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**A COMPARATIVE ANALYSIS OF THE TREATMENT OF BIODIVERSITY
IMPACTS IN MINING ENVIRONMENTAL IMPACT ASSESSMENTS (EIAs)
BEFORE AND AFTER 2013: EXPERIENCES FROM THE MPUMALANGA
PROVINCE, SOUTH AFRICA**

By

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ABSTRACT

Environmental Impact Assessment (EIA) is one of the environmental management tools employed by the relevant authorities to achieve the principles of sustainable development. Biodiversity Impact Assessment (BIA) studies are undertaken as part of the EIA process to ensure that the proposed development considers the potential impacts on the biodiversity. Studies on the state of South Africa's biodiversity have revealed that biodiversity and ecosystems in the country are under serious threat; and mining is one of the major threats to the biodiversity. In 2013, the Mining and Biodiversity Guideline (DEA *et al.*, 2013) was published, with the aim of improving the integration of biodiversity into the mining industry. This research analyses the treatment of biodiversity impacts in mining EIAs before and after the publication of this guideline.

In order to achieve the aim of this research, a customised mining BIA report-review package was developed; and it was employed to review 46 mining BIA reports produced before and after 2013. Secondary data – by means of questionnaires were also employed to get an in-depth understanding of the treatment of biodiversity impacts in mining EIAs. The results of the study revealed that most BIAs failed to consider biodiversity issues properly in their assessments. For instance, the BIAs conducted before, and after 2013 received an overall satisfactory score of 43% and 57%, respectively.

Areas of weakness include project description, sensitivity mapping, stakeholder consultation, consideration of alternatives, as well as monitoring. Faithful representation of the biodiversity specialist input to the main mining EIA report showed an improvement after 2013, by receiving an overall satisfactory score of 78%, compared to the 52% received before 2013.

The results also revealed that the majority of the BIA reports complied with the minimum requirements for specialist studies stipulated by the National Environmental Management Act (Act No.107 Of 1998). The analysis of the questionnaires revealed several inadequacies and areas of weakness regarding the treatment of biodiversity impacts. These include poor consideration of indirect and cumulative impacts, failure to incorporate environmental thresholds, and the ecosystem approach – when assessing biodiversity impacts.

A series of recommendations for improving the treatment of biodiversity impacts in mining EIAs was subsequently formulated. The development and implementation of sensitivity mapping guidelines, capacity building for biodiversity specialists and Environmental Assessment Practitioners (EAPs), and the application of the mitigation hierarchy, among others, is proposed to improve the consideration of biodiversity impacts in mining EIAs.

Key words: Environmental Impact Assessment (EIA), Biodiversity Impact Assessment (BIA), BIA report, Treatment of biodiversity, Mining EIAs, Mining and Biodiversity Guideline.

DECLARATION

I, Pohlo Reanetsie, declare that the dissertation titled: **A comparative analysis of the treatment of biodiversity impacts in mining Environmental Impact Assessments (EIAs) before and after 2013: experiences from the Mpumalanga Province, South Africa**, is my own work and that it has not previously been submitted for assessment to another University or for another qualification. All sources that have been used are cited throughout the document and acknowledged by means of a list of references.

Signature.....

Date.....

R. Pohlo

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DEDICATION

To the memory of my late Father, Wilson Malungisa Pohlo.

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LIST OF ACRONYMS

AMD	Acid Mine Drainage
BIA	Biodiversity Impact Assessment
CEQ	Council on Environmental Quality
DEA	Department of Environmental Affairs
DEAT	Department of Environmental Affairs and Tourism
DWAF	Department of Water Affairs and Forestry
EAP	Environmental Assessment Practitioner
EC	European Commission
ECA	Environmental Conservation Act
EIA	Environmental Impact Assessment
GDACE	Gauteng Department of Agriculture, Conservation and Environment
GDARD	Gauteng Department of Agriculture and Rural Development
GIS	Geographical Information Systems
IAIAsa	International Association for Impact Assessment South Africa
ICMM	International Council on Mining and Metals
IFC	International Finance Corporation
IEM	Integrated Environmental Management
IUCN	International Union for Conservation of Nature and Natural Resources
KZN	KwaZulu Natal
MPRDA	Mining and Petroleum Development Act
MTPA	Mpumalanga Tourism Parks Agency

NEMA	National Environmental Management Act
NEMBA	National Environmental Management: Biodiversity Act
NEPA	National Environmental Policy Act
SAMBG	South African Mining and Biodiversity Guideline
SANBI	South African National Biodiversity Institute
WWF SA	World Wide Fund for Nature South Africa

CHAPTER 1: GENERAL INTRODUCTION

1.1. Background

The Environmental Impact Assessment (EIA) is a systematic process, which is capable of identifying both the potentially negative and positive impacts of the proposed project, including feasible alternatives, such as the socio-economic, cultural and biophysical factors (Aucamp, 2009; Glasson *et al.*, 2012). The field of Environmental Assessment emerged in the year 1969; and the National Environmental Policy Act (NEPA) of the United States of America was the primary catalyst for the establishment of EIA. EIA systems in many developed nations were established earlier (Glasson *et al.*, 2012); while the enactment of EIA legislation in a number of developing nations took place from the 1990s (Singh, 2007). For instance, the South African EIA system became mandatory only in the year 1997.

Specialist studies are usually conducted during the EIA process; and they are incorporated in the main EIA report. These studies may focus on the biodiversity, heritage, air quality and other fields. In order for EIA to improve its effectiveness, the involvement of specialists in EIA needs to be improved (Munster, 2005). In South Africa and internationally, guidelines have been published for the purpose of improving specialist studies in the EIA process. However, the quality of information provided in these studies tends to be highly questionable. For instance, the literature reveals a number of limitations in specialist studies, particularly in biodiversity specialist studies, as will be discussed in section 2.10.

South Africa is one of the countries with a rich biodiversity. The country has approximately 24 000 flora species, of which 10 000 are endemic; but approximately 2 000 of those are threatened (Driver *et al.*, 2005). There are a number of threats to South Africa's biodiversity. Climate change and land-use change are two of the major threats to the biodiversity. The latter tend to be very problematic in developing countries, such as South Africa – where there is a larger number of new developments aimed at improving the economy. It is, therefore, crucial that a rigorous EIA process should always be conducted, before any development with potential negative impacts on the biological diversity is approved.

South Africa is also rich in mineral resources; and minerals contribute significantly to South Africa's economy. Provinces, like Gauteng, the Free State, the Northern Cape, Mpumalanga and KwaZulu Natal make a major contribution in the South African mining industry.

However, mining also has adverse impacts on our precious biological diversity and ecosystems, as will be discussed in section 2.8.

The reviewed literature reveals that biodiversity impacts are poorly considered in most EIAs, as discussed in section 2.10. South Africa's biodiversity and ecosystems are under serious threat, due to a number of environmental problems. The mining industry is regarded as one of the major threats to South Africa's biodiversity (Fick, 2011; Kuntonen-van't Riet, 2007; SANBI, 2013). As a result, the Mining and Biodiversity Guideline (MBG) was published in 2013 by the Department of Environmental Affairs (DEA), the Department of Mineral Resources (DMR), as well as other organisations for the purpose of improving the integration of biodiversity in the mining industry (DEA *et al.*, 2013).

A number of academic studies, dealing with the treatment of biodiversity impacts in EIA, have tended to focus generally on the EIAs of various sectors. This research will focus on mining EIAs, in order to get more insight into the treatment of biodiversity impacts in mining projects. As outlined in the above section, mining is one of the major threats to biodiversity; and an attempt to combat this has been the development of guidelines. It is, therefore, important to evaluate the potential of these guidelines for improving the treatment of biodiversity impacts in mining EIAs.

1.2. Problem statement

During the EIA process, the information provided by the biodiversity specialist is incorporated into the EIA report. However, Kuntonen-Van't Riet (2007) pointed out that the biodiversity information that is incorporated in most EIAs tends to be very general, too vague; and as a result, it cannot be incorporated into a regional and national biodiversity framework. The strategic review of the status of biodiversity management in the South African mining industry also highlighted that the information in the Biodiversity Impact Assessment (BIA) reports is often not properly prepared by the biodiversity specialists (Kuntonen-Van't Riet, 2007). This then makes the quality of biodiversity assessments in the EIA process highly questionable.

South Africa is regarded as the third country in the world with the richest biodiversity (Driver *et al.*, 2003; Fick, 2011; SANBI, 2013). However, South Africa's biodiversity and ecosystems are under serious threat, due to a number of environmental problems. The mining industry is regarded as one of the major threats to South Africa's biodiversity (Fick, 2011;

Kuntonen-Van`t Riet, 2007; SANBI; 2013). For instance, SANBI (2013) emphasised that if many provinces in South Africa keep on losing the natural landscape at the current rate through mining and other developments, the provinces will not have any natural habitat left outside the protected areas by 2050.

In South Africa, a number of mining projects have been approved since the enactment of the EIA legislation; and many of these have the potential to affect the biodiversity. The Department of Mineral Resources (DMR) has processed thousands of mining applications through the Mineral and Petroleum-Resources Development Act (MPRDA) 28 of 2002. Most of the EIA reports for these projects have not been reviewed for academic purposes; as these have a potentially negative impact on the biodiversity. For instance, the recent approval of the controversial sand-mining project on the coast of Bizana in Xholobeni; this is a very rich biodiversity area in the Maputaland-Pondoland biodiversity hotspot. Furthermore, a study conducted in this biodiversity hotspot by Swanepoel *et al.* (2019) highlighted a number of inadequacies in BIA, including poor Public Participation Process, prediction and assessment of impacts and monitoring programmes.

A study conducted by the World-Wide Fund for Nature –South Africa (WWF SA) revealed that there are still further mining and prospecting applications within sensitive areas in South Africa, such as those in the grassland biome (WWF SA, 2014). This, therefore, creates a need to analyse how biodiversity should be handled in the mining EIAs in South Africa. This study will also reveal how the BIA reports conform to the South African legislation and the international EIA best practices.

In May 2013, mining and biodiversity guidelines (DEA *et al.*, 2013) were published, with the aim of improving the integration of biodiversity impacts in the mining industry, and particularly in mining EIAs. It is the principal aim of this research to analyse the treatment of biodiversity impacts before and after the guidelines have been published, in order to determine the potential of these guidelines to promote biodiversity-inclusive mining EIAs in South Africa.

1.3. Aim and objectives of the study

1.3.1. Aim

The principal aim of this research was to analyse the treatment of biodiversity impacts in mining Environmental Impact Assessments (EIAs) before and after 2013 in Mpumalanga Province, South Africa.

1.3.2. Objectives

In order to achieve the aim of this research, the following objectives are defined:

- To develop a customised review package to evaluate the treatment of biodiversity impacts in mining BIA reports, based on a thorough review of the literature and the legislation.
- To review the treatment of biodiversity in mining BIA reports by using a customised review package.
- To determine whether the BIAs conducted for mining projects comply with the legislative requirements, the relevant guidelines and the best practice standards.
- To note how the treatment of biodiversity projects compare with one another – before and after the publication of the Mining and Biodiversity Guideline.
- To assess the extent to which the Mining and Biodiversity Guideline has improved, in the treatment of biodiversity in mining EIAs.
- To highlight the strengths and weaknesses of BIAs for mining projects.
- To formulate some recommendations, based on the research findings, in order to improve the treatment of biodiversity impacts in mining EIAs.

1.4. Significance of the research

EIA as an instrument for sustainable development; and it has the potential to ensure that all the proposed mining projects do not cause severe impacts on biodiversity. Biodiversity Impact Assessments, as one of the aspects of EIA, can therefore play a significant role in ensuring that all the potential impacts of the proposed mining projects on the biodiversity are adequately assessed and incorporated in the EIA reports. By analysing the treatment of biodiversity impacts in mining EIAs; since this would provide valuable insights into the

current treatment of biodiversity impacts in mining EIAs and how they compare with those EIAs that were conducted before the publication of the Mining and Biodiversity Guidelines.

It is crucial to evaluate whether this guideline has achieved its goal, which is to improve the integration of biodiversity in the mining sector. This research will highlight the main strengths and weaknesses of Biodiversity Assessments for mining projects in South Africa and how they compare with international trends regarding the treatment of biodiversity in EIAs. Recommendations on how the current treatment of biodiversity impacts can be improved will also be provided in this research.

There has currently been limited research in the field of Biodiversity Impact Assessment in South Africa; and this research is also aimed at filling this gap. Mining projects have adverse impacts on the biodiversity and the associated ecosystem services; if they are not planned properly. It is, therefore, crucial to evaluate how biodiversity is treated in these projects, in order to provide some suggestions, based on the research outputs, and in order to promote biodiversity conservation in the mining sector.

1.5. The methodological approach used in this research

In order to achieve the objectives of this research, a mining BIA report-review package was developed; and it was used to review the treatment of biodiversity impacts in 46 mining BIA reports. The mining BIA reports were obtained from the Mpumalanga Tourism Parks Agency (MTPA). These included 23 mining BIAs conducted before 2013 and another 23 BIAs conducted after 2013, in order to allow a comparative analysis. These mining BIA reports were further assessed in terms of their compliance with the South African EIA regulations. Finally, the faithful representation of the biodiversity specialist input in the main mining EIA report was assessed.

The study also employed primary data-collection techniques by way of questionnaires, in order to obtain more insights on the treatment of biodiversity issues in mining EIAs from biodiversity stakeholders.

1.6. Chapter outline

In order to facilitate the interpretation and comprehension of results, this dissertation comprises five chapters, as outlined below.

Chapter 1 provides a general introduction to the study by highlighting the context and the rationale of this study. This includes the problem statement, the aims and objectives, and the significance of this research.

Chapter 2 provides a review of the literature relevant to the study. This includes the examination of studies that have contributed to the methodological approach of this study. An overview of mining impacts on biodiversity, as well as the guidelines for incorporating biodiversity in EIAs is provided.

Chapter 3 describes the research design and the methodology employed in this study. Primary data collection in the form of questionnaires was employed; and the secondary data-collection technique by means of mining BIA report review was used in this research.

Chapter 4 discusses the findings of this research in some detail. This includes the results of both the mining BIA reports reviewed and the questionnaires.

Chapter 5 provides the main conclusions regarding the treatment of biodiversity impacts in mining EIAs before and after 2013 in the Mpumalanga Province. This includes the strengths and the weaknesses, as well as the recommendations to improve the treatment of biodiversity impacts in mining EIAs.

CHAPTER 2: THE LITERATURE REVIEW

2.1. Introduction

This chapter reviews the literature on the treatment of biodiversity impacts in EIA. As pointed out by May (2001), the literature review presents what other authors have observed or identified on the subject in hand, as well as any gaps in the knowledge. This chapter begins with a brief overview of the purpose of EIA, the role of EIA in sustainable development, the development of EIA, EIA in South Africa, as well as in the mining sector. The review then examines the value of biodiversity, the impacts of mining on biodiversity, and how biodiversity stakeholders should be engaged in the EIA process. The guidelines that promote the integration of biodiversity in the EIA process, including those for mining projects (DEA, 2013; GDACE, 2008; ICMM, 2006; IFC, 2012) are examined. The last part of the chapter reviews the treatment of biodiversity in EIAs, as well as the methods used to analyse the treatment of biodiversity in EIA.

2.2. The purpose of EIA

EIA plays a crucial role in proposed projects, by taking into account the potential positive and negative impacts of the proposed project on the environment. The alternatives to the proposed project, such as the alternative site and the no-go alternative are assessed; mitigation and monitoring measures are also formulated, in order to ensure that the project meets the needs of the current generation – without compromising the future generation to meet theirs. The main purpose of EIA includes its role in decision-making, design and planning, consultation and participation, as well as in sustainable development (Carroll and Turpin, 2009; Glasson *et al.*, 2012). The following sections briefly describe the purpose of EIA.

2.2.1. An aid to decision-making

Environmental Impact Assessment is regarded as an aid to decision-making; since it provides the necessary information regarding the consequences of the proposed development, including alternative ways of dealing with potentially negative impacts, before any action can be taken, or any decision can be made. EIA reports are prepared by the Environmental Assessment Practitioners (EAPs); and they are used by decision-makers, in order to make informed decisions about the proposed developments (Glasson *et al.*, 2012). Therefore, EIA assists the Competent Authority to make an informed decision (DEAT, 2000).

2.2.2. Design and planning

The use of EIA in the designing and planning of developments ensures that developments with the least impacts on the environment are achieved (Carroll and Turpin, 2009). EIA plays a significant role, by providing an important framework for selecting proper development locations, designs and the associated effects linked to the development thereof (Glasson *et al.*, 2012). EIA is also able to identify severe impacts of a proposed development, and to introduce ways on how negative impacts can be mitigated, or eliminated; and it enhances potentially positive impacts of the proposed activity.

2.2.3. To preserve the quality of life

A proposed project might have both negative and positive outcomes on the socio-economic and environmental setting. Understanding these factors before the project commences would therefore ensure that it takes place without affecting the environment negatively. EIA plays an important role in preserving the quality of life, by ensuring that the impacts of the proposed projects and alternatives are taken into account (Weston, 2004).

2.2.4. Consultation and participation

Consultation and participation in the EIA process is very crucial. In many countries, government policies emphasise the importance of including the affected and interested parties (Glasson *et al.*, 2012; Carroll and Turpin, 2009). EIA ensures that both the affected and the interested parties are aware of the negative and positive potential impacts that a proposed development might have on their environment. The public is also given a mandate to appeal should they not agree with the outcome of an EIA.

2.2.5. A tool for sustainable development

EIA is regarded as an instrument for achieving sustainable development. This is mainly because the main objective of the EIA is to ensure that the proposed development takes place without costing the earth (Glasson *et al.*, 2012). EIA mitigates the harmful impacts in advance; and in certain instances, it avoids those developments with potentially severe impacts on the environment. This is further discussed in section 2.3.

2.3. EIA and sustainable development

EIA is normally regarded as an instrument for sustainable development. Principle 17 of the 1992 Rio Declaration on the Environment and Development stresses the importance of EIA adoption, as a sustainable developmental instrument (Gilpin, 1995; Zeremariam, 2003). Most people tend to assume that EIA only focuses on legal compliance. But, this is not always the case, because EIA also ensures that the approved activities will be implemented, based on the principles of sustainable development (Hendriques *et al.*, 2008).

The National Environmental Management Act (NEMA) (Act No.108 of 1998) defines sustainable development as “the integration of social, economic, and environmental factors into planning, implementation, and decision-making, so as to ensure that development serves the present and future generations” (South Africa, 1998: 10). From this definition, it is clear that the effectiveness of EIA has a direct effect on sustainable development. If EIA does not meet its objectives, this would mean that the needs of the future generations are being undermined.

For example, over-exploitation of certain resources would only favour the present generation. It is therefore of critical importance that EIA should incorporate the principles of sustainability, in order for it to meet one of its purposes as a tool for sustainable development (Glasson *et al.*, 2012). Section 24 of the South African Constitution, Act No. 108 of 1996 also recognizes the need to “secure ecologically sustainable development and the use of natural resources, while promoting justifiable economic and social development” (South Africa, 1996: 25).

In order for the development to be sustainable, the interested and affected parties need to be part of the development in the early stages of the development cycle. For instance, McEwan (2003) pointed out that if the key stakeholders are not part of the development, especially in the decision-making process, it is probable that the project would fail to meet its objectives. EIA is normally regarded as a tool for sustainable development; although to its capabilities to provide crucial information on project consequences, tend to be highly questionable.

The EIA process needs to incorporate the socio-economic and environmental issues associated with the proposed project, as shown in Figure 2.1. In the Figure below, Kruger (2012) argues that EIA has incorporated the three elements of sustainable developments on a limited basis.

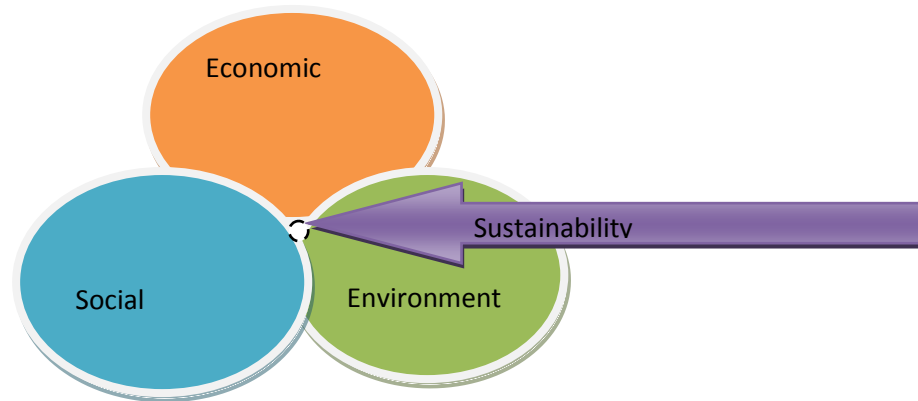


Figure 2.1: The Sustainable development System: adapted from Kruger (2012).

Htun (1990) identified five areas that are important in defining sustainable development in relation to the EIA process. These include: forestry, food and agriculture, industrialisation, energy and urbanisation. For example, EIA should take into consideration the forest-resource development programs in its assessments. These include the social and the economic cost of deforestation in relation to the current reports regarding the national economic importance of forestry. These also need to be assessed for long-term ecological and socio-economic impacts on the primary stakeholders.

Zeremariam (2003) pointed out that the principal goal of EIA is to promote informed decision-making that leads to sustainable development, as shown in Figure 2.2. This Figure illustrates how the EIA process should consider environmental, technological and socio-economic issues, in order to make informed decisions about the proposed project and to promote sustainable development.

EIA helps to achieve sustainable development through its capability of incorporating the views of the public in the EIA process. In EIA, proper public participation allows the affected and interested parties to interact with the decision-makers and to ensure that their views regarding the proposed project are fully considered in the decision-making process (Glasson *et al.*, 2012). EIA also contributes to sustainable development through the enhancement of good governance. EIA promotes information-sharing, transparency, responsibility, accountability and public participation, in order to resolve any environmental conflicts (Kakonge, 1998; Munyazikwiye, 2011).

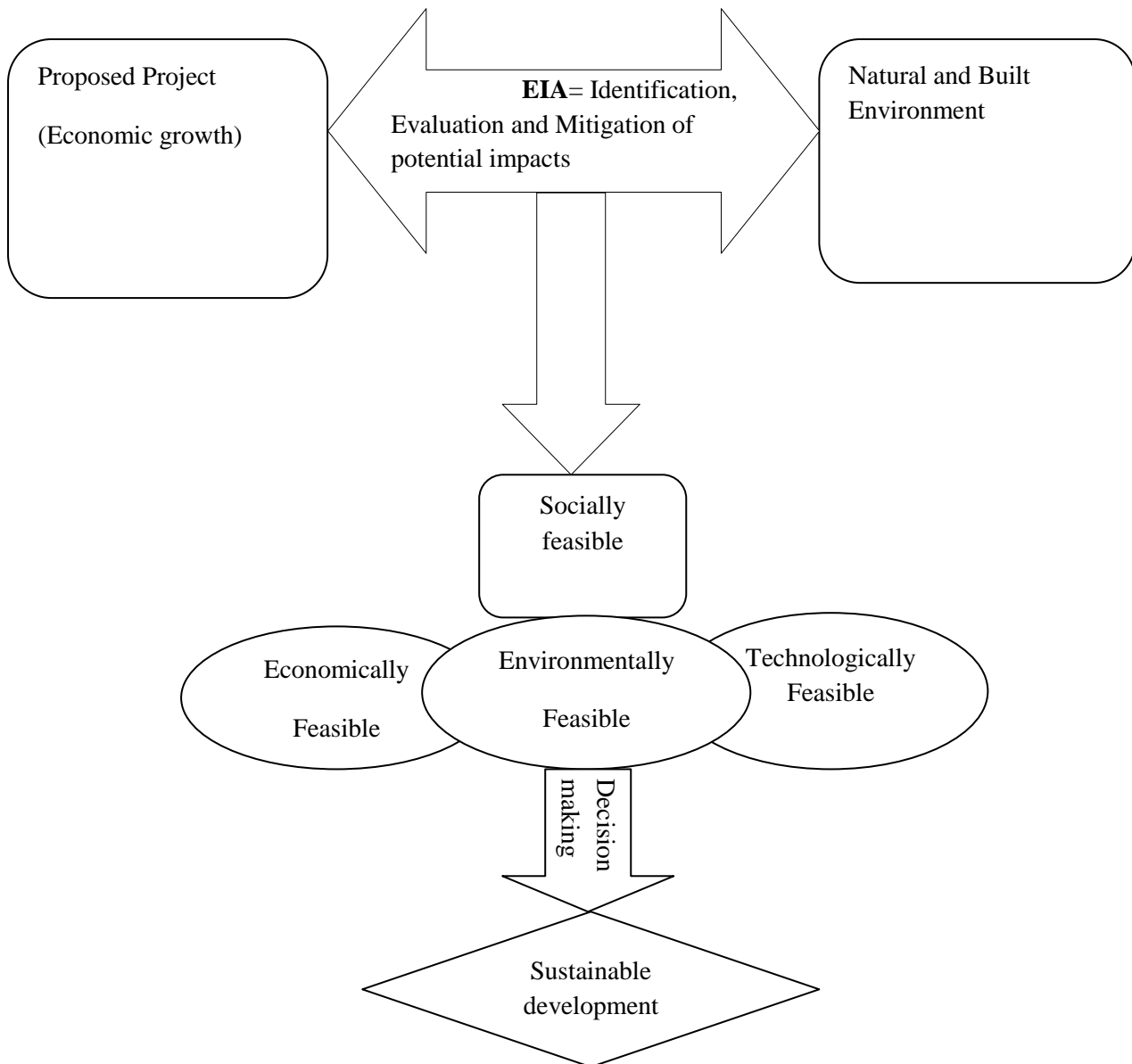


Figure 2.2: EIA as a sustainable development tool (adapted from: Zeremariam, 2003).

2.4. The development of EIA

The field of Environmental Assessment dates back from the year 1969; and it was formally applied in 1970 (Glasson *et al.*, 2012; Sandham *et al.*, 2013; Sandham *et al.*, 2008; SPREP, 2016). The National Environmental Policy Act (NEPA) of the United States of America was the primary catalyst for the establishment of EIA. According to Glasson *et al.* (2012); since the EIA legislation enactment, NEPA has influenced the preparation of more than 25000 EIAs. EIA development is associated with various fields, such as land-use planning, cost-

benefit analysis, modelling and simulation (Barrow, 1997). The phrase “Environmental Impact Assessment” was taken from section 102 (2) of NEPA (Singh, 2007).

The NEPA required that all their federal agencies take consideration of the environment into account in all their developments, by assessing the potential environmental impacts of their activities on the environment. The NEPA also provided an opportunity for the affected and interested parties to appeal against certain decisions (Singh, 2007). EIA systems have been established earlier in most developed nations, such as Canada, Australia, West-Germany and France (Glasson *et al.*, 2012); and later spread slowly to the developing countries. Table 2.1 shows a brief summary of the development of EIA from pre-1970 to 2016.

Table 2.1: Development of EIA (adapted from: Kamijo and Huang, 2017; Sadler, 1996; Singh, 2007).

Development of Environmental Impact Assessment	
Pre - 1970	<ul style="list-style-type: none"> ➤ Projects reviewed based on technical and economic analysis. ➤ Limited consideration given to environmental impacts.
Early/Mid 1970s –	<ul style="list-style-type: none"> ➤ EIA formally introduced in 1970. ➤ Basic principles, guidelines, and procedures such as public participation requirements were instituted. ➤ Standard methodologies developed, such as matrix, checklist and network. ➤ A number of countries including Canada, New Zealand and Australia adopt NEPA-based approach. ➤ Major public inquiries (rather than court litigations) help in improving the process's development.
Late 1970s to early 1980s	<ul style="list-style-type: none"> ➤ More formalized guidance, such as CEQ guidelines. ➤ Some developed and developing nations have introduced formal EIA requirements; and they have begun to use the process informally. ➤ Social-Impact Assessment (SIA) and risk analysis are included in Environmental Assessment (EA). ➤ Increased emphasis on ecological modelling, prediction and evaluation techniques. ➤ Environmental inquiries in various countries encompass policy review aspects.
Mid 1980s to end of decade	<ul style="list-style-type: none"> ➤ EC Directive on EIA introduced basic principles and regulations for all member states. ➤ Increasing efforts to address the cumulative effects. ➤ Development of follow-up mechanisms, such as the effects monitoring, auditing, and impact management. ➤ EA requirements established by the World Bank and other international lending and aid agencies. ➤ An increasing number of developing countries are now carrying out EAs.

Development of Environmental Impact Assessment	
1990s to 2007	<ul style="list-style-type: none"> ➤ EIA has been identified as an implementing mechanism for United Nations (UN) conventions on climate change and biological diversity. ➤ Strategic Environmental Assessment (SEA) systems established by a number of countries. ➤ Sustainability principles and global issues have received increased attention. ➤ Increasing use of the Geographic Information System (GIS) and related technologies. ➤ The enactment of EA legislation by many developing countries.
2007-2016	<ul style="list-style-type: none"> ➤ Revision of the Environmental and Social Consideration Guidelines of Japan's International Co-operation Agency (JICA); the new Safeguard Policy Statement of Environmental Assessment Guidelines of Asian Development Bank (ADB) 2016. ➤ The World Bank reviewed the safeguard policies and approved a new Environmental and Social Framework.

2.5. EIA in South Africa

The EIA process in South Africa originates from a non-mandatory basis in the 1970s. During this period, EIA in South Africa was practised voluntarily, as part of the Integrated Environmental Management (IEM) tools series (Sandham *et al.*, 2013). The first statutory foundation for South Africa's EIA system was through the Environment Conservation Act (ECA) 73 of 1989 (Humbly, 2009). EIA became mandatory in September 1997, when the first EIA regulations were promulgated in terms of the ECA (South Africa, 1989; South Africa, 1997). The regulations highlighted the most crucial activities where EIA should always be conducted. The whole EIA process also involved the public participation process (PPP), so as to get the detailed views from the interested and affected parties.

Table 2.2 provides a summary of the historic EIA benchmarks and policies of South Africa for all projects, except mining. The EIA for mining projects is discussed separately in section 2.5.1.

Sandham *et al.* (2013) pointed out that the EIA process in South Africa, under the ECA EIA regulations, and in line with international standards consisted of the following steps (South Africa, 1997):

- Submission of application for authorisation to undertake an activity.
- Scoping report, to determine environmental issues, including public participation and plan of study for EIA.
- Review of EIA report by the decision-makers.

- Environmental authorisation, including the conditions of approval.

Table 2.2: Historic EIA benchmarks and policies in South Africa (adapted from: Govender, 2009; Kidd and Retief, 2008; Kruger, 2012).

Date	Policy/Legislation	Comment
1976	South African Council of the Environment Report	Various methods and procedures for environmental evaluation were proposed
1979	Symposium “Shaping our environment”	More emphasis placed on the value of EIA as a tool for environmental change management, by introducing EIA principles into guidelines for planners.
1982	Environment Conservation Act (Act 100 of 1982)	The act had a limited scope, established the Council for the Environment, and included provisions relating to natural environment.
1983	Council for the Environment and subcommittee for EIA	EIA committee started workshops and research on EIA in order to establish mechanisms compatible with South Africa.
1989	Environment Conservation Act (amended); Act 73 of 1989	Established provisions for EIA and environmental policy.
1989	Integrated Environmental Management (IEM) process	Introduced principles and procedures related to policy evaluation and projects
1992	IEM Procedure	Formal IEM process guidelines. Compliance gained increasing credibility, but still voluntary practised.
1996	White Paper on Sustainable Forest Development in South Africa (now legislated)	Key implications for the forestry sector, in that, under the Afforestation Permit System, EIAs may be required.
1997	White Paper on a National Water Policy for South Africa (now legislated)	Key implications for EIAs in regard to water resource use and management as well as fostering the philosophy of both public good and sustainability.
1997	EIA Regulations	First era of mandatory EIA in South Africa.
1998	White Paper on Environmental Management Policy for South Africa	Laid basics regarding SEA to be part of the future legislation.
1998	Discussion Document: A National Strategy for IEM in South Africa	Major deficiency of the 1992 IEM procedure was a focus on certain discrete events. Most environmental impacts result from activities, other than individual project level developments. Aimed at promoting legislation of integrated management

Date	Policy/Legislation	Comment
		approaches.
1998	NEMA, Act 108 of 1998	Trying to promote co-operative governance among different levels of government involved in environmental management. Allows for enforcement of environmental laws by the public. Introduced the need for environmental considerations at a policy level.
1998	National Water Act, Act 36 of 1998	To provide for the reform of law related to water resources. A water-use licence might be required as part of the EIA process. There is the need to be evaluated for each project.
2004	NEM: Biodiversity Act, Act 10 of 2004	Legislation pertaining to the importance of conserving biological diversity should protected trees be found on the site, the correct procedures need to be followed.
2004	NEMA: Air Quality Act, Act 39 of 2004	The aim of this Act is to reform the law regulating air quality, in order to protect the environment by providing reasonable measures for the prevention of pollution and ecological degradation, and for securing ecologically sustainable development, whilst promoting justifiable economic and social development.
2005	Amendment of NEMA	This resulted in the Act becoming the over-arching framework for environmental management in South Africa. A number of other pieces of legislation currently fall within the ambit of this framework.
2006	New EIA regulations	These reiterate the importance of EIAs in promoting responsible business practices in South Africa.
2007	Amendments to new EIA regulations	These amendments seek to refine definitions and listed activities to existing regulations.
2010	NEMA: EIA Regulations 2010 (GNR 543, 544, 545 and 546)	Promulgated due to interpretation problems with the old regulations and also because of the changing legal regime. Changes were made to the procedural requirements of the EIA process. New definitions attempt to clarify previous uncertainties.
2014	NEMA; EIA Regulations 2014 (GNR 982, 983, 984, and 985)	2014 regulations repeal previous EIA regulations (GNR 543) except Chapters 5 and 7.
2017	NEMA; EIA Regulations 2014, 2017 amendments (GNR 326, 327, 325, 324)	Changes to certain sections of the 2014 EIA regulations, and the requirements for Environmental Authorisations, including changes to Listing Notices (April 2017).

