim to guide the monitoring plan, although more detailed, site specific methods must be employed during the development and implementation of the monitoring plan:

- Monitoring activities must take place on an annual basis as a minimum;
- Pitfall traps can be installed to monitor invertebrate diversity;
- Sherman and camera traps can be installed to monitor small mammal diversity;
- Fixed and random points for bird counts to determine species composition and diversity trends (should be conducted in the month of February due to the presence of migrants).

- Results of the monitoring activities must be considered during all phases of the proposed mining development and action must be taken to mitigate impacts as soon as negative effects (negative deviation from baseline conditions as determined by the baseline ecological assessments) from mining related activities become apparent.
- The method of monitoring must be designed to be subjective and repeatable in order to ensure consistent results.

7.4.3 AQUATIC MONITORING

- Close monitoring of water quality must take place. Monitoring of water quality should take place at a minimum frequency of once a month during which time major salts and basic metals, are monitored along with basic parameters such as pH, TSS and TDS, dissolved oxygen and EC.
- Biomonitoring should take place at the following key points:

- The Mutamba River upstream of the drainage lines entering the Mutamba River; and
- The Mutamba River downstream of the drainage lines entering the Mutamba River.

- Biomonitoring should take place on an annual basis as a minimum in the summer with quarterly assessments being undertaken in the first year prior to disturbance to gather more detailed baseline information. Biomonitoring should take place throughout the life of the mine, including the closure and aftercare phases. The results of the biomonitoring program should be compared to the results of this study to allow any temporal trends to be observed. Should any problems be indicated, measures to minimise or prevent the impact should be implemented.
- Biomonitoring should take place using the SASS5, MIRAI, SPI VEGRAI and IHAS indices as a minimum along with sediment chemistry monitoring. It is further recommended that the FRAI fish ecostatus protocol be applied if an increased abundance of fish is observed in the system at any time. All aquatic biomonitoring should be undertaken by a SA RHP accredited aquatic ecologist.
- Toxicity testing of the mine process water facilities should take place concurrently with the biomonitoring program in order to monitor the toxicological risk of the process water system to the receiving environment. Tests should include the following test organisms as a minimum:

- *Vibrio fischeri;*
- *Poecilia reticulata*
- *Daphnia pulex;* and
- *Selenastrum capricornutum*.

- The mine must, if possible, be managed as a zero-discharge facility, however definitive toxicological testing according to the DEEEP protocol should take place should it become evident that process water discharge or decant of groundwater will occur for safety reasons in order to define safe discharge volumes and ensure sufficient dilution.

7.5 AIR QUALITY MONITORING

The impact assessment indicated that there is a suite of airborne pollutants that will be emitted from the opencast and underground mining operations. Some of these airborne pollutants are listed as criteria airborne pollutants in the South African National Ambient Air Quality Standards. These identified airborne pollutants are Particulate Matter (PM_{10} and $PM_{2.5}$), Sulphur dioxide (SO_2), Oxides of Nitrogen (NOx), Benzene (C_6H_6) and dust fallout.

The airborne pollutants of importance to measure are Dust (TSP, PM_{10}, $PM_{2.5}$ and dust fallout), Volatile Organic Compounds (VOC's), sulphur dioxide (SO_2) and Oxides of Nitrogen (NOx).

7.5.1 DUST FALL-OUT

It is recommended that monthly dust fallout monitoring be conducted along the boundary of the MRA area and in the surrounding community (a minimum of 8 buckets are recommended for the site both inside and outside the mining area). The positions of the dust monitoring points must still be determined.

Monthly reporting of these results will be required along with the notification to relevant Government Agencies should Alert Thresholds be reached at any monitoring point, along with the cause and mitigation for the exceedance.

7.5.2 PARTICULAR MATTER

Due to South Africa's legislative shift to the inclusion of particulate matter in size fractions below 10µm, a real-time monitoring system will be permanently installed to provide the site with meteorological data, specific for the site, as well as particulate matter data for PM_{10} and $PM_{2.5}$. A permanent installation will allow for the monitoring of mitigation measures to ensure that all are implemented successfully. The position of the monitor should be carefully selected to allow for the monitoring of impacts on the nearby community.

