

IMPACT ASSESSMENT CASE STUDIES FROM SOUTHERN AFRICA

*Compiled by: Ursula Witbooi
& Stefanus Gariseb
(Namdeb Environmental Section)
Consultants: EnviroScience
and African Environmental
Solutions (Pty) Ltd.*

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DIAMOND MINING OF POCKET BEACH AREAS IN THE SPERRGEBIET, NAMIBIA



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Brief description of the development & alternatives considered

The Pocket Beach areas are located in the Sperrgebiet where access has been restricted for more than 100 years because of diamond security regulations. The area is considered sensitive as it is in the Succulent Karoo Biome, one of the biodiversity hotspots of the world. The scenic landscapes and presence of fossils, archaeological, historical and cultural sites, seabirds and seal colonies make it an asset to Namibia for conservation and future tourism (Figure 3).

At the time of the assessment, Namdeb's land based licence areas were designated a "Managed Resource Protected Area" according to the 2002 Ministry of Environment and Tourism (MET) Sperrgebiet Land Use Plan. Chameis Bay and Baker's Bay were designated "Proposed Marine Resources". The objective of these was to ensure the long-term sustainable use of the terrestrial and the marine areas. The Sperrgebiet National Park was proclaimed in 2008 and was followed by the proclamation of Namibia's first Marine Protected Area in early 2009.

The project consists of two phases which include initial mining at Chameis Pocket Beach areas (sites 2 and 3/4) followed by mining of diamond

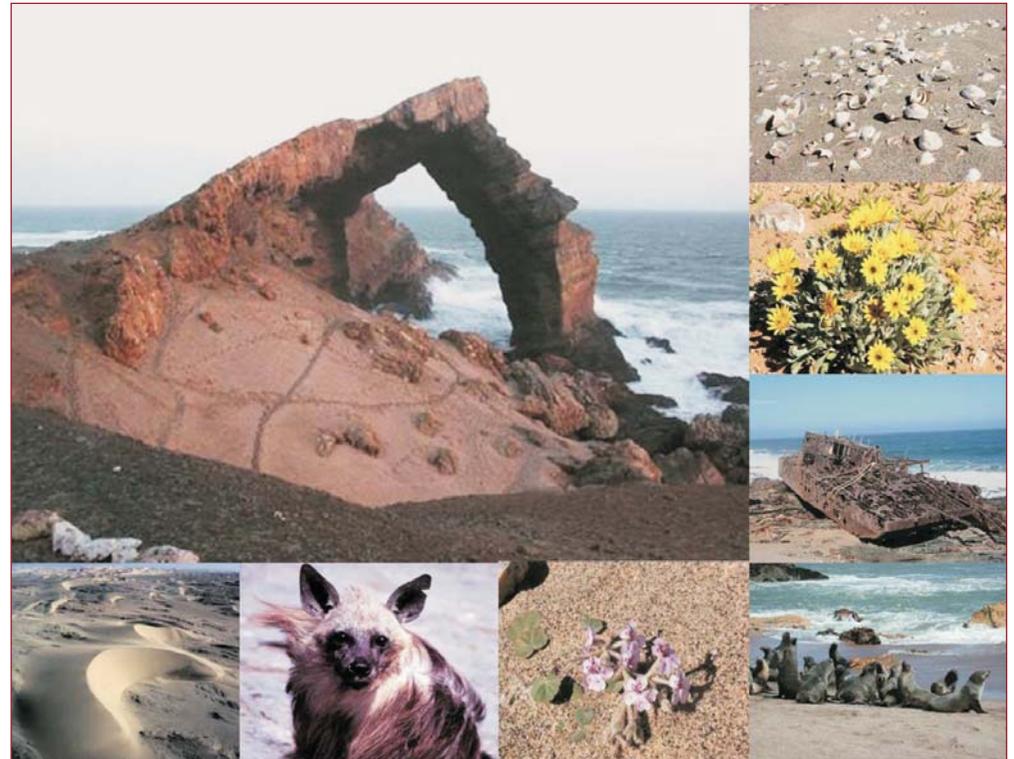


Figure 3. The Sperrgebiet is regarded as an asset for conservation and future tourism
Photos courtesy of the Brown Hyena Research Project