The National Environmental Management Act (NEMA), 107 of 1989 (South Africa, 1998) superseded the ECA 73 of 1989, and also emphasized that an EIA should be conducted for all development proposals with potential negative impacts towards the environment. NEMA was amended in 2004 and the amendment of this Act led to the evolution of EIA regulations which were promulgated in 2006 (South Africa, 2006).

Since the promulgation of the 2006 EIA regulations, the interest in assessing the effectiveness of the EIA system has increased drastically. A large number of studies tend to focus on the quality of EIA reports (Carroll, 2006; Kruger and Chapman, 2005; Kruger, 2012; Mbhele, 2009; Moloto, 2005; Sandham and Pretorius, 2008; Sandham *et al.*, 2008; Sandham *et al.*, 2013) as one of the components used to measure the effectiveness of EIA. The effectiveness of other aspects of EIA such as Social Impact Assessment (SIA) and Biodiversity Impact Assessment (BIA) has also been conducted. However, there is limited academic research in the field of BIA in South Africa, particularly the research that focuses on the consideration of biodiversity issues in the EIA process such as those conducted by Hallatt *et al.* (2015) and Le Maitre *et al.* (1998), compared to other countries with rich biodiversity as discussed in section 2.11. This clearly highlights the need to conduct research that focuses on the treatment of biodiversity in the EIA process in South Africa. South Africa is recognised as one of the countries which are rich in biological diversity and minerals. It is therefore crucial to ensure that biodiversity issues are considered thoroughly in all proposed mining projects.

In South Africa, EIA is administered by the Department of Environmental Affairs (DEA) at National and Provincial level. However, the competent authority for mining EIAs is the Department of Mineral Resources (DMR) as discussed in section 2.6. The approval of most EIAs usually takes place in respective provincial departments, but the policy formulation and coordination takes place in the national department (Walmsley and Patel, 2011).

2.5.1. EIA for mining projects in South Africa

Under the ECA 73 of 1989, mining was not explicitly included in the categories of listed activities which have detrimental effects on the environment (Humby, 2009). Formal legislation governing EIA in the South African mining sector came into effect in 1991 when the Minerals Act No. 50 of 1991 came into force (South Africa, 1991). Before this piece of legislation there was no set of legislation governing environmental impacts associated with mining activities in South Africa. However, “section 39 of the Minerals Act 50 of 1991

introduced a weak form of EIA for prospecting and mining operations” (Humby, 2009:3). According to this Act, only Environmental Management Plans (EMP) and Environmental Management Programme Reports (EMPRs) were needed by the Department of Minerals and Energy (DME). The EIA report was not required since the EMPR’s content was similar to those of the EIA reports. The EMPR was largely ineffective because the legislative requirements were less stringent and rarely enforced (Sandham *et al.*, 2008). The major limitation of this Act was that the main focus of the EMP was limited to the surface area that is directly affected by permitting or mining activity, indirect impacts such as those on underground water resources were hardly assessed (Humby, 2009).

With the increasing environmental concerns, the DME published the Minerals Act of 1991 in order to improve the integration of environmental issues associated with the then proposed mining projects (Hoffmann, 2007). Under the Minerals Act, authorisation process was regulated by the DME. In certain instances, comments or advice from other national departments such as Department of Water Affairs and Forestry (DWAF) was requested. The rehabilitation of disused mine dumps at the time was controlled by DWAF (Oostuizen, 2012).

The Earth Summit which took place in Brazil in 1992 highlighted the importance of sustainability, and this resulted in the drafting of the Minerals and Petroleum Resources Development Act (MPRDA) 28 of 2002 with the aim of contributing to sustainable development (Le Roux, 2012). The MPRDA repealed the Minerals Act of 1991 in 2002 (South Africa, 2002). Regulations dealing with mining EIAs were promulgated in 2004 (South Africa, 2004b), and since then, EIAs for mining projects were required to be conducted based on the requirements of the legislation. The MPRDA is a key national statute governing South African mineral resources. The MPRDA provides regulations for mineral development, petroleum exploration and production. It provides the contents of environmental reports, such as EIA reports, scoping reports, closure plans and EMPRs, to assist those that are responsible for compiling and reviewing these reports. It also describes the application process and the procedure that should be followed in appeals.

Following the agreement between the Minister of Environmental Affairs, Mineral Resources and Water and Sanitation, one environmental system under NEMA was introduced in 2014. According to the one environmental system, the Minister of Environmental Affairs sets the regulatory framework and will be the appeal authority, while the Minister for Mineral

Resources will be the competent authority for implementing regulatory framework for mining projects.

2.6. Biodiversity and its value

Biodiversity plays a crucial role in our environment. Generally, there are many definitions for biodiversity. In South Africa, the National Environmental Management: Biodiversity Act No. 10 of 2004 (NEMBA) defines biodiversity as “the variability among living organisms from all sources including terrestrial, marine, and other aquatic ecosystems and the ecological complexes of which they are part and also include diversity within species, between species, and ecosystems” (South Africa, 2004a). The most commonly preferred definition is that of the Convention on Biological Diversity (CBD) (Byron, 2000), however, the definition provided by the NEMBA also bears close resemblance to that of the CBD (Algotsson, 2009). Biodiversity plays a vital role in shaping the development path of a region or a country. It provides a variety of ecosystem services, and failure to conserve biodiversity will lead to degradation of ecosystems and the associated ecosystem services.

Ecosystem services are the benefits that people obtain from ecosystems. The origin of the concept of ecosystem function; service; and their economic values date back to the mid-1960s and early 70s (Kettunen and Brink, 2006). However, it was only during the 1990s when the concept of ecosystem services became popular (Kettunen and Brink, 2006). Figure 2.3 shows the categories of ecosystem services which includes soil formation and maintenance of soil fertility through the process of nutrient cycling. It also shows its role in primary production, mainly in the process of photosynthesis as a supportive foundation for all life. Other ecosystems services shown in the Figure include provisioning, regulating, and cultural services, and these are further categorised as shown in Figure 2.3.

Biodiversity is an important resource for building sustainable livelihoods, poverty alleviation, food security and land use, delivering water resources and ecosystem services and goods (GBIF, 2011). Other species, particularly plants play an important role in combating climate change, through carbon sequestration. Vegetation has a cooling effect and it is believed to significantly reduce heat waves in most cities, by this, it tends to reduce the urban heat island effect (EC, 2013). Plants also stabilise the soil, therefore reducing the risk of landslides and soil erosion. Table 2.3 provides a list of ecosystem service types and their examples.

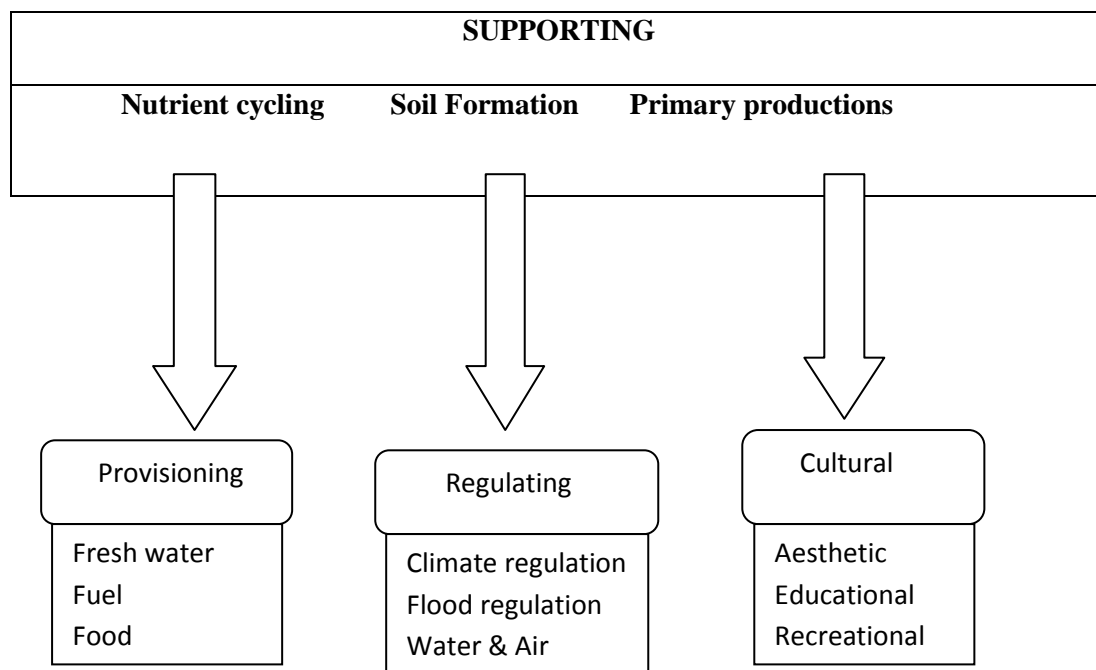


Figure 2.3: Categories of ecosystem services: (adapted from: ICMM, 2006).

Table 2.3: The various types of ecosystem services. (Source: Kettunen and Brink, 2006).

TYPES OF ECOSYSTEM SERVICES
Provisioning Services
Food and fibre
Fuel
Biochemicals, natural medicines, and pharmaceuticals
Ornamental resources
Fresh water
Regulating services
Air quality maintenance
Climate regulation (eg. temperature and precipitation, carbon storage)
Water regulation (eg. flood prevention, timing and magnitude of runoff, aquifer recharge)
Erosion control
Pollination
Storm protection (damage by hurricanes or large waves)
Fire resistance (change of vegetation cover leads to increased fire susceptibility)
Avalanche protection
Other
Cultural services
Cultural diversity, spiritual and religious values, educational values, inspiration, aesthetic values, social relations, sense of place and identity
Cultural heritage values
Recreation and ecotourism
Other

TYPES OF ECOSYSTEM SERVICES
Supporting services
Primary production
Nutrient cycling
Soil formation
Other

2.7. Biodiversity stakeholder engagement

The stakeholder engagement process is one of the most important aspects of EIA. It is crucial that the affected and interested parties are engaged in the planning stages of the development. All those who are affected or interested should be engaged very early and in all the phases of the EIA process. Thorough engagement with stakeholders is the third principle in the Mining and Biodiversity Guideline (DEA *et al.*, 2013). The guideline promotes thorough engagement with biodiversity stakeholders in order to ensure the integration of biodiversity and ecosystem services in the EIA process and to promote good decision making.

Based on the nature of the mining project key stakeholders with an interest in biodiversity issues include the following as outlined by ICMM (2006):

- Non-Government Organisations (NGO) with interest in the conservation of natural resources.
- Academic or research centres with focus on biodiversity.
- Insurance companies, including investors or financial institutions that may require environmental standards to be met.
- Multi-lateral and Government institutions interested or responsible for the protection of the natural resources.
- Local communities
- Employees

2.7.1. Timing and scope of stakeholder engagement

It is advisable that stakeholder engagement should take place as early as possible in the EIA process (ICMM, 2006; DEA *et al.*, 2013). Affected communities including the indigenous people can play an important role in making an informed preliminary analysis of the viability of the mining project (ICMM, 2006). This can also direct the EIA process to focus on crucial issues relevant to stakeholders which will improve the decision-making process.

Another important aspect in stakeholder engagement is that of traditional knowledge. In most instances, the value of traditional knowledge tends to be underestimated. This is mainly because it is not presented in a scientific manner that fits into proper assessment methods (ICMM, 2006). ICMM (2006) emphasise the importance of incorporating this knowledge in biodiversity assessment and management plans since this ensures that traditional rights and ecosystem services are recognised in EIA. In the process of engaging with stakeholders it is highly recommended for one to take note of EIA best practices and the basic principles for stakeholder engagement as shown in Table 2.4.

Table 2.4: Basic principles for stakeholder engagement (adapted from: Business Partners for Development, 2000; ICMM, 2006).

BASIC PRINCIPLES FOR STAKEHOLDER ENGAGEMENT
Promote long-term and sustainable relationships with stakeholders
Cultural differences need to be addressed within indigenous communities. Engaging dialogue can only be a success if mutual understanding exists within different parties and to build levels of respect, cultural training should be introduced.
A neutral third party must be involved. This will lead to reconciliation between parties and this can be instrumental in supporting the development of trust.
Develop trust. Effective engagement occurs with trust, but in most instances, trust tends to be a challenge at the outset of stakeholder engagement. Some of these basic principles are designed to develop trust in stakeholder engagement process.
Comments provided by the stakeholders must be attended to and all the promises made need to be fulfilled.
It is also crucial to ensure that community relations staff is given adequate status and support.

2.8. Mining impacts on biodiversity

Biodiversity is significantly affected by mining activities. As described by Saviour (2012: 126), “mining is essentially a destructive development activity where ecology suffers at the altar of economy”. These impacts are influenced by the type of mining activity, and adverse impacts occur in the case of the open-cast mining method compared to underground mining method (DEA *et al.*, 2013; EC, 2009; Kirkman, 2006). Open-cast mining is among the most

destructive methods in the industrialised world (Mahalik and Satapathy, 2016). It is linked to the removal of natively vegetated areas.

The impacts of mining on biodiversity are directly influenced by the mining method employed, environmental conditions of the area, size and duration of the mining activity (EC, 2009). All these factors need to be considered when assessing the potential impacts of the mining project on biodiversity in order to minimise the impacts on biodiversity and identify suitable alternatives. Mining impacts remain for many years and can be regarded as having a semi-permanent impact on the direct footprint area (Kirkman, 2006). A number of studies on the impacts of mining on biodiversity tend to focus on the impacts of mining process water and drainage on aquatic organisms, while there are few studies focusing on the impact of mining process water on riparian, wetland or terrestrial ecosystems (Widerlund *et al.*, 2014). The following sections describe the impact of mining activities on terrestrial and aquatic biodiversity.

2.8.1. Mining impacts on terrestrial biodiversity

Acid Mine Drainage (AMD) is capable of displacing fresh ground water and cause acid and saline soils which retard plant growth (GDACE, 2008). This results in loss of wetland areas and consequently leads to loss of ecological services provided for by these systems (GDACE, 2008). Mining has negative impacts on biodiversity through clearing of natural vegetation which provide habitat for fauna. Indirect impacts such as the construction of transport routes leading to mines fragments land causing biodiversity and habitat destruction. Table 2.5 provide a summary of potential biodiversity impacts of mining activities from exploration to mine closure.

Mining is capable of destroying flora including some plants with medicinal value such as *saraca asoca* (Mahalik and Satapathy, 2016). Vascular plants are also affected by mining discharge (Harding and Boothroyd, 2004). Mining projects contributes to deforestation, habitat destruction and biodiversity erosion (Saviour, 2012). It is regarded as one of the major threats to boreal forests worldwide and it contributes to change in forest type (Frelich, 2014). For instance, disturbance and fragmentation tend to favour early succession species.

Indirect mining impacts, such as vegetation clearing for infrastructure contribute to the introduction of invasive species (Cameron *et al.*, 2007). There is a strong interrelationship between fragmentation and invasive species (Hawbaker and Radeloff, 2004). For instance, a

large area of fragmentation may lead to a large invasion front of invasive species (Frelich, 2014). In mining impacted environments, wildlife species, occupying the primary mining footprint, would be directly displaced due to the loss of vegetation. For example, loss of vegetation would lead to less nesting habitats for birds (Van Wilgenburg *et al.*, 2013). Amphibians that are found in forests, mainly in swamp forest and wetlands are sensitive to pH change and can be easily affected by acid dust (Frelich, 2014). Clearance of vegetation has serious repercussions on biodiversity in areas affected by mining activities. This can lead to soil erosion and the development of gullies, which would then affect the productivity of the land.

Area-sensitive bird species have experienced direct displacement from their habitat in the primary mining footprint (Frelich, 2014). Unproductive land will lead to the loss of habitat for birds and other fauna species, as well as the destruction of the luxuriant vegetation (Akabzaa and Darimani, 2001; Mensha *et al.*, 2015). Concentration of trace elements in certain organs of small mammals can be significantly affected by airborne emissions from the smelters (Widerlund *et al.*, 2014). The genetic structure of small mammals can be affected at mine sites (Mussali-Galante *et al.*, 2013). Trace elements can also affect the population density (De Jonge *et al.*, 2008; Widerlund *et al.*, 2014), as well as the morphological traits; and these lead to deformations in the affected species (Ferreira da Silva *et al.*, 2009).

2.8.2. Mining impacts on aquatic biodiversity

Discharges from mining activities reduce the biodiversity and alter species' composition in streams that are affected. Tarras-Wahlberg *et al.* (2001) revealed that mining contamination has led to the disappearance of fish from extensive stretches of the rivers in the Puyango river basin; and this has significantly affected the local communities, who directly depend on fishing. Mining activities result in particulate matter which has an adverse effect on fish populations in the affected areas. Acidification and mine leachate both have a significant impact on the fish species.

The toxic effects may be acute, causing death; or, they may be chronic, causing impaired health such as mucous secretion on gills, impairing the gas exchange (Harding and Boothroyd, 2004). Mine discharge creates a chemical barrier to diadromous species, affecting their migration to and from the sea (Harding and Boothroyd, 2004). The impacts of toxic

metals on aquatic fish may include retarded growth, changes in behaviour, and various effects on the reproduction (Saviour, 2012).

Table 2.5: A brief overview of the potential biodiversity impacts associated with mining activities (Source: EC, 2009).

STAGE	ACTIVITIES	POTENTIAL BIODIVERSITY IMPACT
Exploration	<ul style="list-style-type: none"> ➤ Surveying ➤ Drilling / trenching ➤ Exploration camp development ➤ Road construction 	<ul style="list-style-type: none"> ➤ Habitat loss / fragmentation ➤ Disturbance to wildlife ➤ Increased demand for local water resources ➤ Increased colonisation and associated species loss (also due to increased hunting)
Site preparation / mineral extraction	<ul style="list-style-type: none"> ➤ Mine construction (vegetation removal, stripping of soils, etc.) ➤ Mine infrastructure development (roads, powerlines, etc.) ➤ Creation of waste piles 	<ul style="list-style-type: none"> ➤ Habitat loss / fragmentation ➤ Chemical contamination of surface and ground waters ➤ Declining species populations ➤ Toxicity impacts to organisms ➤ Altered landscapes ➤ Increased erosion and siltation ➤ Increased colonisation and associated species loss (also due to increased hunting)
Processing / Smelting	<ul style="list-style-type: none"> ➤ Processing / smelting of minerals 	<ul style="list-style-type: none"> ➤ Discharge of chemicals other wastes, emissions
Transport to final Markets	<ul style="list-style-type: none"> ➤ Packaging and transport of product 	<ul style="list-style-type: none"> ➤ Noise and dust disturbance ➤ Emissions
Mine closure / post operation	<ul style="list-style-type: none"> ➤ Reseeding / revegetation ➤ Re-contouring waste pits ➤ Fencing off dangerous areas ➤ Monitoring leakage 	<ul style="list-style-type: none"> ➤ Persistent contaminants in surface and groundwater ➤ Persistent toxicity to organisms ➤ Loss of original vegetation / biodiversity

Mine drainage impacts on stream invertebrates are almost entirely negative. Suspended solids have the potential to decrease benthic invertebrates and micro-invertebrate populations in affected environments (EC, 2009).

The acute and direct toxicity caused by combinations of low pH, or the presence of toxic metals, tend to impact negatively on benthic invertebrates. The impacts range from indirect effects in areas where there is a limited food resource to altered in-stream habitats (Harding and Boothroyd, 2004). Benthic invertebrates tend to have fewer species in naturally acidic brown-water streams; and this leads to lower densities and altered community composition (Harding and Boothroyd, 2004).

Acid Mine Drainage (AMD) is one of the major threats to aquatic biodiversity. It poses a serious threat to rivers and wetlands, and other aquatic ecosystems (Saviour, 2012). The biological diversity that exists in these systems tends to be significantly affected. AMD has the potential to alter the pH of the stream to pH 4, which is equivalent to battery acid (Saviour, 2012). In this case, the biodiversity found in affected streams would be unable to survive, due to the changes in the pH level. The affected streams lack species; and in those cases where organisms are present, their density could be very low (Harding and Boothroyd, 2004).

Physiological stress to benthic invertebrates can be caused by low pH and high metal concentration (Harding and Boothroyd, 2004). Benthic invertebrates also suffer high frequency of infections in streams experiencing discharge from abandoned gold mines (Harding and Boothroyd, 2004).

In streams affected by mining, suspended sediments increase the turbidity and thereby decrease the light penetration, which leads to the inhibition of photosynthesis (Younger and Wolkersdorfer, 2004). This directly affects the primary producers in aquatic environments that require light, in order to undergo photosynthesis. This, therefore, reduces the availability of food for micro-invertebrates and fish that depend on these primary producers. This also leads to clogging of the gills (Younger and Wolkersdorfer, 2004).

2.9. Guidelines for incorporating biodiversity in EIA

A number of countries and organisations recognise the importance of conserving biodiversity. This is accomplished by developing legislation and guidelines that can be used in development planning. These guidelines are aimed at improving the integration of biodiversity in the EIA process; and these include these guidelines developed by the Commission for Environmental Assessment. South Africa has also developed a number of biodiversity-inclusive EIA guidelines, including environmental legislation. This section will,

therefore, discuss the relevant guidelines used to promote biodiversity-inclusive EIA processes in South Africa and internationally.

2.9.1. International guidelines for incorporating biodiversity in EIA

2.9.1.1. The RAMSAR Convention guidelines for impact assessment

The RAMSAR Convention (Convention on Wetlands) is an intergovernmental treaty with the aim of conserving and ensuring the wise use of all wetlands. A list of wetlands of international importance is available at the RAMSAR Convention website. This convention also promotes the integration of biodiversity in EIA; and it has published a guideline for incorporating biodiversity in EIA and Strategic Environmental Assessment (RAMSAR Convention Secretariat, 2007).

It requires the signatory parties to apply best practice EIA for projects that might negatively affect the wetlands. South Africa is also a signatory party to this convention. Wetlands are very productive systems; and according to the convention, these wetlands include a variety of habitats, such as mangroves, salt marshes and sea-grass beds. Due to the importance of these systems and the impact of changing climate, it is therefore crucial that for any proposed project that might affect the wetlands, a rigorous EIA process should be applied (RAMSAR Convention Secretariat, 2007).

2.9.1.2. Commission for Environmental Assessment guidelines on biodiversity-inclusive impact assessment

The Commission for Environmental Assessment has identified a need for improving biodiversity-inclusive impact assessment. This Commission has published guidelines on biodiversity-inclusive impact assessment, based on the Convention on Biological Diversity (CBD) Decision VIII/28 (Commission for Environmental Assessment, 2006). These guidelines provide a systematic way of integrating the biodiversity in different phases of EIA.

An EIA review should ensure that the information in the EIA report is sufficient for a competent authority to determine whether the proposed development is compliant with, or contradictory to the CBD objectives (Commission for Environmental Assessment, 2006). The commission also provides guidelines for integrating biodiversity at a regional level through Strategic Environmental Assessment.

2.9.1.3. European Commission guideline on integrating climate change and biodiversity into EIA

In 2013, the European Commission (EC) published a guideline on integrating climate change and biodiversity into EIA (EC, 2013). The EC recognises the importance of integrating biodiversity in the EIA process. Since the guidelines also promote the integration of climate change in EIA, this means that all the potential impacts can be identified, because climate change also has adverse impacts on the biodiversity. Therefore, these guidelines play a significant role in ensuring that biodiversity issues are thoroughly considered in EIAs. In order to combat climate change impacts and to halt the biodiversity loss and ecosystem degradation, it is of paramount importance to integrate these issues into plans, programmes and projects (EC, 2013).

2.9.1.4. ICMM good practice guidance for mining and biodiversity

The International Council on Mining and Metals (ICMM) has published good-practice guidance for mining and biodiversity (ICMM, 2006). The ICMM recognises the need to improve the treatment of biodiversity in the mining industry. The sustainable development principle seven of the ICMM aims to significantly contribute to biodiversity conservation and the incorporation of approaches to land-use planning. The ICMM and the International Union for the Conservation of Nature and Natural Resources (IUCN), launched a joint dialogue, based on biodiversity conservation and mining (ICMM, 2006). The dialogue was established, with the aim of engaging with all the relevant stakeholders regarding balancing environmental protection and the social-economic importance of mining.

As a result, an elaboration on sustainable development principle seven has ensured that the ICMM members:

- Respect legally designated protected areas
- Members are encouraged to disseminate scientific data on and to promote practices in biodiversity impact assessment and management
- And to support the development and the implementation of best practices, inclusive, as well as transparent measures for integrated approaches to land-use planning, biodiversity conservation and mining (ICMM, 2006).

This guideline promotes the conservation and integration of biodiversity issues and impacts in the mining-life cycle. It also provides various checklists, which can be used to ensure that

biodiversity is considered in every phase of the mining project, including EIA. The IUCN and the ICMM have also published a manual with case studies that promote the integration of mining and biodiversity (IUCN and ICMM, 2004). These case studies provide examples on how management tools, rehabilitation and restoration processes, together with improved scientific knowledge, can help to conserve the biodiversity.

2.9.1.5. IFC performance standard on the environment and social sustainability

The International Finance Corporation (IFC) is an international financial institution; it provides various services, such as asset management advice and investment. The IFC requires its clients to employ the performance standards, when managing socio-environmental impacts and risks in their projects. The IFC has published a number of manuals to assist businesses in various issues; and among them there is the IFC performance standard on the environment and social sustainability. There are eight performance standards within the IFC. Performance Standard 6 refers to biodiversity conservation and the sustainable management of living natural resources.

This performance standard recognises the fact that maintaining our ecosystem services, protecting and conserving our fauna and flora, and properly managing natural resources is fundamental to sustainable development (IFC, 2012).

2.9.1.6 A good-practice guide for road schemes

Byron (2000) developed a good-practice guideline for road schemes. This good-practice guideline was aimed at improving the consideration of biodiversity impacts in transport projects, mainly road schemes. Road schemes are linked to the loss of biodiversity through habitat loss and fragmentation (Byron, 2000). It is therefore crucial to consider the biodiversity-related issues in road schemes, to ensure that these developments take place in a sustainable manner. Biodiversity conservation is an important element of sustainable development; and it is required by the CBD (Byron, 2000).

2.9.2. National and provincial guidelines for incorporating the biodiversity in EIA in South Africa

2.9.2.1. Western Cape guideline for involving biodiversity specialists in the EIA process

The provincial government of the Western Cape has identified the need to improve Biodiversity Impact Assessment (BIA) in the EIA process. The Western Cape Department of Environmental Affairs and Development Planning have published a guideline for involving Biodiversity Specialists in the EIA process (Brownlie, 2005). This guideline is aimed at improving the effectiveness and the quality of the BIA processes.

The EIA Practitioner's role in planning and coordinating specialist studies and the necessary steps that they need to address in finalising biodiversity specialist Terms of Reference (ToR) is well documented in this guideline. The guideline also explains the role of the biodiversity specialist, in order to provide accurate information on the best possible way to inform the EIA process (Brownlie, 2005). The review of the biodiversity specialist report is also addressed in this guideline. Another two relevant guidelines have been published by the Western Cape Department of Environmental Affairs and Development Planning; these are the guidelines for determining the scope of specialist involvement in the EIA process (Munster, 2005) and a guideline for the review of specialist input into the EIA process (Keatimilwe and Ashton, 2005).

2.9.2.2. GDARD requirements for biodiversity assessments

The Gauteng Provincial Department of Agriculture and Rural Development have developed requirements for biodiversity assessments in the Gauteng Province (GDARD, 2012). This guideline can be used as a guide for EIA Practitioners to set the terms of reference for biodiversity assessments; and for biodiversity specialists to know what exactly needs to form part of the BIA report. The guideline also provides sensitivity mapping rules for biodiversity assessments. A Geographical-Information System (GIS) should be employed to produce a sensitivity map so that it highlights all the important elements of a proposed project lay-out and to allow comparative assessment of the proposed project and the sensitive area (GDARD, 2012).

2.9.2.3. Grassland ecosystem guidelines

The South African National Biodiversity Institute (SANBI) has implemented the Grassland Ecosystem Guidelines (SANBI, 2013). These guidelines act as a catalyst in the management of South Africa's grasslands. This type of guideline plays a significant role in informing development planning and land-use management – when used together with systematic biodiversity plans – and when they are formally incorporated in the terms of reference for EIA's or municipal planning projects (SANBI, 2013). South Africa's grasslands are currently under pressure – due to land-use change and other environmental problems; this guideline is therefore, aimed at protecting the degradation of the grasslands.

2.9.2.4. Guideline for biodiversity impact assessment in KwaZulu-Natal (KZN)

Ezemvelo KZN Wildlife has developed a guideline for the BIA process in KwaZulu-Natal Province (Ezemvelo KZN Wildlife, 2013). The province of KwaZulu-Natal falls under the Maputaland-Pondoland-Albany biodiversity hotspot. This is an area of high biodiversity value, and the conservation of the biodiversity in this region is a priority. This guideline provides general guidance for BIA, as well as specific requirements for BIAs for vegetation, fauna, wetlands, riverines and riparian, coastal and estuarine specialist studies.

The guideline also contains the sensitivity-mapping rules for BIAs; and it highlights the most crucial points that need to be considered by EAPs, when integrating biodiversity specialist input in the main EIA reports (Ezemvelo KZN Wildlife, 2013).

2.9.2.5. Ecosystem guidelines for environmental assessments in the Western Cape

The Western Cape Department of Environmental Affairs and Development Planning continues to take a leading role in the development of guidelines, which are aimed at assisting those who are involved in development planning. This Department has developed the Ecosystem Guidelines for Environmental Assessments in the Western Cape Province (De Villiers *et al.*, 2016). The first edition of these guidelines was published in 2005 (De Villiers *et al.*, 2005). However, due to new developments in the regulatory, legislative, and policy context relating to biodiversity and the availability of new planning instruments and decision-support tools, there was a need to revise the first edition of these guidelines.

The ecosystem guidelines provide useful information for EAPs, biodiversity specialists, decision-makers, and biodiversity stakeholders regarding the ecosystems in the Western Cape

Province – and how these systems should be assessed during the Environmental Assessment process. These guidelines cover the forests, nama-karoo, succulent-karoo, renosterveld, midland and mountain fynbos, and coastal ecosystems (De Villiers *et al.*, 2016).

2.9.2.6. MTPA minimum requirements for biodiversity assessments

The Mpumalanga Tourism Parks Agency (MTPA) has developed minimum requirements that biodiversity specialists should adhere to, when conducting biodiversity assessments in the Mpumalanga province. Part one of this document covers the minimum requirements for vegetation; animals (mammals, birds, herpetofauna, and invertebrates); wetlands; and aquatic ecosystems. Part two provides the conditions for prospecting in areas of conservation importance (MTPA, n.d.).

2.9.2.7. South African Mining and Biodiversity Guideline

The Department of Environmental Affairs (DEA), the Department of Mineral Resources (DMR), the Chamber of Mines, the South African Mining and Biodiversity Forum (SAMBF), and SANBI have published the South African Mining and Biodiversity Guidelines (SAMBG) (DEA *et al.*, 2013). This is an attempt to mainstream the biodiversity into the mining sector.

The idea of developing this guideline was introduced by the SAMBF; and it involves various stakeholders from the mining industry, biodiversity conservation, and government. The guideline provided the mining industry with a user-friendly manual for mainstreaming biodiversity in the mining lifecycle (DEA *et al.*, 2013).

The SAMBG interprets the best available information on biodiversity and science, regarding the impacts of mining (Water Research Commission, 2015). It promotes the concept of sustainable development within the mining sector in a systematic manner, which enables regulators, industry, and practitioners to minimise the impacts on our precious biological diversity and ecosystem services. It provides a practical guide on how to avoid, mitigate, or remedy mining impacts by employing best-practice EIA and a robust Environmental Management Programme (EMP).

The SAMBG offers six best-practice principles that should be employed for good decision-making, when addressing the mining impacts on biodiversity:

- Apply the law

- Use the best available biodiversity information
- Engage stakeholders thoroughly
- Use best-practice Environmental Impact Assessment, in order to identify, assess and evaluate any impacts on the biodiversity.
- Apply the mitigation hierarchy in planning any mining-related activities and develop robust EMP's.
- Ensure effective implementation of the EMP, including adaptive management (DEA *et al.*, 2013).

2.9.2.8. GDACE mining and environmental impact guide

In 2008, the Gauteng Department of Agriculture, Conservation and Environment (GDACE) published a manual on mining and the environmental impact thereon (GDACE, 2008). This manual provides important information on environmental impacts of the mining industry in the Gauteng Province; and it was mainly targeted to those that are responsible for the evaluation of mining license applications. The mining and environmental impact guidelines, therefore aim to assist in the evaluation of mining applications by indicating environment-sensitive areas and mining hotspots in Gauteng, thereby informing the officials about the current legislative framework in the mining sector, providing information about the biodiversity impact and sensitive areas in Gauteng, and guiding them through the review process (GDACE, 2008).

