May 2010

EXXARO RESOURCES LIMITED

Rehabilitation Programme Towards Closure of the Belfast Project Area

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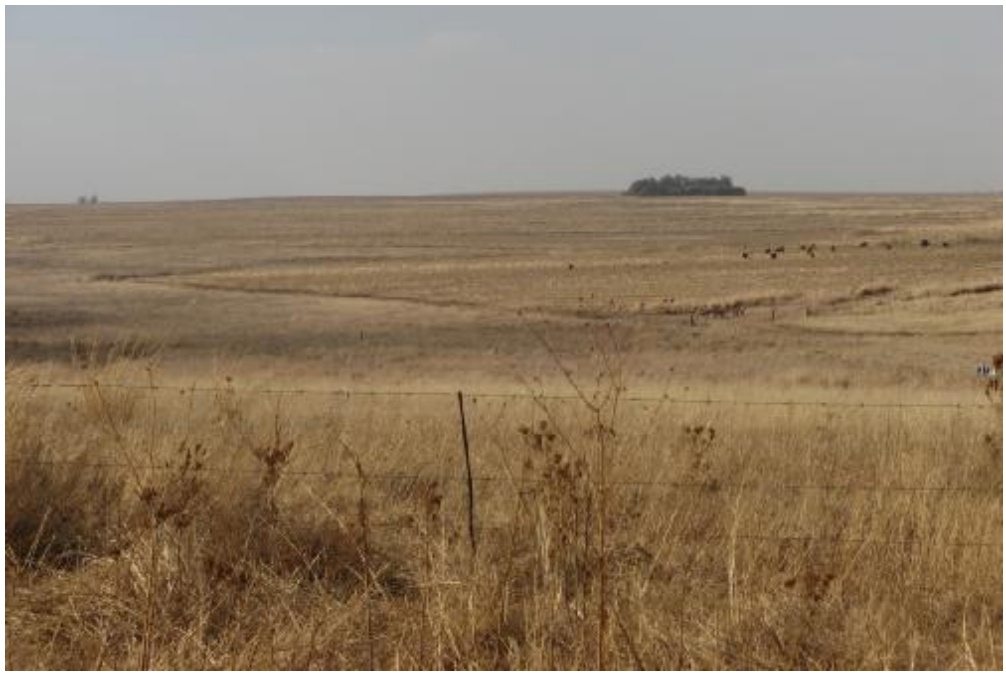

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REPORT

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1. INTRODUCTION

Exxaro Resources Limited (Exxaro) is involved in both underground and opencast coal mining operations within the North Block Complex (NBC), located between towns of Carolina and Belfast in the Mpumulanga Province. The NBC currently consists of the Glisa and Strathae coal mines as well as the Eerstelingsfontein and Belfast coal projects. As part of the NBC, the Belfast Project which is situated approximately10 km south-west of the town of Belfast entails the development of an opencast mine to coal for export, Eskom and other potential markets.

During January 2010, in terms of Regulations 49, 50 and 51 of the Mineral Petroleum Resources Development Act, No. 28 of 2002 (MPRDA) Exxaro submitted an Environmental Impact Assessment and Environmental Management Plan (EIA/EMP) for the proposed operation. As part of this EIA/EMP, a land use framework, closure framework and closure costing report indicating both the scheduled (planned) and unscheduled (immediate) closure costs were compiled, to manage proposed operational activities towards final site relinquishment.

On request of the DMR, this rehabilitation programme has been compiled, delineating the 'areas and aerial extent of the anticipated mined-out areas at the time of closure, from which the quantum of financial provision' was calculated. This document provides additional information on the closure planning already conducted and should improve the information on the surface rehabilitation required for the Belfast Project area.

As mining operations are initiated and proceed, this rehabilitation programme would be updated to reflect improved knowledge as well as alignment to the mine plan as it evolves.