The monitoring can be supported by additional monitoring of other air borne pollutants on a quarterly basis. These airborne pollutants include VOC's, SO_2, NO_x and Methane (CH_3).

7.6 NOISE MONITORING

Monthly noise monitoring will be undertaken to determine the noise levels within the communities and sensitive areas. The positions of the noise monitoring points must still be determined.

7.7 GROUND VIBRATION AND AIR BLAST MONITORING

A ground vibration and air blast monitoring programme will be imperative when mining commences for this project. This will need to include monitoring ground vibration and air blast for every blast. Ground vibration and air blast is monitored using a seismograph. In this case it is recommended that permanent stations are used for monitoring of all blasting done. In addition to this it is recommended that a video of each blast is done as a standard. Monitoring of ground vibration and air blast is done to ensure that the generated levels of ground vibration and air blast comply with recommendations. Proposed positions were selected to indicate the nearest points of interest at which levels of ground vibration and air blast should be within the accepted norms and standards as proposed in this report. The monitoring of ground vibration will also qualify the expected ground vibration and air blast levels and assist in mitigating these aspects properly. This will also contribute to proper relationships with the neighbours.

Currently 11 monitoring positions were identified around the mining opencast pit area. Monitoring positions are indicated in Figure 6. These points will need to be defined finally from testing during first blasts. Only after the first blasts done a final decision should be made with regards to a monitoring programme and this programme shared with all interested and affected parties.

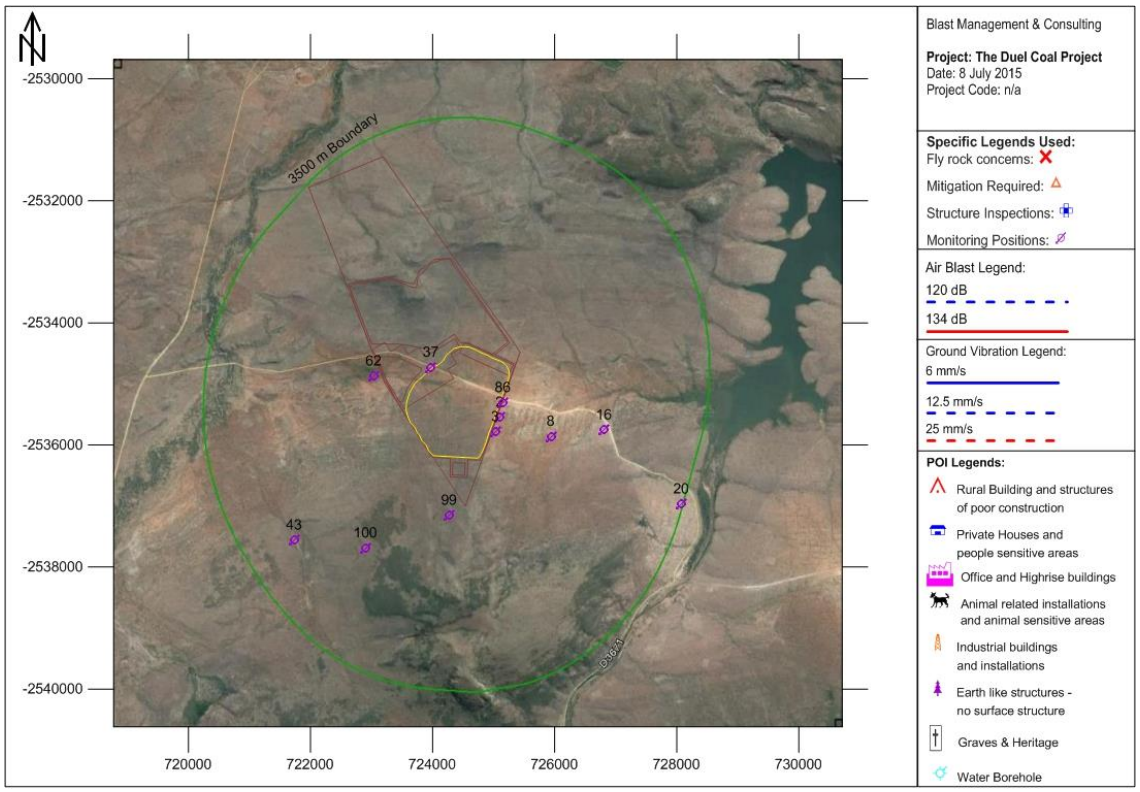

Figure 6: Proposed blast monitoring positions

Tag	Description
2	Rural Community House - Makushu
3	Makushu Graveyard
8	School Structures - Makushu
16	Rural Community House - Makushu
20	Rural Community House - Musekwa
37	Road
43	Buildings/Structures
62	Borehole - WMA-1 (MARTHA)
86	Borehole - NHOLE-10 (TELEMA)
99	Game Farm Areas
100	Game Farm Areas