2.10. The treatment of biodiversity impacts in EIA

Consideration of the biodiversity is encouraged in all the stages of the EIA process. In the literature, various studies on the treatment of biodiversity in EIA have been undertaken; and most of them highlight the strengths and the weaknesses in the areas of project description, baseline conditions, alternatives, mitigation and monitoring, public participation, prediction and the assessment of impacts. The following sections describe these areas with the aim of highlighting how biodiversity is treated in EIAs that are internationally based on the literature review.

2.10.1. Project description

The purpose of the project should be clearly described in the BIA report. The objectives, size and design of the project need to be described, and diagrams, plans and maps make a

significant contribution in this description (Lee *et al.*, 1999). A study conducted by Khera (2010) found that in some of the reports, a map was provided; but, biodiversity-related information was either incomplete or missing; and in some instances, a simple map of the area was provided without, any or limited information on biodiversity.

Another major weakness in project description was highlighted by Soderman (2005); this is mainly because 53 % of the reports reviewed failed to successfully describe the total area of the proposed development. This was identified as a major challenge; since one needs to know the total area of the development, in order to predict the habitat loss due to the proposed development. A number of studies revealed that project description is normally included in the reports (Hallatt *et al.*, 2015; Khera, 2010; Soderman, 2005).

However, the information provided in this review area tends to be poorly described, thereby ignoring the important aspects of biodiversity. According to Hallatt *et al.* (2015) this may be attributed to the fact that project description and alternatives are adequately described in the main EIA report; hence, some biodiversity specialists might assume that project description has been duplicated.

2.10.2. Baseline description

The effectiveness of impact prediction is directly influenced by the available baseline information (Soderman, 2005). It is therefore of critical importance to prepare the baseline information properly – both on biodiversity and ecosystems. Failure to do this might greatly affect the impact prediction (Khera, 2010; Soderman, 2005). In a study conducted by Khera (2010), only 35% of the reports managed to provide sufficient information on the endangered and endemic species; while in other reports, this information was completely missing. Only 24% of the reports managed to provide good biodiversity baseline data (Khera, 2010). This, therefore, means that 76% of the reports completely failed to predict any of the impacts on biodiversity. However, Soderman (2005) argues that it is not possible to study all the aspects in detail; hence, it is advisable for one to select the valuable ecological receptors.

Similar studies revealed that biodiversity specialist studies in EIA tend to focus on the species level, and fail to address the most crucial components of biodiversity affected by the proposed project (Atkinson *et al.*, 2000; Byron *et al.*, 2000; Soderman, 2005; Treweek, 1999). A solution to this, is the so-called “ecosystem approach”, which involves the

assessment of potential impacts on ecosystems and ecological processes, not only on the species level.

Biodiversity surveys have been highly questionable. For instance, in certain cases there was no information provided on how long the survey was, the date, and the person who conducted the survey (Soderman, 2005; Soderman, 2006). Lee *et al.* (2014) argue that poor surveys can also be attributed to tight deadlines and inadequate report reviewing.

Another prevalent finding in BIA is that a number of studies have failed to consider new ecological surveys (Naser *et al.*, 2008; Samarakoon and Rowan, 2008; Thompson, *et al.*, 1997). Hallatt *et al.* (2015) revealed a better performance of BIA reports in baseline studies; and this was linked to the availability of high-quality spatial data produced through systematic conservation planning. Establishing solid spatial biodiversity databases greatly improves the description of the baseline environment in BIA (Hallatt *et al.*, 2015).

2.10.3. Alternatives

In a study conducted by Khera *et al.* (2010), alternatives were partially addressed with only 41% of the reports reviewed managed to describe any alternative solutions and compare the development with a no-go alternative. Soderman (2006) revealed that 92% of the reports addressed the alternatives; but, the no-go option was only addressed in 58% of the reports. In the Cape Floristic Region, consideration of alternatives was identified as a key weakness in Biodiversity Assessments (Hallatt *et al.*, 2015). Poor consideration of alternatives in BIA can be attributed to the fact that biodiversity specialists tend to be involved once a final development plan has been identified (Swanepoel *et al.*, 2019) Failure to integrate specialist studies with the main EIA report is probably a major reason for the poor performance of the alternatives in BIA.

2.10.4. Public participation

The biodiversity stakeholder engagement process plays an important role in the effectiveness of the BIA process. It is regarded as a precondition for best practice EIA (DEA *et al.*, 2013). However, biodiversity stakeholder engagement has been identified as a weakness in a number of studies (Hallatt *et al.*, 2015; Soderman, Swanepoel *et al.*, 2019; 2006; Thompson *et al.*, 1997). For instance, 33% of the reports reviewed by Thompson *et al.* (1997) did not include any form of ecological or nature conservation consultation. The best option to effectively

manage biodiversity, especially in areas with high biodiversity value, is through consultation with the local communities (De Villiers *et al.*, 2005; Hallatt *et al.*, 2015; Treweek, 1999).

Indigenous knowledge has largely also been ignored in Biodiversity Assessments. For example: in a study conducted by Hallatt *et al.* (2015), only 8% of the reports incorporated indigenous knowledge in their assessments.

2.10.5. Prediction and assessment of impacts

Prediction of the impacts associated with the proposed project is the main objective of the EIA process (Soderman, 2005). A study in the Cape Floristic Region revealed that a number of BIA reports failed to include “the degree to which impacts can be reversed”, or “the extent to which the activity can cause irreplaceable loss of biodiversity” as a criterion in the impact significance analysis (Hallatt *et al.*, 2015:17). It has been noted that Environmental thresholds are not properly incorporated in most BIA reports (De Villiers *et al.*, 2008; Hallatt *et al.*, 2015; Slootweg, 2005; Swanepoel *et al.*, 2019).

Studies in Biodiversity Assessment have highlighted that assessments tend to focus on lower levels of biodiversity; while neglecting any impacts on the ecological processes (Brownlie *et al.*, 2006; Byron *et al.*, 2000; Treweek, 1999). However, a study by Hallatt *et al.* (2015) showed that ecological processes were incorporated in BIA reports in the Cape Floristic Region. According to Hallatt *et al.* (2015), this improvement in the integration of ecological processes can be ascribed to the guidelines developed by De Villiers *et al.* (2005) and Brownlie (2005) who focused on the improvement of the biodiversity assessments in the Cape Floristic Region.

These guidelines have the potential to improve the treatment of biodiversity in EIA. This, therefore, shows the importance of this research in assessing whether the publication of the South African Mining and Biodiversity Guideline has improved the treatment of biodiversity in mining EIAs. Another major weakness in Biodiversity Assessment is the poor performance of impact significance (Byron, 2000; Soderman, 2006).

A quantitative description of the biodiversity, of a distinct time scale of the duration of predicted impacts and assessment techniques employed tends to be poorly addressed in BIA (Soderman, 2005). Geographical Information Systems (GIS) are one of the most important tools, which can be used to improve the effectiveness of BIA in the EIA process. Studies

have shown that the use of GIS in Biodiversity Assessment tend to be limited to the production of general maps of the area, without fully utilizing this tool in the impact prediction and assessment phases (Soderman, 2005).

2.10.6. Mitigation and monitoring

Mitigation measures should be addressed at all levels of biodiversity, such as species, the ecosystem and the genetic level. Biodiversity Assessments tend to ignore the mitigation measures for other levels of biodiversity, and to address the mitigation measures at the species level only. In a study conducted by Byron *et al.* (2000), the mitigation measures were acknowledged in all EIA reports reviewed; and suggestions on how the mitigation measures would be put in place were provided. However, most reports failed to provide a detailed prescription of these measures; and 87.5% of the reports failed to provide an indication of the likelihood of success in the mitigation (Byron *et al.*, 2000).

In other studies, BIA failed to specify in which impacts certain proposed measures were designed to mitigate (Samarakoon and Rowan, 2008; Soderman, 2005). They also failed to fully address the feasibility and the effectiveness of the mitigation measures provided (Soderman, 2006). Another prevalent occurrence in BIA is that biodiversity specialists fail to provide a commitment to monitor the impacts associated with the proposed project (Samarakoon and Rowan, 2008; Thompson *et al.*, 1997).

Inadequate provision for monitoring has been identified as one of the major challenges in biodiversity assessment, internationally (Hallatt *et al.*, 2015). Lack of relevant guidelines for practitioners, restricted budgets, and tight time frames were regarded as the contributing factors to the poor quality of such biodiversity assessments (Samarakoon and Rowan, 2008). Currently, a large number of guidelines to assist EIA practitioners and biodiversity specialists are available internationally, as was described under section 2.9.

2.11. Methods for reviewing the treatment of biodiversity in EIAs

A number of review checklists have been developed to review the treatment of biodiversity in EIA reports. These include the checklists developed by Atkinson *et al.* (2000) and Soderman (2005) to mention a few, and these are briefly described below.

2.11.1. Atkinson *et al.* (2000) review checklist

Atkinson *et al.* (2000) developed a systematic review checklist with 19 review questions. The questions are related to the concept of biodiversity assessment, as it is described in the published literature. This review checklist was, therefore, successfully employed to review the treatment of biodiversity impacts in United States (US) EIA reports.

There are two major categories, as far as this review checklist is concerned. The first category is made up of ten questions; and these relate to the biodiversity impact-reporting process. The second category is made up of nine questions; and these are directly associated with biodiversity examination and impact prediction. The questions were structured to determine the level of Biodiversity Impact Assessment in a project, and at the cumulative level (Atkinson *et al.*, 2000). A Biodiversity Assessment Index (BAI) was used in this review, in order to facilitate the comparison between the EIA reports.

An example of how BAI is calculated is illustrated below:

$$\text{BAI} = \frac{(1.0 \times A) + (0.5 \times P)}{19}$$

Where: BAI = Biodiversity Assessment Index for EIA report

A = number of review questions adequately addressed

P = number of review questions partially addressed

19 = total number of review questions

According to Atkinson *et al.* (2000), BAI range between 0.0 and 1.0; and it can be interpreted just how close a report is in completely addressing the review questions. In this case, higher values show better consideration of biodiversity.

2.11.2. Soderman (2005) review the checklist

Soderman (2005) developed a set of review questions, in order to assess the treatment of ecological and biodiversity issues in Finnish Environmental Impact Assessments. This review checklist has 43 questions aimed at reviewing how ecological and biodiversity issues are treated in Finnish EIA. These questions are based on the concepts of Biodiversity Assessments, as detailed in the literature; and these are based on the requirements of the EIA Statute. The questions in this checklist are divided into seven broad categories, each assessing

a specific biodiversity issue. The following are the review categories in the Soderman (2005) review checklist:

CATEGORY 1 questions are formulated, in order to reveal whether the necessary information regarding the project is adequate enough to enable the analysis of any impacts on the biodiversity.

CATEGORY 2 focuses on analysing whether the baseline of the ecological issues was sufficiently addressed, in order to enable impact prediction.

CATEGORY 3 questions assess in order whether a variety of ecological impacts were addressed; the significance of these impacts was analysed; and it was discovered whether there was any use for the quantitative and qualitative approaches.

CATEGORY 4 focuses on the examination of the alternatives, including the no-go alternative.

CATEGORY 5 evaluates how the mitigation and monitoring have been considered.

CATEGORY 6 questions are mainly designed to determine how the cumulative impacts were treated.

CATEGORY 7 questions examine how the information was presented on the maps.

The reports were reviewed, following the procedure set by Atkinson *et al.* (2000), with some modifications. The review also applied the Ecological and Biodiversity Assessment Index similar to the Biodiversity Assessment Index employed by Atkinson *et al.* (2000).

2.11.3. The BIA review package

Hallatt *et al.* (2015) developed a BIA review package to evaluate the quality of biodiversity inputs in the EIA process. A number of studies focusing on how biodiversity impacts are considered in EIAs normally apply various checklists and BAIs. This BIA review package employed the structure of the Lee and Colley review package methodology (Lee and Colley, 1992) with modifications, in order to suit the BIA context. The Lee and Colley review package was developed by Lee and Colley (1992); and it was later modified by Lee *et al.* (1999).

This review package was developed to review the quality of the EIA reports in the United Kingdom (UK); but due to its success, it has been used internationally. The BIA review

package was adopted in this study, in order to further develop a review package to analyse mining BIA reports. This review package will be further discussed in Chapter 3.

2.11.4. Similar review checklists

A similar checklist has been developed by Drayson *et al.* (2015). This checklist was adapted from a checklist developed by Atkinson *et al.* (2000). A total of 47 review questions were formulated, in order to assess the quality of the Ecological Impact Assessments. In this checklist, some alterations were made. For instance, the total number of relevant review questions addressed (C) was created, in order to determine whether the questions were relevant to the ecological chapter of the EIA report. According to Drayson *et al.* (2015), this alteration has some advantages; for instance, it accounts for question interdependency, which results in artificially low BIA scores during the review.

The Naser *et al.* (2008) review checklist draws from a variety of published literature and guidelines. The checklist was utilised to review the quality of the ecological input in a sample of EIA reports produced in Bahrain. The review criteria are grouped into four major categories: namely, descriptions of the existing ecological environment; identification and evaluation of the impacts; mitigation and monitoring measures; and communication of the Ecological Impact Assessment report. This review checklist adopted the assessment symbols used by Lee *et al.* (1999), as shown in Table 2.6, to evaluate the quality of the ecological input in EIA reports.

Lisbey (2015) adapted 32 review questions used by Soderman (2005). In this case, the Soderman (2005) checklist was adapted to suit the Belize's EIA legislation; and it was employed successfully to review the treatment of the biodiversity in the Belize EIA reports. This checklist has the following review areas: description of the development, description of the fauna and flora likely to be affected, description of the ecological impacts, examination of any alternatives, and examination of mitigation measures, and monitoring. In contrast to the Soderman (2005) review checklist, which employed a BAI index, this checklist employed the qualitative rating scale used in the Lee and Colley review package (Lee *et al.*, 1999).

Table 2.6: List of the assessment symbols of the Lee and Colley review criteria (Lee *et al.*, 1999).

Symbol	Explanation
A	Generally well performed, no important tasks left incomplete.
B	Generally satisfactory and complete, with only minor omissions and inadequacies.
C	Can be considered just satisfactory, despite omissions and/or inadequacies.
D	Parts are well attempted; but they must, as a whole, be considered just unsatisfactory because of omissions or inadequacies.
E	Not satisfactory, significant omissions or inadequacies.
F	Very unsatisfactory, important task(s) poorly done or not attempted
N/A	Not applicable. The Review Topic is not applicable, or it is irrelevant in the context of this statement.

Samarakoon and Rowan (2008) also developed a similar checklist to review the treatment of ecological impacts in EIA reports in Sri Lanka. This checklist was developed on the basis of the work done by Treweek *et al.* (1993) and Thompson *et al.* (1997). Khera and Kumar (2010) also studied the inclusion of biodiversity in EIA in India, using the Biodiversity Index.

2.12. Conclusion

EIA plays a crucial role in sustainable development, decision-making, stakeholder consultation and participation, design and planning of developments. However, the effectiveness of EIA tends to be highly questionable. Review checklists are used internationally and locally, in order to review the treatment of biodiversity in EIA. The reviewed literature revealed that most biodiversity issues are neglected or poorly addressed in EIAs. For example, in baseline studies, mitigation and monitoring, prediction and assessment of the impacts, and public participation.

One of the attempts to improve the integration of biodiversity issues in EIA is the development of guidelines; and in this chapter, these guidelines have been discussed. This chapter has also discussed the major impacts of mining activities on terrestrial and aquatic biodiversity. The mining and biodiversity guideline aims to improve the mainstreaming of biodiversity in all stages of the mining lifecycle, in order to minimise the impacts on biodiversity.

CHAPTER 3: THE METHODOLOGY

3.1. Introduction

This section describes a framework that has been employed to successfully achieve the aim of this study. In order to achieve the principal aim, a number of objectives were identified; and the ways that were used to achieve these objectives are addressed in this section. The methods employed to collect both the primary and the secondary data for this study are described. A detailed description of the review methodology and how the mining BIA report review package has been developed is now provided. Furthermore, a technique that was employed to assess the faithful representation of the biodiversity specialist input in the EIA report, and the compliance with the BIA report and with the environmental legislation is also described.

3.2. Selection of the study area

This study required an area that is under extensive mining in South Africa; and Mpumalanga province was identified as a suitable area to conduct this research. Mpumalanga grasslands are mainly found in cool open Highveld landscapes of the Mpumalanga province; and most of the wetlands occur in the grasslands of the wetter Highveld and escarpment regions (MTPA, 2014). Almost 76 % of the Mpumalanga grasslands have been targeted for mining and prospecting applications (CER, 2016). In certain parts of Mpumalanga, such as the Highveld area, air quality is among the worst in the world. In Mpumalanga, the land-use patterns were determined by mapping all the land-use applications received for comment by Mpumalanga Tourism and Parks Agency (MTPA) from 2000 to 2014. The results showed that the greatest pressure for land-use change in Mpumalanga, particularly in the Highveld area, is from prospecting applications (54.2%) and mining (24.5%), (MTPA, 2014). Therefore, this clearly shows that 61.3 % of the surface area of the Mpumalanga Highveld is covered by mining and prospecting applications.

In the Mpumalanga Highveld area, nearly a quarter of its vegetation is gazetted as threatened (CER, 2016). In 2015, there were 239 operating mines and 788 derelict and ownerless mines (CER, 2016). In this area, mining is dominated by coal; and it has been extracted there for more than 100 years. The Mpumalanga natural environment is in crisis; mining is proliferating at an unprecedented pace (CER, 2016). Mpumalanga province was therefore

selected to be a focus area for this study, on the basis of the above-mentioned characteristics; and the fact that this province represents an area of extensive mining in South Africa.

3.3 The data collection

In this study, both the primary and secondary data were used. The primary data were obtained by means of questionnaires; while the secondary data were obtained from the EIA reports and the BIA reports. The following sections describe briefly the data collection phase of this research.

3.3.1 The Primary data collection

The primary data were obtained by means of questionnaires (see Appendix I). The questionnaires were submitted to the relevant key biodiversity stakeholders. An ethics process was followed when conducting this research; however, no informed consent was received from the respondents. The identified biodiversity stakeholders included the Mpumalanga Tourism Parks Agency (MTPA), the South African National Biodiversity Institute (SANBI), the Wildlife Environmental Society of South Africa (WESSA), the Endangered Wildlife Trust, and other environmental Non-Governmental Organisations (NGOs). These key biodiversity stakeholders were selected because they are familiar with the South African mining and biodiversity guideline, and they have experience in providing comments on mining EIA reports. In this study, 15 questionnaires were distributed to the key biodiversity stakeholders by email. However, only 6 questionnaires were returned to the researcher. Due to time constraints during the data collection stage and the nature of this study, the questionnaire was not piloted before being submitted to the respondents. However, this was reviewed by other researchers in order to ensure the appropriateness of the questions.

Proper engagement with the key biodiversity stakeholders is recognised as a prerequisite for good practice EIA (DEA *et al.*, 2013). Key biodiversity stakeholders provide a valuable input in all the phases of the EIA process by ensuring that all the potential biodiversity impacts of the proposed project are given adequate consideration.

3.3.2 The Secondary data collection

In order to get more insight into the treatment of biodiversity impacts in mining EIAs before and after the publication of the South African Mining and Biodiversity Guideline (DEA *et al.*, 2013), it is equally important to obtain the secondary data. The secondary data were obtained

from the EIA reports and their Biodiversity Impact Assessment (BIA) reports. For one to successfully review the treatment of biodiversity impacts in EIA and BIA reports, it is necessary to develop a customised review package, in order to ensure that all the biodiversity issues are integrated in the EIA or BIA report.

In this study, it was decided that a quality review checklist would be more reliable; consequently, a mining BIA report review package was developed, as described in section 3.5.1. This review package was developed, on the basis of the BIA review package developed by Hallatt *et al.* (2015). However, some modifications to the review criteria were introduced; but the structure of the review package was maintained. The following section describes the technique that was employed to select the relevant reports for this study.

3.3.2.1 The report selection

In this study, the mining EIA reports and their biodiversity specialist studies for Mpumalanga province were obtained from the Mpumalanga Tourism Parks Agency (MTPA). A total of 46 biodiversity specialist studies (23 BIAs before and 23 BIAs after the publication of the mining and biodiversity guideline) were reviewed in this study. The sample included EIA studies conducted from 2007 to 2016. The EIA files for this study were selected randomly from all the mining applications submitted to the provincial conservation authorities for comments. Consequently, the selected sample represents EIA studies for major mining projects that have adverse impacts on the biodiversity. A total of 46 BIA reports were chosen in order to strengthen external validity by ensuring that there is no bias towards a particular type of BIA. BIA reports selected in this study included all types of biodiversity specialist studies, such as the fauna; the flora; the wetlands; and aquatic specialist studies. Selected EIA reports formed part of EIAs conducted for different mining projects, including coal, limestone, and sand mining, etc. These projects also included both open-cast and underground mining.

3.4 The review methodology

Review packages are widely used internationally to successfully review the quality of EIA reports. One of the most popular review packages is the Lee and Colley review package (Lee *et al.*, 1999). This review package was initially developed to analyse the quality of EIA reports in the United Kingdom (UK). The Lee and Colley review package has been widely adopted in South Africa (Carroll, 2006; Kruger, 2012; Mbhele, 2009; Moloto, 2005;

Sandham and Pretorius, 2008; Sandham *et al.*, 2008; Sandham *et al.*, 2013) to successfully review the quality of EIA reports.

A number of studies focusing on biodiversity assessment in the EIA process have applied various checklists and biodiversity assessment indices (Atkinson *et al.*, 2000; Dryson *et al.*, 2015; Naser *et al.*, 2008; Soderman, 2005) to assess the treatment of the biodiversity issues in the EIA reports. The Hallatt *et al.* (2015) BIA report review package draws mainly on the Lee and Colley review package. The literature on the methods used to review the treatment of biodiversity issues in EIA (section 2.11) revealed that the application of the biodiversity index and quality review packages are the two techniques that are the most widely used to review the treatment of biodiversity issues in EIA.

A quality review checklist to review the quality of the mining EIA reports have been developed by Sandham *et al.* (2008). However, there are currently no specific checklists and review criteria used to assess the treatment of biodiversity issues in mining BIA reports, regardless of the adverse biodiversity impacts associated with the mining projects. Taking into consideration all the impacts that mining projects pose on biodiversity, a complete Mining BIA report review package was developed in this study to analyse the treatment of biodiversity impacts in selected mining projects. The following sections provide a detailed account of how the mining BIA report review package was developed, and the methodology that was employed when analysing the treatment of biodiversity impacts in mining EIAs.

3.4.1 The development of the Mining BIA report-review package

After a thorough review of the literature on the methods used to review the treatment of biodiversity in EIAs (section 2.11) and the South African environmental legislation, the Hallatt *et al.* (2015) BIA report-review package was used as basis for the development of the mining BIA report-review package for this research. The Hallatt *et al.* (2015) BIA review package draws heavily on the specialist review guideline (Keatimilwe and Ashton, 2005) and the guideline on biodiversity specialist input in the EIA process (Brownlie, 2005).

The use of these guidelines ensures context-specific relevance to South Africa. It is crucial to note that these guidelines also include consideration of the international best practice EIA. The findings of the review highlight how the BIA report conforms to international and local standards (Hallatt *et al.*, 2015). This review package also incorporates the legal requirements for specialist studies (South Africa, 2010). This, therefore, shows that this review package

integrates both the local and the international best practices, as well as the minimum requirements set by the National Environmental Management Act (NEMA, 107 of 1998).

Because of these characteristics, this review package was then adapted in this study to develop the mining BIA report review package. The mining BIA report review package applied the hierarchical structure of the Lee and Colley review package (Lee *et al.*, 1999). Mining has adverse impacts on biological diversity and ecosystem services. Therefore, to successfully analyse the treatment of biodiversity issues in selected mining EIA projects, it was equally important to integrate some review criteria based on the reviewed literature, particularly the Good Practice Guidance for Mining and Biodiversity (ICMM, 2005); Mining and Biodiversity Guideline (DEA *et al.*, 2013); the requirements for biodiversity assessments in Mpumalanga province (MTPA, n.d.) ; KZN Biodiversity Assessment Guideline (Ezemvelo KZN Wildlife, 2013) and the minimum requirements for specialist studies set by NEMA (South Africa, 2014).

3.4.2 Mining BIA report review package

The mining BIA report review package consists of 13 review areas and 66 review criteria, while the Hallatt *et al.* (2015) BIA review package had 11 review areas and 51 review criteria. As described in the above section, some adjustments were made to the Hallatt *et al.* (2015) BIA review package. Table 3.1 shows a summary of the review areas and their review criteria. Opposite each review topic is an indication of whether the review topic has been introduced (N), no change in the review topic (NC), or the review topic has been used with some changes (UWC). A detailed description of mining BIA report review topics is provided in Appendix A.

In this study, it was decided that the structure of the BIA review package (Hallatt *et al.*, 2015) should be retained – due to the nature of the review topics. The Mining BIA report review package also followed the hierarchical pyramid approach. In this hierarchical approach, there are 3 tiers of assessments. A schematic representation of the review topics hierarchy in review area 1 and 2 is provided in Figure 3.1. The review starts at the lower levels of assessment (review criteria) up to the overall assessment of the BIA report.

Table 3.1: A summary of the review topics in all the review areas.

Review topics	Used With Changes=UW C/ New=N/No change =NC	Review topics	Used With Changes=UW C/ New=N/No change =NC
Review area 1: Expertise and professional conduct	NC	Review area 8: Inclusion of legal aspects	NC
Details of Biodiversity Specialist	UWC	Description of legal context and requirements	NC
Qualifications, expertise and experience of specialist	UWC	Description of policy and planning context	NC
Declaration of independence	NC	Identification and description of guidelines and standards	NC
Validity of the information in the BIA report	NC	Support of policy, plans and programmes	NC
Review area 2 : Adequacy and sufficiency of information	NC	Inconsistencies, potential areas of conflict	NC
Sufficient information for decision-making purposes	NC	Review area 9: Stakeholder consultation	NC
Terms of reference(TOR) for BIA	UWC	Description of any consultation process	UWC
Link between TOR and scoping	UWC	Summary and copies of any comments received	UWC
Adequacy of TOR	UWC	Input from key I&As in EIA	NC
Traditional or indigenous knowledge in the BIA report	NC	Need for additional stakeholder engagement	NC
Uncertainties, gaps in knowledge and low levels of confidence	NC	Review area 10: Prediction and assessment of impacts	NC
Degree of confidence in impact assessment prediction	NC	Consideration of plausible environmental & operating scenarios	NC
Review area 3: Clarity of the report	NC	Approach & methodology used to assess impacts	NC
Clear, non-technical summary	NC	Linkages to other specialists input	NC
Date and season of site investigation	UWC	Criteria used to assess impacts of different alternatives	NC
Sources of information	NC	Direct, indirect and cumulative impacts on ecological processes	NC
Description of the methodology adopted	NC	Indirect effects on significant or sensitive resources	UWC
Purpose and scope of the study	NC	Linkages from identification to evaluation	NC
Opinions and statements on report	NC	Consequences of the predicted impacts	NC
Conclusion derived and findings	NC	Nature of the impact on biodiversity & ecosystem services	NC
Summary impact assessment table	NC	Assessment & communication of impact in relation to future goals	NC
Description of the findings and potential their potential implications	NC	Identification of beneficiaries	NC

Review topics	Used With Changes=UW C/ New=N/No change =NC	Review topics	Used With Changes=UW C/ New=N/No change =NC
Review area 4: Description of the project	NC	Differentiation between ecosystems	N
Need and the purpose of the proposed project	NC	Cumulative impacts on biodiversity priority areas and threatened species	N
Description of the project and alternatives	NC	Review area 11: Recommendations for management	NC
Review area 5: Description of the baseline environment	NC	Summary of key management actions	NC
Characteristics of the affected environments	NC	Management of the potential impacts	NC
Description of the surrounding environments	NC	Application of the precautionary principle	NC
Maps, plans and photographs	NC	Viability and practicability of recommended management actions	NC
Reliable identification of biodiversity priority areas	N	Review area 12: Monitoring	NC
Description of key ecological processes	N	Monitoring programmes	NC
Environmental conditions	N	Practicability, viability, description and motivation of the proposed monitoring programmes	NC
Review area 6: Consideration of alternatives	NC	Review area 13: Communication of results	N
Consideration of reasonable alternatives	NC	Comprehensibility of the report	N
Adequate comparison of alternatives	NC	Statements on the report	N
Identification of best alternative	NC	A reasoned opinion on whether the proposed project should be approved.	N
Consideration of no-go alternative	N		
Review area 7: Sensitivity mapping	N		
Ecological linkages	N		
Levels of sensitivity	N		
Methodology for determining sensitivity	N		

This review package employed the qualitative rating scale used by Rajvanshi *et al.* (2007). The qualitative rating scale is used to determine the level of conformity of the report against the review criteria (Hallatt *et al.*, 2015). Studies on the quality of EIA reports tend to use the qualitative rating scale that has been used on the Lee and Colley review package (Lee *et al.*, 1999). Rajvanshi *et al.* (2007) modified the Lee and Colley rating scale; and they introduced the quality-remark component in the assessment symbols.

The quality remark in the assessment symbols provides a clear distinction between the quality grades; and therefore, it makes it easier for the reviewer to allocate a correct assessment

symbol for the review criteria, review area, or the BIA report as a whole. As shown in Table 3.2, the rating scale uses symbols A (the task has generally been well performed with no important omissions of biodiversity-related issues) to F (the work is insufficient to base judgment). A detailed description of the review procedure is provided in Appendix B.

Table 3.2: Assessment symbols with their description and explanation (Source: Rajvanshi *et al.*, 2007).

Symbol	Quality remark	Explanation
A	Excellent	The task has generally been well performed with no important omissions of biodiversity related issues.
B	Good	Task performed satisfactorily and is completed, with only minor omissions/inadequacies.
C	Satisfactory	Task is satisfactory despite some omissions or inadequacies.
D	Weak	Indicates that parts are well-attempted but, on the whole, are just unsatisfactory because of omissions or inadequacies.
E	Poor	Task is not satisfactory, revealing significant omissions or inadequacies.
F	No opinion	The work is insufficient to base judgment on it.
N/A	Not applicable	The review topic is not applicable in the context of the BIA report.

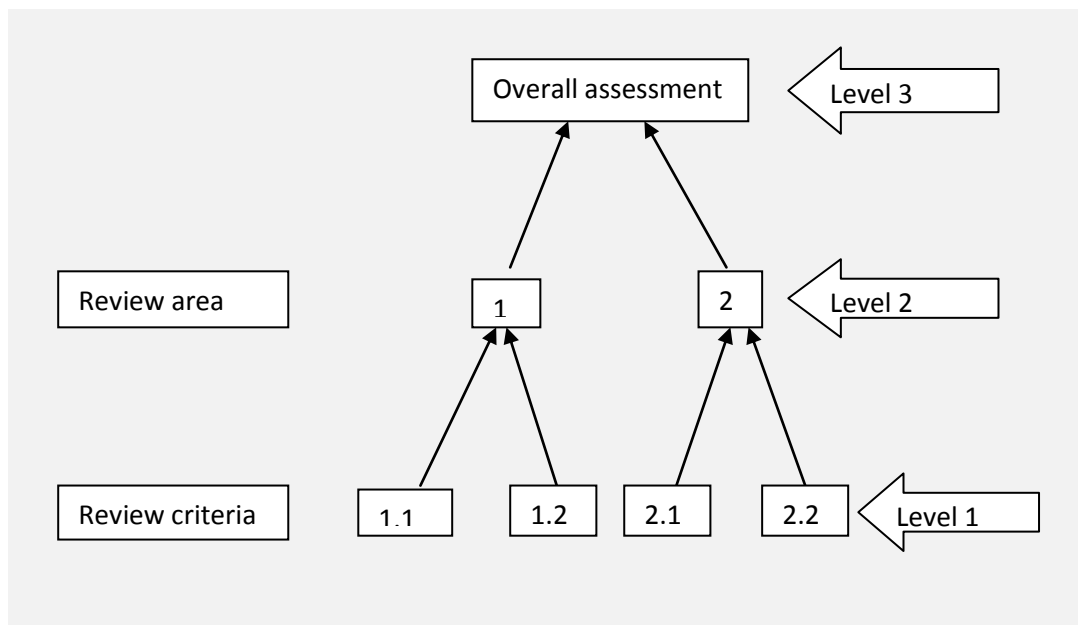


Figure 3.1: A schematic representation of the review-topic hierarchy in review areas 1 and 2 of the review package (adapted from: Hallatt *et al.*, 2015).

3.5. Compliance with environmental legislation

The National Environmental Management Act 107 of 1998, EIA regulations, provides the minimum requirements for specialist reports (South Africa, 2014). It is expected that all specialists adhere to these minimum requirements and other EIA best practice. The compliance of BIA reports with environmental legislation was assessed by using the assessment symbols that were used in the assessment of the mining BIA reports (see Table 3.2).

The BIA report complies with the minimum requirements if their legal review criteria provided in Table 3.3 are assessed as satisfactory (scored A, B, or C). If the review criteria do not attain these levels of assessments, the BIA report should then be assessed as non-compliant with the minimum requirements set by NEMA EIA regulations for specialist studies. A summary of the minimum requirements for the specialist studies (South Africa, 2014) and their corresponding review criteria in this study is provided in Table 3.3.