2. REHABILITATION PROGRAMME

2.1 Land use and closure goal

The following six key land use zones, based on the identified base case land use of high-potential grazing land as well as potential future opportunities in the area, were identified for the Belfast Project area:

- Zone 1 - Areas least affected by mining: Arable agriculture;
- Zone1a - Western riparian zone: Eco-tourism / recreation;
- Zone 2 - Plant and associated infrastructure: Grazing / wilderness;
- Zone 3 - Areas heavily affected by mining: Grazing / recreation;
- Zone 3a - Central riparian zone within mining area: Eco-tourism / recreation; and
- Zone 3b - Area close to N4: Commercial / light industry.

Based on the above, the overall closure goal for the Belfast Project area is to progressively re-instate an area that is safe, stable, and non-polluting to be integrated into the current agricultural, eco-tourism and economic initiatives of the Emakhazeni Local Municipality area, utilising the infrastructure created for the project as far as possible for beneficial re-use.

2.2 Delineation of area requiring rehabilitation

The Belfast Project area is located approximately 10 km south-west of the town of Belfast, adjacent to the N4 highway, running past Middleburg towards Machadodorp. Mining and related activities would cover approximately 5819.18 ha.

A layout map indicating the Belfast Project and associated mining facilities is provided in Figure 1.

The life-of-mine (LOM) is indicated to be approximately 27 years, from 2011-2038, with mining to commence with the East block pit. A box-cut will be established during the construction phase during which topsoil and overburden from the area will be stockpiled to the south of the open pit (P1 – D1, Figure 1).

Mining operations will be expanded to the West Block pit during which strip mining activities similar to those undertaken at the East block pit would be employed. Overburden from the West block pit would be stockpiled south of the open pit (P1 – D2, on Figure 1).

2.2.1 Concurrent rehabilitation

Operations at the Belfast Project will involve conventional strip mining during which overburden would be removed to expose the underlying coal. Mining will be conducted using conventional truck and shovel operations, assisted by roll-over dozing to allow for continuous back-filling and concurrent rehabilitation of the mined-out areas.

Concurrent rehabilitation of the mined-out areas would commence once the first strip at both East- and West block pits have been mined.

2.2.2 Post-closure rehabilitation

It is envisaged at mine decommissioning that only the East block pit will have a final void that would need to be backfilled and rehabilitated. It is expected that the West block pit would be completely backfilled and rehabilitated at this time as mining of this pit would have ceased approximately ten years before the conclusion of mining at the East block pit.

2.3 Local site conditions

The key local site conditions pertaining to rehabilitation and closure of the Belfast Project are as follows:

- Mean temperatures in the project area are conducive to agriculture, with rainfall and evapo-transpiration of approximately 730 and 1 450 mm per annum respectively, and summer temperatures averaging mid-20C's;
- Topography is gently sloping towards the south which contributes favourably to current agricultural and grazing practices;
- The project area is located in the headwaters of the Komati River and drained by the quaternary catchments of the Leeubankspruit (X11C), tributaries of the Klein-Komati River (X11D), and a non-perennial tributary Steelpoort River (B41A). The overall catchment is in good ecological condition;
- Numerous wetlands traverse the project areas which play an important role in moderating the downstream water quantity and quality of local rivers and streams. However, agricultural activities have already led to impacts on these wetlands through the incision of channels, bank slumping, increase in sediment loads and growth of exotic invader plants;
- In addition to the wetland systems, numerous pans are located within and surrounding the project area. Although some impacts such as overgrazing, channelisation, cultivation and growth of exotic plant species have occurred, these pans are largely unmodified, representing largely natural conditions;
- Few red data plant species and, hence, associated faunal species are expected in the area due to current agricultural and grazing practices having already transformed most of the natural habitats to fields and pastures;
- The overall ambient groundwater quality in the project area is good, but displaying some variance due to different co-existing aquifers, impact situations and recharge conditions.
- Groundwater borehole yields vary between 0 and 2 l/s. The dedicated numerical groundwater modelling conducted to predict the annual groundwater seepage rates into the mining blocks indicated a range of between 100 - 950 m^3/d of recharge to the pits when mining occurs at the deepest levels and flow gradients are the steepest;