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deposits at Bogenfels (sites 11 and 12). Feasibility work to evaluate the diamond deposits at sites 3/4, 11 and 12 continued parallel with mining at site 2. The expected life of the pocket beach mine was initially predicted to be 5 years. Production commenced at site 2 in April 2004, and Phase II

commenced production in mid 2007, thereby creating additional revenue from land-based reserves at a time when several of the other Namdeb land-based operations were experiencing a decline in production.

Phase I of the project included conventional mining, involving overburden removal, seawall construction, dewatering of mining sites and removal and transport of diamondiferous gravel to a mobile Dense Medium Separation (DMS) treatment plant on site. The concentrate from the treatment plant was recovered with a modular recovery plant which was also situated at site 2. The fine tailings were initially disposed into the sea but this was later changed to land disposal.

The workshop and storage facilities are all light-weight structures, thereby reducing the civil construction and subsequent rehabilitation requirements. Mobile accommodation units originally located at Fort Reef were re-used at the Bogenfels accommodation site. Fresh water at site 2 was trucked in from Oranjemund.

Phase II entails the mining of two sources of material at site 11/12. These are beach deposits of diamonds and old tailings dumps. The two larger deposits are mined with a specialised dredge (Figure 4). The dredge strips and fluidises the overburden and deposit the overburden on the beach. A beach wall is constructed and strengthened with water impenetrable panels



Figure 4. The dredge is used at Bogenfels sites 11 and 12 as a stripping and rehabilitation tool

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which reach all the way down to bedrock level. The wall allows access to the deposits in the surf zone. The exposed diamond deposits are conventionally dry mined using excavators, dump trucks and finally bedrock cleaning techniques. The old tailings dumps will be mined conventionally.

A medium-capacity DMS processing plant is positioned near the main deposit at site 11 where all excavated material is treated and screened. Some of the oversize material is used to construct the seawall. The rest of the treatment plant tailings will be used as backfilling material during active rehabilitation. Used process water is placed in mined-out paddocks. The dredge movement follows a sequence that maximizes the potential to back-fill mining voids with the overburden and oversize as mining proceeds.

Accommodation for Phase II is provided at the existing Bogenfels Exploration camp, served by a desalination plant, waste water disposal system, electricity from diesel generators, and fibre-optic telecomms. The main infrastructure that is required is the gravel roads. Fuel installation facilities were installed at Chameis and Bogenfels

during the two phases. All waste generated during the construction and operation phases are transported back to Oranjemund.

The anticipated influence of the area of mining and infrastructure on the land is restricted to a 5 x 65 km long stretch of coastline. Approximately 12 km of coastline will directly be affected by excavation. On the marine side the influence will mainly be at the shore area, where seawalls will be erected to shelter the beach mining operations. A range of alternatives were considered for the mining method. Several options regarding dry and dredge mining were discussed and evaluated by engineers and environmental consultants to minimize the impact on the natural marine and terrestrial environment. Since project commencement at site 2, the fines were discharged into the sea and later disposed onto land. However, environmental impacts associated with fines disposal are largely unknown and thus Phase II operations opted to discharge fines into dredge ponds (mined out areas) to reduce the impacts on the marine environment.

Alternatives were discussed regarding positioning routes and alignment of roads, production site

layout, accommodation site layout and routes for power lines. Changes to the mine plan led to changes in the locality of the accommodation site during Phase I of the project. Three accommodation alternatives were considered i.e. Baker's Bay, Chameis airfield and Fort Reef. Baker's Bay is situated in close proximity to a large seal colony which serves as food to the largest desert predator, the brown hyena. To avoid potential wildlife incidents and to make the traveling distance shorter, Fort Reef was preferred since it was already disturbed. The option of not using Chameis airfield was based on the exposure of the area to strong southerly winds.