Table 3.3: Minimum requirements for specialist reports and the corresponding review criteria in the mining BIA report review package (adapted from: South Africa, 2014).

Minimum requirements for specialist reports set by NEMA	Corresponding review criteria in the developed review package
Details of the specialist who prepared the report;	1.1
The expertise of that specialist to compile a specialist report including a curriculum vitae;	1.2
A declaration that the specialist is independent in a form as may be specified by the competent authority;	1.3
The date and season of the site investigation and the relevance of the season to the outcome of the assessment;	3.3
An indication of the scope of, and the purpose for which, the report was prepared;	3.6
A description of the methodology adopted in preparing the report or carrying out the specialised process;	3.5
A reasoned opinion as to whether the proposed activity or portions thereof should be authorised;	12.3
A description of any consultation process that was undertaken during the course of preparing the specialist report;	8.1
A summary and the copies of any of the comments received during any consultation process and where applicable all responses thereto;	8.2
A description of any assumptions made and any uncertainties or gaps in the knowledge.	2.6

3.6. Faithful representation of the biodiversity specialist input in the EIA report

After the BIA report review, it is highly advisable that the reviewer should also assess the integration of the BIA report in the main EIA report. The findings of the biodiversity specialist should be faithfully represented in the EIA report. The KZN biodiversity assessment guideline (Ezemvelo KZN Wildlife, 2013) and the guideline for biodiversity specialist input in the EIA process (Brownlie, 2005) provide some useful pointers to assist the reviewer to assess how the biodiversity specialist input has been integrated in the EIA report.

The review criteria from the Lee and Colley review package have been adapted in the first category. However, due to the nature of this study, faithful representation of biodiversity specialist input focused mainly on the layout and presentation, sensitivity mapping, alternatives, impact assessment, and mitigation and management actions. The review questions were formulated to be more general in order to encourage the reviewer to go through relevant biodiversity sections of the EIA reports and highlight any gaps or inadequacies concerning the input of the biodiversity specialist.

Table 3.4 provides the review topics employed when assessing faithful representation of specialist input. It is important for one to note that the grading system used in the review of the mining BIA reports was also employed in this section in order to facilitate the assessment of the results. However, the reviewer is encouraged to make comments during the review, since they provide more details on how the Environmental Assessment Practitioner (EAP) has incorporated the findings of the specialist in the EIA report, rather than focusing on the grading system.

Table 3.4: Faithful representation of biodiversity specialist input in the main EIA report.

Faithful representation of biodiversity specialist input in the EIA report
Review topics
Presentation and layout
Is the information on the report logically arranged in sections and the whereabouts of important data signalled clearly?
Are the biodiversity sections unbiased? These should not lobby for any particular point of view. Adverse impacts should not be disguised by euphemisms or platitudes.
Is the information on biodiversity presented so as to be comprehensible to the non-specialist? Tables, Graphs and other devices should be used as appropriate. Unnecessarily technical or obscure language should be avoided.
Sensitivity mapping
Does the EIA report include the composite sensitivity map collating the sensitivity mapping products from each biodiversity specialist report? Maps should be signed by the specialists and the highest sensitivity value needs to be depicted.
Is the size (in hectares) and location of all sensitive areas included in the composite map, and is the map in colour?
Is the proposed project footprint map superimposed upon the sensitive map? Proposed project footprint should include all development structures, access roads, service infrastructure, and construction and installation work areas.
Are photographs of all biophysical characteristics of the area including sensitive features part of the EIA report? Photographs should be dated and clearly referenced.
Alternatives
Does the EIA report contain an explicit and defensible statement on the preferred alternative, taking into account the specialists findings?
Impact identification, assessment and prediction
Are the identified impacts in the BIA report soundly reflected in the main EIA report?
Is the assessment of potential biodiversity impacts of the proposed development based on the findings, assessments and recommendations for mitigation in all the biodiversity specialist studies undertaken for each feasible alternative included? In cases where EIA practitioner disagrees with any of the specialist findings/assessments/recommendations, the differences need to be addressed.
Is a clear description of residual adverse impacts on biological diversity provided?
Are cumulative impacts on biodiversity soundly reflected in the EIA report as described by the biodiversity specialist?
Is the significance rating table provided for each biodiversity impact assessed? Significance rating table should resemble that of the specialist as provided in the BIA report.
A description of the proposed method of assessing the significance of the impacts should be given thus the rating and ranking of impacts to attach values to impacts.
Mitigation and management
Is the summary of mitigation and management actions provided by the biodiversity specialist clearly described in the EIA report?

CHAPTER 4: RESULTS AND ANALYSIS

4.1 Introduction

This chapter focuses on the results obtained in this study and their analysis, as discussed in Chapter 3. The presentation of the results starts from the review of the mining BIA reports, followed by the review of the main mining EIA reports (faithful representation of the biodiversity specialist input), and conformity with the mining BIA reports to the NEMA EIA regulations; and lastly, this chapter will also provide the results and the analysis of the questionnaires. It is important for one to note that not all the review criteria are presented in this chapter. However, Appendices C and D provide all the results of the review area and the criteria level (before and after 2013).

4.2 Results and discussion of mining BIA reports review

4.2.1 Review Area 1: Expertise and Professional conduct

Before 2013

This review area was well performed in most BIA reports. Almost all the BIA reports provided the Details of the Biodiversity Specialist that undertook the study (Review criteria 1.1). Review criteria 1.2 (Qualifications and Expertise and Experience of a Biodiversity Specialist) and 1.3 (Declaration of Independence) were the least-performed review criteria, with only 17% and 52% satisfactory cases, respectively (see Figure 4.1).

It is a basic requirement for a specialist report to contain the declaration of independence and the expertise of the specialist to undertake a specialist study. Specialists in the EIA process must be independent, in order to provide objective information (Munster, 2005). A signed declaration of independence ensures that the biodiversity specialist has no vested interest in the proposed mining project. These review criteria form part of the requirements for any specialist report, as set by the NEMA EIA regulations (South Africa, 2014). Therefore, it was expected that the specialists would provide these details in their reports.

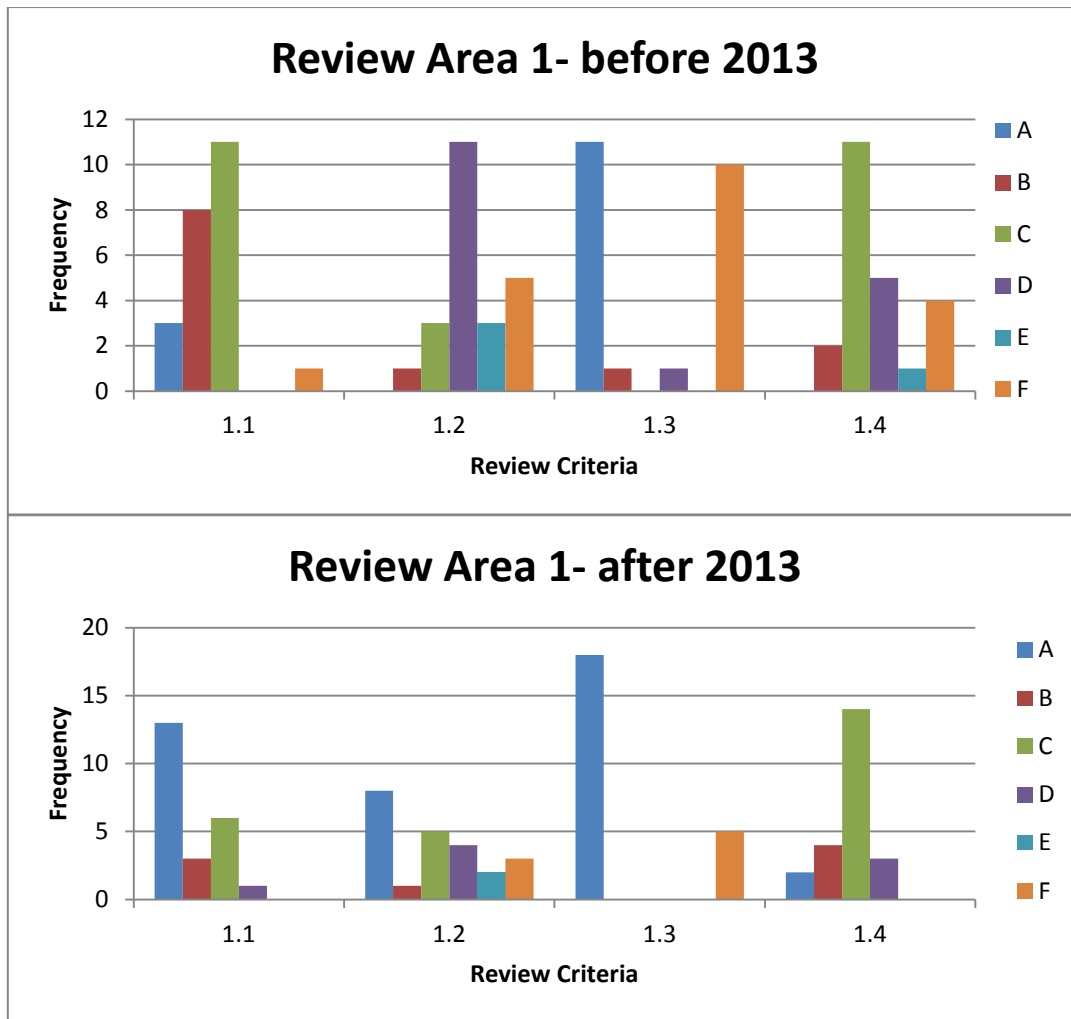


Figure 4.1: Results of the review criteria in review area 1.

After 2013

Review area 1 (Expertise and professional conduct) was well performed after 2013, with 87% satisfactory cases. All the review criteria under this review area were satisfactory. Review criteria 1.2 (Qualifications, expertise and experience of the specialist) and 1.3 (Declaration of independence), which were poorly performed before 2013, improved significantly – with 61% and 78% satisfactory scores, respectively (see Figure 4.1). The majority of the review criteria in this review area scored “A” (Well performed) after 2013, as shown in Figure 4.2.

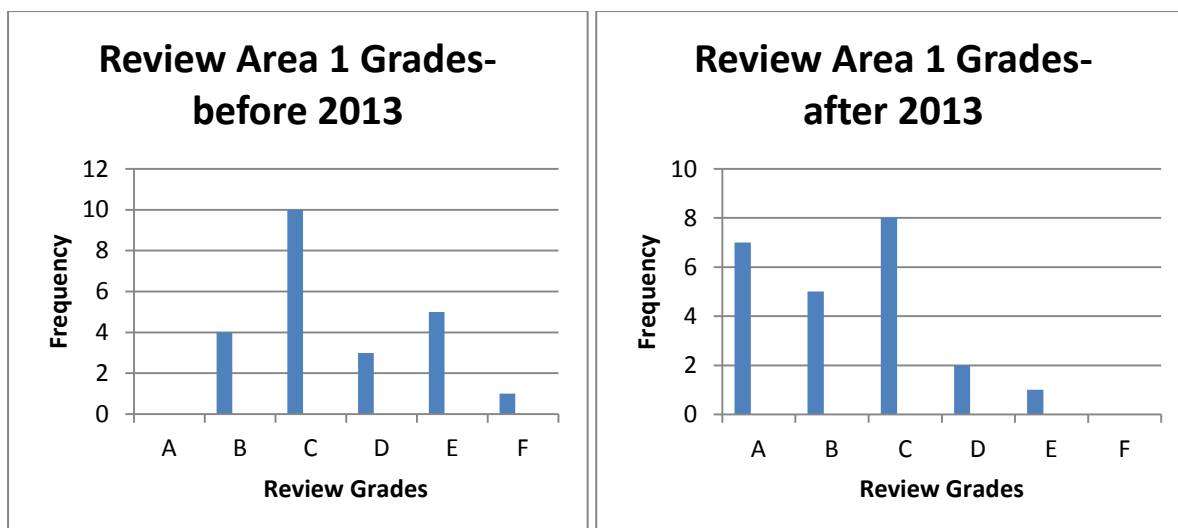


Figure 4.2: Assessment grades for review area 1.

All the reports prepared before 2013 failed to receive “A” in this review area. It is therefore clear that this review area as a whole has improved greatly compared with the results obtained before 2013. However, it was discouraging to see that there were no curricula vitae or descriptions of the expertise to conduct a specialist study in one of the BIA reports. This information is very crucial; since it ensures that the biodiversity specialist has the required qualifications and expertise to undertake a specialist study (Keatimilwe and Ashton, 2005).

There were also a few cases where the declaration of independence was not included in the reports. Signing the declaration of independence ensures that the biodiversity specialist has no personal interest in the proposed mining activity. This clearly shows that even though these results are promising, there is still room for improvement.

4.2.2 Review Area 2: Adequacy and Sufficiency of Information

Before 2013

Review area 2 (Adequacy and sufficiency of information) was poorly performed, with only 48% of BIA reports that managed to do well in this review area. It is clear that a number of mining BIA reports contained inadequate and insufficient information for decision-making purposes. In this review area, there were only 3 review criteria, which were performed satisfactorily, as shown in Figure 4.3. These were the Terms of Reference (ToR) (review

criterion 2.2) for BIA study (83%); adequacy of ToR (review criterion 2.3) (61%); and uncertainties, gaps in knowledge and low levels of confidence (review criterion 2.5) (65%).

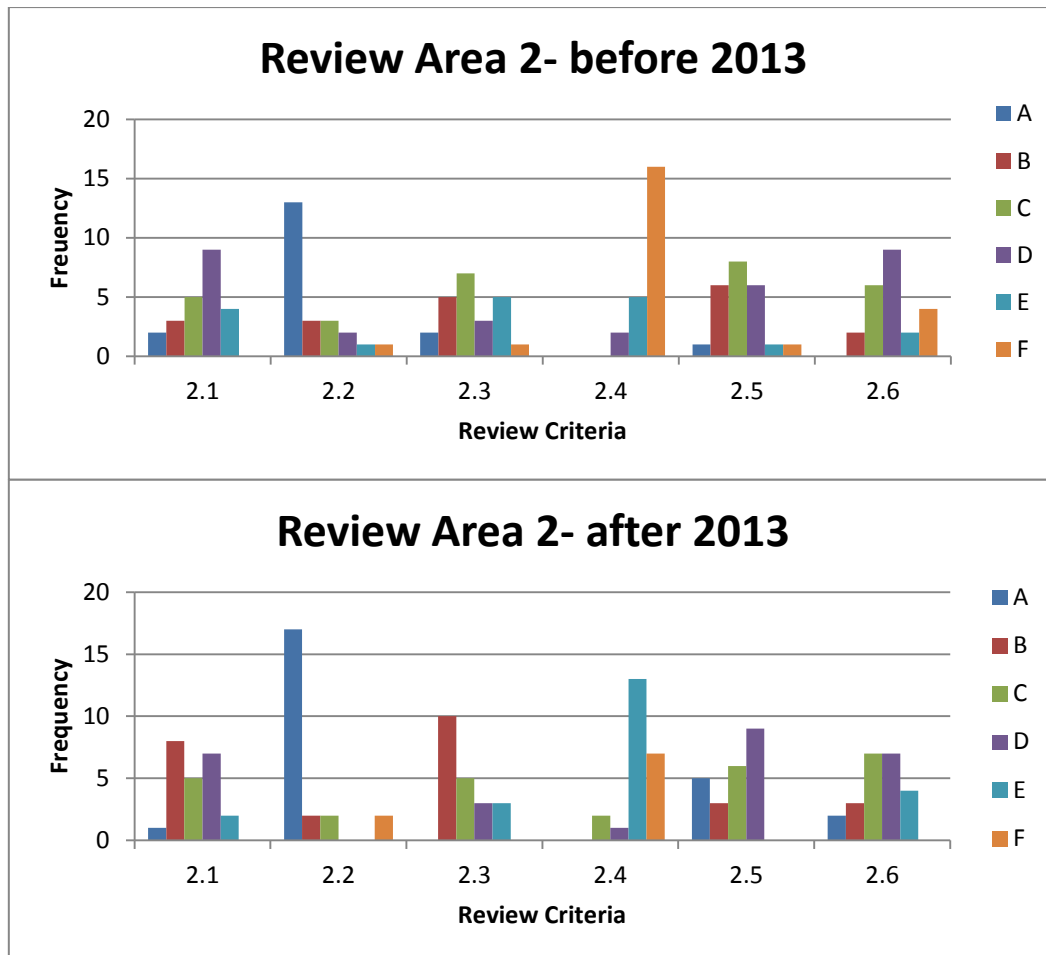


Figure: 4.3: Results of the review criteria in review area 2.

It is important for one to note that the ToR for the other mining BIA reports were very poor and inadequate. For instance, in some BIA reports, the ToR were not included; and sometimes where provided, they were not explicit. Well-defined ToR are crucial to the outcome of the specialist study (Weaver, *et al.*, 2000). However, in certain cases, the biodiversity specialists were able to perform well by providing all the relevant information, including that which was not part of the ToR. Specialist ToR should include the types of approach and techniques to be employed by the specialist (Munster, 2005). In one of the BIA

reports, the Specialist failed to meet the requirements of the ToR. In the ToR, the impact assessment was included, but this was not conducted by the biodiversity specialist.

The inclusion of traditional or indigenous knowledge was not attempted at all in the BIA reports. In all the BIA reports reviewed, none of the reports managed to incorporate some form of traditional or indigenous knowledge. From these results, it is clear that the biodiversity specialists do not value the importance of the traditional or indigenous knowledge in their assessments; or they do not understand the importance of integrating this knowledge into their studies. The degree of confidence in impact-assessment prediction was also poorly performed in most BIA reports, with 65% of the reports failing to clearly specify and explain the degree of confidence. In these BIA reports, only 43% can be regarded as satisfactory in terms of providing sufficient information for decision-making purposes (review criteria 2.1).

After 2013

Review area 2 has been improved with 61% satisfactory cases after 2013, compared to 48% obtained before 2013. However, none of the reports managed to score “A” in this review area (see Figure 4.4). This shows that there is still room for improvement in this review area. Review criterion 2.4 (adequacy of ToR) improved slightly from 61% to 65% satisfactory cases, as shown in Figure 4.3. It is important for one to note that two BIA reports did not include their ToR. This is discouraging; because it is expected that the biodiversity specialists would attach their ToR in their BIA reports, in order to assist the decision-makers when reviewing the BIA reports.

The review criterion 2.5 (traditional or indigenous knowledge) was also poorly done after 2013, with only 9% of the BIA reports reviewed managing to provide some form of this knowledge in their studies. This review area has proven to be of particular weakness in biodiversity assessments conducted in South Africa. For instance, in a study conducted by Hallatt *et al.* (2015) in the Cape Floristic region, indigenous knowledge system in BIA reports was identified as one of the major weaknesses. In this research, only one BIA report attempted this review criterion, for instance, statements like “these species are used traditionally and it is considered to have ‘magical’ and / or medicinal properties by local communities” was noted in one of the BIA reports.

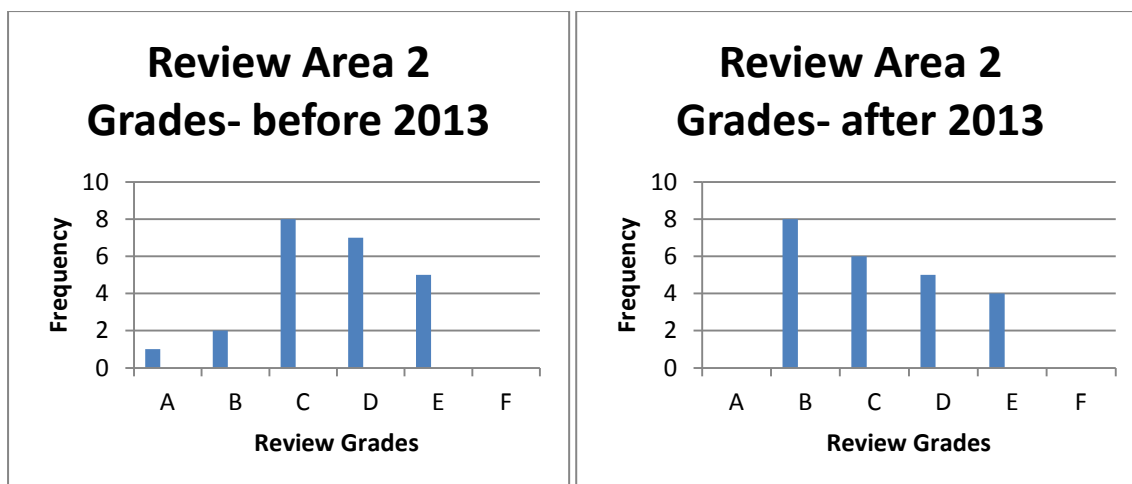


Figure 4.4: Assessment grades for review area 2.

The review criterion 2.1 (sufficiency of information for decision-making) showed some improvement from 43% obtained before 2013 to 61% after 2013. In most BIA reports, the ToR were not explicit, and in certain cases these were adequate; but the Specialists failed to meet the ToR. Figure 4.4 shows that only 1 BIA report managed to score “A” before 2013 in this review area; whereas none of the BIA reports scored “A” after 2013. However, a number of BIA reports performed well after 2013 in this review area – by receiving better grades; and 8 received “B” and 6 received “C” (see Figure 4.4).

A number of the BIA reports that were satisfactory before 2013 were graded as “C”. The results obtained in this review area show that there is still a need to improve the other review criteria, in order to ensure that adequate information is provided in the BIA reports.

4.2.3 Review area 3: Clarity of the Report

Before 2013

Review area 3 (clarity of the report) was well attempted, with a satisfactory score of 78%. All the review criteria in this review area managed to obtain 61%, a satisfactory score and above. As shown in Figure 4.5, most review criteria scored between A and C grades. For instance, review criteria 3.5 (purpose and scope of the study), 3.1 (clear, non-technical summary), 3.3 (sources of information), scored 96%, 91%, and 95%, respectively. From these results, it is

clear that this is not a problem area in most BIA reports. However, there are certain areas that need to be improved. For example, the review criteria 3.2 (date and season of site investigation); 3.6 (opinions and statements on the BIA report) and 3.9 (description of the findings and their potential implications).

In certain BIA reports, the date and season of the site investigation were not included. This is one of the requirements of specialist studies, as set out by the NEMA EIA regulations (South Africa, 2014). Therefore, it was expected that the biodiversity specialists would include this crucial information in their BIA reports.

In one of the reports, a date for the field survey was provided; but there was no motivation, and the survey was conducted in an inappropriate season for faunal surveys. According to the Specialist, only one field survey was undertaken; because the client had requested that the survey should be conducted “as soon as possible”. These types of survey provide only “snapshots” of baseline information (Hallatt *et al.*, 2015), missing important information on biodiversity and ecosystems that need to be considered, in order to make an informed decision about the proposed mining project. The issue of time-frames is one of the major challenges in the field of BIA, where the client would focus on meeting the deadlines without considering the amount of time available to conduct the BIA studies. For example, in a number of BIA reports, only one site visit was undertaken; and sometimes these were undertaken in winter instead of summer – due to the fact that the EAPs want to meet their deadlines.

It is important for one to note that the field surveys need to be conducted in specific time periods; for example, most biodiversity assessments need to be conducted in different seasons, in order for one to understand how the proposed project will impact the biodiversity. Lee *et al.* (2014) highlighted that poor surveys are usually caused by tight deadlines and inadequate report review. In order to improve biodiversity surveys, communication between the EAPs, Specialists, and the Client should be improved.

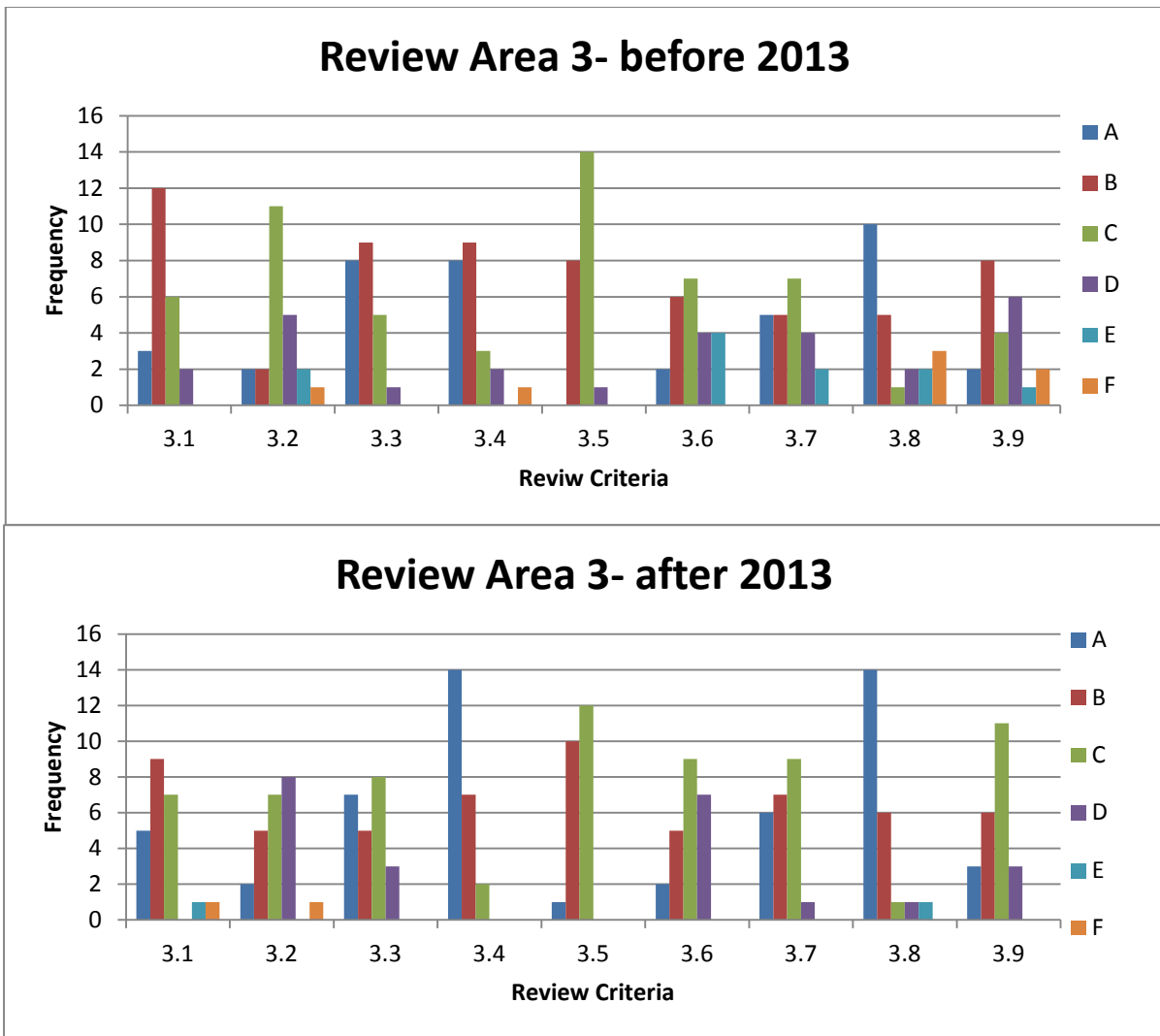


Figure 4.5: Results of the review criteria in review area 3.

There seems to be a miscommunication between these groups, which tends to undermine the biodiversity surveys. This can also lead to cases where by a project commences before a Specialist can conduct a survey to verify potentially sensitive environments. This is prevalent in small environmental projects, which do not require Environmental Authorisation in terms of NEMA, where a Specialist is required, for instance, to provide an input, in order to decide whether the proposed activity will require authorisation in terms of the National Water Act (Act No. 36 of 1998) (NWA).

After 2013

As discussed in the previous section, this review area was also well performed after 2013, with a satisfactory score of 91%. Review criteria 3.4 (Description of the methodology adopted) and 3.5 (Purpose and scope of the study), managed to score 100%, as shown in Figure 4.5. All the other review criteria were improved significantly, with the exception of 3.2 (Date and season of site investigation). This review criterion received 61% compared with the 65% obtained before 2013. This is discouraging, because the NEMA EIA regulations require that specialists should include the date and season of the site investigation in their reports (South Africa, 2014).

Failure to conduct biodiversity assessments during the appropriate and different seasons can be the reason why the specialist decided not to include the date and the season of the survey. Figure 4.6 shows that a majority of the reports were graded between A and C, before and after 2013. However, there were 4 BIA reports that were poorly performed in this review area after 2013, received D and E grades. After 2013, there were only 2 BIA reports that received D grades in this review area (see Figure 4.6).

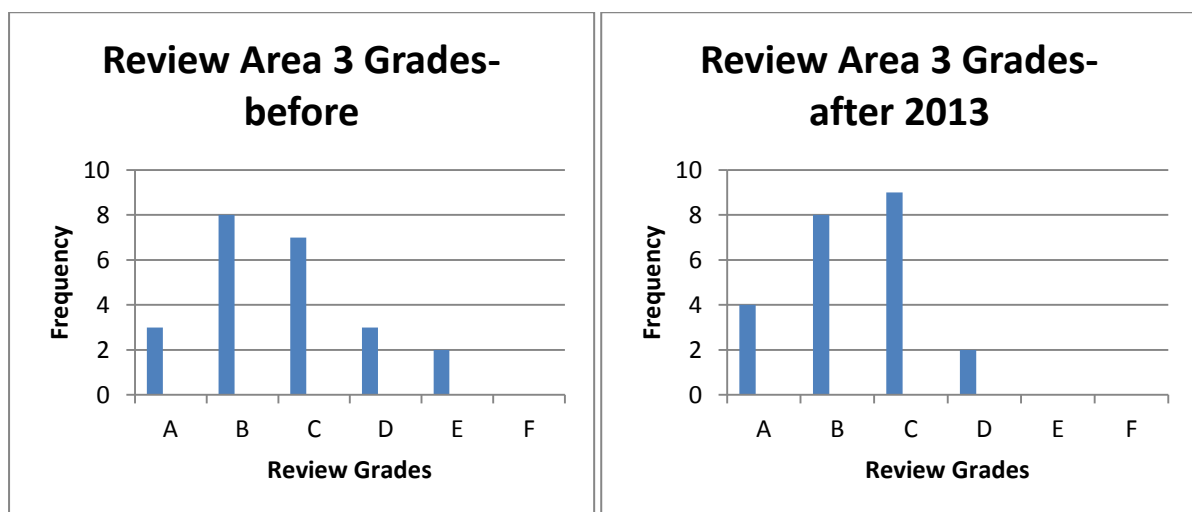


Figure 4.6: Assessment grades for review area 3.

In most BIA reports, only a date for the site visit was given; and the relevance of the season to the outcome of the assessment (3.2) was not given. In cases where these were provided, the motivation was missing. However, it might be difficult for biodiversity specialists to provide this information when they are aware that they have conducted their assessments during an

inappropriate season. In one of the BIA reports which were submitted in 2016, there was still no mention of the Mining and Biodiversity Guideline (DEA *et al.*, 2013). It is clear that the BIA community is not well informed about the importance of applying these best practice guidelines when assessing the potential impacts on biodiversity.

4.2.4 Review area 4: Project Description

Before 2013

The description of the project ensures that the identified potential impacts on biodiversity were assessed; and recommendations for alternatives, management actions and monitoring programmes are provided within the appropriate context (Keatimilwe and Ashton, 2005).

The description of the project was poorly performed in most BIA reports. In this review area, there were only 4 (17%) BIA reports that managed to describe the project. In other reports, this information was either poorly described or completely missing. In one of the reports a repetition of the executive summary was provided under the project description. No information relating to the proposed project was provided. As shown in Figure 4.7, in review criterion 4.1 (Need and the purpose of the proposed project), 10 reports scored F, and 6 scored E, before 2013. This means that 70% of the reports did not even attempt to provide the need and the purpose of the proposed project.

Review criteria 4.2 (description of the project and alternatives) was also poorly performed in most BIA reports, with only 4 BIA reports that attempted this review criterion; and these were graded as C. It seems as if most biodiversity specialists did not really understand what to include in the project description. Project description has been identified as one of the major weaknesses in biodiversity assessments (Hallatt *et al.*, 2015; Khara, 2010; Soderman, 2005). Biodiversity specialists need to understand the importance of including this crucial information in their BIA reports. From the results obtained in review criteria 4.1 (need and the purpose of the proposed project) and 4.2 (description of the project and alternatives), it is evident that the project description is neglected by most of the biodiversity specialists.



Figure 4.7: Results of the review criteria in review area 4.

After 2013

This review area showed a slight improvement when compared with the results obtained before 2013 in the same review area. In this review area, 65% of the cases failed to properly describe the project. All the review criteria also failed to score a satisfactory score of 60%, or above. Review criterion 4.1 (description of the project and alternatives) managed obtain a satisfactory score of 57% (B-C). In most biodiversity studies, the project description was limited to the purpose of the project, and there was no description about the inadequacy of the project.