100000

-2850000

-2860000

P2 - D3

East Block Pit

West Block Pit

P2 - D4

P1 - D1

P1 - D2

DRIEHOEKSPRUIT

KLEIN-KOMATI

LEEUBANK

LEEUBOKSPRUIT

PHASE 1
Crushing and screening plant

PHASE 2
Beneficiation plant
(crushing, screening and washing)

Co-Disposal

Limpopo

Gauteng

Mpumalanga

LEGEND

- Plant layout
- Roads
- Rivers
- Rivers - Non-perennial
- 2m & 5m Contours
- Mineral rights
- Coal reserve
- Dumps

NOTES

REFERENCE

Projection: LO 29 Cape

PROJECT

BELFAST PROJECT CLOSURE FRAMEWORK

TITLE

PROPOSED KEY MINE INFRASTRUCTURE

Golder Associates
Johannesburg, South Africa

PROJECT No. 12484		SCALE 1:50,072	A3	REV. 0
PHASE 1		TASK 0		
GIS	KG	17/12/2009		
CHECK	SC	17/12/2009		
REVIEW	RH	17/12/2009		

FIGURE 1

G:\GISS\Gis Projects\12484 Belfast\Maps\12484_Layout.mxd

- The West block pit is estimated to decant at a rate of approximately 3 600 m^3/day to the north-west and south-east, whilst decant from the East block is estimated at 4 300 m^3/day along its south-western boundary. The time to decant for both of the mining blocks is less than one year after cessation of mining; and
- Acid-base accounting on coal and overburden material indicated a high likelihood of acid mine drainage (AMD) formation, most likely resulting in the decant water from the mine being of poor quality.

2.4 Rehabilitation objective

The key objective for rehabilitation of the Belfast Project is to augment the level of detail of the closure framework in order to improve guidance on site and associated infrastructure remediation towards long-term stable landforms to facilitate a post-closure walk-away situation.

2.5 Rehabilitation measures

As the Belfast Project has yet to be initiated, the following rehabilitation measures area aligned to information generated from baseline specialist investigations. As operational activities are initiated these measures would be updated as the land use- and closure objectives are updated throughout the life-of-mine, to ensure continual appropriateness/applicability of proposed methodologies.

2.5.1 Infrastructural areas

Processing plant and associated infrastructure

- Dismantle remaining buildings and associated steel equipment/infrastructure:
  - For infrastructure that has a beneficial internal re-use/salvage value, utilise within nearby NBC operations; or
  - For infrastructure with no beneficial internal re-use/salvage value, sell to local, authorised scrap merchants.
- Demolish all concrete and brick-related infrastructure as well as associated concrete paved areas and dispose of at a permitted waste disposal site; and
- Demolish oil traps and sumps, after cleaning out the remaining oil and sludge for safe off-site disposal, and dispose of the demolition waste at a permitted waste disposal site.

Access and haul roads

- Excavate gravel haul roads with engineered layers containing added stabilisers such as concrete to approximately 500 mm and disposed of as back-fill within the open pits, or bury within in a trench next to the road;
- Rip disturbed area to a minimum depth of 500 mm to alleviate compaction;
- Rip gravel and haul roads which contain no additional material to a depth of 1 m to alleviate compaction;
- Undertake general surface shaping and profiling, including levelling of safety berms associated with the haul roads; and
- Once topsoil is replaced, ameliorate soil and establish vegetation as mentioned below.

In addition, retain the proposed road extension between District Road 1770 and the R33 post-closure, for use by third parties.