7.8 VISUAL MONITORING

A visual monitoring programme, to ensure that mitigation measures regarding visual impacts are implemented and maintained, must be designed for implementation throughout all development phases. This programme would largely be based on visual reconnaissance at ground level and it must be noted that the monitoring plan must be continually updated and refined for site-specific requirements. The following points aim to guide the design of the monitoring plan:

- The method of monitoring must be designed to be subjective and repeatable in order to ensure consistent results.
- The selected KOPs should be used over the life of the project to review the success of the mitigation plan.
- Predevelopment visual conditions and the inventoried visual quality rating and scenic integrity should be reviewed after construction.
- The visual monitoring programme should be based on the following parameters:

- Airborne dust (in line with air quality assessment)
- Visibility of lights at night from surrounding receptors;
- Number of lights visible;
- Vegetation cover and height; and
- Disturbance to receptors.

- Vegetation must be monitored annually in terms of vegetation growth, density, height, species analysis and soil fertility for a period of five years after closure and in line with the vegetation monitoring plan, to ensure that concurrent rehabilitation is taking place and that mine structure are revegetated.
- At closure the success of rehabilitation would be based on the rate and percentage of vegetation recovery. Monitoring to continue beyond mine closure to ensure that the rehabilitation is successful and that the vegetation is self-sustaining. The success of rehabilitation will also largely be dependent upon the invasion of alien species.
- Maintenance of mining infrastructures and operations must be monitored.

- Results of the monitoring activities must be taken into account during all phases of the proposed mining development and action must be taken to mitigate impacts as soon as negative effects from mining related activities become apparent.

7.9 WASTE MONITORING

Domestic and hazardous waste will be removed and taken to an appropriate waste disposal site as per the Waste Management Procedure. Registered contractors will be appointed for the implementation of the Waste Management Procedure.

The contractors will be required to keep record of the volumes of waste removed from the mine site and the volumes dumped at the disposal facility, which is then reported to the mine.

8 COMPLIANCE AUDITING AND REPORTING

In order to ensure compliance with this EMP and to assess the continued appropriateness and adequacy of the EMP, The Duel Coal Project commits to:

- Conduct the monitoring of the EMPr on an ongoing basis.
- Conduct the performance assessments of the EMPr.
- Compile and submit to the Director: Mineral Resources a report on the performance assessment of the EMPr.
- The performance assessments of the EMP and the compilation and submission of the reports will occur biennially (every 2 years) from the date of approval of the EMPr.
- The first performance assessment of the EMPr will be scheduled to take place within 2 year of the approval of this EMPr report.
- The Duel Coal Project will appoint a responsible person(s), in writing, who will monitor all environmental aspects of the site on a regular basis.

Mechanisms and responsibilities for implementation of the Impact Management Actions to ensure compliance with the EMPr is tabled below.

Table 8: Mechanisms and responsibilities for implementation of Impact Management Actions

Source Activity / Impacts	Functional Requirements for Monitoring	Time period for Implementation	Review/Monitoring Frequency	Roles & Responsibility
Impact on biophysical environment as a result of mining and infrastructure development	Implementation of environmental monitoring programme	Prior to mining	Annual review of monitoring programme or if major change in scheduling	Environmental Dept, in line with the recommendations by the specialists
Impact on biophysical and social environment as a result of mining and infrastructure development	Implement internal environmental awareness programme	Construction Phase	Ongoing review Include in annual induction programme	Environmental Officer Human Resources
Impact on biophysical environment as a result of mining and infrastructure development	Review and analyses of monitoring data for: • Surface water • Groundwater • Mine water balance • Land use management • Air quality • Environmental noise • Blasting • Natural resources, including riverine forest • Waste management	Commencement of mining	Monthly	Environmental Officer HSEC Committee