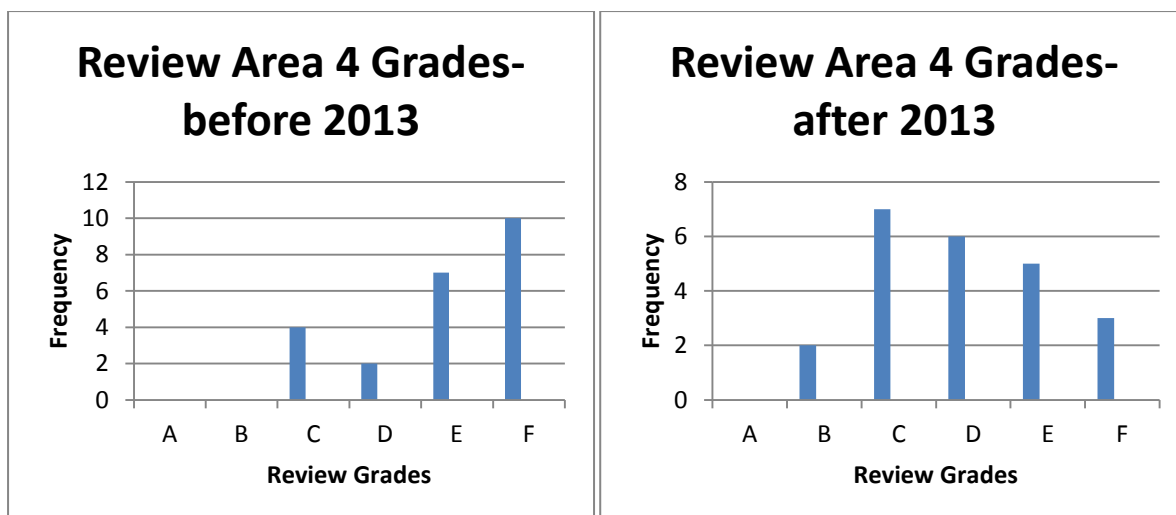


Figure 4.8: Assessment grades for review area 4.

The results on the assessment grades (Figure 4.8) show some improvement in the number of B and C grades obtained after 2013, when compared with those obtained before 2013. For instance, only 4 reports scored between A-C grades before 2013; while there were 9 reports that scored between A-C after 2013. Biodiversity specialists that are involved in mining EIAs need to understand the importance of describing the project in their reports; this would also facilitate the review of the BIA report, such that the reviewer does not have to cross-reference the main EIA report.

Providing the description of the project also shows that the biodiversity specialist understands the proposed mining activity, including the feasible alternatives.

4.2.5 Review area 5: Description of the Baseline Environment

Before 2013

The description of the baseline environment was attempted in 52% of the cases. It was poorly described in 11 BIA reports reviewed. Areas of weakness include: the description of key ecological processes (5.5), reliable identification of biodiversity priority areas (5.4), and the characteristics of the affected environment (5.1), as shown in Figure 4.9. However, the review criteria 5.3 (maps, plans and photographs) was well performed with a satisfactory score of 70%. The description of the baseline environment is one of the most important

aspects of environmental assessment; and therefore it needs to be properly conducted, in order to inform the impact-assessment phase.

According to Soderman (2005), the effectiveness of the impact prediction is directly influenced by the available baseline information. In one of the faunal specialist reports, the faunal surveys were not done; but, according to the biodiversity specialist, some species were observed and recorded during a site visit. There was no explanation as to why the surveys were not undertaken. Studies focusing on the treatment of biodiversity issues in EIA around the world have confirmed the lack of new ecological surveys in biodiversity assessments (Naser *et al.*, 2008; Samarakoon and Rowan, 2008; Thompson, *et al.*, 1997).

The failure to conduct new ecological surveys and dependent on desktop assessments would lead to poor predictions of the impacts on biodiversity and ecosystems.

General weaknesses were noted in the reports; for instance, some specialists failed to provide maps; while others provided black and white maps without any basic map elements (legend/title/scale etc.). Photographs were not properly referenced or dated. Most surveys were proven to be very weak. For example, in one of the BIA reports, the survey for reptiles was conducted during winter, which is not a favourable season for the identification of reptiles; since they tend to undergo hibernation during winter. However, this can also be attributed to the tight deadlines for EIAs (Lee *et al.* 2014).

Baseline information was very subjective in most biodiversity specialist studies. In one of the reports, the specialist highlighted that during the survey there were no red data species recorded; and this was attributed to the fact that the site and the surrounding environment had experienced severe disturbances. However, the specialist mentioned that the survey was undertaken in winter, which is not a favourable season for faunal and floral surveys. This clearly shows that the seasonal factor might have been more influential in poor identification of the Red data species than the disturbed environment. Baseline studies should include different seasons, migrations, breeding, etc.; and they should be long enough to determine pre-project trends (IUCN and ICMM, 2004).

In certain cases, surveys were only undertaken for the underground mining area; and adjacent and surrounding areas were not included in the surveys. EIAs tended to lack proper baseline surveys (IUCN and ICMM, 2004). In most studies, the assessment was mainly based on the individual species; and no ecosystem approach was employed.

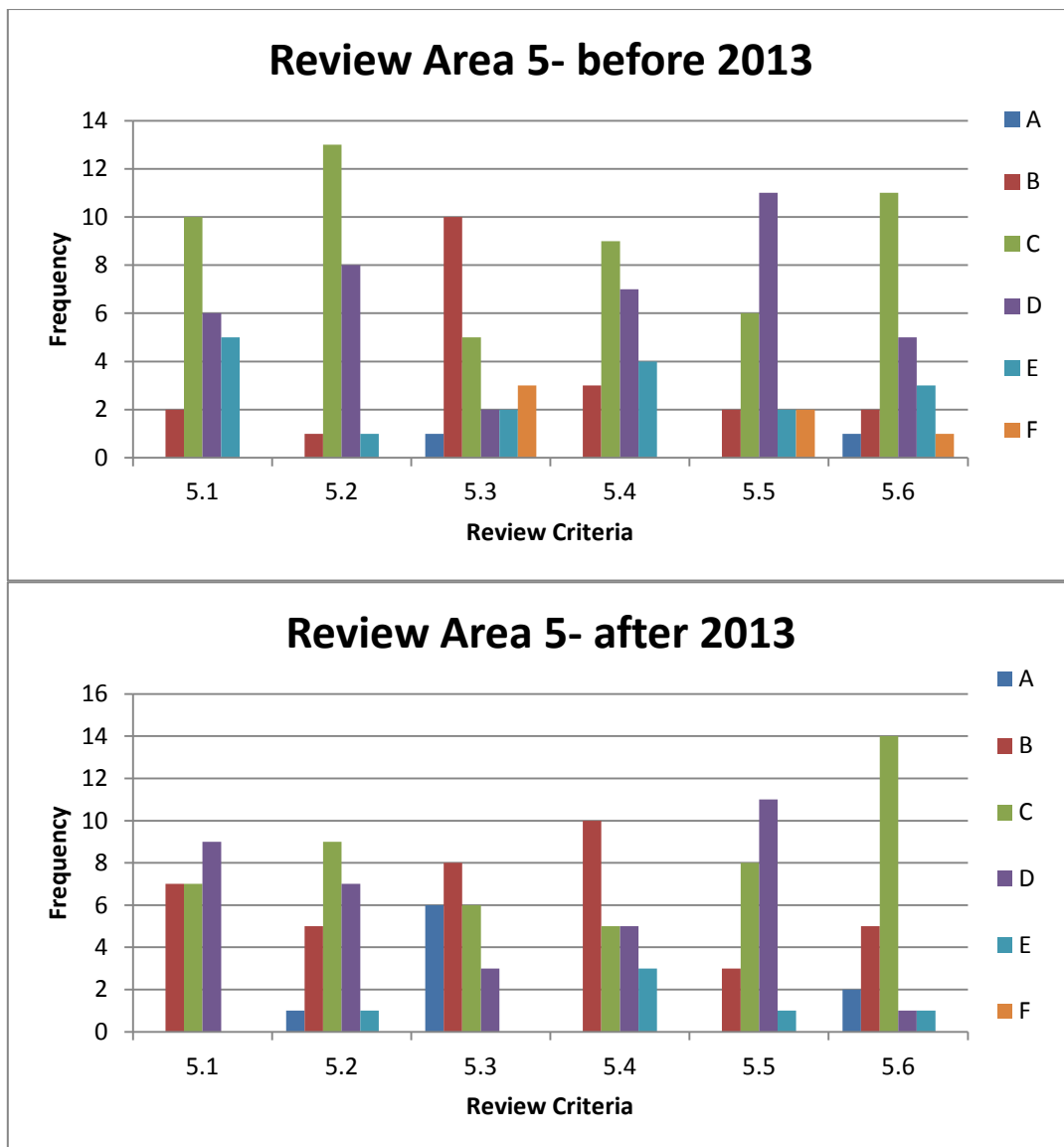


Figure 4.9: Results of the review criteria in review area 5.

After 2013

This review area was well-attended, with 65% of satisfactory cases, compared with the 52% that were obtained before 2013. Review criteria 5.6 (environmental conditions), and 5.3 (maps, plans and photographs) received a satisfactory score of 91% and 87%, respectively (see Figure 4.9). However, the description of the key ecological processes was poorly done in 12 (33%) of the mining BIA reports reviewed. This clearly shows that this important review criterion do not receive the treatment it deserves from most of the biodiversity specialists. International studies in biodiversity assessments have revealed that these studies fail to

address the ecological processes; instead they tend to focus on species level (Atkinson, 2000; Byron *et al.*, 2000; Soderman, 2005; Treweek, 1999).

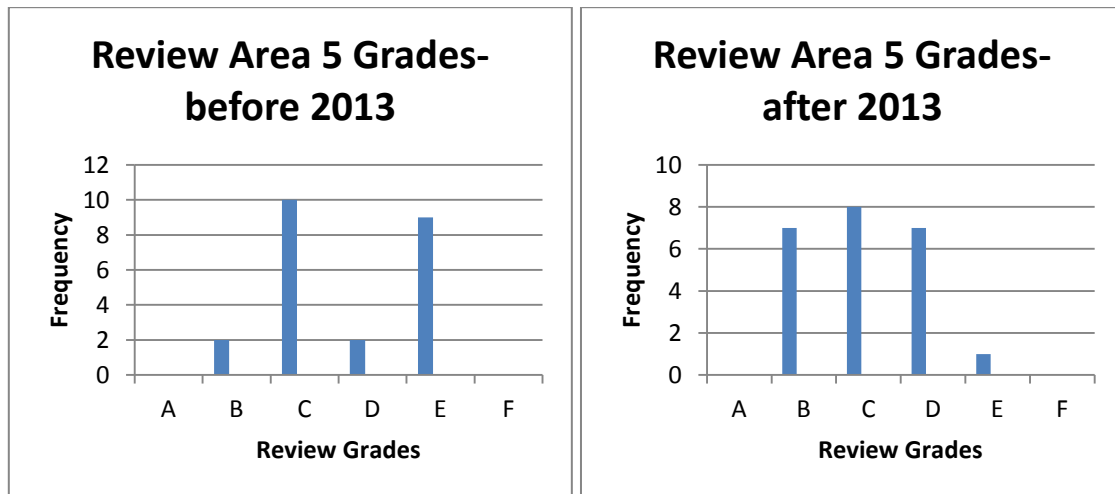


Figure 4.10: Assessment grades for review area 5.

Review criteria 5.1 (Characteristics of the affected environments) and 5.4 (Reliable identification of biodiversity priority areas) managed to obtain satisfactory scores of 61% and 65%, respectively (see Figure 4.9). Therefore, these review criteria show some level of improvement when compared with the results obtained before 2013. In most BIA reports, there was no mention of the Biodiversity Priority Areas (BPAs). This shows that biodiversity specialists have not considered the BPAs during their assessments. One of the reports performed well in this review area, by providing the date and motivation for the season. For instance, statements like “the site visit fell within the wet season on the Mpumalanga Highveld (November-April); and this allowed the identification and use of vegetation indicators in determining the wetland extent” were noted. Figure 4.10 shows that all the reports failed to score A (Well performed) in this review area.

The majority of the BIA reports scored C (10 before and 8 after 2013) showed that none of the reports scored F, and that a number of reports that were poorly performed scored D.

4.2.6 Review area 6: Consideration of Alternatives

Before 2013

This review area was poorly performed in most BIA reports reviewed. The results show that in 11 BIA reports, consideration of alternatives was well attempted. All the satisfactory reports received a C grade, that is, they were just satisfactory. Consideration of alternatives received a satisfactory score of 48% before 2013. All the review criteria in this review area failed to receive a satisfactory score of 60% (C).



Figure 4.11: Results of the review criteria in review area 6.

The no-go alternative (6.4) and the adequate comparison of alternatives with the proposed project (6.2) were the least-performed review criteria, with each receiving 9% and 48%, respectively (see Figure 4.11). From these results, it is clear that the no-go alternative was not assessed in most of the biodiversity specialist studies. Alternatives have been identified as a weakness in most studies focusing on the treatment of biodiversity issues in EIA in South Africa (Hallatt *et al.*, 2015) and internationally (Soderman, 2006; Khera, 2010). Review criteria 6.1 (Consideration of reasonable alternatives) and 6.3 (Identification of best alternative) received 57% and 52% satisfactory cases, respectively. This clearly shows that there is a need to improve the consideration of alternatives in biodiversity assessments for mining projects, in order to ensure that the whole EIA process contributes to biodiversity conservation.

After 2013

Consideration of alternatives after 2013 was also poorly performed in most biodiversity assessments, with an overall satisfactory score of 52%. This is a 4% difference when compared with the 48% obtained before 2013. Review criterion 6.1 (consideration of reasonable alternatives) was the only review criterion that managed to obtain a satisfactory score of 61%. As shown in Figure 4.11, all the other review criteria scored below 60%, which is the minimum. The no-go alternative was the least-performed, with a satisfactory score of 35%, showing only a slight improvement from the 9% received before 2013. The review criterion 6.2 (adequate comparison of alternatives) and 6.3 (identification of best alternative), both received a satisfactory score of 52%.

Figure 4.12 shows that none of the BIA reports managed to score A, before or after 2013. Some improvements were noted on the results obtained after 2013. For instance, 5 BIA reports scored B, while there were none that scored B before 2013. However, the overall results obtained before and after 2013 show that there is only a slight, or no improvement in the consideration of alternatives in most biodiversity assessments. Considering the impacts associated with the mining industry, there is a need to improve the consideration of alternatives, in order to promote sustainable development. Better consideration of the alternatives for the proposed mining projects would minimise the degradation of biodiversity and ecosystems that plays a pivotal role in our environment. Furthermore, this would promote

biodiversity conservation and enhance ecosystem services for the benefit of the local communities.

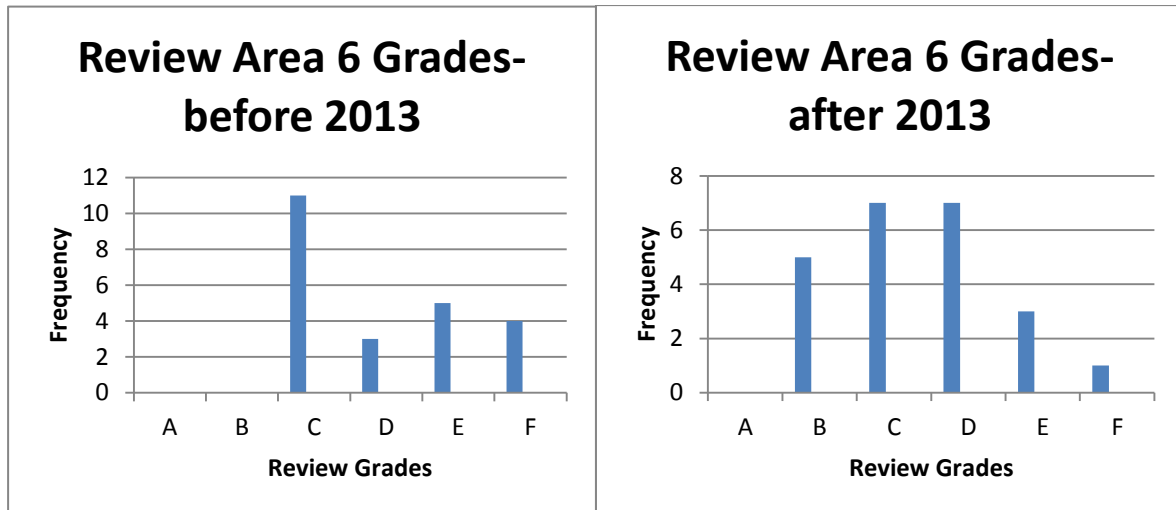


Figure 4.12: Assessment grades for review area 6.

4.2.7 Review area 7: Sensitivity Mapping

Before 2013

Sensitivity mapping was one of the poorly performed review areas. This review area managed to score 35% satisfactory cases. All the review criteria under sensitivity mapping failed to obtain a satisfactory score of 60%. For instance, ecological linkages (7.1), levels of sensitivity (7.2), and the methodology for determining sensitivity (7.3), received a satisfactory score of 43%, 30%, and 35%, respectively (see Figure 4.13). From these results, it is clear that this review area is neglected by the biodiversity specialists. It is not clear what has led to the poor performance of this important review area. However, this is a new concept in the EIA process, especially for those EIA studies that were conducted before 2013. This might be the reason why sensitivity mapping has been neglected in most BIA reports. The experience of the biodiversity specialists in the application of GIS might also have contributed to the poor sensitivity mapping in BIA reports.

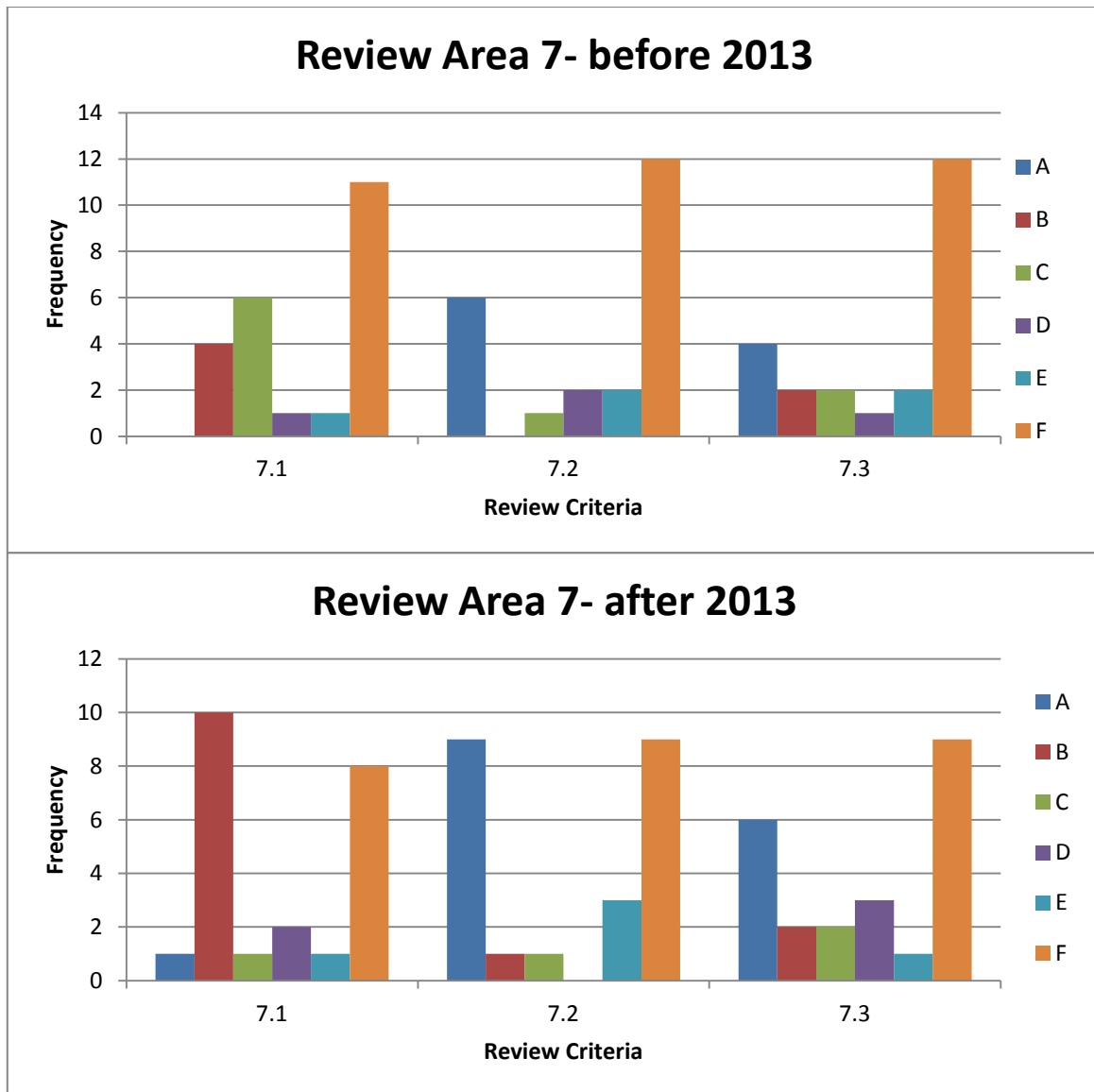


Figure 4.13: Results of the review criteria in review area 7.

After 2013

Sensitivity mapping after 2013 received poor grades in a number of BIA reports. As a result, this review area only obtained 48% of satisfactory cases. That means there were only 11 BIA reports that managed to provide sufficient information regarding the sensitivity mapping. These results show a slight improvement, when compared with the results obtained before 2013 (35%). However, it is important for one to note that this review area as a whole failed to achieve a minimum of 60%. All the review criteria were also poorly performed, with none obtaining 60%, as shown in Figure 4.13. For example, review criterion 7.1 (ecological

linkages), 7.2 (levels of sensitivity), and 7.3 (methodology for determining sensitivity) received 52%, 48%, and 43%, respectively (see Figure 4.13).

Figure 4.14 shows that 4 BIA reports managed to score A after 2013; while there were none before 2013. However, a number of reports were graded as F (work insufficient): 11 BIA reports before 2013 and 8 BIA reports after 2013. This shows that most biodiversity specialists failed to provide this information in their BIA reports. As highlighted under the results that were obtained before 2013, the use of GIS and the expertise of some of the specialists might have contributed to the poor performance of this review area. However, it was expected that the specialists would be able to perform sensitivity mapping after 2013, provided that there is a number of Open Source GIS software available free of charge; and that the training was provided nationwide.

In cases where a biodiversity specialist does not possess the necessary GIS skills, they should at least source the services of a trained GIS technician to assist with sensitivity mapping. Poor performance of this review area undermines sensitive systems and Species of Conservation Concern (SCC), which might be directly or indirectly affected by the proposed mining activity.

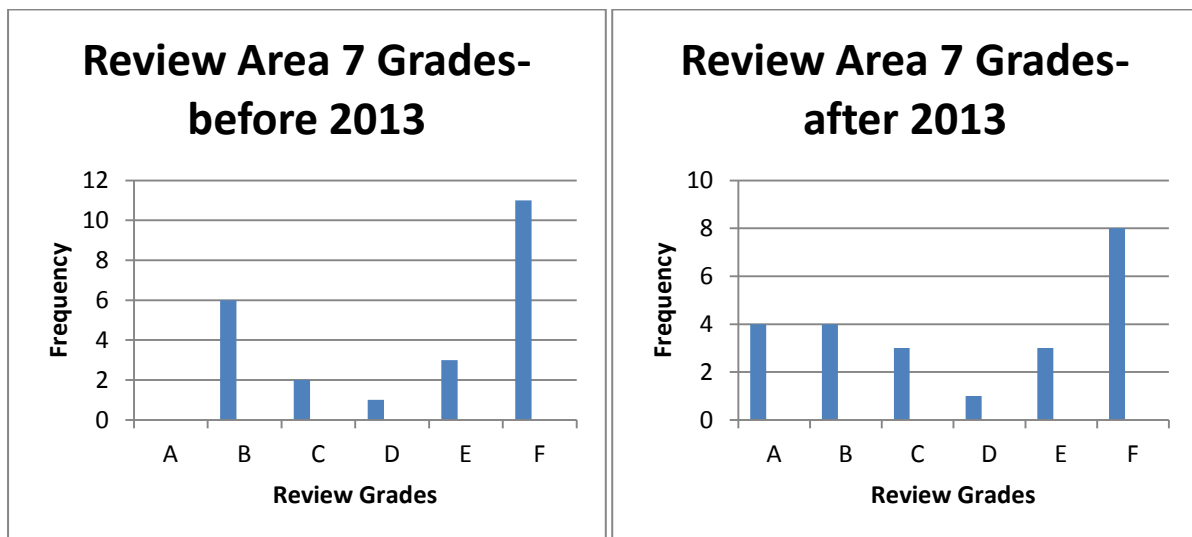


Figure 4.14: Assessment grades for review area 7.

4.2.8 Review area 8: Inclusion of Legal Aspects

Before 2013

The inclusion of legal aspects was poorly attempted in a number of BIA reports reviewed. The results obtained in this review area are discouraging, because some of the information required in this review area is readily available in the environmental legislation, local and international guidelines focusing on biodiversity inclusive impact assessment. For example, review criteria 8.1 (description of legal context and requirements), 8.2 (description of the policy and planning context), and 8.3 (identification and description of guidelines and standards) involves the description of relevant environmental legislation, guidelines, and policies, etc. This review area obtained a satisfactory score of 17%. All the review criteria also failed to score a satisfactory score of 60%. For instance, the review criteria 8.2, and 8.3, both obtained a satisfactory score of 26%; while the review criterion 8.4 (support of policy, plans and programmes) and 8.5 (inconsistencies, potential areas of conflict) both received 17% of satisfactory cases (see Figure 4.15).

These results are consistent with those of the study that was undertaken by Hallatt *et al.* (2015), which highlighted that biodiversity specialists tend to fail to adequately consider the policy and legal context associated with their studies. In this study, it was noted that a number of BIA reports that performed poorly in review criterion 1.2 (qualifications, expertise and the experience of the specialist), also performed poorly in this review area.

A number of biodiversity specialist reports failed to include the international agreements and provincial/national guidelines in their discussions. In certain reports, only a list of environmental legislation was provided, and the Specialist mentioned that a full description was provided by the EAP in the main EIA report. In most cases, mention about guidelines and environmental legislation was made when discussing the methodology, such as Present Ecological State (PES) in the case of wetland specialist studies.

From this study, it was noted that in most wetland and aquatic specialist reports, the specialist was able to integrate some level of national and international policy and planning context in his studies. However, the faunal and floral studies tend to merely focus on the provincial guidelines, with few cases referring to the national guidelines and the environmental legislation.



Figure 4.15: Results of the review criteria in review area 8.

After 2013

The inclusion of legal aspects was also poorly performed after 2013 with only 26% of satisfactory cases. None of the review criteria managed to obtain C (60%). When compared with the results obtained before 2013 (17%), these results show only a slight difference. This therefore, shows that this is one of the problem areas in biodiversity assessments for mining projects. There is a need to improve this review area; because it is basic information that is required in the impact assessment process; and failure to perform this review area well, makes the expertise, experience, and knowledge of Biodiversity Specialists regarding legal

aspects, highly questionable. This is mainly because this review area provides the essential framework for EAPs and Specialists to comply with the environmental legislation and best practice guidelines in biodiversity inclusive impact assessment as relevant to the proposed mining project.

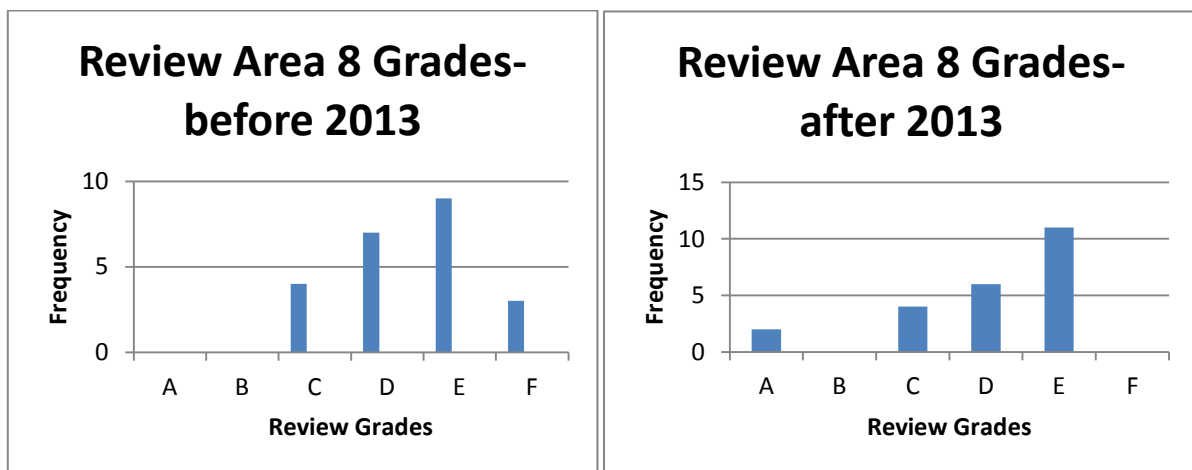


Figure 4.16: Assessment grades for review area 8.

The review criterion 8.4 (Support of the policy, plans and programmes) and 8.5 (inconsistencies, potential areas of conflict) were the least performed, with 13% and 22% satisfactory scores, when compared with the 17% that was obtained before 2013 (see Figure 4.16). In most instances, reference was only made to the South African environmental legislation. Figure 4.16 shows the assessment grades for review area 8. A number of reports were obtained E (not sufficient) and D (just unsatisfactory) in this review area. Most of the reports that were graded as successful before and after 2013 scored C (just satisfactory). The biodiversity specialists should treat this review area like other review areas, by providing the required information in their BIA reports.

4.2.9 Review area 9: Stakeholder Consultation

Before 2013

Stakeholder consultation was not attempted in a number of BIA reports reviewed in this study. In this review area, there was only one BIA report that showed some form of

stakeholder consultation, and it obtained C (just satisfactory). In this BIA report, consultation was only mentioned in the case of the availability of the Giant Bullfrog (*Pyxicephalus adspersus*) in the project area, where the biodiversity specialist indicated that an interview was conducted with the provincial conservation authorities. The Giant Bullfrog is listed as protected in the NEMBA (Act 10 of 2004). All the review criteria were poorly performed in most of the BIA reports. These results show that stakeholder consultation is one of the problem areas in the biodiversity assessments.

Projects that have a potential to affect Biodiversity Priority Areas may involve a greater number of interested and affected parties, who are concerned with the proposed activity, including downstream users of ecosystem goods and services (DEA *et al.*, 2013). However, in this study, a number of mining projects with the potential of affecting the Biodiversity Priority Areas, failed to involve these stakeholders in their assessments. Biodiversity specialists should be made aware of the need and the importance of involving biodiversity stakeholders in their assessments. The EIA process in South Africa emphasizes the importance of stakeholder consultation in all phases of the EIA process. One possible reason for poor stakeholder consultation in biodiversity assessment for mining projects could be that the biodiversity specialists might assume that stakeholder consultation is duplication; since this is covered in the EAPs during the EIA process.

As shown in Figure 4.17, review criteria 9.1 (description of any consultation process), 9.2 (summary and copies of any comments received), and 9.3 (key input from Interested and Affected Parties) scored only 4%. It is important for one to note that the South African EIA regulations also require that the Specialist provided the information. Therefore, it was expected that the biodiversity specialist would consult the relevant biodiversity stakeholders during their studies.

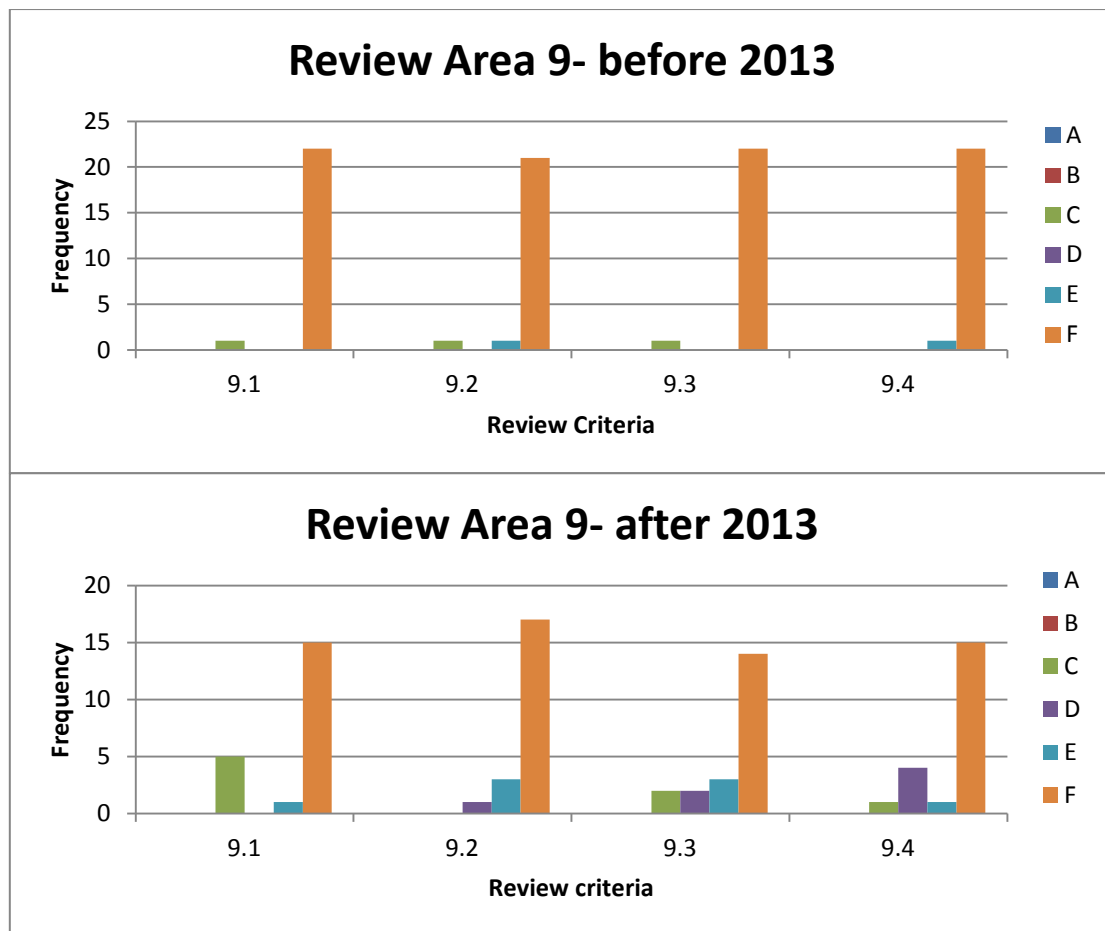


Figure 4.17: Results of the review criteria in review area 9.