2.5.2 Mining areas

Open pits

- Practice concurrent rehabilitation during the mine's operational life-of-mine by maintaining the proposed roll-over method of mining which would compliment concurrent rehabilitation. This would include the following:
  - Strip topsoil and place at demarcated areas of P1 – D1 for the East block pit and P1 – D2 for the West block pit, both located along the southern lips of the respective open pits. Based on soil studies undertaken in the area, the following depths of topsoil could be stripped:
    - Avalon soils - 300 mm thick;
    - Bainsvlei soils – 300 mm thick; and
    - Hutton soils – 1,200 mm thick.

    Based on the above as well as the associated distribution of the soils in the Belfast Project area (Viljoen, 2009), a total of approximately 35,919,000 m^3 (at a bulk density of 1,275 $kg.m^3$) of topsoil is available for rehabilitation.
  - Remove subsoil (softs) and place at demarcated areas of P1 – D1 for the East block pit and P1 – D2 for the West block pit;
  - Once drilling and blasting have been initiated, load-and-haul hards to areas of P1 – D1 for the East block pit and P1 – D2 for the West block pit;
  - Once the first cut has been completed, bulldoze hards into the bottom of the cut, with softs dozed on top;
  - Rip areas where excessive compaction of the upper layers of back-fill have taken place during trucking in of material to a minimum depth of 500 mm to alleviate compaction; and
  - Place approximately 300 mm topsoil on top of the replaced softs.

Continue with the above sequence until the final voids toward the northern boundaries of the open pits have been in-filled. (It is noted that as mining progresses in a northerly direction, the demarcated topsoil, softs and hards areas of P2 – D3 and P2 – D4 for both the East and West block pits respectively (Figure 1) would be utilised due to the proximity to the mining operations).

The following would also be taken into consideration:

- Transport overburden that is to be placed against the highwalls via truck and compact instead of bulldoze, thereby reducing differential crack-producing settlement of the material against the highwall as well as limiting/minimising infiltration of surface water towards seepage generation;
- Back-fill the final landform to an elevation slightly higher that the anticipated final landform to allow for settling of back-filled material;
- Profile back-filled areas to create a stable final landform and to limit ponding of water on-site; and
- Once topsoil is replaced, ameliorate soil and establish vegetation as mentioned below.

Overburden stockpiles

- Utilise overburden at demarcated areas to back-fill open pits as part of concurrent rehabilitation, as explained above;
- Profile disturbed stockpile footprint areas to blend in with the surrounding landscape;
- Rip soil to a minimum of 500 mm to alleviate compaction. On specific areas where severe compaction can be expected, rip soil to a 1 m depth;
- If *in situ* soil cannot be sufficiently rehabilitated to support a sustainable vegetative cover, import a portion of topsoil onto the disturbed footprint areas; and
- Once topsoil is replaced, ameliorate soil and establish vegetation as mentioned below.

Co-disposal facility

- During the operational LOM:
  - Place coarse discard and fines on dedicated constructed engineered base to limit infiltration of water from the facility into the soils beneath;
  - Place material to ensure constructed side slopes of 1:4 (V:H). (If properly designed and constructed, no re-shaping of the side slopes would be required); and
  - Undertake concurrent rehabilitation of side slopes during operational period.
- On decommissioning of mining activities:
  - Plug and seal penstock;
  - Construct a 300 mm thick capillary break layer on the upper surface and shaped outer slopes;
  - Establish a 900 mm thick store-and-release (evaporative) cover op top of the capillary break layer on both the upper surface and outer slopes;
  - Construct a parapet wall around the perimeter of the upper surface to route the water collected on the upper surface to a dedicated stormwater chute to drain the collected water to ground level for controlled discharge to the receiving surface environment. As part of the ongoing update of the closure planning, dedicated landform modelling will be conducted to investigate whether the outer slopes could be integrated with the upper surface and in this way create a uniform landform that, once well vegetated, would require limited care and maintenance. Not only would this facilitate a walk away situation for the mining proponent, but also limit the routing of water on the upper surface to the stormwater chute and the construction of this structure. The routing of upper surface water has the potential to enhance recharge through the evaporative cover and thereby adding to the nett percolation of contaminated seepage that could manifest on the rehabilitated footprint area of the co- disposal facility; and
  - Establish grass-type vegetation on upper surface and outer slopes of the facility as dictated by the design of the evaporative cover.