Source Activity / Impacts	Functional Requirements for Monitoring	Time period for Implementation	Review/Monitoring Frequency	Roles & Responsibility
Impact on SCC/protected faunal and floral species	Develop & implement Rescue & Relocation Plan and Reclamation Plan	Prior to mining	Annual rescue operation for areas to be disturbed in the next 12 months	Specialist to be appointed
Biodiversity impact as a result of mining an infrastructure development and vegetation clearance	Develop & implement Biodiversity Action Plan (BAP), including avifaunal plan	Within one year of mining	Annual review	Specialist to be appointed
Latent impact on the biodiversity and conservation initiatives in the area	Identify off-set programmes and possible contribution to Strategic Environmental tools, programmes and projects within the province	To be initiated within one year of mining	Ongoing implementation as per specialist recommendations	Environmental specialists in conjunction with relevant stakeholders
Impact on soils & land use as a result of mining an infrastructure development	Develop Rehabilitation Plan / Land Use Management Plan	Construction Phase	Annual review or if major change in scheduling	Mining Dept
Impact on soils, land use and biodiversity as a result of mining an infrastructure development	Establish indigenous nursery	Commencement of mining	Ongoing review and improvement	Manager to be appointed
Impact on soils, land use and biodiversity as a result of mining an infrastructure development	Reporting of rehabilitation plan • Areas disturbed • Areas levelled • Areas topsoiled • Areas vegetated	Construction Phase	Monthly	Rehabilitation Officer
Impact on soils, land use and biodiversity as a result of mining an infrastructure development	Vegetation audit to determine effectiveness of land use management plan and long-term sustainability of vegetated areas	Within first 2 years of mining	Annually	External appointment
Impact on soils, land use and biodiversity as a result of mining an infrastructure development	Implement aftercare & maintenance programme for rehabilitated areas	Within 2 years of mining	Ongoing implementation as per specialist recommendations	Rehabilitation Officer
Encroaching / spreading of alien vegetation as a result of vegetation clearance and rehabilitation	Initiate alien vegetation programme	Construction Phase	Annual review	Environmental Officer
Impact on cultural and heritage aspects due to excavations	Conduct Phase 1B assessment of the Stone Age material	Prior to construction	Once-off	Stone Age specialist to be appointed
Impact on cultural and heritage aspects due to excavations	Develop Heritage Management Plan and Chance Find Protocol	Prior to construction	Ongoing review and implementation	Environmental Officer Heritage specialist

Source Activity / Impacts	Functional Requirements for Monitoring	Time period for Implementation	Review/Monitoring Frequency	Roles & Responsibility
Impact on cultural and heritage aspects due to excavations	Heritage monitoring	Construction phase	Monthly or as new areas are excavated	Archaeologist to be appointed
Impact on palaeontological aspects due to excavations	Palaeontological investigation	Prior to opencast mining	Once-off	Palaeontologist to be appointed
Impact on palaeontological aspects due to excavations	Palaeontology monitoring	Construction Phase	Monthly or as new areas are excavated	Palaeontologist to be appointed
Impact on surrounding boreholes, groundwater levels as a result of dewatering	Establish baseline groundwater levels of all boreholes within the impact zone	Prior to any activities	Annually	Environmental Officer Groundwater specialist
Impact on surrounding boreholes, groundwater levels as a result of dewatering	Enter into negotiations with surrounding landowners and communities impacted regarding compensation or alternative water supply	Once monitoring indicates a lowering in water levels of boreholes	Ongoing review, based on monthly monitoring results	Environmental Officer Mine Management
Impact on groundwater quality and levels	Revision of groundwater flow & geochemical model	Within 2 years of mining	Revise every 5 years	Specialist to be appointed
Impact on groundwater quality and potential long-term AMD	Evaluation and assessment of alternative options for final water use and required associated water quality, together with technologies to achieve the required quality	Within 2 years of mining	Ongoing as research development programme	Environmental Dept Specialist to be appointed
Impact on infrastructure as a result of blasting (ground vibration)	Pre-blast survey of all structures within a radius of 1500m	Prior to opencast mining (blasting)	Once-off	Blasting / structural specialist to be appointed
Impact as a result of blasting	Develop detail blasting procedure in line with specialist advise, including evacuation procedures	Prior to opencast mining	Ongoing review based on monitoring data	Blasting contractor
Noise impacts on sensitive receptors and surrounding communities	Stipulate best practice requirements in tender documentation i.r.o. emissions, noise, equipment, transport, etc.	Prior to appointment of contractors	Ongoing review as new technology becomes available	Procurement Dept
Impact on aquatic systems and drainage lines as a result of mining and infrastructure development	Development and implementation of a detail storm water management plan and infrastructure designs	Prior to construction as part of the IWULA	Annual review or if major change in scheduling	Engineering Dept
Impact on aquatic systems and drainage lines as a result of mining and infrastructure development	Maintenance of clean & dirty water system	Operational Phase	Monthly or after a large rain event	Engineering Dept