After 2013

This review area was also poorly performed in most BIA reports prepared after 2013. There were only 2 BIA reports that showed some evidence of stakeholder consultation. The majority of the review criteria in this review area were also poorly performed. From these results, it is clear that there is still a lot that needs to be done, in order to improve the consultation of stakeholders in biodiversity assessments for mining projects in Mpumalanga Province. The results also show that there is slight to no improvement from the results obtained after 2013, when compared with those obtained before 2013. This review area managed to score an overall satisfactory score of 9%, compared with the 4% that was obtained before 2013 (see Figure 4.17). Figure 4.18 indicates that, none of the BIA reports managed to score A or B in this review area (before and after 2013).

All the reports were graded as satisfactorily scored C. Furthermore, 20 BIA reports, before 2013, scored F and 15 BIA reports; after 2013 also scored F. Making this review area one of the poorly performed review areas in this research. These results are consistent with other similar studies that highlighted poor consideration of biodiversity stakeholders in BIAs (Hallatt *et al.*, 2015; Soderman, 2006; Thompson *et al.*, 1997).

In one of the BIA reports, the Specialist mentioned that they consulted a professor at one of the South African Universities during their assessment. No formal consultation was mentioned. This shows that there is a need to raise awareness on the importance of stakeholder consultation with biodiversity specialists, particularly those that are involved in mining projects.

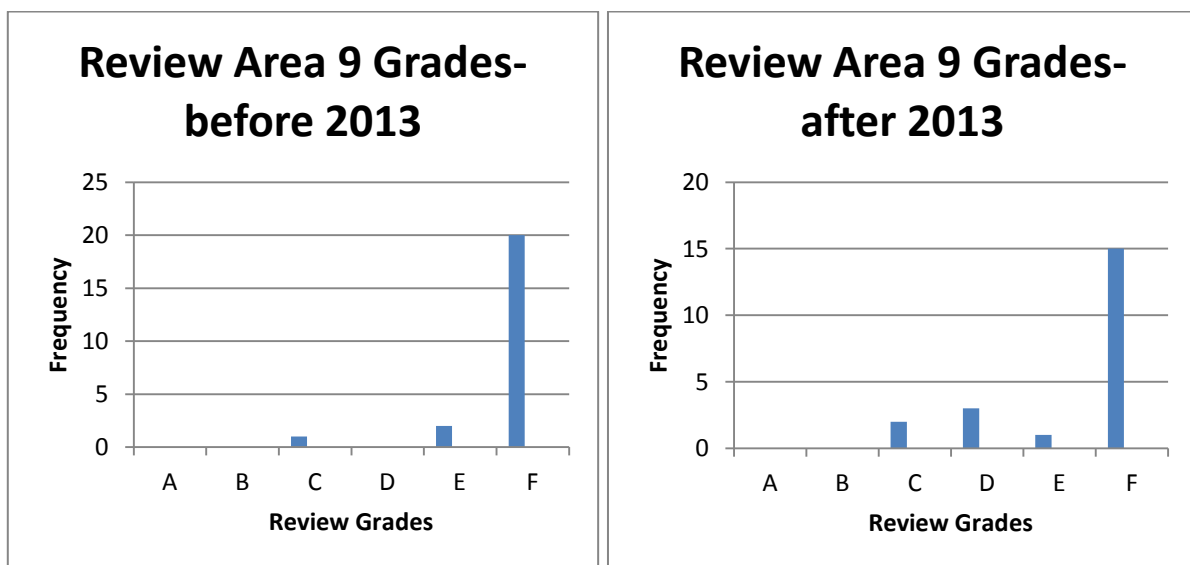


Figure 4.18: Assessment grades for review area 9.

Mining can have serious implications on biodiversity, as discussed in section 2.8; hence, thorough involvement of biodiversity stakeholders could assist in understanding the key impacts on ecosystem goods and services; and it could provide valuable input on how to manage and monitor these impacts during the entire lifecycle of the mine.

Thorough biodiversity stakeholder consultation also plays a crucial role in identifying potential conservation partners, in order to successfully address the biodiversity issues and implement any biodiversity offsets (DEA *et al.*, 2013). The results obtained in this research

indicate that poor integration of the indigenous or traditional knowledge in biodiversity assessments is directly linked to poor consideration of the stakeholder consultation in the BIA process. Therefore, in order to improve the integration of the indigenous or traditional knowledge in biodiversity assessments, biodiversity stakeholder consultation must be improved.

4.2.10 Review area 10: Prediction and Assessment of Impacts

Before 2013

The prediction and assessment of impacts was poorly performed in a number of BIA reports, with only 10 (48%) BIA reports that managed to provide sufficient information in this review area. In this review area, there were only 3 review criteria that obtained a satisfactory score of 60% and above. The review criteria 10.1 (consideration of plausible environmental & operating scenarios), 10.6 (indirect or cumulative effects on significant or sensitive resources), and 10.8 (consequences of the predicted impacts) received a satisfactory score of 65%; while the review criteria 10.2 (approach & methodology used to assess impacts), 10.4 (criteria used to assess impacts of different alternatives) and 10.7 (linkages from identification to evaluation) received 52%, 52%, and 57%, respectively (see Figure 4.19).

A total of 7 review criteria were poorly performed; for example, review criteria 10.3 (linkages to other specialist input), 10.9 (nature of the impact on biodiversity and the ecosystem services), and 10.5 (direct, indirect and cumulative impacts on ecological processes), received a satisfactory score of 39%, 48%, and 39%, respectively. The review criteria 10.10 (assessment & communication of impact in relation to future goals), 10.11 (identification of beneficiaries), 10.12 (differentiation between ecosystems), and 10.13 (cumulative impacts on biodiversity priority areas and threatened species), received satisfactory scores of 17%, 4%, 35%, and 26%, respectively; and these were the least performed.

As shown in Figure 4.19, a number of review criteria that were graded as satisfactory scored C. In some BIA reports, no impact assessment was conducted, although this was required in the ToR. Positive impacts are hardly assessed in biodiversity specialist studies; but from these results, it was noted that the focus is mainly on the negative impacts.

Some of the impacts on biodiversity were poorly assessed; for instance, the impacts that occur in more than one phase of the project were only described in the initial phase. This procedure is not correct; since some mitigation measures cannot be implemented in the same way in different phases of the project. For example, mitigation measures for the same impact during the construction phase can be implemented differently during the decommissioning phase. Therefore, this “one size fits all” approach should be avoided. Cumulative impacts were not quantitatively assessed in one of the BIA reports, because the Specialists felt that “cumulative impacts are very difficult to quantify accurately in general”.

In other reports, potential impacts were only assessed without providing mitigation measures. This is very discouraging; because the significance of the impacts after mitigation needs to be known. Some of the biodiversity specialists failed to provide the methodology used to assess the impacts; and these impacts were described without providing the information on how they were assessed. In certain cases, the impact assessment table was not provided. Impact prediction is the main objective of the EIA process (Soderman, 2005), therefore, biodiversity specialists must ensure that adequate information is provided, in order to predict the potential impacts of the proposed mining activity on biodiversity.

After 2013

This review area was poorly attempted, with a satisfactory score of 57%. However, the review criteria that were performed well before 2013 were also slightly improved. These include review criteria 10.1 (consideration of plausible environmental & operating scenarios) (78%) and 10.8 (consequences of the predicted impacts) (83%). Figure 4.19 indicates that these review criteria managed to score B in 9 cases, showing some improvement when compared to the results obtained before 2019. A number of review criteria also showed a great degree of improvement. For instance, review criteria 10.2 (approach & methodology used to assess impacts) (from 52% to 87%); 10.3 (linkages to other Specialist input) (from 39% to 61%); 10.4 (criterion used to assess the impacts of different alternatives) (from 52% to 65%); 10.7 (linkages from identification to evaluation) (from 57% to 87%); and 10.12 (differentiation between ecosystems) (from 35% to 65%). However, review criterion 10.5 (direct, indirect and cumulative impacts on ecological processes) failed to obtain a satisfactory score of at least 60%; instead it managed to obtain 57% compared to the 39% it received before 2013.

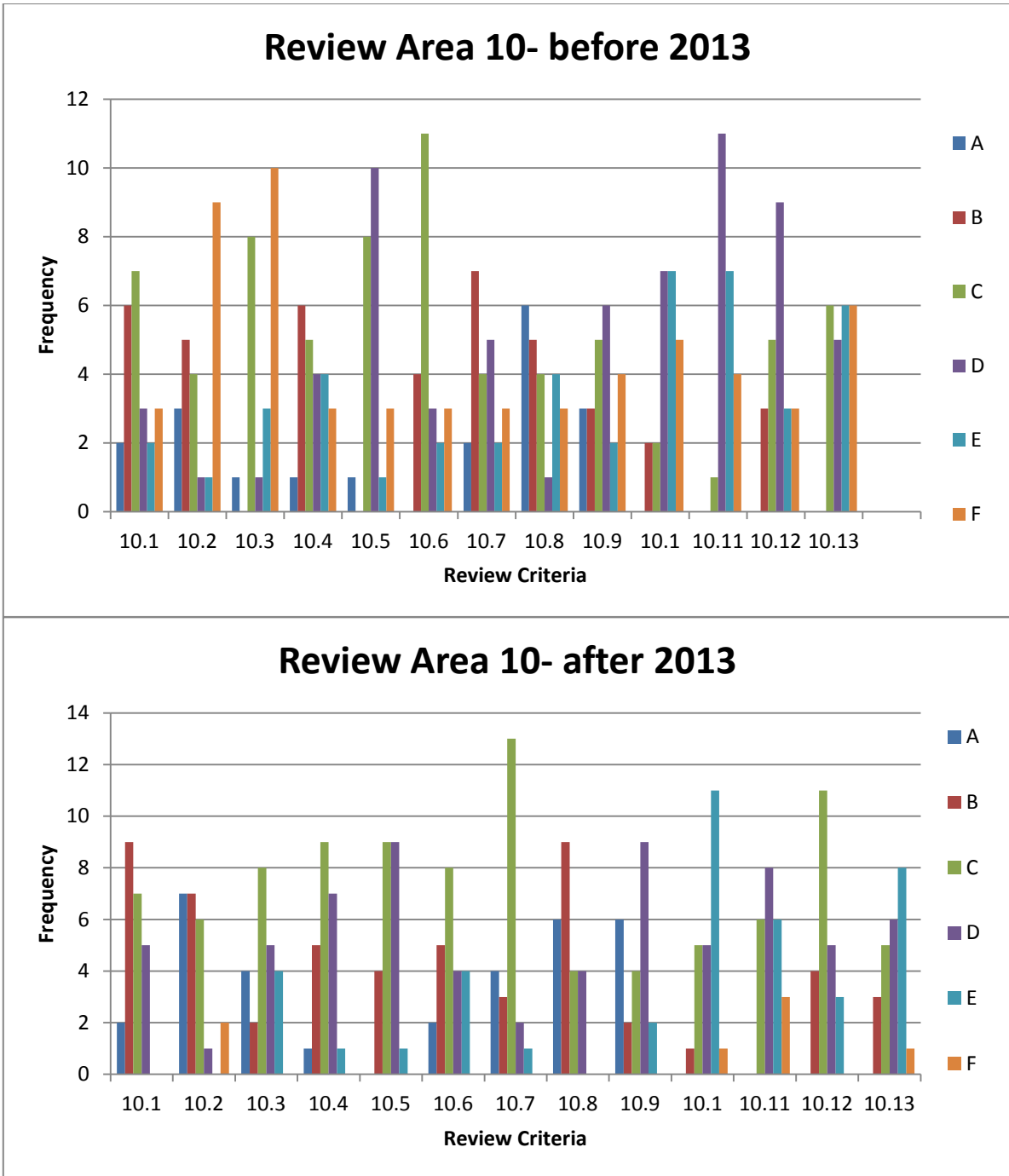


Figure 4.19: Results of the review criteria in review area 10.

This finding concurs with the international trends that show that BIA tends to neglect impacts on ecological processes (Brownlie *et al.*, 2006; Byron *et al.*, 2000; Treweek, 1999). However, review criteria 10.10 (assessment & communication of impact in relation to future goals), 10.11 (identification of beneficiaries), and 10.13 (cumulative impacts on biodiversity priority areas and threatened species), continued to be poorly performed with satisfactory scores of

26%, 26%, and 35%, respectively (see Figure 4.19). A good description of plausible environmental and operating scenarios was given in only one of the reports (review criteria 10.1). Figure 4.20 indicates that none of the BIA reports managed to score A in this review area, before and after 2013. Furthermore, there were 4 reports that were graded as B, before 2013, while only 3 were graded as B, after 2013. Review grades between C and F, after 2013, showed some improvement when compared to the results of the same grades before 2013.

In review criteria 10.2 (approach & methodology used to assess impacts), the motivation was not provided in most reports. Linkages to other Specialist studies were poorly attempted, for example, statements like “surface water is considered separately since it was conducted by the Surface Water Specialist” were common. Others tend to highlight that a particular impact cannot be assessed as it is “beyond the scope” of that study, and that a particular Specialist will assess that impact. In one of the reports, the impact significance rating after applying the mitigation measures was not included. Identification of impacts tends to be very general, for instance, statements like; “deterioration of water quality”, “loss of sensitive species” were noted, without providing a detailed description on how and to what extent will this occur.

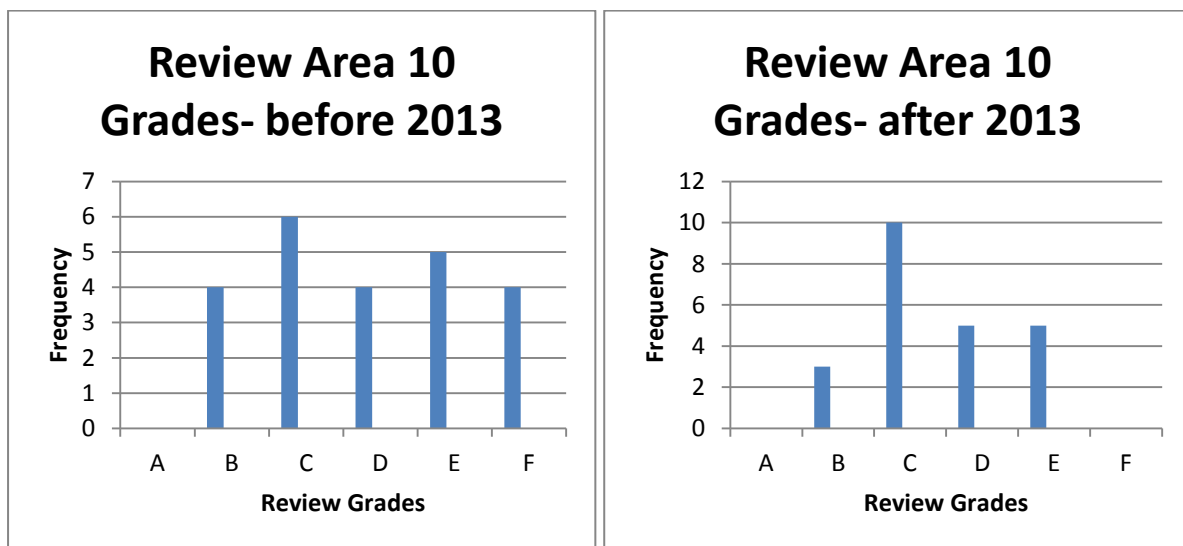


Figure 4.20: Assessment symbols for review area 10.

The causes of impacts/aspects were not provided in some biodiversity specialist studies. It is impossible to assess the impacts when this crucial information is missing. In certain cases, identified potential impacts were given only in a tabular format, no further description was

given. Cumulative impacts were poorly assessed in most BIA reports. Common statements like “cumulative deterioration of aquatic habitat” were trending. This needs to be clearly described. In this case, the EAP managed to describe the cumulative impact on aquatic habitat in the main EIA report. This therefore shows that some EAPs play a significant role in ensuring that the information provided by the Specialist is properly integrated in the EIA reports for decision makers to make an informed decision regarding the proposed project. “Where potentially significant cumulative effects on biodiversity are likely and cannot be effectively addressed in the EIA, the biodiversity specialist should alert the EIA practitioner and decision-maker/s to these effects and make explicit recommendations as to ways of addressing them (e.g. through strategic planning initiatives and/or systems-based approaches)” (Brownlie, 2005:31). At present, this is not happening in mining EIAs, and it is crucial for biodiversity specialists to make use of the best practice guidelines such as the guideline for involving biodiversity specialists in the EIA process.

4.2.11 Review area 11: Recommendations for Management

Before 2013

In this review area, there were 13 (57%) BIA reports that managed to provide sufficient information. Review criteria 11.1 (summary of key management actions), was well performed with a satisfactory score of 87%. As shown in Figure 4.21, this is the only review criteria in this review area that managed to score an A in one of the reports. All other review criteria were poorly attempted. For example, review criteria 11.2 (management of the potential impacts), 11.3 (application of the precautionary principle), and 11.4 (viability and practicability of recommended management actions) received a satisfactory score of 35%, 35%, and 48%, respectively (see Figure 4.21). In one of the reports, the management actions were not provided, but this was requested in the ToR. The emphasis was mainly on the study area that was significantly transformed, for example, the Specialist pointed out that the vegetation of the study site “can no longer be described as natural vegetation”. This might be the reason why the Specialists felt that it was not important to recommend management actions. The Specialists should provide possible management actions for all the potential impacts.

Recommendations for management were not provided for certain impacts identified. For instance, in one of the aquatic specialist studies, the potential impact of increased flow velocity and volume of water in affected streams during decommissioning and post-closure phase was identified. However, no recommendations for management were provided for these impacts. It is therefore clear that the aquatic biota in the affected streams will be significantly affected after project-closure.

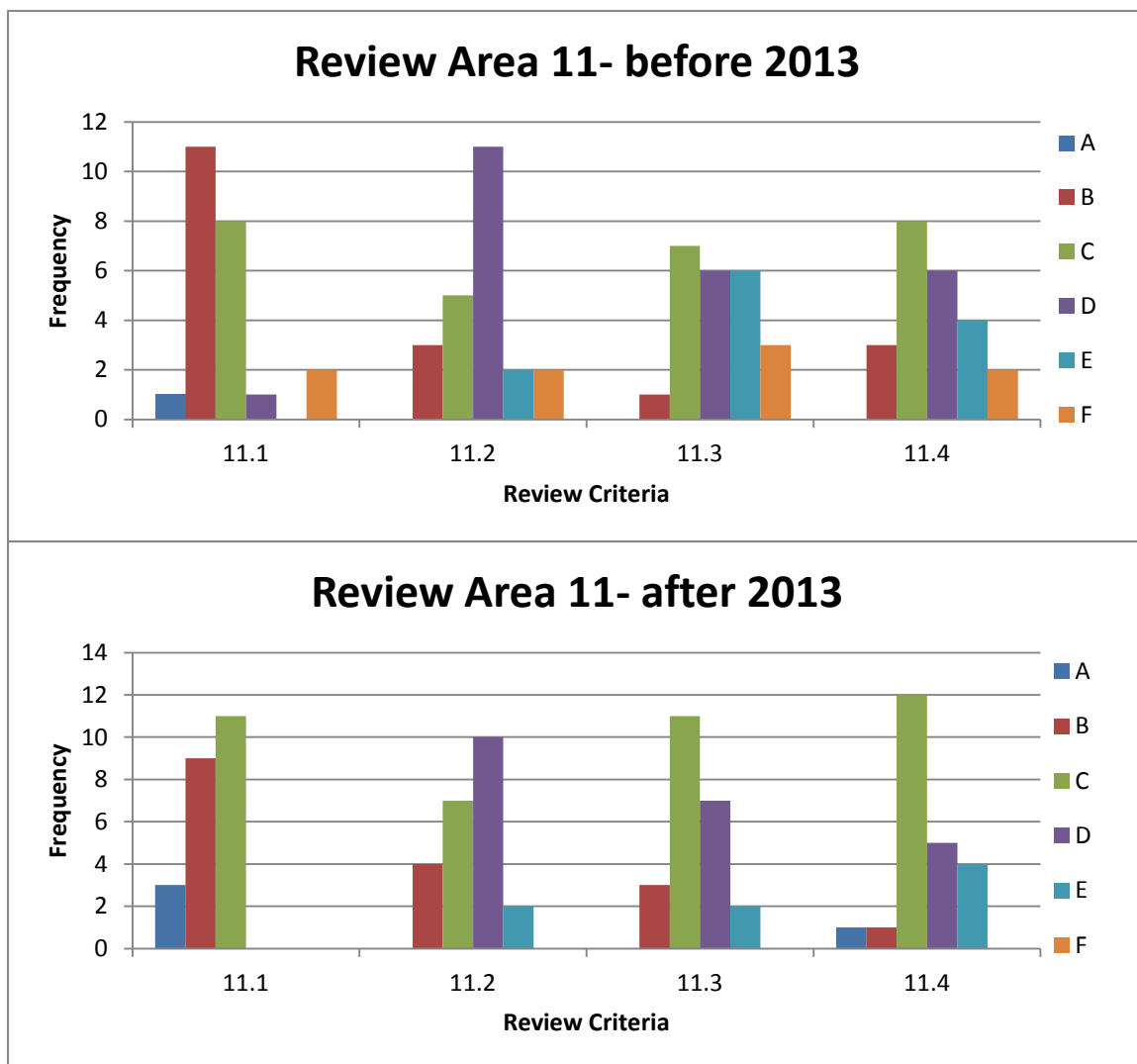


Figure 4.21: Results of the review criteria in review area 11.

After 2013

This review area was well attempted with a satisfactory score of 61% after 2013, compared to the 57% that was achieved before 2013. Review criteria 11.1 (Summary of key management actions) received 100%. Review criteria 11.1 scored 3As, 9Bs, and 11Cs (see Figure 4.21). However, review criteria 11.3 (Application of the precautionary principle) and 11.4 (Viability and practicability of recommended management actions) improved significantly from the results obtained before 2013, by both obtaining a satisfactory score of 61%. Better performance of recommendations for management in BIA is consistent to Hallatt *et al.* (2015). However, review criterion 11.2 was poorly performed in most BIA reports, with a satisfactory score of 48%. This shows that there is still a room for improvement. Figure 4.22 indicates that none of the reports managed to score A in this review area. A number of the reports that were graded as satisfactory scored C, 9 before 2013, and 10 after 2013. This shows that most of these reports were just satisfactory.

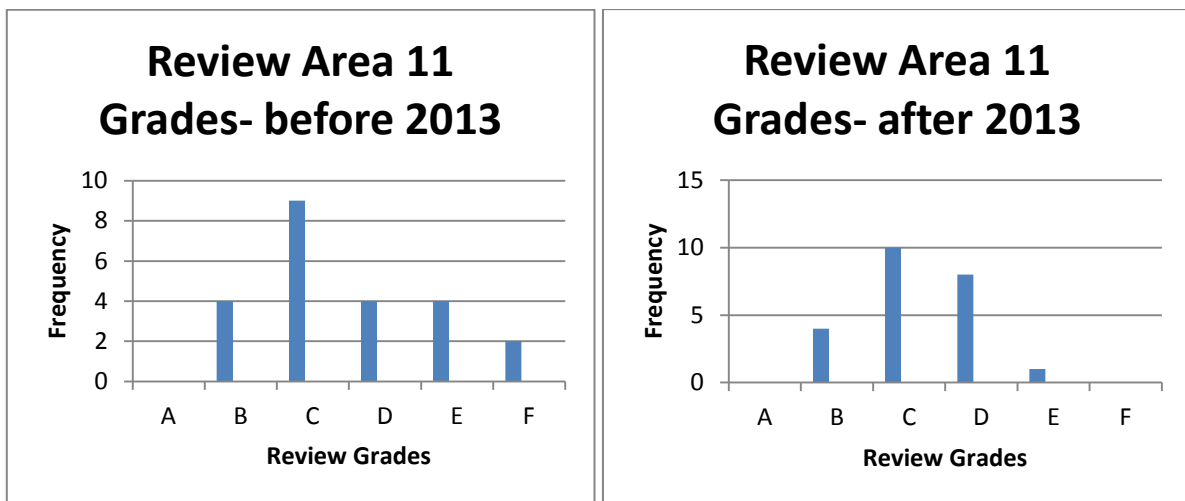


Figure 4.22: Assessment grades for review area 11.

4.2.12 Review Area 12: Monitoring

Before 2013

Monitoring was poorly attempted in most BIA reports reviewed with only 11 (48%) BIA reports that were graded as satisfactory (A-C). Both the review criteria 12.1 (Monitoring programmes) and 12.2 (Practicability, viability, description and motivation of the proposed

monitoring programmes) failed to receive a satisfactory score of at least 60% and they both received satisfactory scores of 57% and 43%, respectively. From these results, it is clear that this important review area is neglected by the biodiversity specialists involved in mining BIAs. Mining can have detrimental effects to the environment, especially when there is no effective monitoring. Therefore, it is of critical importance that monitoring programmes are properly addressed in biodiversity assessments. Monitoring programmes (12.1) managed to score 1A, 4B's, and 8C's as shown in Figure 4.23. This review criteria was better performed than review criteria 12.2 (Practicability, viability, description and motivation of the proposed monitoring programmes).

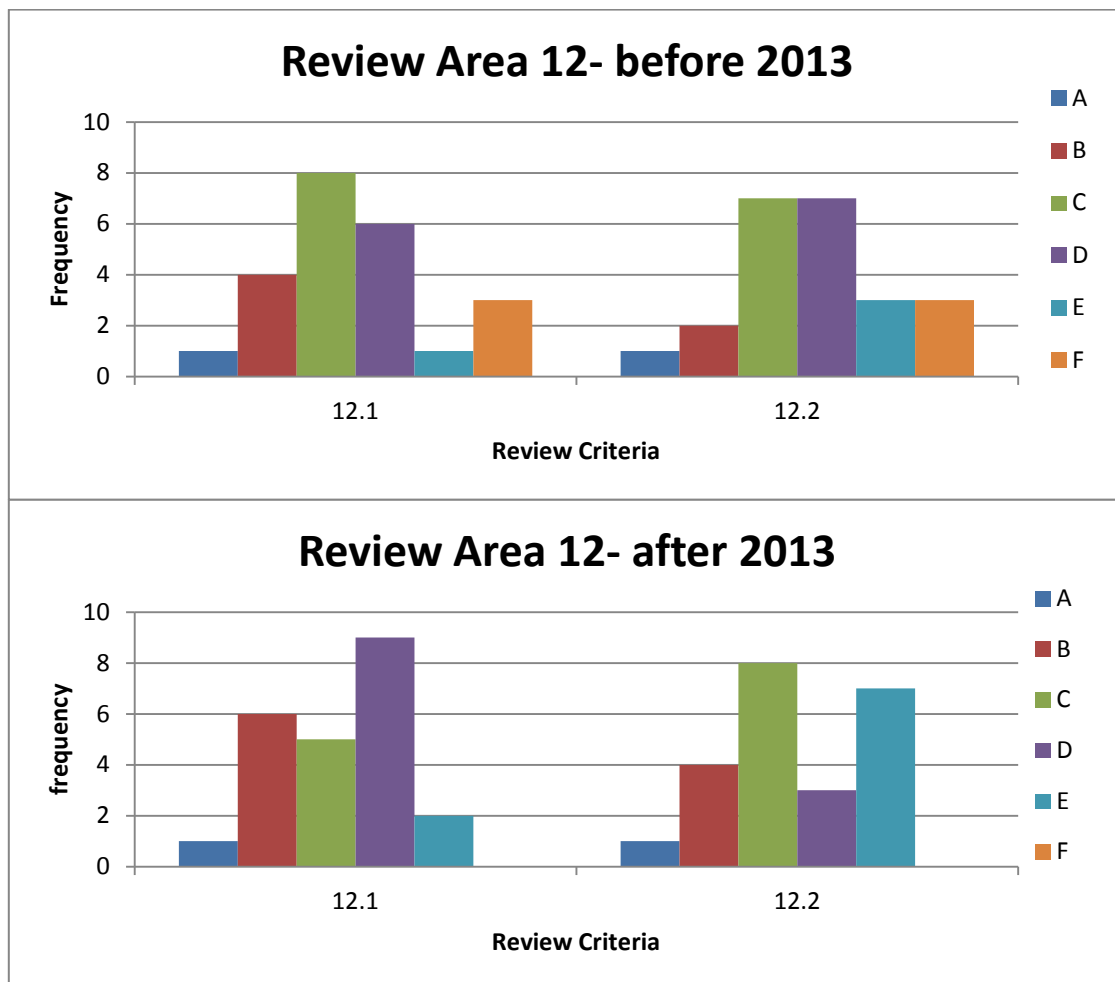


Figure 4.23: Results of the review criteria in review area 12.

After 2013

This review area was also poorly attempted after 2013 with a satisfactory score of 52%. Monitoring is one of the problem areas in biodiversity assessment and needs urgent attention. Review criteria 12.1 (Monitoring programmes) and 12.2 (Practicability, viability, description and motivation of the proposed monitoring programmes) obtained a satisfactory score of 52% and 57%, respectively. Figure 4.23 indicates that monitoring programmes were poorly performed when compared to the results obtained before 2013. However, review criterion 12.2 improved from 43% (before 2013) to 57% satisfactory cases, after 2013. Figure 4.24 indicates that a number of BIA reports that were poorly performed, scored D (just unsatisfactory) before and after 2013. Furthermore, only one BIA report managed to score A, before after 2013. These results concur with international trends that shows significant lack of monitoring provisions in biodiversity assessments (Byron et al., 2000; Hallatt *et al.*, 2015; Soderman 2006; Treweek, 1996).

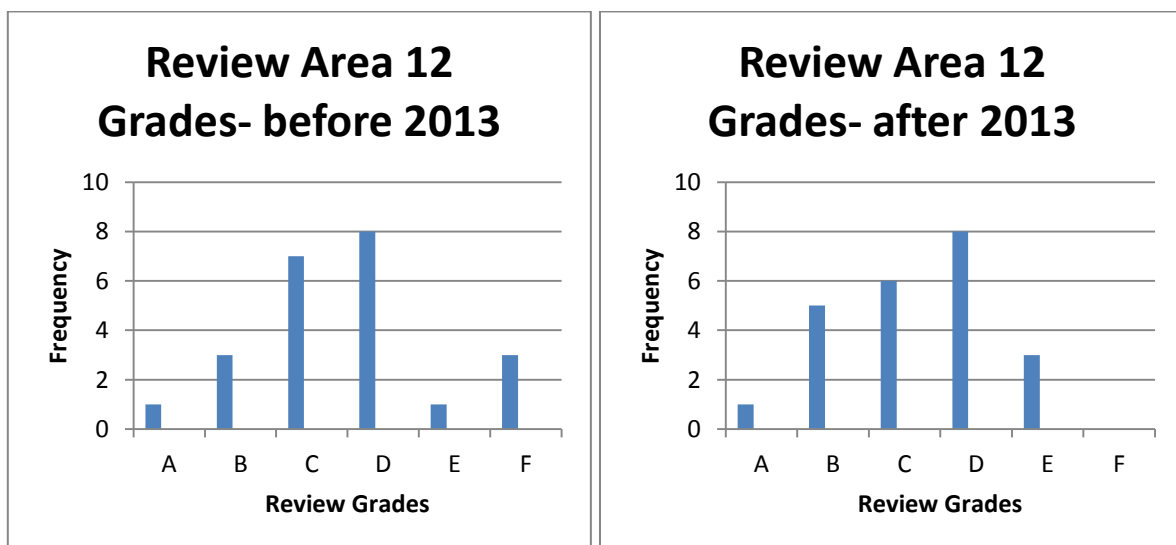


Figure 4.24: Assessment grades for review area 12.

4.2.13 Review area 13: Communication of Results

Before 2013

Communications of results was well attempted with a satisfactory score of 78%. The review criteria 13.1 (comprehensibility of the report) and 13.2 (statements on the report) were well

attempted with a satisfactory score of 82% and 78%, respectively. This clearly shows that this review area is not a problem area in biodiversity assessments. However, the review criteria 13.3 (a reasoned opinion about the proposed project) was not attempted at all, with all the BIA reports failing to provide a reasoned opinion about the proposed project (see Figure 4.25). As shown in Figure 4.25, 15 BIA reports were graded as F (insufficient information) in this review criterion. This is discouraging because this review criterion is also a requirement under the NEMA EIA regulations. It is not clear whether the Specialists do not want to give a negative opinion regarding the proposed mining project or they do not see the need to comply with this important requirement. Furthermore, poor performance of this review criterion might also be influenced by the fact that some Specialist might not want to provide negative opinion regarding the proposed project, since they might fear that they will not be appointed for future work by the EAPs or the Clients.

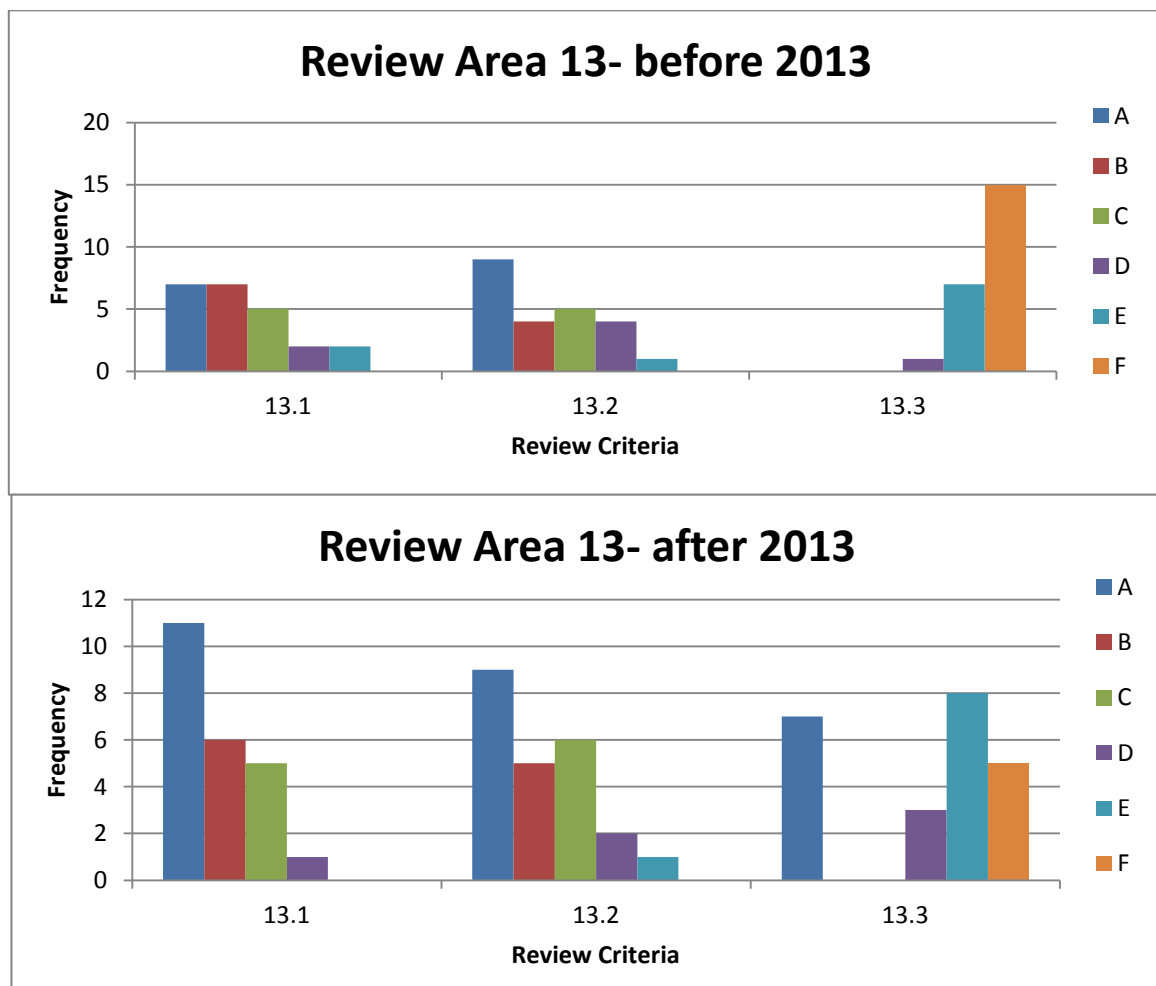


Figure 4.25: Results of the review criteria in review area 13.

After 2013

The results obtained in this review area show a great improvement when compared to the results obtained before 2013. This review area obtained a satisfactory score of 87%, compared to 78% scored before 2013. The review criteria 13.1 (comprehensibility of the report) and 13.2 (statements on the report) also improved significantly when compared to the results obtained before 2013, and they received a satisfactory score of 96% and 87%, respectively. However, the review criteria 13.3 (a reasoned opinion about the proposed project) was partially improved with only 7 BIA reports managing to provide a reasoned opinion about the proposed project (see Figure 4.25). This clearly shows that there is a need to sensitise this issue with the biodiversity specialists in order to ensure that a specialist opinion is always included in the BIA reports. This will also play a significant role in influencing the decision about the proposed project. Figure 4.26 indicates that none of the BIA reports managed to score A before 2013, while there were 6 BIA reports that scored A, after 2013. This shows some level of improvement in this review area. Furthermore, 12 BIA reports (before 2013), and 9 BIA reports (after 2013) scored C. This shows that most of the reports that were graded as satisfactory were just satisfactory.

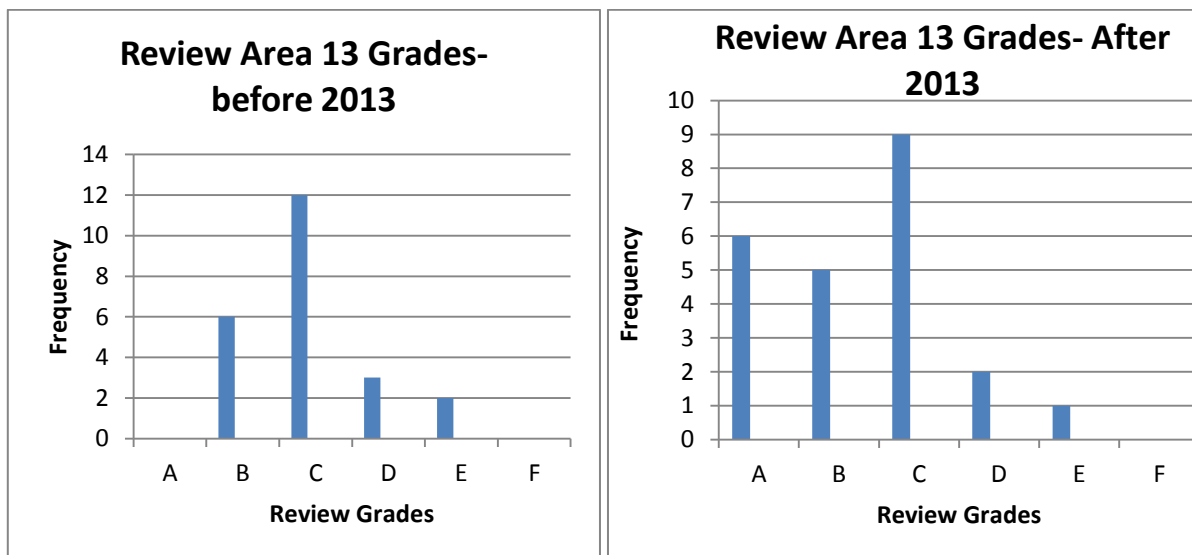


Figure 4.26: Assessment grades for review area 13.

4.2.14 Overall assessment of BIA reports

Before 2013

The results of the overall assessments of the mining BIA reports (before 2013) indicate that only 3 review areas managed to obtain a satisfactory score of 60% and above (minimum). These review areas are expertise and professional conduct (61%), clarity of the reports (78%), and communication of results (78%). The information required by these review areas is normally readily available; this includes the specialists' CV, the declaration of independence, and the purpose and scope of the study, etc. The results of the overall assessment can be seen in Table 4.1 and Figure 4.27. The description of the baseline environment, and the recommendations for management, received a satisfactory score of 52% and 57%, respectively. The adequacy and sufficiency of information, consideration of alternatives, and monitoring obtained a satisfactory score of 48%. The most poorly performed review areas were the description of the project (17%), stakeholder consultation (4%), and prediction and assessment of impacts (43%). The final grade for mining BIA reports before 2013 was 43%.

This means that there were only 10 of 23 mining BIA reports that managed to provide adequate biodiversity information that could be used to ensure that potential mining impacts are taken into consideration for decision-making processes.

Table 4.1: Review areas, scores for review grades and their satisfactory scores before 2013.

Review areas	Scores for review grades						
	A	B	C	D	E	F	% A-C
1.Expertise & professional conduct		4	10	3	5	1	61
2. Adequacy and sufficiency of information	1	2	8	7	5		48
3.Clarity of the report	3	8	7	3	2		78
4.Description of the project			4	2	7	10	17
5.Description of the baseline environment		2	10	2	9		52
6.Consideration of alternatives			11	3	5	4	48
7.Sensitivity Mapping		6	2	1	3	11	35

Review areas	Scores for review grades						
8.Inclusion of legal aspects			4	7	9	3	17
9.Stakeholder consultation			1		2	20	4
10.Prediction and assessment of impacts		4	6	4	5	4	43
11.Recommendations for management		4	9	4	4	2	57
12.Monitoring	1	3	7	8	1	3	48
13.Communication of results		6	12	3	2		78
FINAL GRADE FOR MINING BIA REPORTS		3	7	5	6	4	43

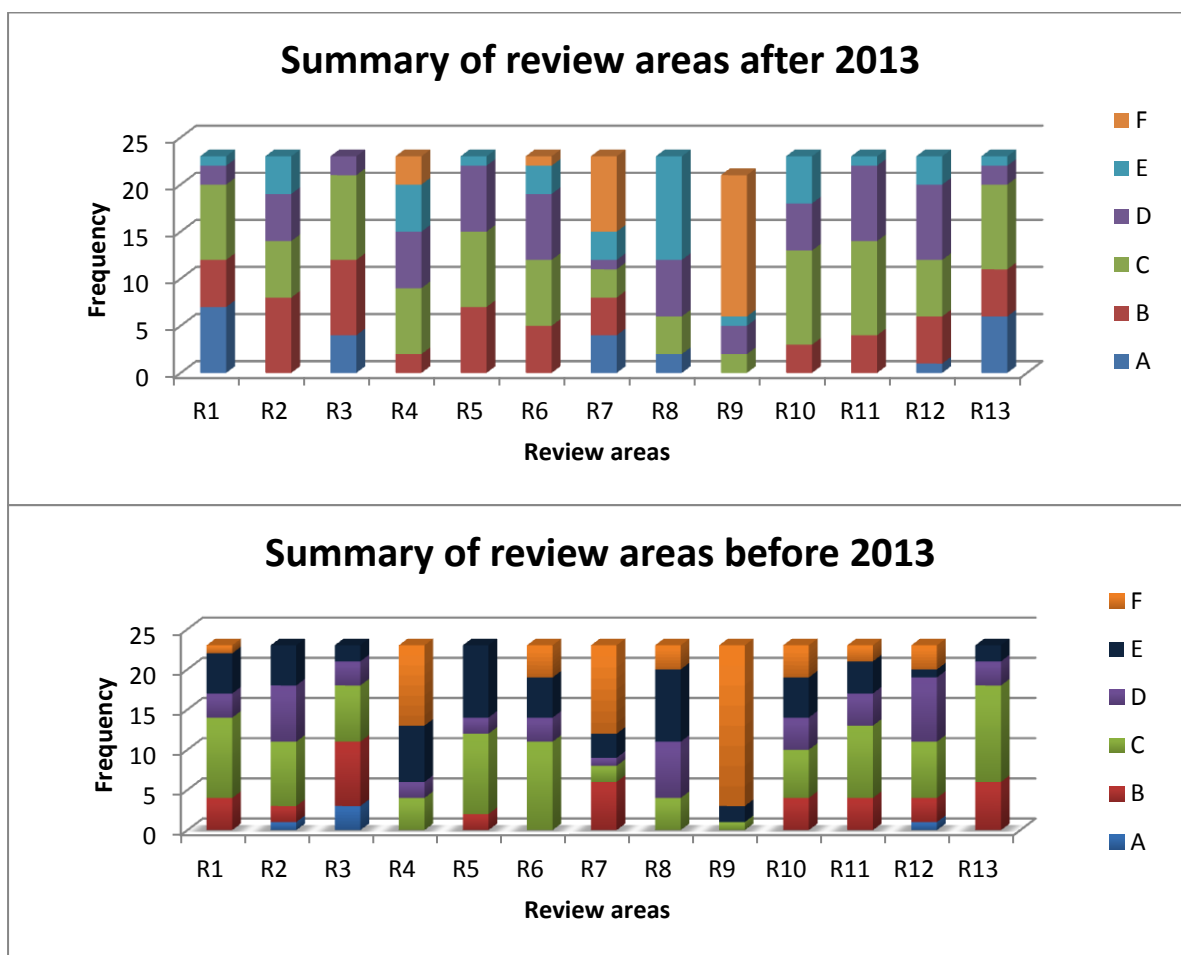


Figure 4.27: Results of the review areas before and after 2013.

After 2013

The results of the overall assessments of the mining BIA reports after 2013 revealed that only 6 of 13 review areas managed to provide sufficient information on biodiversity issues. The results of the overall assessment of the mining BIA reports (after 2013) can be seen in Table 4.2 and Figure 4.27. Best-performed review areas include the clarity of the report (91%), expertise and professional conduct (87%), and communication of results (87%). The adequacy and sufficiency of information, the description of the baseline environment, and recommendations for management obtained a satisfactory score of 61%, 65%, and 61%, respectively. The results further show that a number of review areas were poorly attempted: for instance, the consideration of alternatives (52%), sensitivity mapping (49%), prediction and assessment of impacts (57%), and monitoring (52%). The description of the baseline environment, the inclusion of the legal aspects, and stakeholder consultation were the most poorly performed review areas.

The final grade for mining BIA reports after 2013 was 57%. This shows that the mining BIA reports prepared after 2013 failed to receive a satisfactory score of 60% or above, as a minimum. However, this is a 14% improvement when compared with the results obtained before 2013. This shows that there is a potential for improvement. The results show that none of the reports managed to score A before and after 2013 (see Figure 4.28). A number of the BIA reports that were graded as satisfactory managed to score C, 7 reports before 2013, and 8 reports after 2013. From these results, it is clear that the majority of the mining BIA reports received a satisfactory grade of C (just satisfactory). None of the reports were graded as F after 2013; while there were 4 reports graded as F before 2013. This indicates some level of improvement when compared with the results obtained before 2013.

Table 4.2: Review areas, scores for review grades and their satisfactory scores after 2013.

Review areas	Scores for review grades						
	A	B	C	D	E	F	%A-C
1.Expertise & professional conduct	7	5	8	2	1		87
2. Adequacy and sufficiency of information		8	6	5	4		61
3.Clarity of the report	4	8	9	2			91

Review areas	Scores for review grades						
	A	B	C	D	E	F	%A-C
4.Description of the project		2	7	6	5	3	39
5.Description of the baseline environment		7	8	7	1		65
6.Consideration of alternatives		5	7	7	3	1	52
7.Sensitivity Mapping	4	4	3	1	3	8	49
8.Inclusion of legal aspects	2		4	6	11		26
9.Stakeholder consultation			2	3	1	15	9
10.Prediction and assessment of impacts		3	10	5	5		57
11.Recommendations for management		4	10	8	1		61
12.Monitoring	1	5	6	8	3		52
13.Communication of results	6	5	9	2	1		87
FINAL GRADE FOR MINING BIA REPORTS		5	8	7	4		57

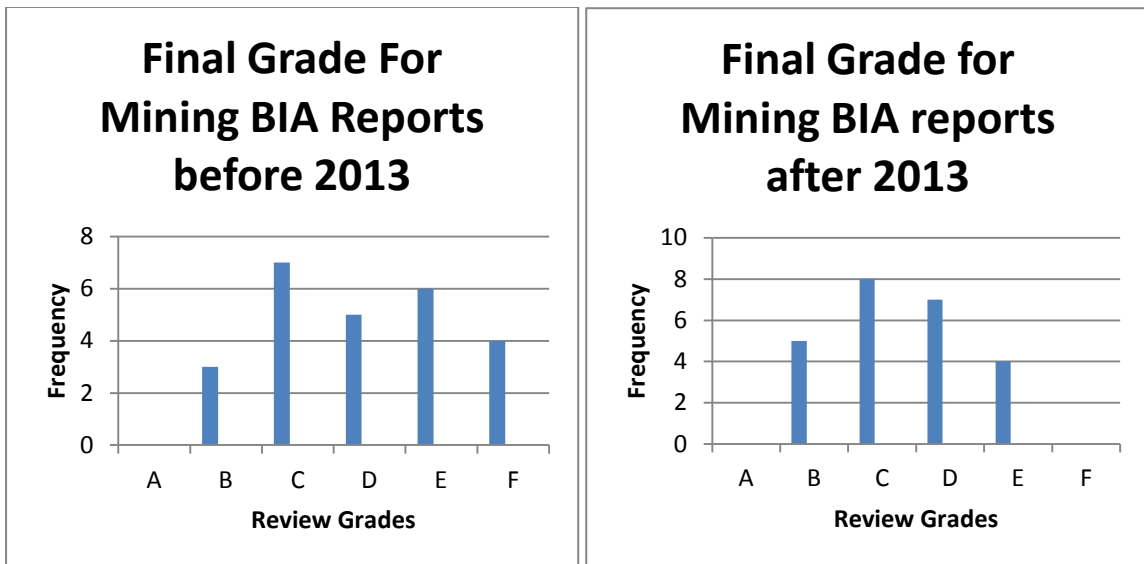


Figure 4.28: Final Grade for mining BIA reports before and after 2013

4.3 Compliance with EIA regulations

This section focuses on the compliance of the mining BIA reports with the South African EIA regulations. Appendix 6 of NEMA EIA regulations provides the minimum requirements for specialist studies (South Africa, 2014). The compliance of BIA reports with EIA regulations was assessed by using the assessment symbols provided in Table 3.2; and these formed part of the mining BIA report review package. As discussed in section 3.5, The BIA report complies with the minimum requirements if their legal review criteria provided in Table 3.3 are assessed as satisfactory (A, B, or C). The results of the BIA reports compliance with NEMA EIA regulations are provided in Appendices G and H, before and after 2013, respectively.

Before 2013

Minimum requirements for specialist studies before 2013 were poorly attempted, with only 50% of cases that managed to score above 60% (minimum score to be satisfactory). Review criteria 13.3 (a reasoned opinion as to whether the proposed activity or portions thereof should be authorised) was the most-poorly performed, with no report attempting this review criterion. Review criteria 9.1 (a description of any consultation process that was undertaken during the course of preparing the specialist report) and 9.2 (a summary and copies of any comments received during any consultation process and where applicable all responses thereto) were also poorly performed; since they each received a satisfactory score of 4 %. The expertise of the specialist to compile a specialist report was also poorly attempted, with a satisfactory score of 17%.

In this study, the review criteria 1.1 (Details of Biodiversity Specialist); 3.4 (Description of the methodology adopted); and 3.5 (Purpose and scope of the study) all received satisfactory score of 96%, 87%, and 96%, respectively. These were the most well-performed review criteria in the BIAs that were conducted before 2013. However, the review criteria 3.2 and 2.6 were poorly attempted with a score of only 65%.

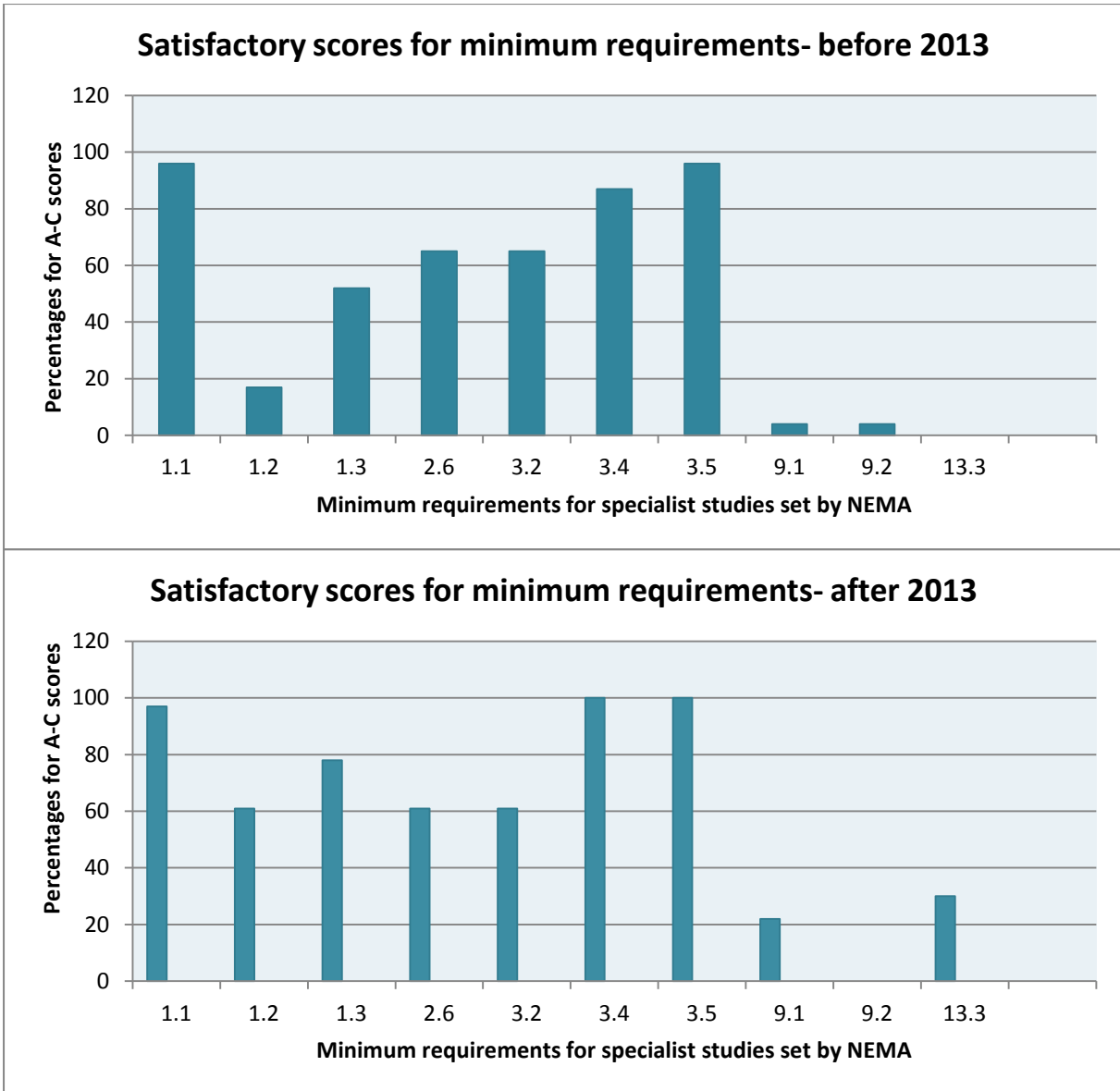


Figure 4.29: Satisfactory scores for minimum requirements for specialist studies set by NEMA.

After 2013

After 2013, there were 7 (70%) legally motivated review criteria, which received a score of 60% and above. Review criteria 3.4 (Description of the methodology adopted) and 3.5 (Purpose and scope of the study) received satisfactory scores of 100%. Review criteria 1.1 (Details of Biodiversity Specialist) and 1.3 (Declaration of independence) received satisfactory scores of 97% and 78%, respectively. Review criteria 1.2 (Qualifications, expertise and experience of the specialist), 3.2 (Date and season of site investigation), and 2.6 (Uncertainties, gaps in knowledge and low levels of confidence) were merely attempted; and

they all managed to score a satisfactory score of 61%. All the reports failed to provide a summary and copies of any comments received during any consultation process. Review criteria 9.1 (Description of any consultation process) and 13.3 (A reasoned opinion about the proposed project) were also poorly attempted with 22% and 30% respectively.

The results obtained after 2013 showed some level of improvement regarding compliance with EIA regulations when compared to the results obtained before 2013. For instance, review criteria 1.2 and 1.3 managed to receive a satisfactory score of 60% and above. However, review criteria 9.1, 9.2, and 13.3 were poorly attempted; and they all failed to receive a satisfactory score of 60%, as shown in Figure 4.29. From these results, it is clear that although a number of review criteria were performed well, there is still room for improvement, particularly in areas that were poorly performed. Specialists should treat all the requirements provided in Appendix 6 of NEMA EIA regulations equally, in order to provide a valuable input in the decision-making process.

4.4 Faithful representation of biodiversity specialist input in the main EIA report

This section focuses on the faithful representation of the biodiversity specialist input in the main EIA report, as discussed in section 3.6. The KZN biodiversity assessment guideline (Ezemvelo KZN Wildlife, 2013) and the guideline for biodiversity specialist input in the EIA process (Brownlie, 2005) provide some useful pointers to assist the reviewer to assess how the biodiversity specialist input has been integrated into the EIA report. In this study, faithful representation of the biodiversity specialist input focused mainly on layout and presentation, sensitivity mapping, alternatives, impact assessment, and mitigation and management actions. In order to facilitate the assessment of the results, the grading system used in the review of the mining BIA reports was also employed to assess the faithful representation of biodiversity specialist input in the main EIA reports. Appendices E and F, provides a detailed results of the faithful representation of the biodiversity specialist input in the main EIA report, before and after 2013, respectively.

4.4.1 Presentation and layout

Before 2013

Faithful representation for the presentation and layout (review area 1) was well-attempted with all the review criteria scoring above 80%. Review area 1.1 (presentation of information) and 1.3 (comprehensibility of the information), both received a satisfactory score of 91% (see Figure 4.30). While review area 1.2 (bias of information) received a satisfactory score of 83%. It is clear that the EAPs understand the importance of including this review area in the main EIA report as required; since it is also required by the legislation and other EIA best-practice guidelines.

After 2013

After 2013, this review area was also integrated well, as shown in Figure 4.30. For instance, the review criterion 1.1 (presentation of information) received a satisfactory score of 100%. This review area showed significant improvement when compared with the results of the same review area before 2013. However, the review criterion 1.3 (comprehensibility of the information) failed to maintain a satisfactory score of above 90%, which was obtained before 2013. Instead, this review area received a satisfactory score of 87%. These results are consistent with the results obtained in the original BIA reports, which shows better performance of presentation and layout in the mining BIA reports.

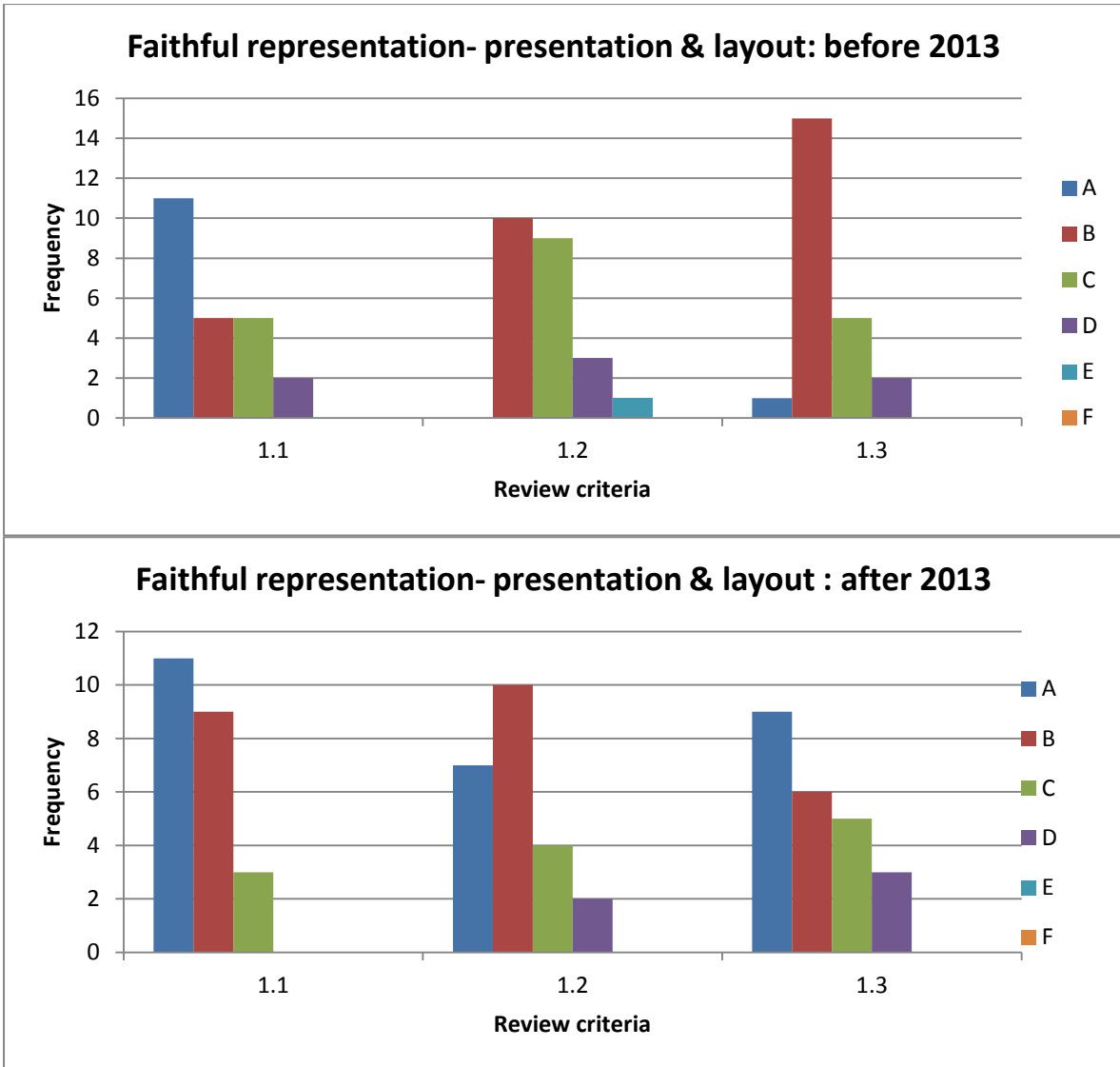


Figure 4.30: Faithful representation for presentation and layout.

4.4.2 Sensitivity mapping

Before 2013

The integration of sensitivity mapping was poorly done in most EIA reports with an overall score of 35%. This was the most-poorly performed review area, with all the review criteria scoring below 50%. From these results, it is clear that the EAPs do not understand the importance of integrating this review area properly into the main EIA reports. In certain instances, photographs of biophysical characteristics were provided by the biodiversity specialist; but these were not included in the mining EIA report. A composite sensitivity map collating the sensitivity products from each biodiversity specialist report was not included in

most mining EIA reports. A countless number of guidelines that promote the integration of sensitivity mapping in the main EIA report are available for EAPs and other stakeholders that are involved in the EIA process. This includes the guidelines by Ezemvelo KZN Wildlife (2013) and Gauteng Department of Agriculture and Rural Development (GDARD, 2012). This shows that this review area has not received the attention it deserves from the EAPs, particularly those that are involved in mining projects. The results of sensitivity mapping before and after 2013; can be seen in Figure 4.31.

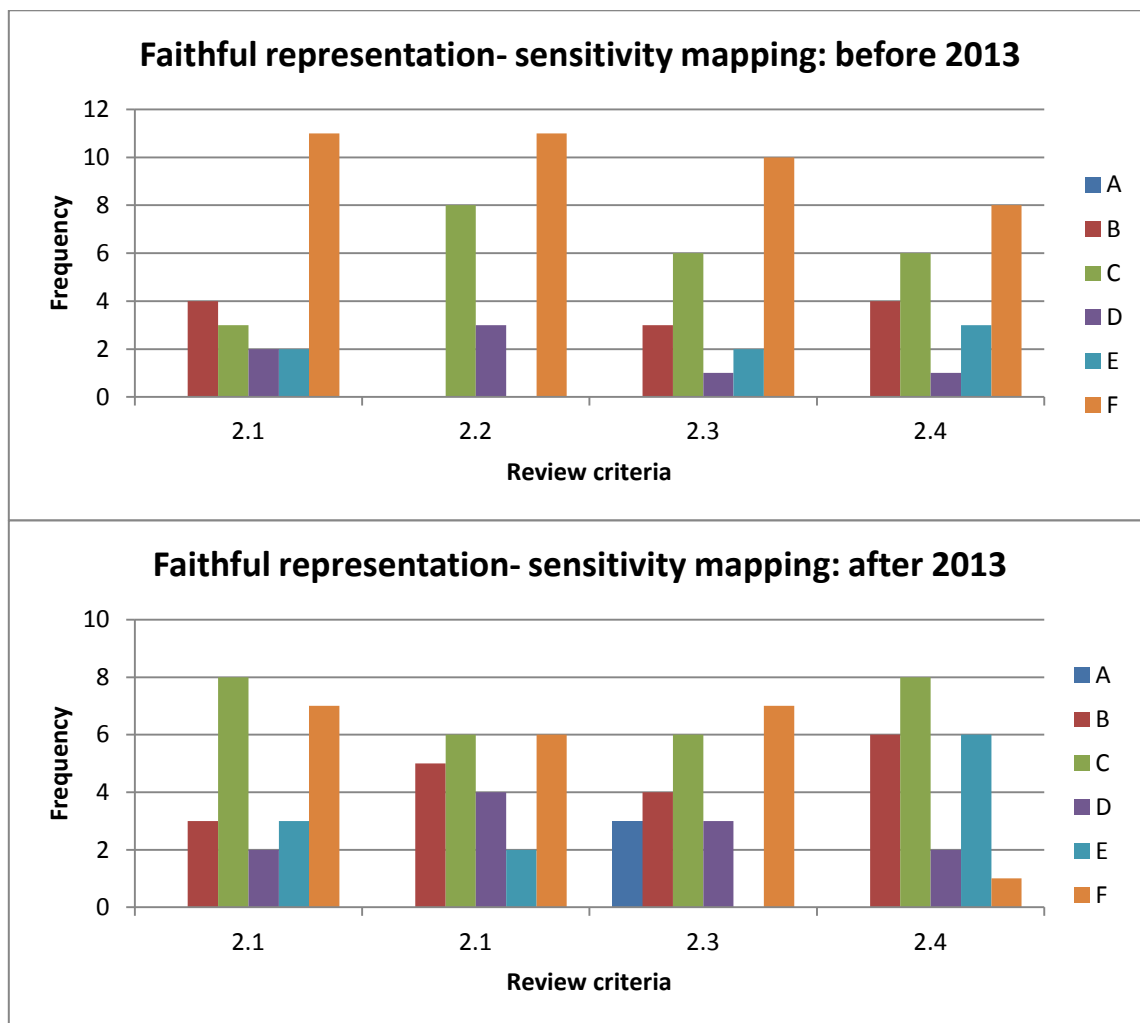


Figure 4.31: Faithful representation for sensitivity mapping.