A more detailed rehabilitation programme would need to be developed for the co-disposal facility once the design of the facility has been completed, including the above foreseen long term landform modelling.

Return water dam

- Remove a 500 mm layer of silt from the return water dam basin, and dispose of on top of the co-disposal facility before the facility is rehabilitated;
- Remove liners and dispose of at a permitted waste disposal site;
- Breach dam walls and re-shape to at least 1:5 (V:H);
- If necessary, utilised dam wall material as an alternative to topsoil;
- Place a 400 mm thick layer of topsoil on the reclaimed basin and wall areas and ameliorate soil and establish vegetation as mentioned below.

2.5.3 Surface reclamation

General surface reclamation

- Undertake general surface shaping and levelling of disturbed footprint areas to create a free draining profile to blend in with the surrounding landscape;
- Rip soil to a minimum of 500 mm to alleviate compaction. On specific areas where severe compaction can be expected, rip soil to a 1 m depth;
- If *in situ* soil cannot be sufficiently rehabilitated to support a sustainable vegetative cover, import a portion of topsoil (from the existing topsoil stockpiles) onto the disturbed footprint areas; and
- Once topsoil is replaced, ameliorate soil and establish vegetation as mentioned below.

Soil amelioration

- Ameliorate topsoil to support re-establishment of vegetation by applying fertiliser, if required, to rectify soil nutrient deficiencies to support the re-vegetation;
- Apply lime and/or gypsum to counteract/rectify possible chemical/pH imbalances that could cause dispersion of the soil, possibly leading to excessive erosion;
- Due to probable partial mixing of soils during excavation and replacement of topsoil, adjust amelioration of topsoil according to specific soil analyses during implementation of the rehabilitation.

Vegetation

- Re-establish a vegetative cover on ameliorated disturbed areas aligned to/supportive of the identified end land use, which is generally assumed to be grazing and/or agriculture;
- Establish vegetation early in the growing season to ensure sufficient time for reproduction of seeds as well as to assist in reduction of possible erosion of the topsoil layer;
- Ensure timing of concurrent rehabilitation actions is sufficient to support one another. For example, ensure that areas where topsoil has been replaced are not left bare throughout a rainy season, reducing the potential for erosion;
- Ensure that species seeded as part of the rehabilitation are of species adapted to the specific environmental conditions within the Belfast area, and are biologically diverse.
- Concurrently, consider the availability of seeds as well as those species better suited to re-establishment in previously disturbed areas. Examples of grass species that could be considered during re-establishment of vegetation include *Digitaria Eriantha, Chloris Gayana, Eragrostis Curvula, Eragrostis Tef, Cynodon Dactylon and Themeda Trianda*. Application rates for the seeds are estimated to be in the order of 15kg/ha;

- Investigate the need for follow-up treatment such as additional applications of fertilisers and/or controlled grazing/cutting and baling of grass. This would be highly dependent on the nature and operational mining activities, and could only be established closer to the actual time of rehabilitation. Consider that grazing with cattle is the preferred option as cattle manure assist in the re-introduction of micro-organisms into the soil. In addition, hoof action aids breaking of crusts that might form on the soil as well as trampling seeds into the soil thereby increasing potential for germination;
- Control alien and invader vegetation as early as possible (i.e. as soon as identified) to limit spread of these species.

It is noted that all of the above is dependent on the end land use, the actual method of seeding used by the mine, timing of rehabilitation actions and the characteristics of the soil (growth medium). Hence, it is recommended that this rehabilitation programme be periodically revised during the operational LOM to ensure that all detailed requirements have been identified in time for implementation of full-scale rehabilitation.