Source Activity / Impacts	Functional Requirements for Monitoring	Time period for Implementation	Review/Monitoring Frequency	Roles & Responsibility
Product transport, increase in traffic	Initiate agreement with Roads Agency Limpopo re diversion of road D3672, product transport roads and road maintenance	Prior to mining	Once-off	Engineering Dept
Product transport	Identify & clean-up of any spillages along access and product transport roads	Construction Phase	Weekly	Engineering Dept
Product transport	Identify & report any road maintenance issues	Construction Phase	Ongoing discussions and auditing of road conditions	Engineering Dept Roads Agency Limpopo
Social aspects identified as a result of the proposed mining development	Develop and implement Social Management and Monitoring Strategies as per the SIA related to employment, procurement, health, education and housing	Prior to and during construction	Ongoing review	Human Resource Dept Procurement Dept
Resettlement of households due to the impacts associated with mining (blasting & noise)	Resettlement, Compensation and Mitigation Strategy	Immediately after granting of MR	Ongoing review until implemented to the satisfaction of the impacted parties	Mine Management Resettlement specialist
Consultation	Develop Communication and Consultation Plan and Grievance Procedure	Prior to construction	Ongoing review through the EMC	Human Resource Dept Environmental Dept
Consultation	Establish Environmental Monitoring Committee (EMC)	Commencement of mining	Six-monthly meetings	Environmental Dept
Consultation	HSEC stakeholder meeting	Commencement of mining	Annually	Mine Management
EMPr compliance review	Internal review of EMP compliance, conformance to environmental objectives and strategies and the implementation thereof	Commencement of mining	Annually	Environmental Officer HSEC Committee / EMC
EMPr compliance review	EMP performance assessment to determine conformance with the EMPr, including effectiveness and appropriateness of EMP	Within first 2 years of mining	Biennially (every 2 years)	External appointment
EMPr compliance review	Environmental legal compliance audit	Commencement of mining	Annually	External appointment
EMPr compliance review	Revision of closure cost assessment	Commencement of mining	Annually	Engineering Dept

9 ENVIRONMENTAL AWARENESS PLAN

The awareness plan will be implemented at all employees' levels i.e. junior, senior and middle management levels (for unskilled, semiskilled and skilled workforce). In general, the objectives of the environmental awareness plan will be to:

- Ensure that all employees understand the company's Environmental Policies and Objectives;
- Ensure that information regarding the environment is communicated effectively and is readily accessible to all relevant parties, including employees, contractors and stakeholders;
- Provide for the establishment of forums to discuss environmental issues, allocate resources and ensure that adequate measures are being taken to address the environmental problems;
- Provide guidelines for communication with outside organisations and IAPs;
- Ensure effective and constructive response with IAPs; and
- Ensure that environmental communication and interactions are documented and recorded and accessible.

The formal training, awareness campaigns, sharing of environmental information in meetings and issuing of management instructions will be used to inform employees of potential environmental degradation, compliance levels and feedback on implementation of the required standards.

9.1 INDUCTION PROGRAMME

All new employees and contractors carrying out work on the entire mine property will undergo an environmental induction programme. Included in the programme will be all relevant environmental aspects and conditions of the Environmental Authorization. An advanced environmental programme will be conducted and employees performing specific tasks (e.g. workshop workers) that have a high-risk potential to impact negatively on the receiving environment will undergo specific training. All employees will as a condition of employment, be subject to undergo the annual environmental refresher programme.

