PHASE

EXPLORATION

2

Tsumeb smelter · Dundee Precious Metals Tsumeb
Tsumeb
Oshikoto
Namibia

ACKNOWLEDGEMENTS

This Best Practice Guide was developed through extensive engagement with government and industry, along with expertise from consultants and specialists who availed their time to make this publication possible. The following organisations contributed substantially to the development of the Best Practice Guide, and without their expertise, this publication would not be possible.

MINISTRY OF MINES AND ENERGY
The Ministry of Mines and Energy provided indispensable input, in terms of government expectations for bi-annual reports, as well as for permit and licence obligations throughout the mining life cycle.

MINISTRY OF ENVIRONMENT AND TOURISM
The Ministry of Environment and tourism provided input about streamlining government expectations for bi-annual reporting with industry standards.

NATIONAL RADIATION PROTECTION AUTHORITY (NRPA)
The Ministry of Health and Social Services' National Radiation Protection Authority (NRPA) provided input regarding all matters relating to the regulation, licencing and permitting of all uranium sources throughout the mining life cycle.

MINISTRY OF AGRICULTURE, WATER AND FORESTRY
The Ministry of Agriculture, Water and Forestry provided input on permit obligations during the mining life cycle phases

NAMIBIAN CHAMBER OF MINES
One of the publication's joint initiative partners and key stakeholders, is the Namibian Chamber of Mines (CoM).

The CoM is an industry body that aims to effectively promote, encourage, protect, foster and contribute to the growth of responsible exploration and mining in Namibia, to the benefit of the country and all stakeholders.

NAMIBIAN CHAMBER OF ENVIRONMENT
Another of the publication's joint initiative partners and key stakeholders, is the Namibian Chamber of Environment (NCE).

One of the core NCE objectives is to promote best environmental practices, including habitat rehabilitation, and to support efforts to prevent and reduce environmental degradation and pollution. This project aligns to several of the NCE core objectives.

OTJIKOTO GOLD MINE
Case studies supplied:
- Corporate social responsibility
- Rehabilitation

DUNDEE PRECIOUS METALS TSUMEB
Case studies supplied:
- Air quality monitoring

TREKKOPJE MINE
Case studies supplied:
- Securing a mine's water supply
- Restoration trials

SKORPION ZINC
Case studies supplied:
- Water management

ACKNOWLEDGEMENTS

DEBMARINE NAMIBIA
Case studies supplied:
- Environmental monitoring

NAMPOWER – NAMIBIA NATURE FOUNDATION STRATEGIC PARTNERSHIP
Case studies supplied:
- Powerline monitoring

NAMIBIAN URANIUM ASSOCIATION
Case studies supplied:
- Namibia's uranium SEA

HUSAB MINE
Case studies supplied:
- Water quality monitoring
- Tailings management

NAMDEB
Case studies supplied:
- Biodiversity monitoring
- Concurrent rehabilitation
- Heritage

RÖSSING URANIUM
Case studies supplied:
- Hazardous Waste Management
- Tailings Management
- Air Quality

ENVIRONMENTAL COMPLIANCE CONSULTANCY
Authors of this publication
Contact details:
+264 81 669 7608
info@eccenvironmental.com

UTOPIA CONSULTING - communications solutions for sustainable business | Dr Paul Godard assigned photographer of the publication

Desalination Plant - Orano
Swakopmund
Erongo
Namibia

FOREWORD

The first two decades of the 21st century have starkly revealed our unprecedented impact on the natural world. The level of impact threatens our very existence. Climate change, biodiversity loss and pollution are at the top of the list. No longer can we do business as usual, with sectors being isolated from one another, and business focusing only on the financial bottom line. We need a new approach that is more holistic, inclusive and responsible. In short, we need a "profit, people and planet" triple bottom line approach whereby companies generate profit for shareholders and national revenue while simultaneously improving people's lives and safeguarding the planet from climate change, biodiversity loss and pollution. This new holistic and responsible approach to business will not necessarily reduce profit but can certainly enhance opportunities, attract discerning investors, increase sector resilience and social acceptance, reduce risk and reputation damage, and leave a nett positive legacy.

This Best Practice Guide applies the new triple bottom line approach to the Namibian mining sector to ensure a lasting legacy for mining companies, the country and her people. From the outset this initiative embraced transparent governance and a collaborative approach which involved the Namibian government – the Ministry of Mines and Energy and the Ministry of Environment and Tourism; the private sector – the Chamber of Mines and its member mining companies; and the environmental civil society sector – represented by the Namibian Chamber of Environment.

Namibia is rich in a variety of mineral deposits such as zinc, gold, uranium and diamonds, some of which are considered world-class. The Namibian Government recognises the importance of prospecting and mining to social and economic development, as expressed in various national development plans. Equally important is Namibia's commitment to ensuring a safe and healthy environment. The Best Practice Guide for mining in Namibia highlights leading practices in social, economic and environmental aspects at all stages of the mining life cycle, namely Exploration, Projects and Construction, Operations, and Mine Closure and Completion. Further, this Best Practice Guide brings together all the regulatory requirements for the mining sector from all government agencies into one reference document, with links to download forms, submit reports, etc. The Guide is available in electronic format, and we would encourage all mining companies to ensure that it is available to their staff, management, boards of directors and investors.

The Namibian mining industry strives to play an active role in sustainable development by implementing world class environmental practices in their operations. Through the implementation of these practices, exploration and mining companies can maintain a good relationship with regulators, lawmakers, investors and the communities in which they operate. This guide is ultimately aimed at assisting the Namibian mining industry to implement their "planet, people and profit" approach as they develop Namibia's mineral resources, by delivering practical mining solutions that are benchmarked against best practices and striving for ever more ambitious legacy impacts.

Finally, the mining sector has taken the lead in Namibia by being the first economic sector to develop such a Best Practice Guide. It is our wish that other sectors follow suit and that, sector by sector, we implement a "planet, people and profit" philosophy and programme of action across Namibia.

Tom Alweendo, MP
Minister of Mines and Energy

MINISTRY OF ENVIRONMENT AND TOURISM
REPUBLIC OF NAMIBIA
2019 11 19
OFFICE OF THE MINISTER
PRIVATE BAG 13346, WINDHOEK

Pohamba Shifeta, MP
Minister of Environment and Tourism

CONTENTS

PART ONE
SETTING THE SCENE **1**
1.1 How to use the exploration chapter 1
1.2 Exploration in Namibia 1
Exploration and land ownership 3
Exploration on communal land 3
Exploration on privately owned land 4
Exploration in protected areas 5

PART TWO
EXPLORATION PROCEDURES **9**
2.1 Approvals for exploration in Namibia 9
2.2 Additional conditions for exploration 13
2.3 Key management tasks in the exploration stage 14
2.4 Risk management and exploration 14
2.5 Community engagement 16
Good consultation 20
Stakeholder analysis 21
Heritage 21
2.6 Biodiversity 27

PART THREE
LEADING PRACTICE STANDARDS FOR LOW IMPACT MINERAL EXPLORATION **30**
3.1 Remote sensing techniques 30
3.2 Geological surveys 34
3.3 Geochemical techniques 39

PART FOUR
LEADING PRACTICE STANDARDS FOR MEDIUM- AND HIGH-IMPACT MINERAL EXPLORATION **41**
4.1 Construction of access roads and tracks 41
4.2 Drilling 47
4.3 Trenching 58
4.4 Decommissioning 61

PART FIVE
REPORTING GUIDELINES **67**
5.1 Low impact 67
Reporting – From industry to government 67
5.2 Medium to high impacts 70
Reporting – From industry to government 70
5.3 Reporting from government to industry 70

PART SIX
TRANSITION FROM EXPLORATION TO MINING **71**
6.1 Key management tasks during the planning and design phase 72

PART SEVEN | REFERENCES **73**

TABLES

1	Licence requirements related to exploration	11
2	Fees for applications and renewals of exploration licences	13
3	Community development tools during the exploration stage	19
4	Recommended practices to mitigate impacts on heritage sites	22
5	Leading practice standards for operating drones	32
6	Leading practice standards for remote sensing exploration	33
7	Typical rating levels for noise as per sans 10103	34
8	Compliance requirement for activities associated with geological surveys and geochemical techniques during exploration	35
9	Leading practice standards for geological surveys	38
10	Leading practice standards for geochemical methods during exploration	39
11	Compliance requirement for the construction of access roads and tracks	42
12	Leading practice standards for construction of access tracks and roads	43
13	Compliance requirements for drilling	49
14	Leading practice standards for drilling	51
15	Compliance requirements for trenching	58
16	Leading practice standards for trenching	59
17	Compliance requirements for decommissioning	62
18	Leading practice standards for decommissioning	63

FIGURES

1	Layout of the best practice guide for exploration in Namibia	2
2	Application process for mining in protected areas	6
3	Factors influencing costs, revenues and risk of exploration	15
4	Potential impacts on biodiversity associated with the exploration phase	28
5	Airborne geophysical survey	29

DEFINITIONS AND ABBREVIATIONS

EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EMS	Environmental Management Systems
EPL	Exclusive Prospecting Licence
GSN	Geological Survey of Namibia
ICMM	International Council of Mining and Metals
MARC	Minerals Ancillary Rights Commission
MAWF	Ministry of Agriculture, Water and Forestry
MET	Ministry of Environment and Tourism
MME	Ministry of Mines and Energy
MPMRAC	Minerals (Prospecting and Mining Rights) Advisory Committee
NCAA	Namibian Civil Aviation Authority
NEPL	Non-Exclusive Prospecting Licence
NHC	National Heritage Council
NRPA	National Radiation Protection Authority
RBS	Risk-Based Solutions
RL	Reconnaissance Licence
ROC	Operator Certificate
SANS	South African National Standards

PART ONE

SETTING THE SCENE

Exploration is one of the prominent phases of the mining life cycle, and this chapter focuses particularly on the legislative and regulatory guidance required during this phase. The Minerals (Prospecting and Mining) Act, No. 33 of 1992, governs all mining activities in Namibia. Applied to all phases of the mining life cycle, this Act makes it illegal for any prospecting or exploration activity to occur without the relevant licence(s).

The purpose of this document is to serve as a guiding framework during the exploration phase of the mining life cycle in Namibia. By highlighting best practices from Namibia and internationally, this guide will assist exploration companies to effectively address potential challenges, such as environmental and social impacts, while adhering to all legal and regulatory frameworks, and setting leading practice standards, which can be applied to all exploration companies in Namibia. Based on the legislative and regulatory frameworks particularly relevant to exploration in Namibia, and considering the diverse range of exploration activities, this guide also explains the approval and reporting requirements implied.

This chapter of the Best Practice Guide should be studied in conjunction with the Overarching Chapter, which provides an overview of legislative and regulatory frameworks relevant to mining in Namibia.

1.1 HOW TO USE THE EXPLORATION CHAPTER

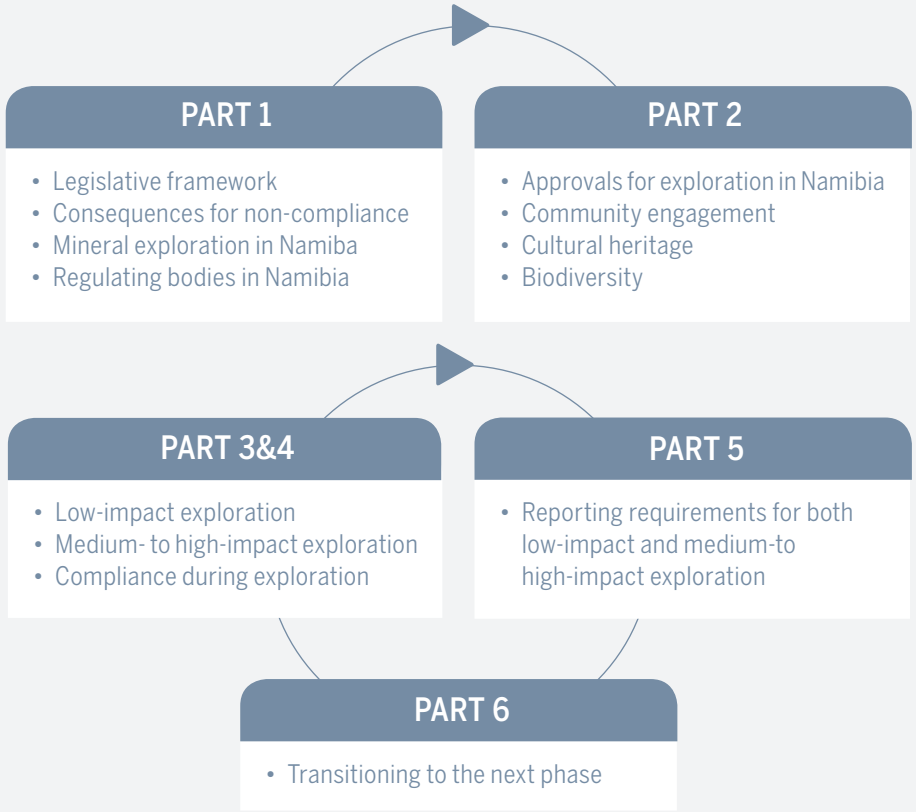
This chapter has been structured to allow quick and easy access to key elements of best practice throughout the exploration phase of the mining life cycle. The layout is designed such that exploration personnel, the government, environmental managers, and stakeholders, can conveniently obtain all pertinent information relating to best practices in the exploration phase. FIGURE 1 illustrates the main areas addressed in this chapter relating to exploration in Namibia.