2.6 Additional investigations/studies

It is proposed that future versions/updates of this rehabilitation programme incorporate more detailed measures on the following aspects, as information becomes available:

- Materials balance for topsoil, softs and hards to determine the generation and utilisation with associated interim stockpiling along the pit perimeters to meet back-fill requirements as these arise;
- Dispersive nature of soils and appropriate/applicable amelioration actions for these soils;
- Defined species list for vegetation re-establishment, taking cognisance of biodiversity and seed availability. This would include requirements for additional of fertilisers and/or lime and gypsum; and
- Detailed rehabilitation design, per facility.

2.7 Monitoring, measurement and inspection

The following table provides the monitoring objectives and related parameters and abandonment criteria for rehabilitation of the Belfast Project area:

Monitoring objective	Frequency of monitoring, and method of assessment	Abandonment criteria
Soils		
To determine if remediation of previously contaminated areas was successful and land is suitable for envisaged land use.	Once off, after removal of surface infrastructure by undertaking 50 m grid soil sample of footprint areas analysed for all constituents of concern as determined in the soil remediation work.	¡ Soil analysis results comply with remediation targets at a 95 percentile level.
Land use		
To ensure that a sustainable final land use has been obtained	Once off, after removal of surface infrastructure and rehabilitation of disturbed areas, by assessing activities completed, as well as legal and related documentation completed and signed-off.	¡ Completion of back-filling and associated profiling and re-vegetation of open pits; ¡ All surface infrastructure has been removed; and ¡ Vegetation re-establishment is sustainable.

Monitoring objective	Frequency of monitoring, and method of assessment	Abandonment criteria
Biodiversity		
¡ To determine whether the re-established vegetation communities, in the absence of intervention, have propagated naturally by sexual means (ie, not the vegetation spreading of individuals); and ¡ To determined whether a stable self-sustaining community dominated by species typical of the climax-species present in the adjacent veld areas has been achieved. (It has been assumed that if the reclaimed mine site is suited for the return of animal life, this would occur naturally and does not require ongoing attention).	¡ Conduct monthly (or more frequently in times of heavy rainfall), inspections of re-vegetated areas to assess vegetation establishment and provide for early detection of erosion in recently planted/seeded areas, for a period of at least five years; ¡ Conduct annual independent evaluation of replanted/re-vegetated areas. During these assessments measurement of growth performance and species abundance will be carried out to determine: ¡ Plant basal cover and species abundance in the grassed areas; and ¡ Distribution, growth and survival of woody species.	¡ Plant basal cover and species abundance in the grassed areas and distribution, growth and survival of woody species has been achieved.
General site status		
¡ To ensure that the site is aesthetically neat and tidy; and ¡ To ensure no health or safety risks exist on site.	Once off general visual site assessment, after removal of surface infrastructure and rehabilitation of disturbed areas.	¡ Site is clean and neat and aesthetically acceptable; and ¡ No health or safety risks remain on sites.

2.8 Care and maintenance

The care and maintenance requirements related to the following need to be addressed as part of implementation of the rehabilitation programme:

- Re-instatement of surface drainage to ensure re-integration into local drainage patterns;
- Re-establishment of vegetation over reclaimed areas and covers where vegetation die-back is observed;
- Undertaking other reclamation-related requirements such as the in-filling of erosion gullies, sediment wash-off, etc.; and
- Removal and disposal of alien/exotic vegetation.

3. CONCLUSION

Aligned to the closure planning already underway at the Belfast Project, this rehabilitation programme is aimed at guiding/directing final reclamation of the open pits and related mining areas. Should rehabilitation be undertaken according to this programme, it is envisaged that re-instatement of a suitable/appropriate final post-mining land use could be achieved as the mine moves towards final site relinquishment.

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APPENDIX A

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