Namdeb was approached by Nampower in connection with a low cost electric line. However, the decision was taken by the project team to not consider this option, since it will be routed through the pristine area that would in the end increase rehabilitation costs. The decision was taken to use generators instead. A short temporary powerline was constructed to provide electrical power to the accommodation site at Fort Reef, approximately 2 km from the treatment site. Nampower investigated the option to supply power from Lüderitz via a powerline for Phase II of



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the project. However, this option proved not economical and would have resulted in larger environmental impacts than a set of generators at the mining site. The project team also looked at supplying the proposed sites with power from Mining Area 1, but this option was also not cost effective.

One of the social principles developed for the project is to support local communities with short and long term effects by outsourcing services and supply delivery, where possible, to small enterprises and local suppliers in Oranjemund, Lüderitz and Keetmanshoop. In addition if possible, support to local communities in Lüderitz and Keetmanshoop to improve their health and educational welfare will continue. The assessment of alternatives to reduce costs and environmental impacts forms part of the economic principle that was formulated at the beginning of the project.

Environmental setting

The mining project is located in the Karas region which is the southernmost region in Namibia. The climate can be described as arid with coastal fog and strong southerly and south-westerly winds throughout the year. Winter and summer rains are possible. The terrestrial habitats include coastal and inland dunes, salt pans, rocky outcrops and gravel plains. The marine habitats include sandy beaches and rocky headlands which occur along this high energy coastline. Biota of conservation importance includes seals, seabirds, brown hyena and a great diversity of endemic southern Namib plants. The natural resources of economic importance include rock lobsters, fish and diamonds.

The local economy comprises the fishing industry and large-scale and contractor based mining, as well as the accompanying infrastructure which provide the bulk of employment in the region. Land and marine use include mining, seasonal rock lobster and other fishing and future tourism. Shell middens of early to late Stone Age form part of the interesting archaeological record of the area. Historical mine sites and shipwrecks are evidence of man's attempts to mine the diamonds along this coastline. An extensive network of

rudimentary roads and tracks exist in the project area.

The population of Karas has the lowest density of any region in Namibia. There are no permanent settlements near the mining sites. Access to the area is restricted because of diamond security regulations. Social problems in the region relate to high levels of in-migration to Lüderitz, HIV/AIDS and alcohol abuse.

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EIA process followed

Namdeb appointed EnviroScience and African Environmental Solutions to conduct the original EIA for the project. The Environmental Management Programme Reports (EMPRs) of 2001 and 2002 were compiled by both consultants. Subsequent amendments to the project in 2003 and 2005 were done by EnviroScience.

Innovative mining technology together with the quantification of more diamondiferous beach

deposits influenced the Pocket Beach mining project resulting in scope changes. Consideration of additional environmental impacts and monitoring requirements for the area became necessary and the EIA was amended to incorporate these significant changes.

The approach that was adopted by the consultants included not only the accepted Scoping Reports and Environmental Impact Reports, but also the

incorporation of environmental issues for inclusion into the planning stage of the project and the EMPR (Figure 5).

Actions anticipated with the Namdeb project team's preliminary project proposal (A in Figure 5) were considered together with the information obtained from the baseline studies and specialist workshops.