1.2 EXPLORATION IN NAMIBIA

The importance of the exploration phase of the mining life cycle is heavily emphasised in Namibia's Mineral Policy of 2003:

"The Namibian government promotes exploration by the private sector, and therefore focuses on creating an enabling environment. This is done through appropriate competitive policy and a regulatory framework for the promotion of private sector investment, along with the provision of national databases, which are essential for attracting competitive exploration and mining."

[FIGURE 1]
Layout of the best practice guide for exploration in Namibia



Commitment towards establishing Namibia as Africa's most attractive exploration and mining environment, and encouraging exploration companies, forms a core objective of the Policy:

"Promote and stimulate investment in exploration and mining, so as to discover new ore deposits that will lead to the development of new mines, and also to maintain the existing ones."

The aspects and impacts of exploration activities vary widely; and the effects can be measured in terms of severity, scale, duration, consequences, and significance. Exploration activities range from undertakings with low impacts to more invasive methods. In Namibia, low-impact exploration methods can be defined as those activities that have minimal environmental and social impacts, such as remote sensing techniques, mapping, geophysical and geochemical techniques. The environmental and socio-economic impacts of exploration escalate with the inclusion of intensive activities such as the construction of access roads and tracks, drilling, and trenching. These activities have the potential to negatively impact the environment and to create socio-economic impacts of note, depending on the type and scale of the exploration project being undertaken. To fully comprehend the possible impacts of exploration, however, demands an understanding of land ownership in Namibia first.

Exploration and land ownership

There are two major categories of land owners in Namibia: Central and local government owns about 59%, while private individuals and companies own about 41% (freehold land). State-owned land is comprised of protected areas (almost 17%), communal land (37%), and land for other official uses, such as resettlement, quarantine, and agricultural research (5%).

The state manages state land directly through the line ministries of the government. Protected areas are formally proclaimed, belong to the State, and are allocated for nature conservation, under the auspices of the Ministry of Environment and Tourism (MET). The entire coastline of approximately 1,570 km is included in the protected area network of Namibia, and the mandate to look after the coastline is the combined responsibility of the MET and the Ministry of Fisheries and Marine Resources. The Ministry of Lands and Resettlement is the custodian of surveyed and unsurveyed state land, while the Ministry of Works and Transport administers infrastructure on governmental land. Water management is mandated through the Ministry of Agriculture, Water and Forestry (MAWF). Urban land is managed as municipalities, town councils, village councils, or settlement areas, under the auspices of the Ministry of Regional and Local Government, Housing and Rural Development. A number of parastatal enterprises provide services of national importance: TransNamib (railways); NamPower (bulk electricity supply); NamWater (bulk water supply); Roads Authority (roads); and Telecom (telecommunication).

Exploration on communal land

Communal land is formally owned by the state – the land may be used, but not owned by the people living there. Communal land is vested in the state by constitution and not surveyed. The state is obliged to administer communal land in trust, for the benefit of the traditional communities residing on these lands. In contrast to state land managed as protected areas and for other official uses such as agricultural research, is the land allocation and administration of unsurveyed communal land, which is impeded by the absence of clear and coherent legislation. Shortly after independence, Namibia adopted a land redistribution programme aimed at equitable ownership. Initial work to develop reform on land ownership began in 1995 and resulted in the enactment of the Communal Land Reform Act, No.5 of 2002. This Act deals with access to rural land in communal areas, regulates the allocation of land rights and the establishment of Communal Land Boards, and clearly states the powers of Chiefs, Traditional Authorities, and Land Boards. The Act stipulates two broad categories of land rights allocations: Customary Land Rights and Rights of Leasehold. The rights that may be allocated under Customary Land Rights, are rights to residential units and rights to farming units. Chiefs and Traditional Authorities allocate Customary Land Rights, and Land Boards verify these allocations. Rights of Leasehold are mainly relevant to land for agricultural use, and vest in the Land Boards.

Communal conservancies are legally gazetted areas on state communal land through Namibia's Community-Based Natural Resource Management Programme. Most of the conservancies in Namibia are run by elected committees of local people, to whom the government devolves user rights over wildlife within the conservancy boundaries. Technical assistance in managing the conservancy is provided by government officials and local and international non-governmental organisations (NGOs). To qualify, communities applying must define the conservancy's boundary, elect a representative conservancy committee, negotiate a legal constitution, prove the committee's ability to manage funds, and produce an acceptable plan for the equitable distribution of wildlife-related benefits. Once approved, registered conservancies acquire the rights to a sustainable wildlife quota, set by the ministry. The animals can either be sold to trophy hunting companies or hunted and consumed by the community. As legal entities, conservancies can also enter into contracts with private sector operators. At the beginning of 2019 there were 86 registered conservancies in Namibia, covering a combined surface area of close to 20% of the entire country.

Exploration on privately owned land

Privately owned land (including urban land) is freehold, which means that it may be bought and sold, and the owners hold the full title to their property. The system under which privately owned land is regulated, is well organised. Land is properly surveyed and is held under title deeds kept in a central deeds registry. Privately owned land may be used as security for financing.

In Namibia, all minerals are vested in the state. If prospecting activities are intended on private property, there are certain conditions that must be met in terms of the Minerals (Prospecting and Mining) Act, No. 33 of 1992, prior to and during any prospecting or exploration activities. These include, but are not limited to, the following:

- Prior to any prospecting or mining activities, an agreement must be reached between land owners and the mineral explorers
- If the land owner waives the right to compensation, a written copy of this agreement needs to be submitted to the Mining Commissioner The holder of a mineral licence shall not exercise any rights conferred upon such holder by the Act in or on any private land, until such holder has been granted an ancillary right as provided in section 110(4) to exercise rights on such land
- Holders of mineral licences are not allowed to exercise their rights in or under any private land until:
  - The holder has entered into agreement in writing with the owner of the land
  - Conditions of compensation are included
- Compensation is discussed between the land owner and the exploration or mining company
- Arbitration shall be used if the land owner and the mineral licence holder are unable to decide on a price. The price and mode of payment shall be fixed by arbitration.
- The Minerals Ancillary Rights Commission (MARC) offers an opportunity for the implementation of a co-operative process between land owners and mineral explorers if a dispute arises
- The holder of the mineral licence shall be liable to pay compensation to the land owner for damages caused (during any prospecting or mining operations) to any surface land, water source, cultivation, building, or other structure

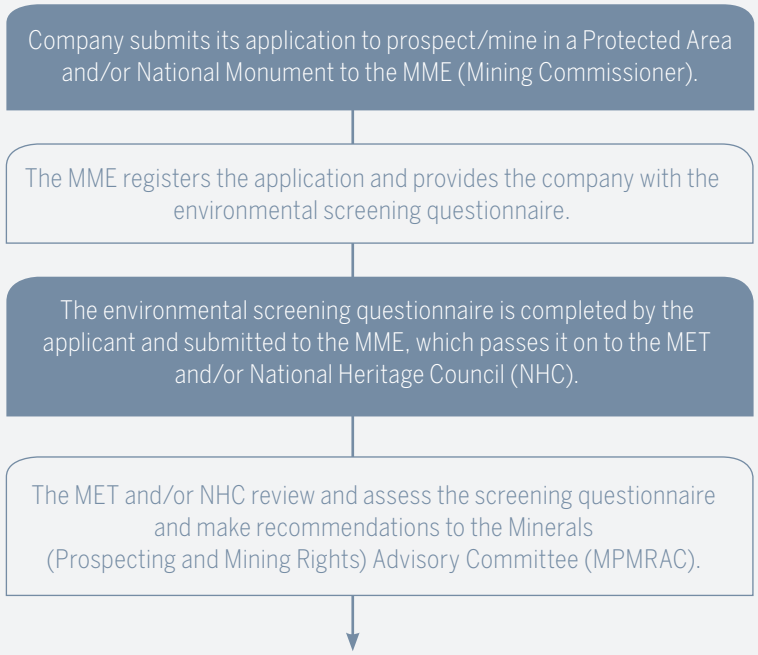
Exploration in protected areas

Namibia has a mining history of more than a century, and much of the early activities took place in today's protected areas. Evidence of environmental degradation in the forms of soil, air and water pollution, loss of vegetation, and a changed ecological state, can all be witnessed (Mansfeld, 2006). Several legacy issues were left behind by exploration, especially in the central Namib Desert, an area of high endemism with several rare and protected species, as well as sites of archaeological importance. Currently, there are many abandoned, unrehabilitated exploration and mine sites in Namibia, of which several are located within the national parks. This situation highlights the need to address the minimising, avoidance and mitigation of the negative impacts of mineral exploration and mining in protected areas, and is also addressed as a concern in Namibia's national development plans.

On the positive side, there exists a comparatively substantial number of environmental-related studies and investigations in the mining industry. That is mainly because of legislation, which requires proponents to conduct Environmental Impact Assessments (EIAs). In addition, most of the mining companies are foreign-owned, and operate within the parent company's code of conduct, which usually includes adhering to environmental standards and conducting EIAs. As a result, several studies were post facto, having been conducted several years after the mines were established (e.g. Rössing Uranium Limited, and Namdeb mines), and this also accounts for the escalation of studies since the second half of the 1990s.

According to the Policy on Exploration and Mining in Protected Areas (2018), it is the intention of the MET, along with the MME, to ensure that mining-related activity in protected areas is only initiated when rehabilitation is assured. Applying this approach, Langer Heinrich Uranium became one of the first larger scale mines entirely located within a protected area, after a full environmental impact assessment was completed in 2007 and an Environmental Clearance Certificate was obtained. The application process for mining in protected areas is illustrated in FIGURE 2.

[FIGURE 2]
Application process for mining in protected areas.



[FIGURE 2]
Application process for mining in protected areas.
(continued)

The Mining Commissioner includes the recommendations made by the MET and/or the NHC in the application file and presents the file to the MPMRAC, who assesses the application.

If the application is recommended, the MET and/or NHC set environmental conditions and help develop Terms of Reference for an Environmental Assessment (EA) and/or Environmental Management Plan (EMP).

The MME endorses the Terms of Reference for the EA and/or EMP

The EA and/or EMP are conducted according to the procedures in the Environmental Management Act, No. 7 of 2007.

The MME/MET/NHC review the EA/EMP and agree to recommend approval/or disapproval

The EA is positive and if the Minister approves that the prospecting or mining should proceed, the MET issues an Environmental Clearance subject to specific conditions as set in the Environmental Contract

Husab mine - Swakop Uranmium
Swakopmund
Erongo
Namibia
2019 © paulgodard.com

PART TWO

EXPLORATION PROCEDURES

Any person or company intending to conduct prospecting or exploration in Namibia, must obtain the appropriate and relevant permits in terms of the Minerals (Prospecting and Mining) Act, No. 33 of 1992, prior to any works commencing. Depending on the situation and conditions related to the earmarked area, land ownership, and the type of commodity, etc. an applicant may require one of various types of licences. Legislative and regulatory frameworks are quite clear in terms of the legal requirements, and this section sheds some light on these requirements. In addition, this section provides guidance on key management tasks and procedures required from applicants, such as risk assessment, community engagement, and consideration of environmental conditions.

2.1 APPROVALS FOR EXPLORATION IN NAMIBIA

Since May 2018, the MME uses a Licences, Rights and Permits Application and Assessment Procedures document to guide applicants in terms of the application and evaluation processes followed by the authorities in granting licences. This document aims to explain the types of licences and permits administered and issued by the ministry, and the expected outcome of the document is to provide a quick overview and understanding of how the licensing of the exploration permit activities is undertaken in the context of the relevant regulatory frameworks.

The licence required by an exploration company depends on the scale and extent of the proposed exploration activity. The intention of the Minerals (Prospecting and Mining) Act, No. 33 of 1992 is that an application for a claim and / or a Non-exclusive Prospecting Licence (NEPL) is the route for small operators and prospectors, while the application for a Reconnaissance Licence (RL) and an Exclusive Prospecting Licence (EPL) is for established larger companies.

The permission for an NEPL allows the holder of such licence the right to prospect anywhere in the country, except for game parks and reserves and existing licences, and the holder of the NEPL is not entitled to exclusive rights for any specific mineral group or area. The licence is issued for a year and is neither transferable nor renewable.

Designed for regional, mainly remote sensing exploration, a RL is valid for six months and facilitates the identification of exploration targets. Usually it covers large areas, for example 1 million ha. Under special circumstances this licence can be renewed for another six months. Ideally the holder should be in a position to apply for EPL within the area previously covered by the RL.

An EPL is the most common type of mineral licence issued by the MME and serves as a more formal ownership right and confers exclusive rights to the land (up to 1,000 km2) for an initial period of 3 years. It is meant for more detailed investigations such as geological mapping, ground geophysics, geochemical sampling, trenching, drilling, bulk sampling, trial mining, etc. The exclusive rights are granted for only the minerals specified in the licence; another entity may therefore have an EPL for a different mineral on the same land. The EPL may be extended twice for two-year periods, if demonstrable progress is shown.