9.2 ADVANCED TRAINING PROGRAMME

An advanced awareness programme will be conducted for all employees in line with the job descriptions or work specific tasks, after the initial environmental induction training has been conducted. The training will be applicable and specific to certain employees working in specialized areas of the operation. The training will include, but not limited to waste management, spill kit training, conservation of water, soil, energy and oil, and firefighting.

9.3 EMS WORKING GROUPS

The company will identify appropriate employees to be included as members of the Environmental Management System (EMS) Working Group, including the management team, to discuss environmental issues on a monthly basis.

Environmental action plans will be compiled at each meeting and followed up during each subsequent meeting until the action plans are completed.

9.4 INTERNAL COMMUNICATION AND AWARENESS CAMPAIGN

Internal communication will be conducted as follow:

- Notices - Awareness raising initiatives to capacitate both employees and communities and equip them with environmental knowledge will be implemented. Environmental news flashes with relevant messages will be distributed and placed at strategic sites on a monthly basis. The environmental news flashes will be discussed in employees' environmental forums and form part of the toolbox talks. Awareness raising intervention will further be conducted for specific employees in areas where constant environmental non-compliance activities are experienced. The most effective communication methods will be utilized to communicate environmental topics.
- Management meetings – The mine will conduct monthly meetings where relevant Health, Safety, Environmental, Community (hereafter referred to as the HSEC) issues are discussed with the General Manager of the mine.
- Review meetings – The mine management team will provide feedback to the Operations Director on a monthly basis and all HSEC issues will be included in these meetings.
- Environmental information sharing sessions on environmental risks and performance will be conducted. All employees will be afforded an opportunity to interrogate environmental issues. Monitoring and environmental performance reports will be made available to employees and managers of specific business units.

9.5 EXTERNAL COMMUNICATION AND AWARENESS CAMPAIGN

A detail Communication and Consultation Plan will be developed to ensure continuous engagement with project affected parties and stakeholders. It could, amongst others, include the following aspects:

- Stakeholder Register – The Duel Coal Project has a comprehensive Stakeholder Register as a result of the EIA process. The register contains a list of all stakeholders and includes the name of the stakeholder organisation, contact details of the IAPs, such as the address (both physical and postal), e-mail address, telephone number, cell phone number and fax number. This register will be maintained by the Mine's Environmental Department and updated on an annual basis.
- Stakeholder Reports – HSEC reports will be prepared annually and distributed to all the major stakeholders. To encourage feedback and facilitate stakeholder participation, each report will contain a feedback sheet, which will allow the stakeholders to change their contact details, if necessary, and to comment on or enquire as to HSEC matters. Any feedback sheets received will be managed according to fixed operating procedures and any actions taken will be recorded for reference purposes.
- Public Forums – Annual public meetings will be held with major stakeholders to present and discuss HSEC issues. A register of attendees will be completed, and minutes taken during the proceedings, which will be distributed to all the major stakeholders for information purposes, whether they attended the meeting or not. To encourage feedback and facilitate stakeholder participation, feedback sheets will be handed to each stakeholder upon registration and collected after the forum. This will allow the stakeholders to change their contact details, if necessary, and to comment on or enquire as to HSEC matters. Any feedback sheets received will be managed according to fixed operating procedures and any actions taken will be recorded for reference purposes.

- External Complaints Register – An external complaints register will be stationed at the office of the Mine's Environmental Manager. If a complaint and/or concern are raised, a formal Incident Investigation will be opened, managed and investigated in accordance with the Issue and Grievance Procedure.
- Environmental Management Committee (EMC) – Representatives from IAPs, authorities and the mine will constitute the EMC. Six-monthly meetings are envisaged, to discuss the environmental monitoring results and implementation of the Impact Management Actions (Table 8).

10 SPECIFIC INFORMATION REQUIRED BY THE COMPETENT AUTHORITY

Financial provision will be updated on an annual basis in line with the requirements of GN R.1147.

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11 UNDERTAKING

I, Maria Catharina Eksteen, herewith confirms:

a. The correctness of the information provided in the reports;
b. The inclusion of comments and inputs from stakeholders and IAPs;
c. The inclusion of inputs and recommendations from the specialist reports where relevant; and
d. The acceptability of the project in relation to the findings of the assessment and level of mitigation proposed.

Signature of EAP

Date: