



# Sustainability through responsible environmental mining

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## Synopsis

The Constitution of the Republic of South Africa advocates the importance of sustainable economic development and justifiable environmental consciousness by business. The government needs to ensure that every citizen of the Republic has access to an environment that is protected, pollution free, and sustainable by enacting certain regulations. However, there are more than 5 700 derelict and unrehabilitated mines of all types in South Africa. Former asbestos operations were among the first to be targeted for clean-up under the programme instituted by the Department of Mineral Resources (DMR), owing to the proven direct impact of asbestos pollution on health.

This paper seeks to investigate the challenges faced by the coal sector as far as mine rehabilitation and closure is concerned. For the purpose of this paper rehabilitation is defined as per the Chamber of Mines Rehabilitation Guidelines publication, which defines rehabilitation as putting the land impacted by mining activities back to a sustainable and usable condition.

Some of the current rehabilitation challenges are technical skills (know-how), leadership focus, poor planning, cost saving initiatives, and the government's lack of capacity to enforcement rehabilitation requirements.

It is imperative that mining companies identify rehabilitation as a critical strategic pillar that directly influences license to operate. The case study evidence indicates that relevant policies, appointment of accountable people, sufficient leadership support, and the correct choice of rehabilitation equipment can assist to improve the rehabilitation and land management challenge.

## Keywords

surface coal mining, rehabilitation, land management, sustainability.

## Introduction

The South African coal mining industry has been in existence since the 18th century. Many companies have exploited coal and other valuable minerals in this country without properly rehabilitating the land, leaving behind excavations and improperly closed mines. Due to the non-binding/non-prescriptive regulations of the past those companies were able to extract minerals without the responsibility of land restoration and consideration of the lasting impacts that result from mining activities.

Since then, South Africa has come a long way in protecting its people and environment from mining and other activities that have negative impacts on its society and environment.

In the coal mining industry, both surface and underground mines are doing all that they can in recent times to ensure proper restoration and sustainable rehabilitation. It is critical that rehabilitation is conducted correctly in line with the environmental management programme (EMP) of the company and that it is sustainable. Mining companies are encouraged to rehabilitate beyond mere compliance.

The recent negative publicity on environmental issues such as acid mine water drainage and destruction of protected areas by mining companies has elevated the awareness of ordinary citizens on the negative impacts that comes with mining. Section 24 of the Constitution of the Republic of South African<sup>1</sup>, which is continuously quoted by environmental activists, deals mainly with the prevention of pollution and ecological degradation and promotion of conservation.

In most developing countries, mining is one of the significant contributors to the success of the economy. It empowers communities through employment and skills development by the provision of basic operational skills as well as bursaries for future engineers and other industrial skills. Throughout Africa mining has helped governments in building schools, hospitals, and other essential infrastructure that is highly needed for social survival.

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### Sustainable development

Sustainable development should be at the heart of the economic activities of a country, the social wellbeing of its communities and the environment. The synergies between these three pillars must be well aligned for the realization of sustainable development (Figure 1).

South Africa has endorsed many international conventions, protocols, and treaties, thereby committing itself to sustainable development as well as to global co-operation on environmental matters, which include protection of wetlands, biodiversity, climate change and waste disposal.<sup>2</sup>

The Johannesburg Plan of Implementation (JPOI), Chapter 4, 2002 deals with protecting and managing the natural resource base of economic and social development (water, oceans, vulnerability, disaster management, climate change, agriculture, desertification, biodiversity, mountains, tourism, forests, mining).<sup>2</sup>

The World Bank, Environmental Sustainability Report 2008<sup>3</sup> also raised the need for more strategic and coordinated approaches by governments and private business in ensuring sustainability and prosperity for countries.

The UN Global Compact—Accenture CEOs Survey 2010, also highlighted the fundamental shift by most CEO in the appreciation of sustainability issues; 96 per cent of the interviewed CEOs believed that sustainability issues should be fully integrated into the strategy and operations of a company' (Figure 2)

### General mining impacts

Mining operations disturb the natural environment as well as the structural cohesiveness of societies in general, and South Africa is not an exception. Mining activities have the following impacts: disturbance to landscape and topography; poor management of waste such as ore stockpiles, spoils, tailings, and dumps; loss of topsoil and greenery (due to topsoil removal and acid water).<sup>4,5</sup> Underground mining, if not well managed, also has long-term negative impact with regard to acid water or mine water decanting to rivers, and failure of old underground workings will normally lead to

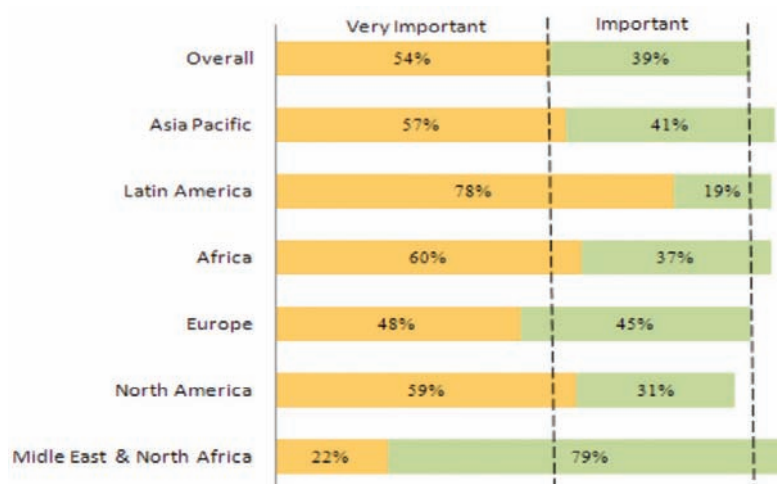
surface sagging which can result in damage to houses, roads, and other infrastructure such as power lines.

Opencast mining also disturb the aquifers and the water table. Mine water is very hard in nature and has high total dissolved solids (TDS) and bacterial contamination which reduces its chance of being drinkable. When channelled to streams and rivers it has negative impact of polluting them.<sup>4</sup> The major pollutants associated with coal mining are suspended solids, dissolved salts, acidity and iron compounds.<sup>4</sup>

Mining also has negative impact on land topography, but most importantly on soil fertility.<sup>6,7</sup> Soil can become less fertile due to removal of topsoil, destruction of crops through uncontrolled blasting activities, and contamination of soil and oil spillages. Soil can lose its ability to retain water through blasting-induced cracks and subsidence due to underground pillar collapse.<sup>7</sup>



Figure 1—The basic sustainable development model



Source: UN Global Compact-Accenture CEO Study 2010

Figure 2—CEOs' perceptions on sustainability as a critical future success factor, by region

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### Coal mining process

Coal is mined through two methods opencast and underground. Both mining methods have been employed since the 18th century. With the increase of small mining companies and shallower reserves, opencast mining is gaining popularity in the Highveld area.

### Environmental impacts

The environmental impacts of opencast mining (Figure 3) include:

- Disturbance of vast amounts of land
- Destruction of wetlands and rerouting of water streams
- Destruction of biodiversity and landscape
- Contamination of ground and surface water.

The environmental impacts of underground mining include:

- Surface subsidence
- Total extraction methods—disruption of water table
- Spontaneous combustion and underground fires.

### Mine rehabilitation

Rehabilitation, according to the Chamber of Mines guidelines for the rehabilitation of mined land, means putting the land impacted by the mining activity back to a sustainable usable condition.<sup>9</sup>

Rehabilitation normally comprises the following:<sup>10</sup>

- Developing designs for appropriate landforms for the mine site
- Creating landforms that will behave and evolve in a predictable manner, according to the design principles established
- Establishing appropriate sustainable ecosystems.

Landform design for rehabilitation requires a holistic view of mining operations, where each operational stage and each component of the mine is part of a plan that considers the full life cycle of a mine such as planning operations and final end use of the site.<sup>9</sup> Rehabilitation has the advantages

such as a better control of the rain water runoff or mine drainage that would otherwise contaminate surface and groundwater sources, posing danger to water side dwellers, animals, and people that rely on these water resources for drinking. It is not only advantageous to the environment, but also to mining operations as it reduces the amount of water that would otherwise flow into the pit.

The objectives of rehabilitation include:

- Providing an end product as requested by affected communities, rather than focusing on the previous *status quo*
- Restoration of previous land use capability
- No net loss of biodiversity—the focal point.

In South Africa, rehabilitation objectives include all three objectives through the process of the environmental management programme (EMP) and closure objectives post-mining.

The rehabilitation process involves

- Rehabilitation planning and financing
- Designs preparations and scheduling
- Topsoil stockpiling and management
- Levelling and shaping
- Topsoil-placement and contouring
- Seedbed preparation and fertilizer application
- Seeding
- Maintenance
- Monitoring.

### BHP Billiton Energy Coal (BECSA) Case study

#### BHP Billiton's policy on Environment

'We will ensure that we:

Take action within our own businesses and work with the governments, industry and other stakeholders to address the challenge of climate change.

Set and achieve targets, including energy efficiency and greenhouse gas intensity that promote efficient use of resources and include reducing and preventing pollution.



Source: Mining and environmental impact guide, 2008

Figure 3—Strip mining with concurrent rehabilitation (after Wells et al.<sup>8</sup>)



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Enhance biodiversity protection by assessing and considering ecological values and land—use aspects in investment, operational and closure activities’.

These are the commitments that BHP Billiton has made public and is directing its efforts in all its operations to achieve these aspirations.<sup>11</sup> (Figure 4)

### Health, Safety, Environment, and Community (HSEC) energy coal strategy

Due to the urgency that has been placed within the company to address rehabilitation, BECSA has made a decision to include on its HSEC strategy the rehabilitation of disturbed land. A separate team at Middelburg Colliery was put together to be solely responsible for rehabilitation activities that did not previously exist. Also at long-term business planning an official was appointed to be responsible for the long-term planning of the group regarding water and rehabilitation. This appointment is over and above the mine closure department and group environmental personnel. A rehabilitation-focused contractor was also appointed to specifically address the levelling challenge, and another contractor responsible for the land management services, which include seeding, cut and baling, as well as maintenance activities. An independent assessor that comes visits the mine on an annual basis to monitor the rehabilitated areas is also appointed in line with the mine’s EMP commitment.

This setup was introduced about two years ago. Since then a dramatic improvement has been observed in Middelburg Colliery’s rehabilitation performance, and the colliery is certain to realize its objective of addressing the past poor performance on rehabilitation.

### Challenges encountered

- The colliery did not have resources in-house to design rehabilitation slopes and scheduling
- There was not sufficient machinery within the mine to

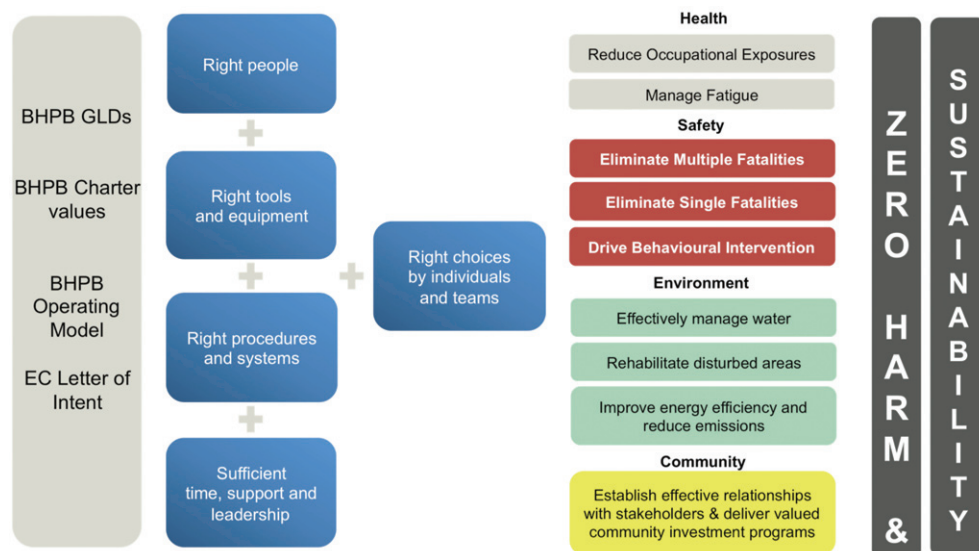
deal with the amount of bulk material that needed to be moved to achieve set targets

- The contractor that won the tender had to be given time and space to source big enough equipment and personnel
- BECSA has an overriding commitment to safety; therefore the contractor had to swiftly adjust to our safety culture and other requirements of our safety systems e.g. all the fatal risk control (FRC) requirements.
- The mine had also to change the attitudes of its own employees and coach them regarding the importance and cost of rehabilitation and the role it plays on water management and legal compliance. Mine employees had to have an appreciation and respect for rehabilitated land.
- The cost of rehabilitation especially hot spoils have almost tripled in the past few years compared to five years ago, therefore the mine had to develop better financial instruments to assist in the accuracy of closure financial provision.
- With over 400 ha to level and seed annually the contractor is competing with bigger mining houses to source larger dozers, haulers and excavators needed to get the job done.

Figure 5 indicates the results of the directed effort of rehabilitation at Middelburg Colliery

### Conclusion

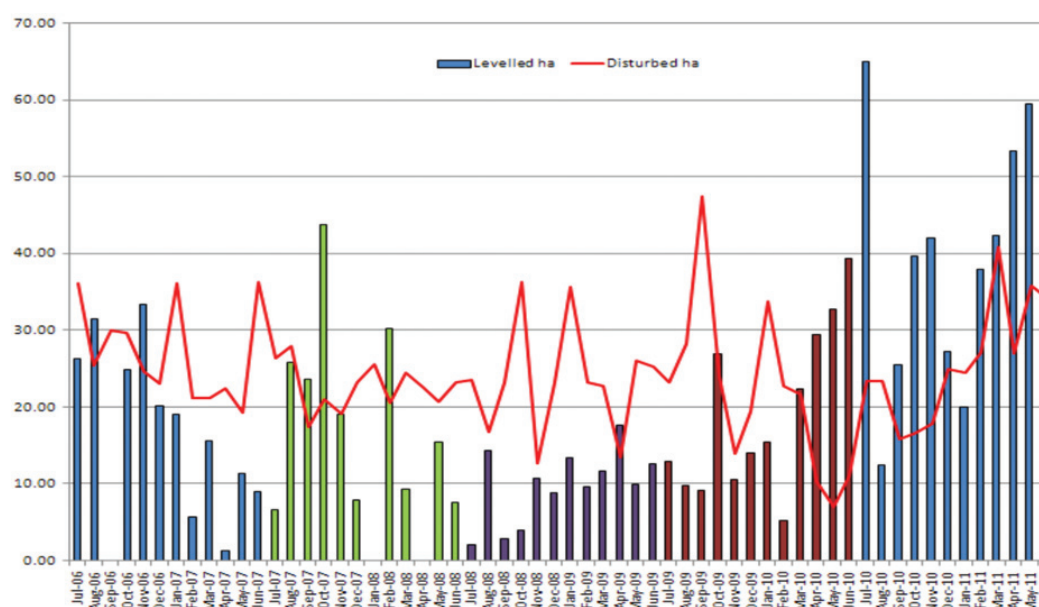
It is evident that ordinary South Africans have in recent times decided to be actively involved in the conservation of their environment. This can be seen in the amount of attention environmental issues receive in print and electronic media. The number of environmental groups has increased to so many categories that there is now a group dedicated to preserving almost anything that is indigenous and proudly South African.



Source: BHP Billiton, HSEC Energy Coal Strategy

Figure 4—BECSA’s Health, Safety Environment, and Community strategy

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Source: Middelburg Colliery

Figure 5—Rehabilitation progress at Middelburg Colliery

From the UN Global Compact report, CEOs are increasingly realizing the importance of integrating sustainable development into their overall corporate strategy, unlike in the past when sustainable development matters were perceived as a 'nice to have'. Some companies have already experienced the negative impact that comes with reputational damage as a result of significant environmental incidents. A lot of work usually has to be done to regain customer confidence and share value following such negative publicity.

In the past in this country, the regulatory bodies was not as stringent as the private sector when it came to monitoring businesses impacts on the environment. Recently we have seen some government departments following up on mining companies, commitments on their license to operate and EMPs. We have also witnessed companies like BECSA taking the initiative to redress the wrongs by proactively putting systems in place that will make them benchmarks and good neighbors in their hosts communities.

'...We abuse land because we regard it as a commodity belonging to us. When we see land as a community to which we belong, we may begin to use it with love and respect...' Aldo Leopold<sup>12</sup>, 'A Sand County Almanac', 1949

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### References

1. The Constitution of the Republic of South Africa, Section 24 (a) and (b), p. 6.

2. KUNTUNEN-VAN 'T RIET, J. Strategic review of the status of biodiversity management in the South African mining industry. Matrix + Consulting (Pty) Ltd. 2007.
3. WORLD BANK. Environmental Sustainability. An Evaluation of World Bank Group Support. Washington, DC, 2008.
4. TIWANY, R.K. and DHAR, B. Environmental pollution from coal mining activities in Damodar River Basin, India. *Mine Water and Environment*, vol. 13, June-December, 1994.
5. ASSAM, D. Environmental Monitoring at North Eastern Coal Fields. Coal India Ltd. 2010.
6. PETJA, B. Review of case studies on successful measures to manage land use, protect land and mitigate land degradation. National Agro-Meteorological Committee, Agricultural Research Council-Institute for Soil, Climate and Water, Pretoria, South Africa, 2006.
7. GHOSE, M.K. Effect of opencast mining on soil fertility. *Journal of Scientific and Industrial Research*, vol. 63, December 2004. pp. 1006–1009.
8. DIGBY WELLS AND ASSOCIATES. Mining and environmental impact guide. Chamber of Mines, Johannesburg, South Africa, 2008.
9. TANNER, P. Guideline for rehabilitation of mined land. Chamber of Mines of South Africa, Johannesburg. 2007. p. 4.
10. LINDBECK, K., LOCH, R., NICHOLS, O., TIBBETT, M., and WILLIAMS, D. Mine Rehabilitation. Minister for Industry, Tourism and Resources, 2006.
11. BHP BILLITON. Sustainability report 2010.
12. LEOPOLD, A. A Sand County Almanac. Oxford University Press, 1949. ◆