Some circumstances (e.g. commodity price, lack of infrastructure, or technical difficulties) may prevent the holder of an EPL from taking a project from the exploration phase to mining. If the holder of the EPL has reason to believe that these negative circumstances would improve, the holder may choose to preserve rights over the deposit by applying for a Mineral Deposit Retention Licence (MDRL). The latter is issued for five (5) years and is renewable.

A brief description of the licence duration (tenure) and restrictions are shown in TABLE 1. Additional conditions are outlined in the Minerals (Prospecting and Mining) Act, No. 33 of 1992, and licence holders should be informed about all conditions stipulated.

TABLE 1 | Summarises the different types of closure costs used

LICENCE TYPE	DESCRIPTION	DURATION AND FEES	RENEWABLE	RESTRICTIONS
Non-Exclusive Prospecting Licence (NEPL)	The holder of such licence has the right to prospect on any land for any mineral or group of minerals outside game parks and reserves and existing mineral licences	One year Annual fee is N$50	No	Not entitled to exclusive rights for any specific mineral group or area. Non-transferable. In case of a person, such holder shall be a Namibian citizen and over the age of 18; in case of a company only Namibian citizen may hold shares in such a company
Reconnaissance Licence (RL)	Designed for regional remote sensing exploration Entitles the holder to an exclusive right and preferential right over the area Maximum acreage size is two one-by-one degree squares	Valid for 6 months N$500-00 per quarter degree square or part thereof for exclusive rights; N$250 per quarter degree square or part thereof without exclusive rights	Can be renewed for another 6 months under special circumstances Generally non-renewable and non-transferable	The holder is obliged to keep all relevant prescribed records and submit at the end of the licence term a report setting out an evaluation of the prospects of the area and other geological data and information, a statement of income, expenditure and other financial declarations
Exclusive Prospecting Licence (EPL)	Allows systematic prospecting in areas of up to 100,000 ha (1,000km^2)	• Valid for up to three (3) years initially, with renewals possible • A minimum of N$2000-00 for 20,000 ha or part thereof plus • N$1000-00 per 10,000 ha or part thereof bigger than 20,000 ha (see also Table 2)	• May be renewed twice; each renewal is valid for a two-year period. • The area decreases by 25% for each renewal, the 25% reduction might be exempted on application. • Under exceptional circumstances it is renewable for further periods. (Renewals beyond 7 years require special approval by the Minister)	• In case of a person, such holder shall be a Namibian citizen; in case of a company it should be duly registered in Namibia • Sound description of the exploration target, model, program and budget • The holder is obliged to submit reports on the progress of prospecting work, resources and reserves, and to keep all relevant records • A scoping study / EIA report accompanied by an Environmental Clearance Certificate are required
Mineral Deposition Retention Licence (MDRL)	Applicable when economic circumstances do not justify the development of the deposit due to downward trending commodity prices, or if the deposit is of such a nature that it cannot be economically exploited on its own	Valid for up to five (5) years with renewal possible N$5000-00 to be paid annually	Renewable for a period not exceeding two (2) years	**NB!** Do not undertake any exploration or mining activities in namibia without a licence (Refer to table 1)

Once an application is lodged, the MME registers the application on the Flexi Cadastre Namibia – the software solution of the ministry – to evaluate all aspects of the application.

Upon request, the holder of an NEPL has to deliver a report to the Mining Commissioner. The holders of an RL and an MDRL have to report annually to the Mining Commissioner while the holder of an EPL has to report monthly and annually to the Mining Commissioner.

Diamond licences and permits are issued under the Diamond Act, No. 13 of 1999 and administered by the Diamond Commissioner and petroleum (upstream) licences are provided for under the Petroleum (Exploration and Production) Act, No. 2 of 1991 administered by the Petroleum Commissioner.

2.2 ADDITIONAL CONDITIONS FOR EXPLORATION

Different fees are payable with respect to the application and renewal of the various licences related to exploration (see TABLE 2).

TABLE 2 | Aspects and triggers to consider when developing a mine closure plan

NATURE OF APPLICATION	AMOUNT (FEE)
Application for reconnaissance licence (*without exclusive rights*)	N$250 per quarter degree square
Application for reconnaissance licence (*with exclusive rights*)	N$500 per quarter degree square
Application for an EPL < 20,000 ha	N$2,000
Application for an EPL 20,001 – 30,000 ha	N$3,000
Application for an EPL 30,001 – 40,000 ha	N$4,000
Application for an EPL 40,001 – 50,000 ha	N$5,000
Application for an EPL 50,001 – 60,000 ha	N$6,000
Application for an EPL 60,001 – 70,000 ha	N$7,000
Application for an EPL 70,001 – 80,000 ha	N$8,000
Application for an EPL 80,001 – 90,000 ha	N$9,000
Application for an EPL 90,001 – 100,000 ha	N$10,000
Application for MDRL	N$5,000
Application for transfer of RL	Not transferable
Application for transfer of EPL	N$250
Inspection of register	Not charged
Obtaining copy of entry in register, per copy	N$1.50

2.3 KEY MANAGEMENT TASKS IN THE EXPLORATION STAGE

During the exploration phase, it is beneficial to undertake activities that can guide and assist the future management of a site, i.e. after the exploration phase has been completed. For example, critical information can be obtained during the exploration phase, which is highly relevant for the operational phase (e.g. volume of waste material that could be generated when the ore body is mined). This important information can aid in the planning, establishment and closure of an eventual mine.

Based on recommendations for Australia, it is considered best practice in Namibia to conduct the following activities during the exploration phase (Department of Resources, Energy and Tourism , 2011):

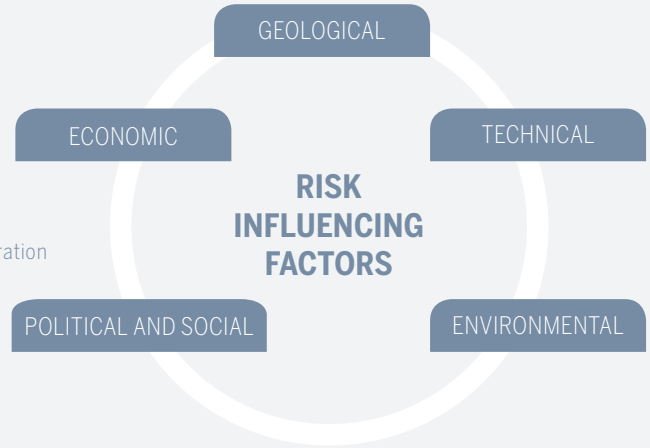
- Collecting baseline environmental data, including vegetation types, soil types, weather data (i.e. install a weather station), and surface and groundwater quality
- Identifying and assessing current land ownership and land use
- Preliminary assessment of waste rock characteristics—this includes testing sulphide ore bodies
- Community and stakeholder consultation on key issues, including anticipated environmental and social impacts and benefits
- Establish a platform to build good relationships with the local community, stakeholders and shareholders

Although some of these activities are impliedly part of the environmental impact assessment process, it is advisable that an exploration company remains sensible and attentive towards these aspects, right from the start. Water, for example, is a scarce commodity in Namibia, and it is advisable to understand the surface and groundwater characteristics of an area prior to exploration activities.

2.4 RISK MANAGEMENT AND EXPLORATION

In many cases, the exploration phase of any mining project is a lengthy process, which involves different techniques accompanied by a high level of economic uncertainty, to determine and quantify mineral deposits, in order to warrant mining. Exploration involves the finding, analysing and defining of a mineral resource body, and paves the way forward for the feasibility study that follows, to determine the economic viability of a project. This phase also involves large capital investments, and not all exploration prospects materialise into a profitable mine. As a result, the exploration phase is thus closely associated with risks, and is decisive for the continuation of a project.

To adequately manage risk throughout the exploration phase, risk management principles need to be effectively applied. Prior to initiating a new exploration project or advancing to the next stage of an existing exploration project, project due diligence should also be conducted. Due diligence assists in identifying, controlling and managing risks, and serves as a broad-based risk management process. Influencing factors relevant to the risks of exploration activities in Namibia are illustrated in FIGURE 3.



[FIGURE 3]
Factors influencing costs, revenues and risk of exploration

Political and social risks

One of the risks that foreign companies often face when investing in the minerals sector in any country, is the possibility of political unrest. Fortunately, Namibia offers an attractive investment environment into the minerals sector, as it has a politically stable environment and moderately developed infrastructure, enabling exploration companies to gain access to mineral deposits. In striving to establish Namibia as the country most attractive for mining in Africa, the state places emphasis on creating a conducive political environment through appropriate legislation relating to land access, tenure, and tax. To some extent, many of the risks pertaining to political stability, land ownership and social implications, are mitigated this way.

Economic risks

The economic risks during exploration are high, due to the uncertainty of the existence of a resource; as well as whether it exists in a sufficient quantity and grade to validate mining. When compared to the other phases of the mining life cycle, the exploration phase is classified as a high-risk phase, due to economic factors—a potentially low success rate in combination with high commercial costs, may even cease exploration activities abruptly. Fluctuating commodity prices due to global events may also influence the viability of a potential project decisively. Flooding of the world market with graphite from China prevented the full development of the Okanjande Graphite Mine near Otjiwarongo, for example.

Geological risks

Many mineral prospects could be investigated, but only a few of the holes drilled might result in extensive drilling operations. As mapping and drilling progress, the understanding of the geology increases and that might mean that there is the risk to find out that there is no mineral deposit.

Technical risks

In its efforts to establish Namibia as the country most attractive for mining in Africa, the state maintains a strong emphasis on the continuous improvement of technical infrastructure in support of the mining industry. An excellent range of high-quality geological information is available to exploration companies, including a geological archive that is one of the most extensive in Africa—incorporating a complete inventory of previous exploration work that stretches back almost a century. Moreover it means that many of the technical risks are mitigated because geological information is publicly available.

Environmental risks

Depending on the scope and extent of the exploration programme, there is an associated risk of environmental harm. To ensure that environmental risks are effectively managed, a scoping report with an accompanying EMP must be submitted, in order to obtain an Environmental Clearance Certificate prior to the exploration program. If major impacts are likely to result from exploration activities, an EIA is also required; this will be pointed out by the scoping report and provide the Environmental Commissioner with enough evidence to recommend a full EIA or not, before the project can continue. In the EMP, mitigation measures are based on the risks assessed in the EIA—when applied these measures can ensure minimal environmental damage during the exploration phase.

2.5 COMMUNITY ENGAGEMENT

It is best practice to consult land owners prior to exploration. In the event that the exploration area is situated on private land, for example, the exploring company is required to enter into negotiations with land owners prior to exploration, to decide on the compensation amount and method (Refer to Section 1.2.3).

Community relations management and the development of a project are distinctive but overlapping processes, vital during the exploration phase of the mining life cycle. Community engagement involves more than community interaction, often linking multiple processes and stakeholders, and ultimately improving the quality of life of a community. Put differently, it involves strengthening the viability of a community, whilst giving them an opportunity.

Tsumeb smelter - Dundee Precious Metals Tsumeb
Tsumeb
Oshikoto
Namibia
2019 © paulgodard.com

ALTHOUGH THE SPECIFIC NEEDS OF EACH CASE MAY DIFFER, BASIC COMMUNITY ENGAGEMENT PROCESSES START WITH COMMUNICATION AND COMMUNITY-RELATED ACTIVITIES DURING THE EXPLORATION PHASE, WHICH INCLUDE:

- A socio-economic baseline study of the local community
- Identification of all stakeholders and the compiling of a stakeholder map
- The appointment of a designated staff member responsible for communication and community-related activities
- The development and implementation of a set of standardised communication tools, messages and techniques for the duration of the exploration phase
- The enlightening of stakeholders about the exploration activities by means of two-way liaison channels
- The creation of a communication platform with representatives from both the exploration company and stakeholders, and the establishment of an agreed upon interaction schedule
- The identification and assessment of community initiatives, which can be supported by the exploration company
- The purchasing and hiring of local supplies and services whenever possible

The International Council of Mining and Metals (ICMM) has developed a toolkit, which provides practical guidance in community relations management through all stages of the mining life cycle. The toolkit serves as a good reference for international best practices for community engagement during the exploration stage, and includes guidance for building relationships, planning, assessment, management, monitoring and evaluation. Tools for building relationships and performing assessments are most relevant during the exploration phase (see TABLE 3).

TABLE 3 | Aspects and triggers to consider when developing a mine closure plan

	CATEGORY OF COMMUNITY ENGAGEMENT TOOL	
	RELATIONSHIP TOOLS	ASSESSMENT TOOLS
Tool name	Stakeholder identification Stakeholder analysis Grievance mechanism on its own	Social baseline study
Initial use	Stakeholder identification Stakeholder analysis Grievance mechanism	Exploration and feasibility
Full implementation	Feasibility	Construction
Updating	Regular, ongoing – annual full update	Annual review

Assessment tools – socio-economic baseline study

As early as possible, and preferably during exploration, a socio-economic baseline study is necessary, to describe the social and economic environment of the area. Key components of a socio-economic baseline study include:

- Demographic factors (numbers, age, sex, growth, mortality ratios, household heads and size, trends and tendencies, population distribution and density, and the urban-rural continuum, etc.)
- Socio-economic determinants (schooling/education, skills, housing and accommodation, access to necessities, institutions and facilities—schools, health, sport and recreation, religion, access to potable water, sanitation, electricity, transport, and the provision of government services such as Law and Order, and Home Affairs, etc.)
- Social organisation (social networks and dynamics, history and culture, needs, norms and values, tenure and ownership, and political and governance context, etc.)
- Economic factors and determinants (employment and unemployment/labour force participation, in-migration and out-migration, sources of income, average income, employment per sector, livelihoods, living standards, income dependencies, vulnerability and marginalisation, and deprivation, etc.)
- Economic organisation (importance of agriculture, tourism, mining, manufacturing, trade and retail, services, public investments in municipalities, regional infrastructural and services development, sport, recreation and leisure, youth development, employment creation, urban and regional development patterns and expectations, regional and local economic growth trends, business trends and spending patterns, long term prospects, economic challenges and opportunities, policies and views of local and regional authorities, public views, and perceptions and concern, etc.)

Good consultation

Meaningful and participative community engagement should commence at the same time an exploration project is initiated. It is imperative that there is early communication, in order to maintain an open and transparent process of information sharing, and in order to ensure clear understanding and collaboration between the explorer, land owners, neighbours, the local community, the government, and all other stakeholders. A late start, on the other hand, may easily lead to constant misunderstandings, confrontation and opposition. An early start can also assist in the process of identifying potential risks, aspects and impacts, and the avoidance, management and mitigation thereof.

Good community engagement practices during the life cycle of an exploration project, set a basis for an eventual positive post-mining legacy. It is mutually beneficial for the exploration company and the community, if emphasis is placed on engagement from the early stages of a project. In doing so, the company gains credibility from the community, making future endeavours easier. The establishing of good community engagement protocols, and the enabling thereof, prevents a potentially destructive process and the possible cessation of exploration activities (in extreme cases). Sound consultation with the community also assists the exploration company in understanding the viewpoint and expectations of the community.

The initial stages of exploration should place emphasis on building good community relations, which involves:

- Considering the views and opinions of stakeholders on issues impacting the community before making decisions
- Making the purpose of consultation clear, and documenting consultation processes to indicate compliance
- Providing feedback to stakeholders on how their inputs have influenced decisions
- Enforcing regular stakeholder consultation sessions by means of a communication platform with representatives from both the exploration company and stakeholders, and an agreed interaction schedule

Stakeholder analysis

To assist in developing a consultation matrix, and to determine how frequently stakeholder engagement is required, the level of interest of each stakeholder is required. The more information is known about each stakeholder, the more success will be realised when building and retaining good relationships with them. A stakeholder analysis normally results in a stakeholder map, which is updated during reviews, and portrays stakeholders in terms of influence and importance.

NB! The licensee should identify the affected communities for the proposed operation(s) and consult with the identified communities.

Heritage

Heritage—legacies of tangible and to a lesser degree intangible attributes in its widest sense—could potentially be impacted by various activities during the mining life cycle, in particular during the exploration phase.

ACTIVITIES THAT COULD IMPACT HERITAGE SITES PHYSICALLY INCLUDE (YUKON TOURISM AND CULTURE , 2010):

- Land clearing
- Access track and road construction
- Trenching and drilling
- Camps and infrastructure construction

NB! Disobeying the National Heritage Act No. 27 of 2004, by relocating or disturbing the position of a fixed protected object/artefact can lead to a fine of up to **N$ 100,000**.

To mitigate and minimise impacts on heritage sites by exploration activities, actions in line with global best practices are recommended (see TABLE 4).

TABLE 4 | Recommended practices to mitigate impacts on heritage sites

ACTIVITY	NAMIBIAN RECOMMENDED PRACTICE
Access track and road construction	• It is a good practice to georeference or map existing roads on EPLs, as this can be used at a later stage during the project • If there is a need for new track construction, avoid sensitive areas • Use existing tracks and roads whenever possible • Minimise stream crossings whenever possible
Trenching and drilling	• Areas cleared and levelled to install drilling platforms should be minimised • Use backhoe equipment when carrying out trenching, whenever possible, to minimise ground disturbance
Land clearance for the construction of camps and infrastructure	• Locate camps near existing roads and tracks whenever possible • Locate camps in existing clearings whenever possible

WHAT COULD GO WRONG?

If tracks are not rehabilitated, the resulting impact could be:

- Loss of heritage resources, if heritage surveys/assessments are not conducted, and continuity may be lost
- Visual impacts of the environment
- Unauthorised persons could be encouraged to enter an area (e.g. protected areas)
- A company's reputation may be damaged

As a precautionary principle, in respect of public concern, and to make decisions that consider the interests, needs and values of stakeholders, it would be wise to conduct an early archaeological assessment of an exploration area. Taking precautions with regard to heritage resources is not only to prevent damage or destruction, but should also been seen in a positive light. For example, there is a close link between exploration and the discovery of palaeontological finds. If it was not for exploration, some of these important treasures would have remained unknown, as the case studies below highlight.

ARRISDRIFT AND BERG AUKAS FOSSIL SITES

by Namdeb and Dr Gabi Schneider

LOCATION:

At Arrisdrift, on the banks of the Orange River, some 30 km inland from the river mouth, and Berg Aukas located north east of Grootfontein.

BRIEF DESCRIPTION:

At Consolidated Diamond Mines (CDM)—the precursor of today's Namdeb—a fantastic palaeontological find was made. Namibia has an extraordinary natural heritage, including a wealth of different fossils spanning a period of 830 million years. Many of them distinguish themselves in global fossil records, such as the Ediacaran fauna from the Nama Group of southern Namibia, which is amongst the best preserved and most extensive early multi-cellular biota in the world. This case study deals with two superlatives amongst Namibian fossils that were only found because of exploration and mining activities: the richest and most important Miocene fossil occurrence in Africa, and the first known Miocene hominoid south of the equator.

KEY ISSUE(S) ADDRESSED:

This case study highlights how exploration and mining activities led to the discovery of fossils in Namibia.

DESCRIPTION OF THE CASE STUDY:

A vast number of Middle Miocene, mainly vertebrate, fossils in a very good state of preservation, occurred in an old river channel within the proto-Orange River valley. Since the discovery of these first fossils, systematic excavation and research has yielded more than 10 000 specimens from the site. They belong to 36 mammalian taxa, many of which were new to science at the time of the find. There are also crocodiles, tortoises and other members of the reptile family; 13 different bird species; and fish, including sharks. To this day, the site remains the richest and most important Miocene fossil occurrence on the African continent (Schneider, 2009).

A diamond was also discovered in one of the fossils. Not only did this eventually prove the theory that the diamonds mined in Namibia travelled from the southern African interior via the Orange River to the coast, it also gave scientists the opportunity to date this event (Corbett, 2002). Arrisdrift is a good example of the close link between palaeontology and mining, since the search for and exploitation of minerals has uncovered many fossil occurrences, which would otherwise have remained beyond the reach of palaeontologists. When exploration geologists working at Arrisdrift first realised that the site contained fossils, an expert palaeontologist, Dr Gudrun Corvinus, was immediately called in to undertake research and excavate the fossils. Her pioneering studies are remarkable, considering that, in general, the Middle Miocene faunas of Africa were poorly understood at the time (Pickford & Senut, 2003).

Unfortunately, the fossils were all deposited at the South African Museum in Cape Town. However, after Namibian Independence, the fossils were repatriated, and many are now on display at the National Earth Science Museum of the Geological Survey of Namibia (GSN). It was also during the time after Independence, that Namdeb geologists decided that further palaeontological studies were needed, to throw additional light on the ages of the Orange River terrace deposits, and palaeontologists Dr Brigitte Senut and Dr Martin Pickford have been working at Arrisdrift on a regular basis since 1993, finding more new species and genera, and tremendously contributing to our understanding of the lineages of African faunas as we know them today.

Work on the Arrisdrift fossils has also allowed researchers to establish valuable facts about the local palaeoclimate during the Middle Miocene, a time when biodiversity was higher than today. The local environment must have been considerably more humid than it is today, and the climate was most probably tropical. The main fossil occurrence is associated with a shallow channel, which contained flowing water only during flood events, but otherwise was a quiet pool a mere 1-2 m deep. The presence of brackish water-dwelling worms indicates that the sea level must have been much higher during the Middle Miocene, and the area around Arrisdrift most probably constituted an estuarine environment (Schneider & Marais, 2004). This sheds light on climate change as it happened in the past.

The second case, the find of the first known Miocene hominoid south of the equator, is associated with the vanadium-lead-zinc mine of Berg Aukas in the Otavi Mountainland.

Berg Aukas made world headlines, when the fossil jawbone of the creature was found in 1991, and aptly named *Otavipithecus namibiensis*. The hominoid family, which includes both the great apes and humans, is part of the order of primates. The fossil record of the shared ancestry of humans and other primates is extremely patchy, and hence, any new find is met with enthusiasm. Recent evidence increasingly suggests that many critical events in human evolution occurred in Africa, and there is a likelihood that modern humans originated in southern Africa and spread to other places from there. The significance of the Berg Aukas find must be seen in this light.

The Berg Aukas Mine had ceased production in 1978, but during its operation, the entire central ore body, which had been located within a karst palaeontological cave structure, had been mined out. Apart from massive ore, the structure contained partly mineralised breccias. These are so richly fossiliferous, that Berg Aukas has yielded by far the most comprehensive series of micromammal faunas known, from the African continent. The breccias were mined together with the ore and dumped on the northern side of the Berg Aukas hill. To this day, the breccias still provide a valuable source of research material for palaeontologists, and are yet another outstanding example of the benefits that palaeontological research in Namibia has derived from mining activities.

Otavipithecus namibiensis was a medium-sized ape, and its lower jaw, part of its skull, some isolated teeth, and parts of the neck, arm and a finger bone have been recovered. Although Miocene apes have long been known to be from near the equator, none had ever been found to the south of it. The Namibian discovery is therefore the first proof that apes were also present in southern Africa during the Miocene (Schneider & Marais, 2004).

REFERENCES:

Corbett, A. (2002): *Diamond Beaches*. Namdeb Diamond Corporation, Windhoek.

Pickford, M. & Senut, B. (2003): *Geology and Palaeobiology of the Central and Southern Namib*, Vol 2, Palaeontology of the Orange River Valley, Namibia. 398 pp., Memoir 19, Geological Survey of Namibia, Windhoek.

Schneider, G.I.C. (2009): *Treasures of the Diamond Coast*. 320 pp., Macmillan Education Namibia, Windhoek.

Schneider, G.I.C. & Marais, C. (2004): *Passage through Time: The Fossils of Namibia*. 158 pp., Gamsberg Macmillan, Windhoek.

Photographs courtesy of G. Schneider and Namdeb.

2.6 BIODIVERSITY

Exploration activities have the potential to negatively affect biodiversity. Direct impacts typically result from activities involving physical destruction and land-clearing activities such as creating access tracks or roads, infrastructure construction, exploration drilling and overburden removal. Direct impacts are typically easy to identify, but indirect impacts are harder to identify, and might only appear later, even as cumulative or knock-on effects. For example, the restriction of water as an ecological driver may only show its detrimental effects later. Significant impacts are most likely to occur when extensive exploration activities, such as closely-spaced, and large-scale drilling operations are conducted in sensitive, remote, or protected areas. A number of causes can potentially destroy biodiversity composition in terms of species and their abundance. Key species and rare, vulnerable, threatened or endangered species are particularly important, because a limited change may have a disproportionate effect on the stability or resilience of an ecosystem, or effects beyond the site where these species occur.

Taking a proactive approach in the management and assessment of the negative impacts of exploration on biodiversity is considered global best practice. Leading practice standards are set out in Section 4.

Why should exploration companies consider biodiversity?

There are a variety of sound business reasons for mining and exploration companies to address biodiversity. Adopting reasonable practices with respect to biodiversity management is increasingly important with respect to:

- Reputation, which has a significant influence on the perception of stakeholders
- Land access and tenure at the initial stages of project development and for ongoing exploration
- Compliance with legislation and commitment towards values, such as land stewardship and conservation
- Access to capital for exploration—with environmental protection becoming increasingly important across the globe, investors are keener to invest in projects that place emphasis on biodiversity and the protection thereof

The impacts of exploration on biodiversity is dependent on the nature and extent of the exploration process. Potential impacts on biodiversity associated with the exploration phase are illustrated in FIGURE 4.

[FIGURE 4]
Potential impacts on biodiversity associated with the exploration phase

IMPACTS ON TERRESTRIAL BIODIVERSITY
- Loss and fragmentation of ecosystems and habitats
- Loss of species
- Restriction of water as an ecological driver

IMPACTS OF DISCHARGES AND EFFLUENTS
- Increased heavy metals, acidity or pollution can poison aquatic life
- Manipulation of run-off and groundwater can introduce non-indigenous species

SOCIAL INTERFACES WITH BIODIVERSITY
- Loss of grazing and browsing potential can alter migration routes
- Can encourage poaching, illegal fencing, off-road driving, collecting of firewood and timber, collecting of plants, and pet trade

AIR QUALITY IMPACTS ON BIODIVERSITY
- Increased particulates (dust, fumes, smoke) and increased pollutants (noxious and offensive gases) may repel or evict species

Namdeb
Oranjemund
Karas
Namibia
2019 © paulgodard.com

[FIGURE 5]
Airborne geophysical survey

PART THREE

LEADING PRACTICE STANDARDS FOR LOW IMPACT MINERAL EXPLORATION

Exploration companies should always aim to have the smallest environmental footprint possible, because it instils a culture of environmental commitment and care, awareness and respect, and enhances the chances of successful remediation of a project site, once exploration activities have ceased.

Typical exploration activities, with low environmental and social impacts, entail remote sensing techniques, geological mapping and geophysical and geochemical techniques. Although the impacts of these activities are low, it is considered best practice for exploration companies to always be compliant, to minimise disturbances, and to monitor and mitigate their impacts, nevertheless. To conduct exploration, the proponent must be in possession of a licence, as the Minerals (Prospecting and Mining) Act, No. 33 of 1992 stipulates.

This chapter outlines the prominent low-impact exploration methods and seeks to provide guidance on identifying and mitigating the associated possible impacts during this phase.

3.1 REMOTE SENSING TECHNIQUES

What is remote sensing?

Remote sensing during mineral exploration enables explorers to find and assess deposits without having to undertake massive exploration operations such as drilling and excavation. Remote sensing involves using an airborne platform to gather and record spectral data do geophysical surveys, photo-geological maps, aerial sensing techniques, and image gathering. FIGURE 5 shows an aircraft used for a geophysical survey. (Photo credit: WestAir Aviation).

In addition, remote sensing entails the application of several tools and techniques, to extract information from satellite images, geographical information systems, radar and sonar. The images collected can be used for identifying fractures and faults, and the geology of an ore deposit, and to identify hydrothermally altered rocks by using their spectral signature (Kay, 2018).

What are the benefits of using remote sensing techniques?

Remote sensing is a useful tool when searching for minerals. It gives a good indication of where deposits are situated, and aids in narrowing down the field survey area. Remote sensing techniques aid in identifying which areas to explore first, thereby reducing the risk of the exploration project, whilst deferring costly operations such as drilling, to only after sufficient data has been collected (Kay, 2018).

Compliance

The use of any form of aircraft for remote sensing during the exploration phase, is subject to all current civil aviation regulations in Namibia.

According to Namibia's Civil Aviation Authority, flying a drone is legal in Namibia if it is compliant to specific regulations. For commercial purposes, users need to apply for permission from the Authority prior to a drone's usage – for foreigners this must be done at least 120 days prior to the planned flight, and for Namibians it must be done 90 days prior to the planned flight. Additional legal requirements include: restrictions on height, distance from controlled and air traffic zones, aerodromes, restricted and protected areas, public roads, safety, weather and visibility conditions, and liability. Drones need to be registered, each with a document specifying the technical standards, proof of insurance, proof of payment for the registration, risk analysis, a safety management plan, and its purpose of use. Furthermore, it is recommended that a map and the coordinates of the location are declared prior to its usage, and that permission is required from property owners before each flight. The use of drones within protected areas is illegal. Once the necessary permit(s) have been obtained to operate drones in Namibia, the rules in TABLE 5 apply (Namibia Civil Aviation Authority, 2017).

In line with global best practices, some leading practice standards have been established to ensure that remote sensing exploration activities have the smallest environmental footprint possible, as illustrated in TABLE 6.

TABLE 5 | Recommended practices to mitigate impacts on heritage sites

CRITERIA	RESTRICTIONS FOR DRONES
Maximum altitude	Limited to 45 meters
Maximum horizontal distance	Allowed to only operate within direct range of sight
Compulsory insurance	Aviation liability insurance is mandatory
Distance to airports	A distance of 9.3 km (5 nautical miles) of the outer boundary
Flight bans	• Public roads may not be used for landing or take-off sites • Not permitted to fly within protected areas • Not permitted to fly over crowds
Other safety distances	A minimum distance of 50 m must be maintained for uninvolved persons and other objects such as vehicles, and buildings, etc.
Special legislation	Each drone is only allowed to be registered under one Operator Certificate (ROC)
Operating hours	Only permitted in daylight
Rules for commercial drone pilots	Commercial drone pilots are obliged to apply for an Operator Certificate

NB! Intending to fly a drone for your exploration activities?

Make sure to get a permit from the Namibia Civil Aviation Authority.

TABLE 6 | Leading practice standards for remote sensing exploration

EXPLORATION ACTIVITY	POSSIBLE IMPACTS
Exploration Activity	Conducting aerial sensing techniques over large areas, including photo-geological mapping or image gathering from a helicopter in search of minerals.
Possible Impacts	• Effects on animal feeding and migratory patterns because of the noise generated from aircraft • Disruption of human activity due to excessive noise • Disruption on hunting farms
Leading Practice Standards	• Correspond with the responsible authorities to determine the best time to conduct aerial surveys • When possible, avoid flying directly over human settlements • Only conduct exploration activities during the day, and adhere to respective regulations relating to noise in the South African National Standards (SANS) regulations, outlined in TABLE 7

WHAT COULD GO WRONG?

If exploration companies do not comply with the standards set out relating to operation time, and flying over settlements or protected areas without permission, this can result in an unwanted incident and possible criminal charges. The noise and increased level of activity associated with remote sensing equipment can lead to nuisance disturbances such as disturbing game hunting on hunting farms or in disruption of animal feeding, and migratory and mating patterns.

The biggest issue to address during aerial surveys, is noise. The SANS 10103 is used to address the way environmental noise measurements are to be assessed and taken.

SANS provides guidelines on recommended noise levels and typical recommended noise levels are illustrated in TABLE 7.

TABLE 7 | Typical rating levels for noise as per sans 10103

TYPE OF DISTRICT	EQUIVALENT CONDITIONS RATING LEVEL ($L_{REQ,T}$) FOR OUTDOOR NOISE Day-time $L_{Req,\,d}$ [(a)] (dBA)
Rural districts	45
Suburban districts with little road traffic	50
Urban districts	55
Urban districts with business premises and roads	60
Central business districts	65
Industrial districts	70

a) $L_{Req,\,d}$ = The L_{Aeq} rated for impulsive sound and tonality in accordance with SANS 10103 for daytime, where the daytime period is from 06:00 to 22:00.

3.2 GEOLOGICAL SURVEYS

Geological maps provide explorers with geological information, which allows potential mineral deposits to be identified. During the mapping process, geologists spend time analysing mineral indications and rocks, to create a high-quality map on a small scale. These maps are generally built on existing maps obtained from the government or other sources.

Geological surveys provide mineral explorers with scientific data on rock types, structures and minerals to determine further exploration or termination of efforts. Field surveys typically have limited impacts on biodiversity, however, in some instances, subsurface sampling is required.

Localized subsurface sampling is usually carried out using the pitting or trenching method. Pitting and trenching are a fast way of determining local geological structure and assay information in areas of shallow soil cover. Pits and trenches are used to obtain a clearer picture of the rock composition, where pitting is used to test flat lying, shallow bodies of mineralisation, and trenching is mostly used to expose steeply dipping bedrock, which is covered by a thin layer of overburden. Trenches are typically excavated by manual labour, or with a light-weight mechanical digger. The pits created are usually relatively shallow and square-shaped, whereas trenches are longer.

Compliance

Proponents need to be aware of the requirement for a vegetation clearance certificate during the exploration activities, as illustrated in TABLE 8.

TABLE 8 | Compliance requirement for activities associated with geological surveys and geochemical techniques during exploration

ACTIVITY	ACT	PERMIT	RELEVANT MINISTRY	LIVE LINK
Vegetation clearing	• The Forest Act, 2001 • Policy on Exploration and Mining in Protected Areas (2018)	Vegetation clearance permit	MET	**form 10 under the forestry regulations (page 33 of 62)

Leading practice standards

Pitting and trenching are typically more cost-effective in comparison to drilling or large-scale excavation. Although the environmental impacts of pitting and trenching are not as severe as those of an extensive drilling programme, leading practices should be applied, to reduce and mitigate environmental damage.

In accordance with global leading practices, the following should be ensured during pitting and trenching, to reduce environmental harm (Department of Primary Industries, 2008):

- Where possible, select sites in a manner that minimises earthworks
- Where possible, use existing tracks and roads
- Opt for human labour instead of equipment, where practical. If earthmoving equipment is used, use the minimum sized earthmoving equipment required to complete the task
- During backfilling, replace subsoil first and topsoil afterwards, with the organic matter on top

In accordance with global leading practices, the following should be ensured during pitting and trenching operations, to optimise the sampling and mapping process (Geology Hub , 2014):

- To ensure safety, both sides of the trench should be cut back to a depth of 50-100 cm, as this ensures that unconsolidated material does not fall into the trench
- Stack bedrock and any loose unconsolidated surface material on opposite sides of the trench. This enables easier sampling and bulk sampling from the bedrock heap

Tsumeb smelter - Dundee Precious Metals Tsumeb
Tsumeb
Oshikoto
Namibia
2019 © paulgodard.com

Orange river mines
Oranjemund
Karas
Namibia
2019 © paulgodard.com

- Avoid entering deep trenches 24 hours after excavation, as wall collapses typically occur within the first few hours after excavation
- Avoid entering trenches after heavy rains, as the chances of wall collapses are increased during this period—good practices entail waiting 24 hours before entering a trench after heavy rains
- If the trench is deep and longer than 50m, an access ramp should be provided at its midpoint.

Additional impacts can potentially occur when conducting geological methods. Leading practice standards have been outlined in TABLE 9, to ensure the least environmental damage in line with global best practices.

TABLE 9 | Leading practice standards for geological surveys

EXPLORATION ACTIVITY, POSSIBLE ASSOCIATED IMPACTS, AND LEADING PRACTICE STANDARDS	
Exploration Activity	Carrying out field surveys to obtain basic geological data and to map rock types, which sometimes involves subsurface sampling (pitting and trenching).
Possible Impacts	Loss of flora and fauna due to land clearing during subsurface sampling and construction of access tracks. Conflict with local community and land owners.
Leading Practice Standards	• Select sites that minimise earthworks • Use existing tracks or roads • Inform communities about the nature and scope of exploration activities prior to starting exploration • A month prior, write to the land owner detailing what activities will occur and when. This should include, but not be limited to » Map of exact area » Duration » Number of people » Security, etc. • Rehabilitate pits and trenches as soon as possible/practical.

WHAT COULD GO WRONG?

If the exploration activities are not fruitful, exploration companies go in search of new areas to be explored. Even relatively small excavations can trap small animals, and they should therefore be backfilled as soon as practically possible.

3.3 GEOCHEMICAL TECHNIQUES

Geochemical techniques refer to the chemical analysis of materials, which involves sampling and testing. Samples are collected from the exploration site and sent to a laboratory for analysis. Typically, there are a few types of samples of rocks used (New Pacific Metals Corp., 2018):

- Grab – grab samples are typically used to define further exploration work. These samples are simply pieces of rock collected from the exploration site at random, or at the highest level of visual mineralisation, and therefore the resulting concentrations should not be regarded as being representative of the overall potential of the exploration site
- Channel – the objective of a channel sample is to continuously sample the length of a rock formation. This is commonly achieved by using a chisel and rock saw to make several cuts into the chosen rock
- Chip – a rock sample made by continuously chipping an exposed rock to obtain a composite rock sample. Information about the grade and width of mineralisation can be obtained from a chip sample
- Stream sediment sampling
- Soil sampling

TABLE 10 | Leading practice standards for geochemical methods during exploration

EXPLORATION ACTIVITY, POSSIBLE ASSOCIATED IMPACTS, AND LEADING PRACTICE STANDARDS	
Exploration Activity	Collecting samples for further examination, testing and assaying.
Possible Impacts	• Disturbance of activity on privately owned land (farms) • Loss of flora and fauna due to land clearing • Migratory patterns of animals disrupted by human presence
Leading Practice Standards	• Follow standard procedure in terms of reaching an agreement with the farm owner as outlined in earlier section • Monitor environmental impacts from baseline study • Minimise earthworks as much as possible

WHAT COULD GO WRONG?

Sample collection during geochemical methods can lead to disputes with land owners if prior arrangements have not been made.

Scorpion Zinc Mine
Rosh Pinah
Karas
Namibia
2019 © paulgodard.com

Sample preparation for analysis is conducted at the lab. This involves drying and milling to create fine material, which is tested to determine the chemical elements contained in the sample, as well as the respective concentration of these elements. In Namibia, the chemical analysis of samples can be carried out by various laboratories.

LEADING PRACTICE STANDARDS

To ensure leading practice when using geochemical methods, leading practice standards have been formulated in accordance to global best practices, to minimise damage to the environment. This is illustrated in TABLE 10.

PART FOUR

LEADING PRACTICE STANDARDS FOR MEDIUM- AND HIGH-IMPACT MINERAL EXPLORATION

During medium- and high-impact exploration, there are more visible impacts in comparison to those caused by low-impact exploration. This is mainly because medium- / high-impact exploration often involves extensive close-spaced drilling over vast areas in search of mineral deposits. During the drilling operations, several activities are carried out, including but not limited to, the construction of access tracks / roads, sumps, drill pads and drill holes (Eggert, 2010). To carry out exploration activities, one must be in possession of the necessary licence(s) and permit(s) governing exploration activities. Special considerations should be made with respect to the validity of such licences.

4.1 CONSTRUCTION OF ACCESS ROADS AND TRACKS

Introduction

Properly constructed and carefully sited access roads and tracks will remain visible and environmentally acceptable. Well-planned access roads and tracks cost less than the ones that are badly placed and require frequent maintenance (Mansfeld, 2006). When planning access roads and tracks, the maintenance, rehabilitation, and flora, fauna and heritage surveys, must be considered along with the cost evaluations (NSW Mineral Council Ltd., 2013). Suitably qualified personnel should be employed, to ensure that the best environmental and cost outcomes are achieved (Department of Primary Industries, 2008). In addition, the location of access roads and tracks is closely related to land ownership and tenure, which requires permission from land owners and neighbours.

Compliance

In addition to the compulsory Environmental Clearance Certificate, proponents need to be aware of the legal requirement for a vegetation clearance certificate implied by construction of access roads and tracks (See TABLE 11).

Leading practice standards

Global best practices can be benchmarked to mitigate impacts associated with the various activities carried out during the construction of access roads and tracks, to set the best standards for Namibia as shown in TABLE 12. Therefore, the following standards can assist in selecting best practices to work with and achieve set targets, whilst optimising Environmental Management Systems (EMS).

TABLE 11 | Compliance requirement for the construction of access roads and tracks

Activity	**CLEARING OF VEGETATION FOR CONSTRUCTION OF ACCESS ROADS AND TRACKS**
Act	• The Forest Act, No. 12 of 2001, and • Policy on Exploration and Mining in Protected Areas (2018)
Permits/licences	Forestry licence for harvesting, issued under (section 22, 23, 24, 27 and 33 / regulation 8 and 12)
Relevant ministry	MAWF
Live link	**Form 10 under the forestry regulations (page 33 of 62)

NB! Provision of false information during the permit application process, is subject to a fine of **N$ 12,000** or imprisonment.

Bannerman Resources
by Jessica Bezuidenhout

TABLE 12 | Leading practice standards for construction of access tracks and roads

EXPLORATION ACTIVITY, POSSIBLE ASSOCIATED IMPACTS, AND LEADING PRACTICE STANDARDS

Exploration Activity	Possible Impacts	Leading Practice Standards
Carrying out a Cost Benefit Analysis to determine the best access method	Cost benefit analysis help management take precautionary measures to minimise and manage the impacts of all exploration activities.	• Use of helicopters is cheaper and has minimal environmental impacts in the initial phases of exploration. • All-terrain vehicles (quad bikes) may be advantageous and convenient if narrow access tracks need to be accessed.
Planning	Lack of proper planning consequently leads to exorbitant costs incurred by the exploration company and for environmental remediation.	Once the planner has determined the standard of tracks to be constructed, estimated costs should include the following: • Flora, fauna and heritage survey costs • Allowance for proper drainage and cost of pipes and culverts • Maintenance and rehabilitation costs
Selection of location / siting	• Location of access roads and tracks may raise conflict • Loss of native flora and fauna • Disturbance of indigenous heritage and loss of irreplaceable artefacts	Consult relevant interested/affected stakeholders about local settings and the ideal locations for access roads and tracks. Exploration companies can assist in heritage protection through resource identification and by establishing site avoidance by: • Buffering when heritage resources are encountered • Avoid level tracks, as water will pool on the flat sections • If there is potential for items of heritage significance to occur, or if such items are found, consider relocating exploration activities
Removal of vegetation	• Water contamination • Loss of native flora • Erosion • Threaten existing protected, endemic, indigenous plant species (i.e. Acacia erioloba or Welwitschia mirabilis)	• If possible, human labour should be used. However, if not practical, then excavators are recommended for exploration earthworks • Removed topsoil and vegetation should be stored in a secure windrow alongside the track • If an additional cut is made, subsoil must be stored in a second separate windrow alongside the track • Do not needlessly remove vegetation from either side of the roadway
Construction of drainage system	• Steep sections of tracks are prone to severe erosion and generally incur high maintenance costs • Floods can occur in flat areas along the access roads and tracks	• Grips should be at an angle across the track to best intercept and direct the water into a drain • Grips function most effectively in combination with a table drain • Where excessive silt loads are anticipated, and water quality is an issue, large cross drains and culverts should be constructed in conjunction with a sediment trap

TABLE 12 | Leading practice standards for construction of access tracks and roads

EXPLORATION ACTIVITY, POSSIBLE ASSOCIATED IMPACTS, AND LEADING PRACTICE STANDARDS

Exploration Activity	Possible Impacts	Leading Practice Standards
Determine class of access roads and tracks	• Most exploration tracks will never be subject to heavy road use, and are highly unlikely to be of a higher grade • Environmental impacts are minimal because tracks are temporarily erected	The intended function and duration of use of an access track is used to determine the class of access track required. Low-use exploration tracks are typically constructed to the following standards: • 3-3.7m pavement width • No shoulder required • +15%, -15% desired maximum grade
Constructing new access roads and tracks	• Environmental disturbance • Loss of flora and fauna • Disturbance of migratory activities of wild animals in the area	• When developing a new track off an existing roadway, ensure the junction is discreet but is also safe (traffic management may be required) • Where possible, new roads and tracks should join (dogleg) existing roads and tracks • Learn to recognize and avoid rare or valued plant species
Use of public and other pre-existing roads	• Environmental disturbance is minimized • Increased traffic density	• Always use an existing road or track in preference to constructing a new one • Monitor the condition of the track before, during, and after use • Where the mining or exploration activity is in a protected area, operators of such vehicles should not derail from provided tracks • Do not accelerate the deterioration of the route by speeding • Driving speed should be kept at a speed limit that prevents dust generation
Use of tracks	• Disturbance to migratory activities of wildlife due to increased human and vehicular activities • Loss of biodiversity	• Carry a spade to unblock grips and culverts • Keeping water off the surface of tracks will reduce the expenditure required for maintenance • Regular maintenance work is advised, to prevent tracks failure • Choose a suitable vehicle to minimise both the expenses and environmental impact on the track • Drive in 4x4
Re-opening of old tracks	Reduced environmental impacts.	• Overhanging vegetation should be cut, not pushed out of the way • Logs across the track must be cut • Re-open old drainage and install additional drainage where necessary

TABLE 12 | Leading practice standards for construction of access tracks and roads

EXPLORATION ACTIVITY, POSSIBLE ASSOCIATED IMPACTS, AND LEADING PRACTICE STANDARDS

Exploration Activity	Possible Impacts	Leading Practice Standards
Rehabilitation of tracks	• Introduction of invasive plant species • Restoring the environment to its natural regime	Should ripping be required: • Rip along the contour, and the spacing of rip lines should be approximately equal to ripping depth • Do not rip when soil conditions are too wet to allow the soil to shatter • If ripping brings substantial amounts of rock to the surface, discontinue • Pull out culverts (pipes, logs, etc.) and re-establish natural drainage pathways • Replace stockpiled topsoil over the track (after ripping, if this was needed) to a depth of 0.3–0.4 meters • Tracks should be rehabilitated by seeding with species consistent with the surrounding vegetation, unless other requirements are specified either by land owner(s) or the MET • Tracks, roads and associated infrastructure required as part of the state track network, or by the private land owner, should be left in a serviceable condition • Tracks should be removed by dragging a used tyre behind a light off-road vehicle, thus smoothing tracks out in this manner

4.2 DRILLING

Introduction

Drilling is considered an invasive exploration method, and is an important part of exploration because it is used to obtain detailed information about rock types, mineral content, rock fabric, and the relationships between rock layers near to the surface and at depth – depending on the type of information required. The target of all drilling activities is reliant on the results obtained during the preceding phases of prospecting, namely the geological mapping, geophysical and / or geochemical methods (van de Giessen, 2017).

The duration, methodology and magnitude of the drilling program depend on the scale of the project, and is often influenced by economic factors such as commodity price, financing support, and competitive advantages, etc. The impact of a drilling program is closely associated with its duration, methodology and magnitude.

Compliance

With regards to the drilling of boreholes, the Minerals (Prospecting and Mining) Act, No. 33 of 1992 stipulates in part 8 section 53, that no boreholes are to be drilled relating to any prospecting operations or mining operations, unless the licence holder has given written notice to the Mining Commissioner, indicating the intention to drill on the prescribed form. In addition to the compulsory Environmental Clearance Certificate, prospective mineral explorers should be supportive, and acquaint themselves with the provisional standards, regulations, permits and/or licences pertaining to all drilling activities (shown in TABLE 13) and should ensure that all legal requirements are in place before commencing with drilling.

Leading practice standards

The following best practices will ensure that the drilling activities are within legal requirements, and in doing so, will protect the environment and achieve environmental sustainability. The practices summarised in TABLE 14 are aimed at reducing, eliminating and minimising impacts from drilling operations.

NB! PERMIT
Don't forget to apply for the renewal of an abstraction and water use permit, 3 months prior to the expiry date.

TABLE 13 | Compliance requirements for drilling

ACTIVITY	ACT	PERMITS/LICENCES	RELEVANT MINISTRY / Live link
Removal of mineral samples	The Minerals (Prospecting and Mining) Act , No. 33 of 1992.	Application for permission to remove controlled minerals or the sale or disposal of any minerals; required in terms of Section 16(4), 31(4)(b), 67(4) or 90(3) of the Act; • A high-value mineral permit • An export permit	MME **Visit the MME website and obtain the necessary documents
Exporting of mineral samples	Minerals (Prospecting and Mining) Act, No. 33 of 1992.	• Application for Permission to export minerals • Required in terms of Section 127 of the Act	MME **Visit the MME website and obtain the necessary documents
Drilling of water supply boreholes	Water Act 1956.	Permit for borehole.	MAWF Form WA-001
Water abstraction	The Water Act No. 54 of 1956 (enforced). Water Resources Management Act 11 of 2013.	Permit/licence to utilise a control water resource.	MAWF WA-002
Wastewater discharge	Permit is issued under the Water Act No. 54 of 1956 (enforced) but the forms of the Water Act No. 24 of 2004 are used.	Wastewater discharge licence issued in terms of the Water Act of 1956.	MAWF DWA_EFFPER
Clearing of vegetation for drilling	The Forest Act, 2001. Policy on Exploration and Mining in Protected Areas (2018).	Forestry licence for harvesting, issued under (section 22, 23, 24, 27 and 33 / regulation 8 and 12)	MET **Form 10 under the forestry regulations (page 33 of 62)
Radioactive substances	Atomic Energy Radiation Protection Act No. 5 of 2005. Radiation Protection and Waste Disposal Regulations (No. 221 of 2011).	Import into, or export from Namibia, or transport, storage, possession or disposal of any radiation source or nuclear material need to be registered, authorized, and subsequent licenced by the NRPA Operation licence required for a business with uranium-bearing ore exceeding a grade threshold of 80 ppm Any generator of radioactive waste needs to be licenced, and radioactive waste needs to be managed in consultation with the NRPA and in accordance with Regulation 58 – 74	Ministry of Health and Social Services; National Radiation Protection Authority (NRPA) Form NRPA_AG

TABLE 14 | Leading practice standards for drilling

EXPLORATION ACTIVITY, POSSIBLE ASSOCIATED IMPACTS, AND LEADING PRACTICE STANDARDS

Exploration Activity	Possible Impacts	Leading Practice Standards
Supplying water to the sites	• If sourcing water from a shared resource, other water users can be impacted • Resource depletion (in the case of borehole)	• Monitor abstraction and comply with the permit/licence conditions • To reduce dust emissions, make use of spray nozzles to apply water to the ground
Installing and use of water and fuel pumps	• Groundwater and soil contamination • Barriers to wildlife movement	• Water pumps must be placed on oil-absorbent material and regularly checked for hydrocarbon leaks because of their proximity to water courses • Pump water away from watercourses and allow it to drain through vegetation, where possible • Fuel pumps, pouring spouts and funnels must always be used • Fuel tanks must be sealed and secured and meet the engine manufacturers' specification
Installation of drainage systems	Risk of cave ins and flooding.	• Proper placements and installation of drill pads to aid drainage • Where appropriate, facilities such as cut-off drains, and silt traps are installed
Use of sumps	• Possible spillage of drill fluids • Can lead to sink holes if not properly constructed • Can cause soil compaction	• Drill pads should be designed with the sump on the downhill side • Drainage systems should be dug to direct any accidental spills into the sump • Sumps must always have oil-absorbent booms floating in them • Excess water from the supply pump should be redirect away from the sump • Sumps to be backfilled and separately stockpiled topsoil to be re-spread on top • If it is not possible to produce a sump, drill hole return water must pass through an oil-absorbent boom and pumped away, and allowed to sieve through vegetation
Setting up of equipment	Soil contamination.	• Equipment must be in good condition to ensure that oil and hydraulic leaks do not contaminate the site • During drilling, oil-absorbent matting should be placed under and around the rig • Store hydraulic fluids and oils in a fire-safe bund that does not fill up with rainwater • Keep vehicles, water tanks, and core samples, etc. in demarcated working area

TABLE 14 | Leading practice standards for drilling

EXPLORATION ACTIVITY, POSSIBLE ASSOCIATED IMPACTS, AND LEADING PRACTICE STANDARDS

Exploration Activity	Possible Impacts	Leading Practice Standards
Storage of fuels	• Leakage into groundwater • Soil contamination • Fuel spills	• All drums and other containers should be in a sound condition • No hydrocarbons should be stored on drill sites but in approved designated areas in appropriately bunded facilities • Fuels and oil stored on site must be contained in a bund wall, away from any watercourses, which is fireproof and does not fill up with rainwater • A supply of oil-absorbent material should be kept on hand to clean up any minor spills
Accidental spills	• Hydrocarbon spills/drilling fluids/drill water – contamination of soil, surface and ground water • Fauna entrapment and death down drill holes	• Where, and whenever possible, biodegradable drilling fluids such as geo-foam or similar must be used • The drill rig and accompanying vehicles must be free of leaks • During drilling operations, dust control measures must be implemented (e.g. suppression with water) to minimise impacts on exploration personnel and the surrounding vegetation • Have emergency cleaning equipment in place • Absorbent mats are practical for managing spillages from refuelling or leaks, (available products on the market include: Sunsorb, Peatsorb, Drizit, etc.) • Oil-absorbent booms must be replaced at regular intervals • In the event of a hydrocarbon spill of greater than 200L, the Minister of the MME must be informed
Abandonment of drill holes	• Compacting of soils • Waste generation • Drilling fluids and additive containers	• Waste, such as drilling fluid, additive containers, rags, or refuse of any kind, is not to be disposed of on site • Backfilled, and mounded with soil. Uncollared holes to be plugged at least 1m below ground level • Drill spoils returned to drill holes and remaining inert material should be re-spread on the drill site or placed in the bottom of the sump • Rehabilitation of the drill holes should be conducted after completion of downhole geophysics and chemical assays returned, no longer than 6 months after drill hole completion • Unrecoverable radiation sources may only be sealed down the drill holes with the permission of the Mining or Environmental Commissioner • Accurate records of abandonment procedures should be kept, for future reference

TABLE 14 | Leading practice standards for drilling

EXPLORATION ACTIVITY, POSSIBLE ASSOCIATED IMPACTS, AND LEADING PRACTICE STANDARDS

Exploration Activity	Possible Impacts	Leading Practice Standards
Radioactive substances	• Long term impacts of radioactive waste disposal (including through airborne and water pathways) • Long term public exposure risks	• Prepare in consultation with the NRPA radiation safety rules and within a practice or for the use, handling, storage, transportation, or disposal of radiation sources or nuclear material produced or prepared by the licence holder • Import into, or export from Namibia, or transport, storage, possession or disposal of any radiation source or nuclear material need to be registered, authorized, and subsequent licenced by the NRPA • Operation licence required for a business with uranium-bearing ore exceeding a grade threshold of 80 ppm • Any generator of radioactive waste needs to be licenced, and radioactive waste needs to be managed in consultation with the NRPA and in accordance with Regulation 58 – 74
Rehabilitation	• Attainability of land to its original topography • Introduction of alien invasive species • Erosion due to improper rehabilitation	• For areas supporting native vegetation, tillage and seeding with species native to the area may be required during rehabilitation • Only indigenous plant species must be used during the revegetation of disturbed areas—a plant specialist must be consulted for this purpose • Any excess or waste material or chemicals, including drilling muds, must be removed from the site and must preferably be recycled (e.g. oil and other hydrocarbon waste products) • Waste materials or chemicals that cannot be recycled must be disposed of at a suitably licenced waste facility • Restoration and rehabilitation of disturbed areas must be implemented as soon as prospecting activities are completed • Sites must be restored to the original condition, with vegetation cover (where applicable) matching the surrounding vegetation cover • All debris and contaminated soils must be removed and suitably disposed of • Natural drainage patterns must be restored and surface infrastructure on site must be removed • Temporary access routes/roads must be suitably rehabilitated • Sites must be monitored by the environmental control officer

WHAT COULD GO WRONG?

Impacts due to drilling activities can be indirect and unintentional. If precautions are not undertaken, the activities can lead to subsequent detrimental impacts on the environment, including;

- Waste generated left onsite
- Soil erosion due to improper/inadequate rehabilitation actions
- Sink holes are left behind

Tsumeb smelter - Dundee Precious Metals Tsumeb
Tsumeb
Oshikoto
Namibia
2019 © paulgodard.com

4.3 TRENCHING

Introduction

In areas where soil cover is thin, the location and testing of bedrock mineralisation is made relatively straightforward by the examination and sampling of outcrops. However, in locations of thick soil cover, such testing may involve a deep sampling program by pitting, trenching, or drilling (Marjoribanks, 1997). Pits and trenches can be a quick and cheap way of obtaining lithological, structural and assay information in areas of shallow cover (Department of Primary Industries, 2008; Bain, 2016). Pitting to depths of up to 30 m is feasible and, with trenching, forms the simplest and least expensive method of deep sampling, but is much costlier below the water table. Despite their relatively shallow depth, pits and trenches have some distinct advantages over drilling, in that detailed geological logging can be carried out and, if necessary, undisturbed samples could be collected. Trenches are usually employed to expose steep dipping bedrock buried below shallow overburden and are normally dug across the strike of the rocks or mineral zone being tested (Marjoribanks, 1997). Pitting and trenching may involve land clearance to some extent, thus impacting on biodiversity. Access tracks are needed, and heavy equipment is sometimes brought in. Usually bulk samples are taken, which leaves visual impacts and causes traps for animals.

Compliance

In addition to the compulsory Environmental Clearance Certificate, proponents need to be aware of the legal requirement for a vegetation clearance certificate implied by trenching, as illustrated in TABLE 15.

TABLE 15 | Compliance requirements for trenching

Activity	REMOVAL OF VEGETATION DURING EXCAVATION OF TRENCHES AND CLEARING FOR EQUIPMENT
Act	The Forest Act, 2001 Policy on Exploration and Mining in Protected Areas (2018)
Permits/licences	Forestry licence for harvesting, issued under (section 22, 23, 24, 27 and 33 / regulation 8 and 12)
Relevant ministry	MET
Live link	**Form 10 under the forestry regulations (page 33 of 62)

Leading practice standards

The best practice standards for exploration activities will not only attract investment that delivers outcomes of sustainable development and prosperity, but also helps the holder of such licence to develop a long-term relationship with all stakeholders. In addition, applying the best practices provides opportunities to minimise future costs, because the costs for rehabilitation will be less. Best practice standards to consider during trenching activities are summarised in TABLE 16.

TABLE 16 | Leading practice standards for trenching

EXPLORATION ACTIVITY, POSSIBLE ASSOCIATED IMPACTS, AND LEADING PRACTICE STANDARDS

Exploration Activity	Possible Impacts	Leading Practice Standards
Planning	• Trenching and bulk sampling operations are inherently hazardous activities and should be carefully planned to minimise damage to the environment • Environmental impacts are minimised with advanced proper planning that facilitates effective rehabilitation on the disturbed areas	• Planning should precede the trenching activities • Site selection should be based on the reflection of environmental, cultural, heritage, and occupational health and safety aspects • Supervised by a suitably trained and experienced person (e.g. environment health and safety officer)
Selection of location	• Environmental disturbance	• Where possible, select leveled sites to minimise earthworks • Sites should be located adjacent to existing tracks and within previously cleared or disturbed areas where possible • Work sites should be selected to avoid waterways, drains and channels • Drill pads, trenches and bulk sample excavations should be confined to the smallest area in which it is safe and feasible to conduct operations
Construction of trenches	• Erosion can occur on the steeper slopes • Damage to vegetation through excavation or clearing for equipment access and mixing of topsoil with subsoils • Dust generation	• Avoid unnecessary removal of vegetation • Where temporary trenches are left open for longer than 24 hours and the safety of humans is at risk, temporary fencing and barricades should be erected • Dust control measures onsite may include: • Vehicular movements and speed limits should be minimised • Utilising recycled or reclaimed water to spray unsealed tracks/roads and disturbed areas
Rehabilitation	• Introduction of alien invasive species • Erosion due to improper rehabilitation	• Rehabilitation entails the revegetating of bare areas with species consistent with surrounding vegetation • Trenches should be refilled in such a way that subsoil is replaced first, and topsoil replaced last

4.4 DECOMMISSIONING

Introduction

Decommissioning is strengthened by a decommissioning plan which, inter alia, covers safety, health, environmental and contingency aspects. To achieve environmental sustainability, it is best practice to ensure the removal of all platforms including the removal of camps, concrete plinths, backfilling, drill casing and waste materials generated during exploration activities; and disposal thereof in an environmentally responsible manner. In events where there is hazardous waste, the licensee should have a facility which is fully equipped and licenced to receive such hazardous materials (Risk-Based Solutions (RBS), 2018). If the site is properly constructed and operated during the exploration phase, the tasks of decommissioning and rehabilitation should not be too difficult and costly. Therefore, best practices and technologies for determining impacts on the environment should be employed (Tarr, 2014).

Compliance

The state administers and manages the mining sector through several legislative frameworks, which relate to mineral exploration, mining activities and environmental protection. The same frameworks govern, enforce and foster the engagement of all stakeholders and account for all exploration activities, including decommissioning. TABLE 17, shows a summary of the compliance requirements during the decommissioning phase.

Leading practice standards

To minimise the risk of safety and environmental incidents, it is vital to ensure that sites are properly closed and all surface infrastructure on site are removed after the cessation of activities. Temporary access roads and tracks need to be suitably rehabilitated, and sites have to be monitored by an environmental officer (based on specialist inputs if necessary) until the desired rehabilitation objectives have been achieved (State Government of Victoria, 2018). The best practice standards are illustrated in TABLE 18.

TABLE 17 | Compliance requirements for decommissioning

ACTIVITY	ACT	PERMITS/LICENCES	RELEVANT MINISTRY / Live link
Wastewater discharge	Permit is issued under the Water Act of 1956 (enforced), but the forms of the Water Act of 2004 are used	Wastewater discharge licence issued in terms of the Water Act of 1956	MAWF DWA_EFFPER
Disposal of hazardous waste	Hazardous Substance Ordinance 14 of 1974 as amended	No permit required for the disposal of hazardous waste at a certified hazardous waste site in Namibia	MET
Radioactive substances	Atomic Energy Radiation Protection Act No. 5 of 2005. Radiation Protection and Waste Disposal Regulations (No. 221 of 2011).	Import into, or export from Namibia, or transport, storage, possession or disposal of any radiation source or nuclear material need to be authorized, and subsequent licenced by the NRPA Operation licence required for a business with uranium-bearing ore exceeding a grade threshold of 80 ppm Any generator of radioactive waste needs to be licenced, and radioactive waste needs to be managed in consultation with the NRPA and in accordance with Regulation 58 – 74	

TABLE 18 | Leading practice standards for decommissioning

EXPLORATION ACTIVITY, POSSIBLE ASSOCIATED IMPACTS, AND LEADING PRACTICE STANDARDS

Exploration Activity	Possible Impacts	Leading Practice Standards
Closing of sumps	• Drill fluids seepage into ground • Groundwater contamination	• Sumps to be backfilled and covered with separately stockpiled top soil, re-spread on top • Excavations for sumps shall be refilled with the subsoil first and the topsoil last • Where portable sumps are unfeasible, drilling muds and fluids should be contained in appropriately sized and lined sumps or tanks for re-circulation and/or disposal at appropriate waste management facilities • Above-ground tanks are preferred over excavated sumps • At the completion of drilling, the sump shall be drained, and the liner removed • Inspection of sumps should be conducted at the end of the wet season or within six months, to monitor site stability
Closing of drill holes	• Drill cuttings • Surface and groundwater contamination • Loss of fauna and flora	• Effective relocation of drill cuttings • Remove pegs, cut collars and plug holes with plastic cones 300mm below ground level • Holes should not only be filled with sand alone, as the wind will scour the sand out and re-establish the hole
Waste management	• Environmental pollution	• Hazardous waste near the structures should be mapped thoroughly to plan for careful removal and disposal • Any excess or waste material or chemicals, including drilling muds etc. must be removed from the site and must preferably be recycled (e.g. oil and other hydrocarbon waste products)
Rehabilitation	• Introduction of alien invasive species • Erosion due to improper rehabilitation	• Rehabilitation entails the revegetating of bare areas with species consistent with surrounding vegetation • Trenches should be refilled in such a way that subsoil is replaced first, and topsoil replaced last

TABLE 18 | Leading practice standards for decommissioning

EXPLORATION ACTIVITY, POSSIBLE ASSOCIATED IMPACTS, AND LEADING PRACTICE STANDARDS

Exploration Activity	Possible Impacts	Leading Practice Standards
Radioactive waste	• Long term impacts of radioactive waste disposal (including through airborne and water pathways) • Long term public exposure risks	• Any generator of radioactive waste needs to be licenced, and radioactive waste needs to be managed in consultation with the NRPA and in accordance with Regulation 58 – 74 • In consultation with the NRPA radiation safety rules and within a practice or for the use, handling, storage, transportation, or disposal of radiation sources or nuclear material produced or prepared by the licence holder need to be prepared.
Revegetation surface or seeding	• Introduction of alien invasive plants • Erosion due to improper rehabilitation	• Only indigenous plant species must be used during the revegetation of disturbed areas—a plant specialist must be consulted for this purpose • Natural drainage patterns must be restored
Rehabilitation	• Environmental (habitat) restoration	• To restore the natural functioning of the environment requires a good ecological understanding • Understand the nature of the damage done • Start rehabilitation during the exploration phase • It is a best practice to assess rehabilitation work • If the approach employed does not appear to be working, amending of the methodologies may be required • Record photographs for comparison for the ''before impacts'' photographs • If operations are in a protected area, conservancy or private land, the warden or land owners should be informed, to assess the rehabilitation efforts

WHAT COULD GO WRONG?

If the best practices are not applied, the mining company may face liabilities for environmental impacts and greater environmental damage, including groundwater pollution, encroachment due to the introduction of alien invasive species (e.g. Prosopis spp. or feral cats), and loss of landscape ecological functioning.

PART FIVE
REPORTING GUIDELINES

Reporting during the exploration phase is mainly conducted to give the government an overview of exploration activities and to show compliance to approved programs. In Namibia, there is a need to streamline reporting requirements from both industry and government.

5.1 LOW IMPACT

Reporting is a key component of best practice, even if a company's impacts are low and even when reporting is voluntary. Amongst others, reporting reflects accountability and transparency, respect for stakeholders, and shows that a company is committed to environmental management and is serious about its reputation.

Reporting – from industry to government

The reporting requirements for low-impact exploration varies, depending on the exploration activities carried out. When using non-invasive methods such as remote sensing techniques, environmental impacts are less extensive, as compared to using exploration techniques that involve using subsurface sampling.

In accordance with global best practices, if airborne surveys are conducted, a written notice is required to be submitted to the Namibian Civil Aviation Authority prior to conducting the survey. For non-Namibian companies a Foreign Operators Permit (FOP) must be obtained to be submitted to the Namibia Transport Commission and Namibian Aviation Authority. The notice should contain, but not be limited to, the following information:

- Licence of aircraft
- Licence of pilot
- Map of area to be surveyed
- GPS co-ordinates of area to be surveyed
- Flight lines
- Aircraft number
- Duration and exact time of survey
- Flying altitude

Bannerman Resources
by Jessica Bezuidenhout

The requirements related to records, plans and maps by the holder of a reconnaissance licence are stated in section 66 of the Minerals (Prospecting and Mining) Act, No. 33 of 1992. Normally a reconnaissance licence is valid for six months. Descriptions should include, but not be limited to:

- Standard scale maps indicating flight lines and survey locations
- Specifications of the survey and instruments
  - Survey type, recorded parameters, line spacing and aircraft type
  - Ground clearance
  - Instrument design, type, units of measurement
  - Additional information including data on the nature of ground, conversion factors for any units used other than those in the S.I. system
  - Raw data along with calibration data
- Digital copy of raw and processed data
- Specifications and results from other remote sensing surveys
- Flight specifications of aerial photography
- Details of data processing techniques
- Results and interpretation of surveys including an interpretation of results

Public Consultation for aerial survey operations

Prior to undertaking aerial surveys, both directly and indirectly affected parties are required to be informed in writing of exploration activities. The contact details of these parties can be retrieved from the Ministry of Lands and Resettlement at the office of valuation and asset management.

International best practice dictates that a notice is to be placed in a local newspaper approximately 2 weeks prior to conducting aerial surveys, to adequately inform the community about intended exploration activities. The following information is to be included in the newspaper advert:

- Company name
- Survey dates, time and duration
- Purpose of the survey
- Flight altitude
- Survey location
- Map of survey area and flight lines
- Contact details for enquiries

5.2 MEDIUM TO HIGH IMPACTS

As per the Minerals (Prospecting and Mining) Act, No. 33 of 1992, reports from exploration companies with a medium to high impact, are required to be submitted to MET on a bi-annual basis and to MME an expenditure report on a quarterly basis and exploration results with the renewal application of the licence. Exploration programs conducted within a Mining Licence have to be reported on every two years. A detailed description of the records to be kept by the holder of an EPL is stated in section 76 of the Minerals (Prospecting and Mining) Act, No. 33 of 1992.

Reporting – from industry to government

In accordance with global best practice, the bi-annual environmental reports submitted to MET should include:

- General details of licence holder
- Exploration activities (drill holes, drill sites etc.)
- Changes to exploration activities and subsequent environmental hazards
- Compliance with national standards and approved programs
- Status of rehabilitation carried out during reporting period
- Rectification of non-compliance
- Water and wastewater management (groundwater quality, final effluent quality, management of tailings facilities, etc.), also to the Department of Water Affairs and Forestry
- Complaints
- Relevant maps
- Photographs (to prove monitoring and compliance with approved environmental outcome)

An example of a bi-annual report required by MET is illustrated in the appendix toolkit.

5.3 REPORTING FROM GOVERNMENT TO INDUSTRY

In the event that an exploration company submits its bi-annual report, there is an expectation to receive feedback from the authorities in a similar fashion. This feedback should entail a written notice from the MET, verifying that the bi-annual report has been received. The feedback expected by industry from government includes:

- Written verification that the bi-annual report has been received by the MET. This verification should be sent within 7 days of receiving the bi-annual report. An example of this notification is illustrated in the appendix toolkit.
- Feedback report, stating the level of satisfaction with the status of the project as reported in the bi-annual report. This feedback report is to be sent back to explorers 60 days after receiving the bi-annual report. An example of this is illustrated in the appendix toolkit.

PART SIX

TRANSITION FROM EXPLORATION TO MINING

Once sufficient data of the mineral resource has been collected and the results are promising, the project advances to the pre-feasibility and feasibility stages. In preparation for the application of a Mining Licence (ML) the proponent has to be aware of the following:

- The application is subject to an Environmental Clearance Certificate from MET
- The holder is obliged to keep all relevant records at an appropriate place in Namibia, and to submit detailed quarterly and annual reports on all relevant aspects of operations
- The holder has to keep detailed reports comprising proposed development plans, the mining program and estimated expenditure, and an environmental management plan is required and must accompany the licence application
- An amount of N$1000-00 is payable in respect of a mine earning gross annual revenue of up to N$10 million; and N$5000-00 in respect of a mine earning gross annual revenue in excess of N$10 million
- An ML is valid for the estimated Life of Mine or a period not exceeding 25 years

There is often an overlap between the last stages of exploration and the pre-feasibility stage. During the pre-feasibility stage, the objective is to determine whether a probable reserve is economically viable (International Council on Mining & Metals, 2012). From an environmental point of view, it is important to gain a biodiversity context of the project site during the pre-feasibility stage. The following commitments are important to undertake during this stage (International Council on Mining & Metals, 2012):

- Identify important areas for biodiversity and the status of protected species and protected areas
- Identify and assess potential impacts, considering the time frame for development
- Review possible mining options, processing options, waste products, site infrastructure needs, options for waste rock storage, options for tailings facilities and water demands. This should include the merits of each from technical, environmental, social and economic perspectives

6.1 KEY MANAGEMENT TASKS DURING THE PLANNING AND DESIGN PHASE

The objective during the planning and design phase is to propose a workable model in which minerals can be extracted and prepared to the desired specifications, as cost-effectively as possible and considering social, environmental and legal constraints. During the planning and design phase, professionals need to consider the expected life of the mine, and address potential mine closure issues, as well as considering the expectations of stakeholders for post-closure land use. So, for example, material characterisation is an important aspect during the mining life cycle and should commence as early as the exploration stage. Material characterisation allows for plans to be developed, in order to sidestep potential risks.

TO MOVE INTO THE PROJECTS AND CONSTRUCTION PHASE, THE FOLLOWING MUST BE IN PLACE:

- The pre-feasibility studies show economic potential
- The development of the resource is supported by stakeholders (investors, local community and the government)
- Financing for development and construction is available (bankable feasibility is in place)
- Commodity prices stance is optimistic
- EIA in place
- EMP in place

Once the required plans, documentation, design and legal paperwork are in place, the exploration company/mining company advances into the projects and construction phase.

REFERENCES

State Government of Victoria. (2018). *Exploration and rehabilitation of mineral exploration sites: Guidelines for Environmental Management in Exploration and Mining*. Retrieved June 4, 2018, from Earth Resources: http://earthresources.vic.gov.au/earth-resources-regulation/licensing-and-approvals/minerals/guidelines-and-codes-of-practice/exploration-and-rehabilitation-of-mineral-exploration-sites?SQ_DESIGN_NAME=mobile&SQ_ACTION=set_design_name

Bain, C. J. (2016). *Exploration Mining Management Plan*. Davenport Resources Limited. Melbourne: Davenport Resources Limited.

Department of Primary Industries. (2008). *Code of practice for mineral exploration*. Victoria, Melbourne, Australia: Victorian Government.

Department of Primary Industries. (2008). *Code of Practice for Mineral Exploration* . Victoria : Department of Primary Industries, Minerals and Petroleum Division.

Department of Resources, Energy and Tourism . (2011). *A Guide To Leading Practice Sustainable Development in Mining*. Canberra.

Department of State Development. (2015). *Mineral exploration reporting guidelines for South Australia*. Adelaide: Department of State Development.

Eggert, R. G. (2010). *Mineral Exploration and Development: Risk and Reward*. Phnom Penh, Cambodia: Colorado School of Mines. Retrieved June 12, 2018, from http://www.miningnorth.com/_rsc/site-content/library/education/Mineral_Exploration_&_Development_Roderick_Eggert_Eng.pdf

Geology Hub . (2014, February 9). *Pitting and trenching* . Retrieved from GEOLOGYHUB: http://geologyhub.blogspot.com/2014/02/pitting-and-trenching.html

International Council on Mining & Metals. (2012). *Good Practice Guidance for Mining and Biodiversity*.

Kay, A. (2018, January 1). *Introduction to Remote Sensing in Mineral Exploration*. Retrieved from Gold Investing News : https://investingnews.com/daily/resource-investing/precious-metals-investing/gold-investing/introduction-to-remote-sensing-and-mineral-exploration/

Mansfeld, C. (2006). *Environmental Impacts of Prospecting and Mining in Namibian National Parks: Implications for Legislative Compliance*. University of Stellenbosch, Department of Geography and Environmental Studies. South Africa: University of Stellenbosch.

Marjoribanks, R. W. (1997). *Pitting, Trenching and Stripping. In: Geological Methods in Mineral Exploration and Mining*. Springer, Dordrecht.

Markert, F. (2018, March 23). *Drone traveller*. Retrieved from Drone Laws in Namibia: https://drone-traveller.com/drone-laws-namibia/

Namibia Civil Aviation Authority. (2017). *Flight operations* (OPS) : RPAS/Drones. Retrieved from Namibia Civil Aviation Authority: http://www.dca.com.na/sos-fops-rpa.htm

New Pacific Metals Corp. (2018, March). *Types of Mineral Exploration* . Retrieved from New Pacific Metals Corp.: https://newpacificmetals.com/mining-101/types-of-mineral-exploration

NSW Mineral Council Ltd. (2013). *NSW Minerals Industry Exploration Handbook: Leading practice for NSW explorers*. Australia: NSW Mineral Council Ltd.

Risk- Based Solutions (RBS) . (2017). *Risk- Based Solutions (RBS) CC - Delivering the solutions*. Retrieved from Risk- Based Solutions (RBS) CC: https://www.rbs.com.na/minerals-exploration-gallery/

Risk-Based Solutions (RBS). (2018). *Draft Environmental Social Impact Assessment (ESIA) and Environmental Social Management Plan (ESMP)*. Walvis Basin, North-central Namibia: Tullow Namibia Limited. Retrieved June 08, 2018, from http://www.rbs.com.na/tullow-namibia-cormorant-1-Well-Draft-ESIA-and-ESMP-Report-24-March-2018.pdf

Tarr, D. (2014). *From exploration drilling to decommissioning : where does responsibility lie for regulating and monitoring offshore oil platforms in Liberian waters?* World Maritime University. Malmo, Sweden: World Maritime University. Retrieved June 12, 2018, from http://commons.wmu.se/all_dissertations/452

van de Giessen, S. (2017). *Scoping Report: Amendment to mining right and an amendment to mine works programme* . Enviromental Impact Management Services (Pty) Ltd. Randburg: Enviromental Impact Management Services (Pty) Ltd. Retrieved January 10, 2019, from https://www.sahra.org.za/sahris/sites/default/files/additionaldocs/Pembani%20SR_170131_Liam.pdf

Yukon Tourism and Culture . (2010). *Yukon Mineral Exploration Best Management Practices for Heritage Resources*. Yukon.

ISBN: 978-99916-967-6-8

TU
RI
PAM
WE

Communication Design for Sustainability
www.turipamwe.com

Bannerman Resources
by Jessica Bezuidenhout

Chamber of Mines
OF NAMIBIA

NCE
Namibian Chamber of Environment

Ministry of Mines & Energy
"promoting Namibia's mineral, geological and energy resources"

Republic of Namibia
Ministry of Environment & Tourism

A joint publication proudly produced by the Chamber of Mines (CoM), Namibian Chamber of Environment (NCE) , the Namibian Government and members of the Namibian mining industry.

ECC
ENVIRONMENTAL
COMPLIANCE CONSULTANCY

Authors of this publication
Contact details:
+264 81 669 7608
info@eccenvironmental.com
www.eccenvironmental.com