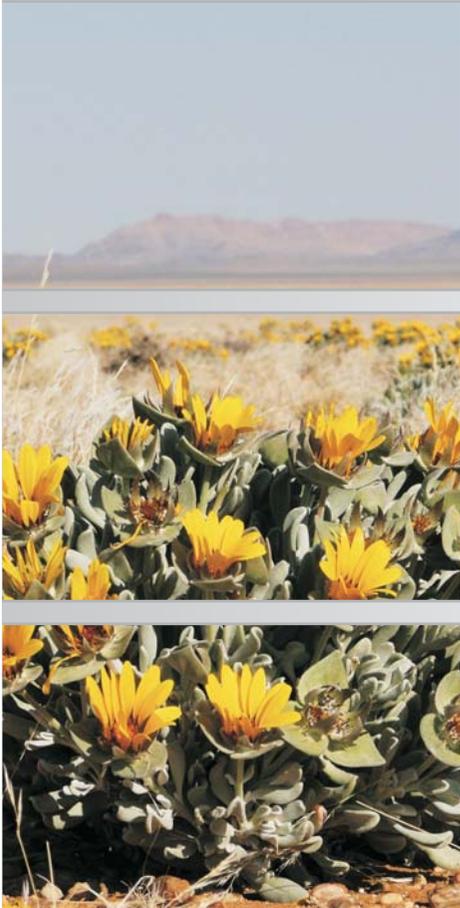
The vision for the project was: *Namdeb will strive to ensure that, while generating economic benefits from the project, there will be no sign of its mining activities (including current and past infrastructure) or associated impacts within the Study Area, within a maximum period of 5 years from the end of mining each pocket beach.*

History of scope changes for Pocket Beach Areas mining project

| | | |
|-----------|---|---|
| EMPR 2001 | - | scope restricted to Chameis Pocket Beach areas (site 2, 3/4) |
| EMPR 2002 | - | scope extended to include sites 11 and 12 at Bogenfels |
| EMPR 2003 | - | only mining at site 2, major changes to the use and location of infrastructure |
| EMPR 2005 | - | innovative mining technology at sites 11 and 12, and addition of mining of old tailings dumps |

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EIA process followed

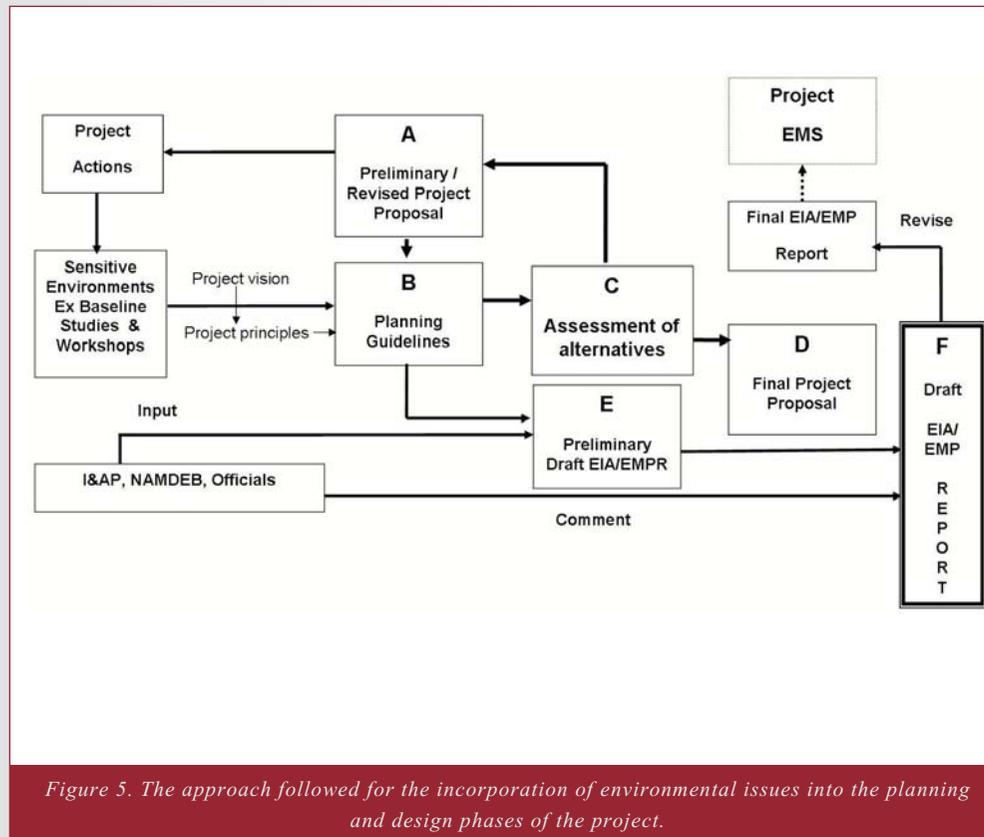


Figure 5. The approach followed for the incorporation of environmental issues into the planning and design phases of the project.

Social, ecological and economic principles were developed from the vision and various planning guidelines (B) based on each principle were drawn up. These guidelines were used by Namdeb's project team to assess the alternatives (C) for the various project actions. The project proposal was revised until the best project option was derived (D), which considered the anticipated environmental impacts. The revised project proposal (A) and planning guidelines (B) were used to draw up the preliminary draft EIA/EMPR (E). This document was reviewed internally by Namdeb and an external review consultant. The draft EIA/EMP Report (F) was circulated to I&APs for comment and was finalised once all comments were received.

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EIA process followed

The scoping phase was aimed at informing interested and affected parties of the project and included the use of baseline reports (1997-2001), public involvement, site visits and specialist workshops. These ensured that potentially significant aspects were identified and addressed in the impact assessments (Figure 6).

Baseline studies were identified with the aim to obtain data prior to the commencement of mining in the area. These included field surveys of land and marine habitats and their associated biota, and archaeological surveys. The baseline reports were used to provide information on sensitive areas and to assist with the development of general guidelines for mine planning.

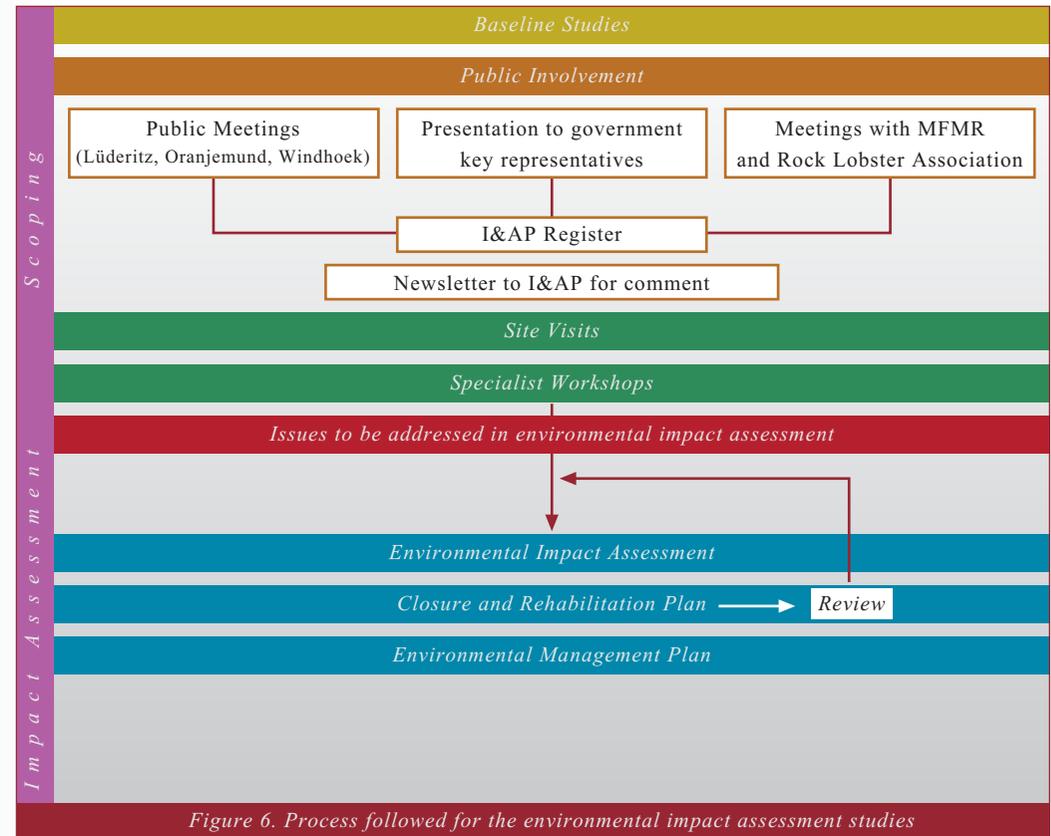


Figure 6. Process followed for the environmental impact assessment studies

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EIA process followed

Environmental issues of significance that were identified and needed to be addressed with the public participation process, included the Sperrgebiet Land Use Plan, the Lüderitz-based rock lobster fishery and the public perceptions on the effects of mining operations on the marine environment. Where necessary, a subcontractor specialising in social impact assessments was appointed to jointly undertake the formal public participation process with the appointed consultant. Public meetings were conducted in both the Karas and Hardap regions. Project proposals were presented to key government representatives and routed through Namdeb's Steering Committee which represents the company's top management. Separate engagements with research and management staff of key stakeholders such as the Ministry of Fisheries and Marine Resources (MFMR) and the Rock Lobster Association were conducted to discuss the potential impacts on the marine and fishing industry and to identify and address concerns. Interested and affected parties (I&APs) were also kept abreast of progress with updates of the study via newsletters. This afforded them the opportunity to comment and the feedback was incorporated in the scoping reports.

In addition, site visits with the consultants, Namdeb project team and key government representatives took place as part of the scoping phase. The aim of these visits was to develop practical guidelines that could be implemented and that could be used to assess the alternatives during the planning phase of the project.

Experts in marine and terrestrial sciences and representatives from the tourist industry, government and Namdeb project team engaged in specialist workshops as the need to review the study became necessary. The aim of such engagements was to identify the potential environmental impacts associated with the changes to the project related to the different mining localities, mining methodologies and infrastructure requirements. The aim was also to identify any gaps in the environmental studies and environmental monitoring that accompanied the project.

Specialist reports included in the original study included archaeology, avifauna and marine ecology, and a proposal for monitoring. A detailed historical and archaeological specialist report for the area between Bogenfels and north of Chameis

was conducted when the scope was extended to include sites 11 and 12. This also included a specialist report on invertebrate fauna between Bogenfels and Chameis and a proposal for a baseline study of the brown hyenas in the Baker's Bay area.

As part of the public participation process of the EIA, numerous queries were raised by various interested and affected parties with regards to the draft report. All these queries were captured in the Response Report detailing how the issues raised were to be incorporated in the main EIA report, along with identified mitigation measures.

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Main environmental impacts & issues

The vision, principles and environmental impact assessment identified main environmental impacts and issues for both marine and land-based fauna and flora. Changes to the beach habitats and aesthetic appearance of the area were identified as main negative environmental impacts. The lack of understanding of the cumulative impacts and the magnitude of the impacts associated with diamond mining in the south and future mining operations on the terrestrial and marine environments was identified as a gap. The development of a cumulative impact framework to address this issue was recommended.

Bogenfels Arch is an important tourist attraction and the operations at sites 11 and 12 are visible from this landmark. Mining operations are known to affect populations of coastal endemic vegetation and associated fauna. In addition to impacts caused by this project there are also the impacts from past activities in the area. Impacts in the marine environment may affect food sources and habitat of commercially important rock lobster and fish. The studies identified that the restoration of disturbed habitats on land and in the sea is fundamental, and the vision and principles to achieve minimal disturbance and recovery of

disturbed habitats was adopted. Past practise of not actively rehabilitating disturbed areas and not adequately monitoring adverse impacts was highlighted as an issue. On a positive note, it was recognised that many parts of the larger Sperrgebiet area have been maintained in a fairly pristine condition due to the access restrictions.

In socio-economic terms the proposed project is designed to sustain rather than increase current production levels. This means Namdeb's current workforce will be maintained and re-positioned, and few new jobs will be created. However, increased expenditure associated with the construction phase of the project and services that could be outsourced are likely to positively benefit communities in Lüderitz, Oranjemund and Keetmanshoop. It was noted that if the project does not go ahead, job losses within Namdeb's current workforce will lead to negative socio-economic impacts unless people find alternative employment.

Decision-making process

Throughout the project planning phase the Namdeb project team strived for continual environmental improvement which included the review of infrastructure requirements, mining techniques and the mine plan. Environmentally sensitive areas from the baseline reports were incorporated into GIS to allow for spatial mapping. These assisted with the development of planning guidelines for the assessment of the potential impacts and the development of management actions. Criteria that were used to rate the significance of the impacts were addressed at two levels i.e. local and cumulative. Local level assessments included impacts that could be quantified, and strategic level assessments included those that could not be quantified at present. The impacts of the latter were measurement against the project vision. The strategic level assessment was applied to the marine, socio-economic and terrestrial environmental aspects.

To ensure that the process and reports were of a high standard, an external review consultant of the EIA process and reports was used.

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Decision-making process

Namdeb received clearance for the project by the Ministry of Environment and Tourism on the basis of two environmental impact studies which were conducted in 2001 (site 2 and 3/4 at Chameis) and site 11/12 (Bogenfels) in 2002. The final clearance certificate for the project was received in 2005 prior to the implementation of phase II of the project at sites 11 and 12. Throughout the process no appeals were made.

Implementation of the EMP & compliance auditing

Namdeb has an environmental management system that is certified to the ISO14001:2004 standard. This system was rolled out to the Pocket Beaches project and all EMPs were integrated with the existing environmental management system. The implementation of EMPs is primarily driven by the presence of dedicated environmental staff on site who assist with pointing out important issues for consideration during the operational and decommissioning phases.

Assurance of effective environmental management is confirmed with regular operational self check audits, internal compliance auditing and external ISO14001 surveillance and recertification auditing. Results of compliance auditing to date have confirmed continual environmental improvement and compliance to the ISO14001:2004 standard.

Namdeb has a government-approved rehabilitation plan in place for its land operations. A draft rehabilitation and closure plan was also developed for the marine portions of the land licences and all perceived activities in the midwater licences. In line with the adopted vision for the project, a rehabilitation task team was formed for phase I

of the project. Tasks included the reshaping of landforms as close as possible to pre-mining conditions, the removal of current and past infrastructure, bioremediation of any contaminated soil and the testing of re-vegetating methods. An internal closure audit was conducted and sign-off from relevant authorities was obtained for the area.

Measures to re-establish plant growth are tested in different localities in Namdeb's licence areas with the purpose to develop appropriate techniques tailored to specific operations. In partnership with Namibia's National Botanical Research Institute and Millennium Seed Bank Project, Namdeb is pioneering appropriate re-vegetating techniques that will assist in rehabilitating mined areas. A process to integrate rehabilitation into mine planning was tested at Pocket Beaches site 11 and 12 (Figure 7).

This progressive rehabilitation required the storage of plants, backfilling of mined out areas and replanting. All road and access tracks without hard-padding were ripped and smoothed. Remaining trenches were back-filled.

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Implementation of the EMP & compliance auditing

The monitoring and financial support of key biodiversity species such as the brown hyena is a testament to Namdeb's commitment to conserve biodiversity in this sensitive desert environment. Annual marine monitoring is conducted by external marine specialists for the sandy beaches, rocky shores and subtidal environments.

The monitoring results are included and described in consolidated reports for the southern Namibian coastline focusing on cumulative impacts, and the consultant provides for a description of the impacts in a regional context. Recommendations from monitoring reports are incorporated into Namdeb's EMS.

Main elements of excellence in this EIA

The EIA process was used as a fully-internalised element and was integrated with the environmental, social, economic and technical aspects of project planning and design. Environmental concerns were considered and addressed at the earliest appropriate stage of planning, and involvement of specialists and key stakeholders during the scoping and assessment phases contributed to informed decision making. Site visits and meetings resulted in a refinement of the guidelines, making them practical and implementable. Alternatives were considered and assessed throughout the process. The study also allowed for the incorporation of lessons learnt from the first phase of the project into the second phase ensuring continual environmental improvement.

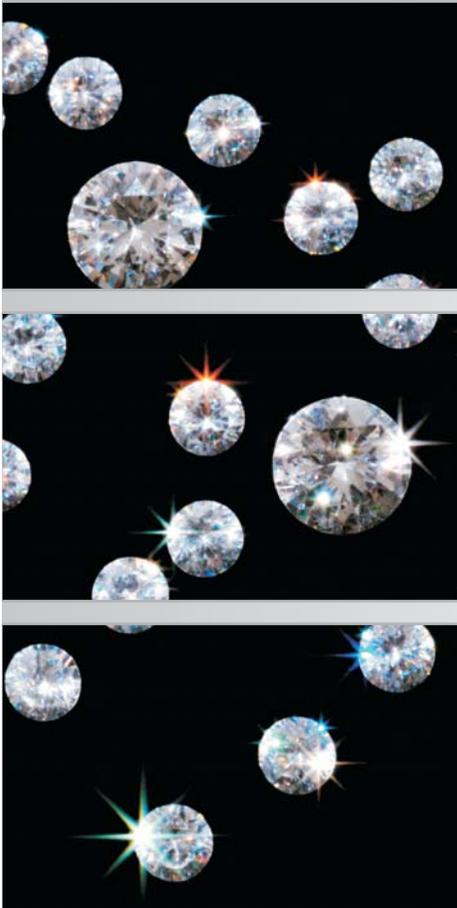
The commitment from Namdeb's top management and multi-disciplinary project team in recognising the importance and significance of the area, by adopting a vision aligned to the future land use of the area, is commendable. The vision was developed at the beginning of the project and contained principles of high standards in social, ecological and economic aspects. Throughout the



Figure 7. Integration of rehabilitation into mine planning is evident at the Bogenfels mining sites

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Main elements of excellence in this EIA

project Namdeb showed willingness to consider environmental issues favourably and therefore allowed the mine plan to be influenced to accommodate these. Innovative mining technology is currently employed at Bogenfels that offers better solutions to recreate the pre-mining topography, thus reducing the visual impacts. Evidence that the vision is so far realistic and implementable can be seen at site 2 where extensive rehabilitation has been completed and the area signed off by the relevant authorities.

At the time of these studies, a strategic environmental assessment for the coastal areas of the Karas region was non-existent. Nonetheless, these studies considered the local impact of the project and made provision for the development of a cumulative impact framework for Namdeb. Previous EIAs did not address this issue and focused on project specific impacts. Gaps related to the conservation of the area were also identified that needed to be addressed by the relevant governmental authorities on a national level. Although the studies were conducted a few years back, future trends in the area were considered. The EMPs of this study are well aligned with recent developments such as the proclamation of

the Sperrgebiet National Park and the Marine Protected Area, giving Namdeb a head start in meeting the future requirements for the area. The studies further promote the sustainable use of the area by integrating rehabilitation with mine planning at an early stage and creating opportunities for smart partnerships (Brown Hyena Research Project, National Botanical Research Institute and Millennium Seed Bank Project).

The environmental information obtained so far provides valuable information on the diamond mining impacts along the southern Namibian coastline, the Karas region and Namibia.

Lessons learnt

Prior to the commencement of mining, baseline studies need to be completed since they can influence the decision-making process. If not done in time this could potentially hamper the development and implementation of a project with a tight timeframe. Gaps in the baseline studies should be detected and filled early in the project.

Careful consideration should be given when developing the scope of an EIA. The long term strategic mine plan of the company needs to be considered, and all potential mineral resources should be included in the scope of the study to ensure that later amendments are not needed. Later amendments could lead to more financial expenditure for environmental monitoring, baseline surveys and specialist studies, and a repeat of the scoping phase. Amendments also slow down the decision making process from governmental authorities due to the consideration of many studies, or the late detection of fatal flaws in a project that has several phases.

These compromise the success of a project.

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