After 2013

After 2013, some improvements were noted in a number of review areas (see Appendix F). However, sensitivity mapping received an overall satisfactory score of 52%. Review criteria

2.4 (photographs of all biophysical characteristics) showed an incredible improvement from 43% (before 2013) to 61% (after 2013). Review criteria 2.3 (project footprint map superimposed upon the sensitivity map) also showed some improvement from 39 % (before 2013) to 57% (after 2013). Review criteria 2.1 and 2.2 both managed to score 48%, showing some level of improvement from the results obtained before 2013. However, this review area was not properly integrated in most mining EIA reports. This therefore means that the EAPs need to take serious note; and use the available guidelines, when integrating sensitivity mapping in the main EIA reports. Sensitivity mapping was poorly performed in the mining BIA reports reviewed; and from the results obtained in this section, it is clear that sensitivity mapping is neglected by most biodiversity specialists and EAPs. There is therefore a need to improve the sensitivity mapping in BIA and EIA.

4.4.3 Alternatives

Before 2013

Alternatives were poorly integrated into the mining EIA reports produced before 2013 (see Figure 4.32). This review area obtained an overall satisfactory score of 52%. Review criterion 3.1 (explicit and defensive statement on the preferred alternative) received a satisfactory score of 52 %. The EAPs should consider the alternatives provided by the specialists, in order to ensure that biodiversity is considered in the EIA process. A number of studies focusing on the quality of EIA reports in South Africa have identified the consideration of alternatives, as one of the weaknesses in EIA; and some have criticized EIA for failing to investigate more than one alternative, including the no-go alternative (Kruger and Chapman, 2005; Sandham and Pretorius, 2008; Sandham *et al.* 2005).

Failure to consider these alternatives leads to biodiversity degradation; and this undermines the attempts made by the South African mining and biodiversity stakeholders in publishing the Mining and Biodiversity Guideline.

After 2013

The integration of alternatives improved significantly from 52% to 78% (see Figure 4.32). This improvement can be ascribed to the availability of local and international guidelines that

stress the importance of considering the alternatives in the EIA process, including the no-go alternative. The South African EIA regulations also provide pointers to EAPs on how they should consider alternatives in the EIA process. These review criteria have showed better performance when compared with the results obtained in the review of the mining BIA reports. This therefore shows that there is a potential for other review criteria to improve as well, if the EAPs can comply with the EIA regulations and employ the published EIA best practice guidelines in their assessments.

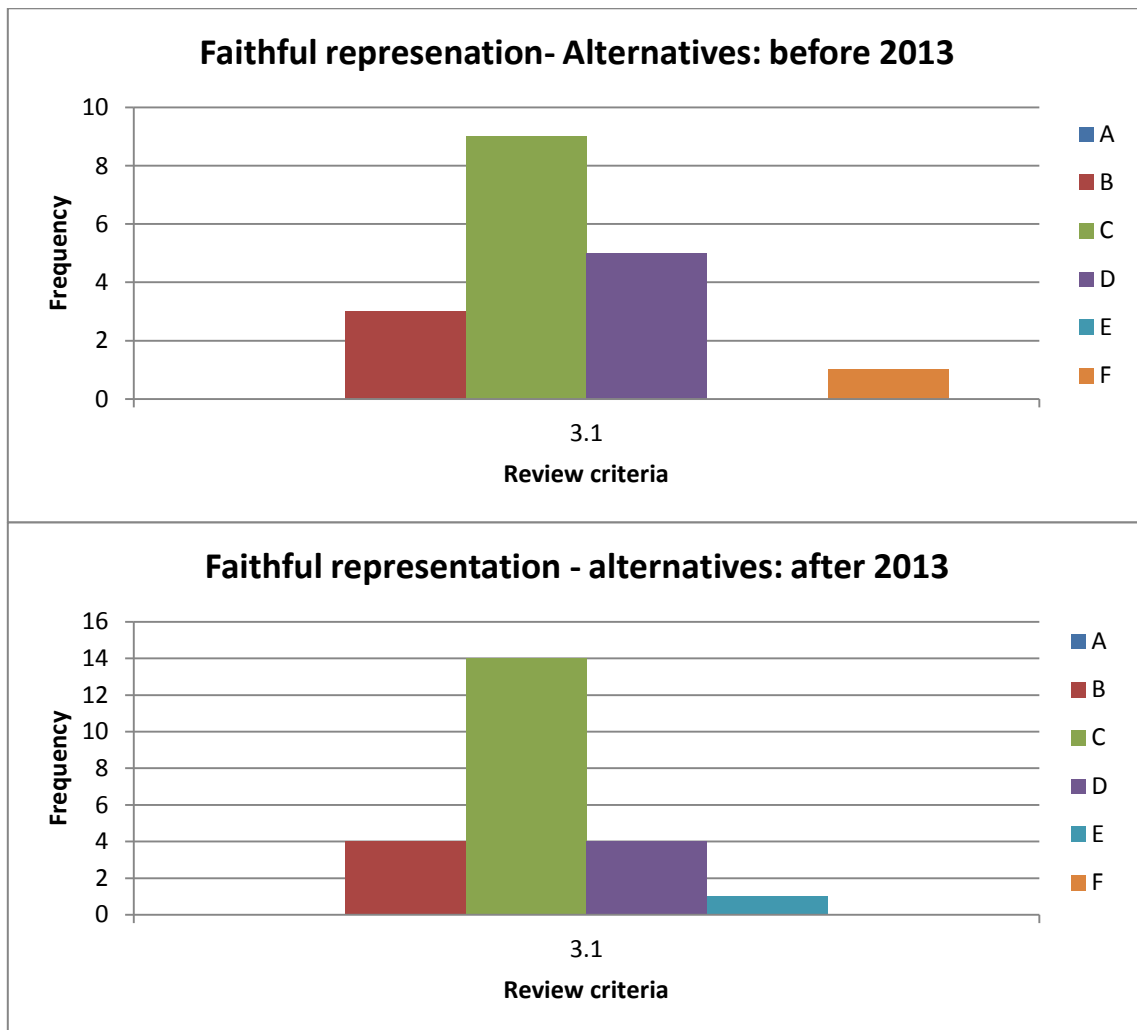


Figure 4.32: Faithful representation of the alternatives.

4.4.4 Impact identification, assessment, and prediction

Before 2013

Impact identification, assessment, and prediction were poorly integrated. As shown in Figure 4.33, in most EIA reports, review criterion 4.6 (impact significant methodology) was the only review criterion that was properly integrated in the main EIA report. It was expected that the EAPs would integrate this review area into their reports; since the methodology is readily provided by the biodiversity specialists. However, in one of the reports, the biodiversity specialist mentioned that the methodology that was used in the assessment was provided by the EAP. This in itself is the question that needs to be raised, since the biodiversity specialist needs to be independent, as required by the legislation. Another interesting question to be asked in this case is the expertise of the EAP in conducting biodiversity assessments. The biodiversity specialists need to provide the methodology used to assess the potential impacts of the mining project on biodiversity.

The EAPs failed to successfully integrate the results obtained from the biodiversity assessment studies. All the review criteria in this review area scored below 60%, except review criterion 4.6 (impact significant methodology) (83%). It is clear that the work done by the biodiversity specialist in identifying, assessing and predicting the potential impacts of the proposed project on biodiversity does not get the treatment it deserves. This is the heart of the EIA process; and if this information is misrepresented in the main EIA report, this means that the potential impacts of the proposed mining project on biodiversity are neglected. A common observation in most reports was that the EAPs do not include some of the significant impacts described by the biodiversity specialist.

In one of the mining EIA reports, the biodiversity specialist highlighted the potential impact on underground contamination through pollution, leachate and runoff, as being of high significance during mine closure (without mitigation). This potential impact was not included in the mining EIA report. The aquatic specialist identified the potential increase in water temperature as an impact; and this was not included in the mining EIA report. The aquatic specialist highlighted that the solar radiation of the concrete in the water diversion canal will increase water temperature which can possibly lead to thermal shock of fish and other aquatic organisms. This has a potential to affect the seasonal migration of these species; since some of them take their cues from the increased water temperature. This tends to influence the

decision-making process; hence, it is crucial that the EAPs integrate the specialist input in a proper manner.

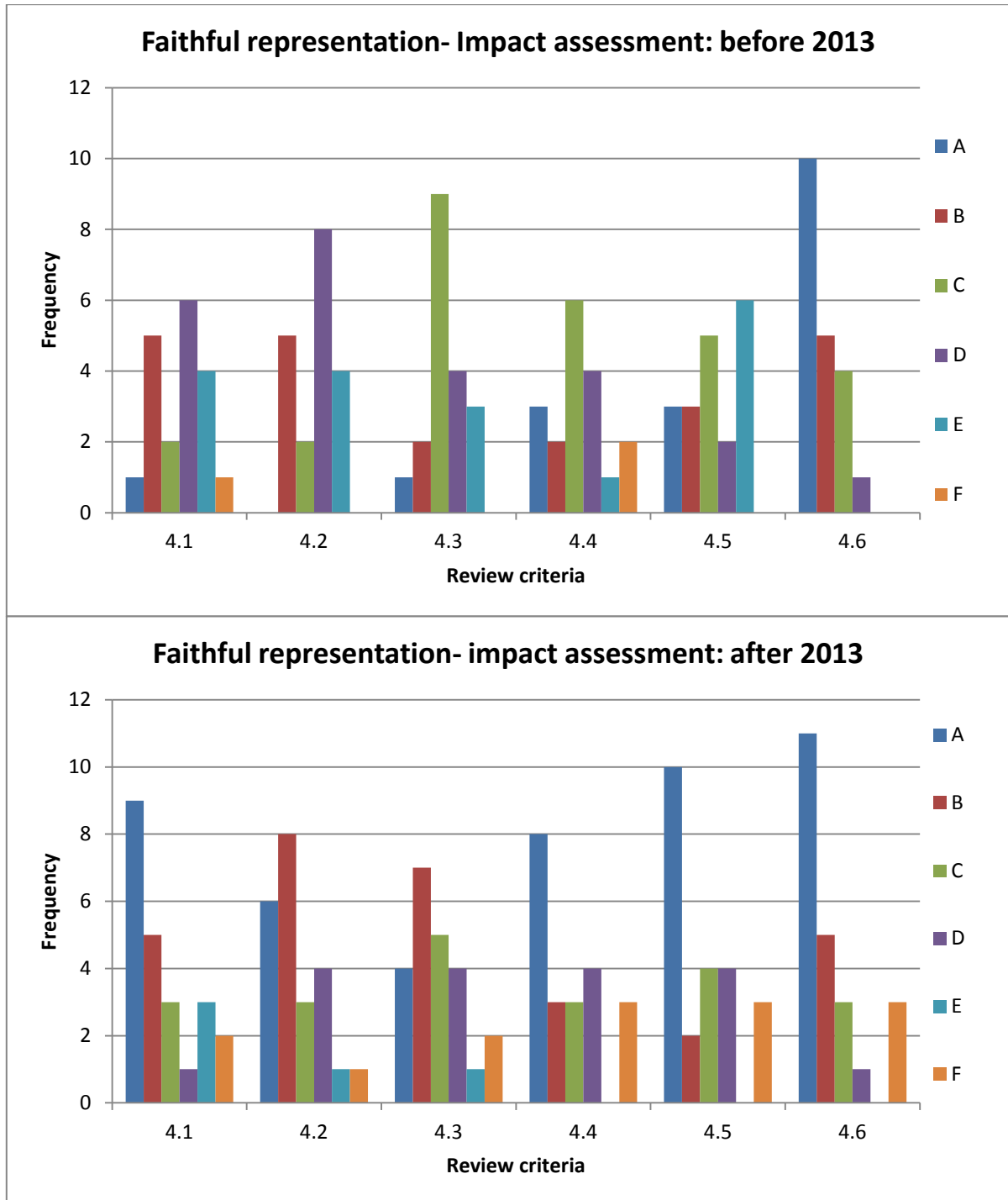


Figure 4.33: Faithful representation for impact identification, assessment, and prediction.

After 2013

This review criteria improved significantly after 2013, from 39% to 70%. All the review criteria scored above 60%, with review criteria 4.5 (Impact significance) and 4.6 (Impact significance methodology) both scoring 83%. It is clear that the EAPs now understand the importance of integrating the assessments of the specialist into the mining EIA reports. This review criterion shows a better performance, when compared with the results obtained in the mining BIA reports. However, the integration of the cumulative impacts was the least performed (67%). In some of the mining EIA reports, the potential impacts were not clearly described. For instance, in the BIA report, the biodiversity specialist mentioned that “mixing of concrete or collection and delivery could result in pollution of the water resources and/or the soil”. In the mining EIA report, the EAP only mentioned that this activity “could result in pollution”.

One of the critical findings from a wetland specialist was not included in the mining EIA report. These potential impacts had a significance of high and moderate with and without mitigation during the operational phase. A number of residual and cumulative impacts were highlighted by the wetland specialist; and these were not considered in the main mining EIA report. In one of the mining EIA reports, a fauna and flora study was not included in the impact-assessment stage. In this study, the biodiversity specialist highlighted that the loss of species was a matter of special concern; and the associated ecosystem services cannot be avoided. It was further suggested that “from the biodiversity perspective, the project is not desirable”.

It is not clear whether the EAPs involved in mining EIAs understand the importance of integrating the specialist input into the main EIA report; or whether they chose to act unethically in their assessments by putting the interests of the client above their integrity. The independence of the EAPs has been highly questionable; and in order to ensure that the information provided in the EIA reports is sufficient and of high quality, an external review of the EIA reports by other external EAPs or a specialist should be encouraged.

4.4.5 Mitigation and management

Before

This review area was poorly attempted before 2013 – with an overall satisfactory score of 48% (see Figure 4.34). The mitigation measures, which were proposed by the biodiversity Specialist, were not integrated properly into the mining EIA reports. This is discouraging; because the mitigation and the management actions provided by the specialist need to be integrated into the main EIA report, in order to ensure that the potential impacts to the environment are minimised. In cases where the EAP disagrees with the information provided by the specialist, the EAP should consult another specialist or reviewer with expertise in that particular field. This would then ensure that the specialist opinion is assessed and the EAP would be able to get clarity on the mitigation measures provided by the specialist.

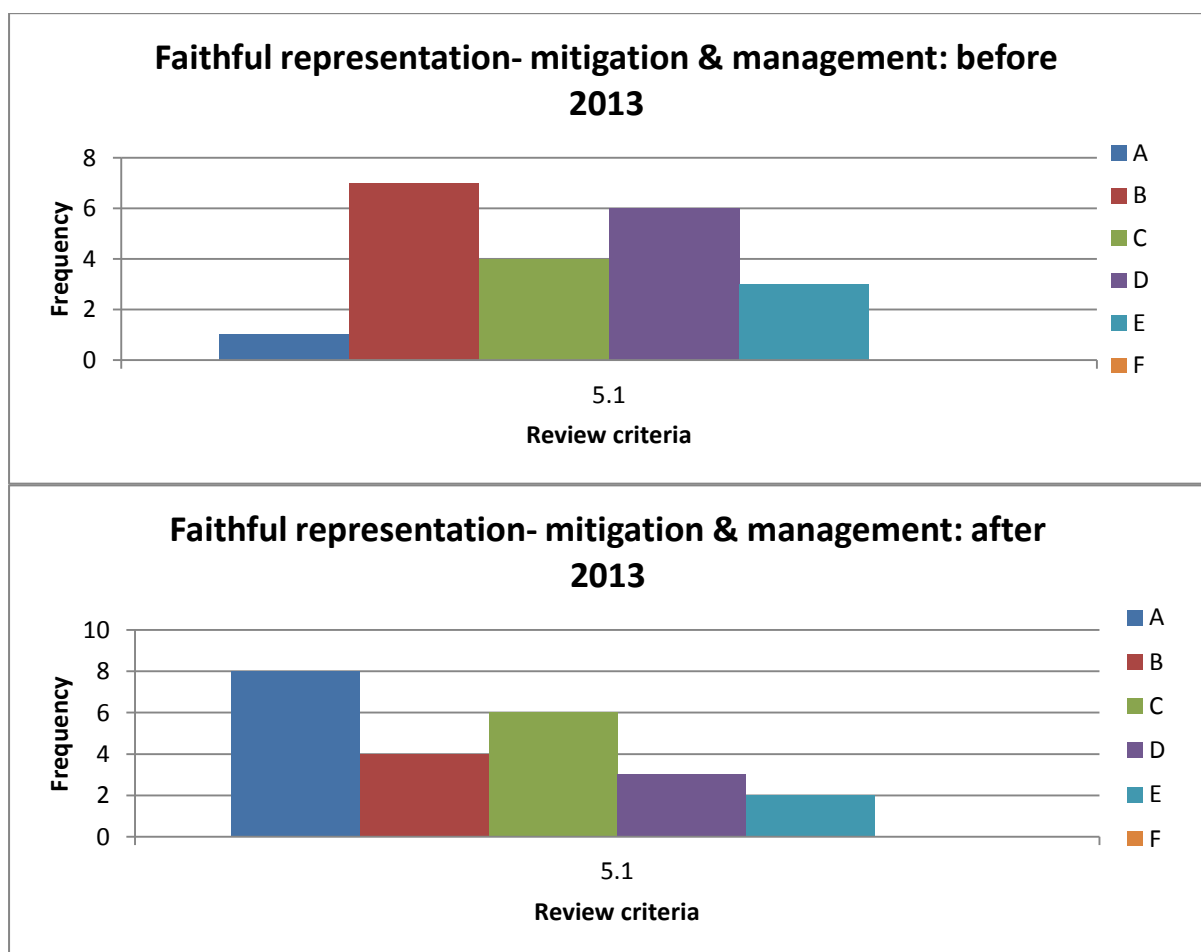


Figure 4.34: Faithful representation for mitigation and management.

After 2013

A notable improvement was observed in most mining EIA reports after 2013, as shown in Figure 4.34. As a result, an overall satisfactory score of 83% was obtained. This improvement can be ascribed to the available best-practice guidelines, including the current Mining and Biodiversity Guideline, which emphasises the mitigation hierarchy (DEA *et al.*, 2013). The mitigation hierarchy includes ways to avoid impacts on biodiversity, to minimise impacts on biodiversity, to rehabilitate, and to offset any residual negative impacts on biodiversity (DEA *et al.*, 2013). These results performed better than the results obtained under the mitigation section in the BIA reports reviewed for this research. From these results, it is clear that the EAPs understand the importance of integrating the mitigation measures provided by the biodiversity specialist.

4.4.6 Final grade for faithful representation of biodiversity specialist input into the main EIA report

Before 2013, the mining EIA reports and the associated BIA specialist reports received a satisfactory score of 52%. None of these managed to score “A” (see Figure 4.35). A total of 22% of the reports were graded as “B”; while 30% of the reports only scored a “C”. However, 48% of the reports failed to successfully integrate the input of the biodiversity specialist. A number of EIA reports that were poorly performed scored “D”, as shown in Figure 4.35. This shows that there is still room for improvement. Faithful representation of biodiversity specialist input into the main EIA reports needs to be improved, in order to improve the quality of the EIA reports.

The biodiversity and ecosystem services are under threat, if the recommendations of the biodiversity specialist are not properly integrated into the mining EIA reports. This means that the impacts associated with mining, as discussed in section 2.8, would continue to negatively affect the biodiversity and the associated ecosystems.

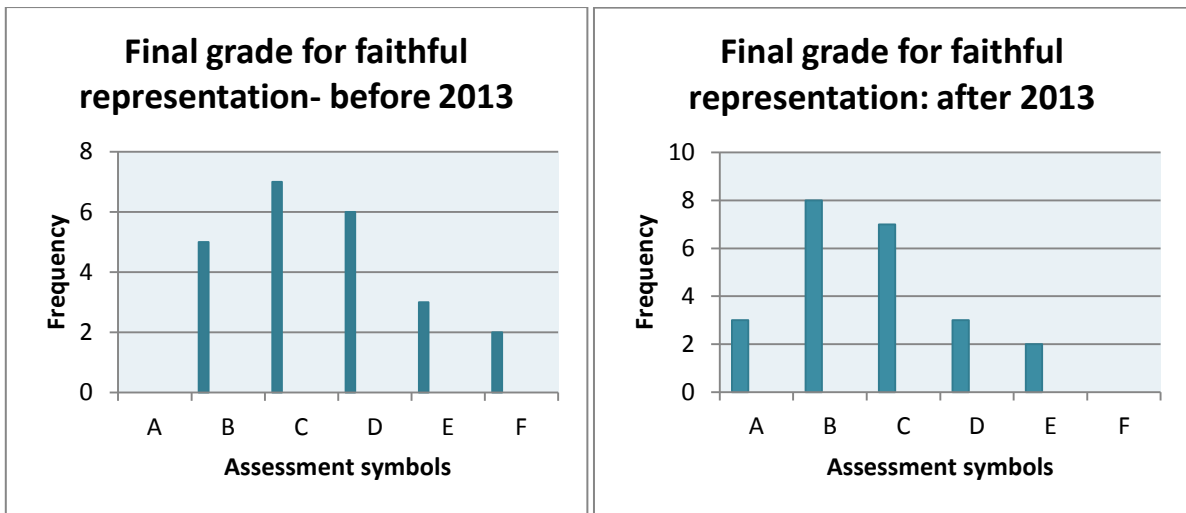


Figure 4.35: Assessment grades for the final grade (faithful representation, before and after 2013).

After 2013, a notable improvement in the faithful representation of the biodiversity specialist input was visible in most mining EIA reports. A satisfactory score of 78% was obtained after 2013. A total of 13% of the mining EIA reports received “A” grade; while 34% of the reports and 30% of the reports received a satisfactory grade of “B”, and “C”, respectively. The remaining 22% of the reports failed to properly integrate the input of the biodiversity specialist into the mining EIA report. This is a great improvement from the EAPs, when compared with the results obtained before 2013. From these results, it is clear that the biodiversity specialists need to improve their assessments, especially now that the majority of the EAPs are faithfully integrating their input into the mining EIA reports. This therefore means that if the biodiversity specialists continue to produce reports of poor quality, this would have a direct effect on the mining EIA reports.

There is a need to improve the assessments conducted by the biodiversity specialist, in order to ensure that the information integrated by the EAPs into the mining EIA reports contributes to informed decision-making.

4.5 Analysis of questionnaires

4.5.1 Background of participants

All the participants in this study indicated that they were familiar with the mining and biodiversity guideline; and they have provided comments on mining EIAs after the publication of the mining and biodiversity guidelines. One of the participants has worked for his organisation for more than 30 years. All the participants are currently working in an advisory position in their organisations. This was very helpful; since the participants were able to successfully complete the questionnaires and to provide meaningful input to this research.

4.5.2 The use of best available biodiversity information in mining EIAs

The South African Mining and Biodiversity Guideline categorise Biodiversity Priority Areas (BPAs) into 4 categories, based on the importance of their biodiversity and the ecosystem services. This section of the questionnaire aims to get more insights into the consideration of these BPAs in mining EIAs; and whether this is done in line with the requirements of the South African Mining and Biodiversity Guideline.

As many as 67% of the respondents indicated that they strongly agreed that the consideration of category A (legally protected) Biodiversity Priority Areas is in line with the Mining and Biodiversity Guideline; and 33% indicated that they agreed. Legally protected Biodiversity Priority Areas include all protected areas, such as nature reserves, protected environments, and world-heritage sites. It is therefore clear that EAPs understand the importance of this BPA. However, it is also important to note that, in most instances, key biodiversity stakeholders and civil society tend to be very keen on the protection of these protected areas. Consequently, various stakeholders are usually consulted in a proposed project that is likely to affect the protected environments.

Category B (highest biodiversity importance) Biodiversity Priority Areas (BPAs) include critically endangered and endangered ecosystems, Critical Biodiversity Areas (CBAs), River and Freshwater Ecosystem Priority Areas, and Ramsar sites. These BPAs are very rich in biodiversity; and they provide valuable ecosystem services. All the participants indicated that they agree that this category of BPAs is considered in mining EIAs in line with the Mining and Biodiversity Guideline. This is very important; since South Africa is one of the countries

with a rich biodiversity. Biodiversity is currently under threat from various environmental issues; and these are natural and anthropogenic in nature. Current impacts include climate change and natural disasters; however, biodiversity loss is also faced by a number of issues related to developments, including mining.

Category C (high biodiversity importance) BPAs include high-water yield areas, protected area buffers, transfrontier conservation areas, coastal protection zones and estuarine functional zones. While, Category D (moderate biodiversity importance) includes for example: valuable ecosystems, ecological support areas, and focus areas for protected area expansion. These BPAs also need to be protected; since they provide a number of ecosystem services. In this category, 33% of the participants indicated that they disagree that these BPAs are considered in mining EIAs as being in line with the requirements of the Mining and Biodiversity Guideline. The EAPs and biodiversity specialists need to treat all the BPAs equally important during their assessments. However, another 67% of the participants indicated that they agree that mining EIAs consider these BPAs, according to the requirements of the mining and biodiversity guidelines. None of the participants indicated that they strongly agreed or strongly disagreed that these BPAs are considered in mining EIAs in line with the requirements of the mining and biodiversity guidelines.

All the respondents indicated that the ecosystem approach has not been successfully incorporated into biodiversity specialist studies for mining projects. This is in line with the results obtained during the review of the BIA reports. The analysis of the BIA reports showed that the ecosystem approach was not used in mining BIAs. Furthermore, international studies highlighted that BIAs tend to focus on the species level; and they fail to address the most important components of biodiversity affected by the proposed project (Atkinson *et al.*, 2000; Byron *et al.*, 2000; Soderman, 2005; Treweek, 1999).

This means that these biodiversity studies tend to focus mainly on the species and the habitat level; and they fail to include other aspects of biodiversity. This is discouraging, because the concept of the ecosystem approach has been emphasised in the biodiversity-assessment community; and with the current threats to the biodiversity and ecosystem services in general, biodiversity specialists and EAPs are expected to understand the importance of integrating the ecosystem approach in their assessments. One of the respondents indicated that there are a number of prospecting applications within the Pilanesberg National Park; but according to the

National Environmental Management: Protected Areas Act (Act No. 57 of 2003), this should not be allowed.

In many cases, phrases like “specialists typically avoid looking at the cumulative impacts of development on specific ecosystem types. Ecosystems that are threatened, or in need of protection, are still in decline and are facing death by a thousand cuts”; and “When it is recommended that the development should proceed, mitigation measures are usually recommended; but little attention is paid to the persistence of the specific ecosystems in those mitigation measures”. Firstly, it is very crucial that biodiversity specialists and EAPs consider accumulative impacts on their assessments, particularly in mining projects. For instance, as highlighted in the Mpumalanga Biodiversity Sector Plan, mining and prospecting applications account for 61.3 % of the surface area of Mpumalanga (MTPA, 2014).

In areas of intensive mining, like the Highveld, it is of pivotal importance that these cumulative impacts are considered; since there are also other additional types of developments that put the same stress on the biodiversity. When providing mitigation measures for mining projects, these should be able to demonstrate best practices by considering the persistence of the ecosystem systems, especially those that are threatened. Other respondents have also highlighted that, in most instances, mining companies tend to be more concerned about their mining right area only; and they avoid taking responsibility for the larger ecosystem. Mining companies need to consider these ecosystems; because, some of the impacts emanating from their activities can affect other ecosystems outside their mining right area. For instance, AMD can decant downstream of their mining right area; and thereby they can affect other ecosystems.

4.5.3 Biodiversity stakeholder engagement process in mining EIAs

Biodiversity stakeholder engagement is regarded as a key for the effective biodiversity integration in the EIA process. The third principle of the Mining and Biodiversity Guideline promotes thorough engagement with biodiversity stakeholders. Therefore, this principle aims to improve biodiversity stakeholder consultation in the EIA process, in order to ensure that all potential biodiversity impacts are identified and assessed in mining EIAs.

Approximately 33% of the respondents indicated that they disagree that the consultation with biodiversity stakeholders has improved since the publication of the Mining and Biodiversity

Guideline. This shows that some key biodiversity stakeholders have not experienced any change in terms of consultation after 2013. In order to improve the treatment of biodiversity issues in mining EIAs, it is crucial to effectively involve the biodiversity stakeholders. However, 67% indicated that they agreed that since 2013, there has been an improvement in the consultation with biodiversity stakeholders in mining EIAs.

Consideration of biodiversity issues raised by the biodiversity stakeholders and the integration of traditional or indigenous knowledge was criticised by 67% of the respondents, indicating that they disagreed that this has improved since 2013. This is consistent with the results obtained during the review of the mining BIA reports. For instance, no form of traditional or indigenous knowledge was incorporated into the BIA reports reviewed. Furthermore, a study conducted by Hallatt *et al.* (2015), only 8% of the BIA reports reviewed managed to incorporate some form of indigenous knowledge in their assessments. Comments provided by the biodiversity stakeholders should be considered, when assessing the impacts of a proposed mining project, in order to ensure that all potential biodiversity impacts are assessed. For instance, statements like “Engagement with biodiversity stakeholders remains a perfunctory exercise. I have not seen any comments from biodiversity stakeholders that have resulted in any meaningful change”; and “in most cases, from my experience it is the project leader who has always a nice answer to the concerns raised; but in reality, the true issues raised by the stakeholders are watered down: and the negative impacts or mitigation methods thereof make only empty promises, especially in the coal mining industry” were noted.

This clearly shows that the consideration of the issues raised by the biodiversity stakeholders does not really influence any decision in mining EIAs. Biodiversity-stakeholder engagement has been identified as a weakness in a number of studies (Soderman, 2006; Thompson *et al.*, 1997). This is consistent with the results obtained in the review of mining BIAs (section 4.2.9). For instance, the mining BIA reports prepared before and after 2013 managed to score only 4% and 9%, respectively. One of the respondents mentioned that “Stakeholders, such as conservation agencies, are still being marginalised”. An effort should be made to ensure that biodiversity stakeholders are involved in mining EIAs, and that their input is considered.

4.5.4 Consideration of biodiversity issues in mining EIAs

The treatment of biodiversity impacts in EIAs is one of the burning issues in the Environmental Assessment community. Section 2.10 of this study; discusses some of the

weaknesses of Biodiversity Impact-Assessment studies worldwide. This study has therefore requested the input of biodiversity stakeholders, in order to determine whether there has been any improvement since the publication of the mining and biodiversity guideline. All the respondents indicated that the Terms of Reference (ToR) for biodiversity specialist studies have partially improved since 2013. This is consistent to the results obtained in the review of the mining BIA reports (section 4.2.2). Review criteria 2.2 (Terms of reference for BIA) and 2.3 (Adequacy of ToR) managed to score more than 60% before and after 2013. This is important; since well-defined ToR would guide the biodiversity specialist; and ensures that relevant biodiversity information and impacts are identified and assessed in the EIA process.

Indirect and cumulative impacts in EIAs are regarded as one of the major weaknesses in the EIA literature. As a result, all the respondents in this study highlighted that the indirect and cumulative impacts are still poorly considered in mining EIAs, regardless of the publication of the Mining and Biodiversity Guideline and other international guidelines. The results obtained in the review of the mining BIA reports indicate that cumulative impacts are poorly performed. For instance, the review criterion 10.13 (cumulative impacts on biodiversity priority areas and threatened species) received a satisfactory score of 26% and 35%, before and after 2013, respectively. This shows that cumulative impacts on biodiversity are neglected.

The connection between biodiversity, ecosystems services, and human wellbeing, including the dependence on resources by vulnerable communities are seldom clearly articulated in most EIAs. From this study, all the respondents indicated that this has not improved since 2013. It is discouraging to see that this important aspect of biodiversity is not being considered in mining EIAs. The link between biodiversity, ecosystems services and human wellbeing should be established, in order to understand the impact that the proposed mining activity would have on the society. However, most specialists and EAPs tend to fail to provide this connection in their reports. This is consistent with the results obtained in the review of mining BIA reports; since most BIA reports have failed to involve the biodiversity stakeholders in their assessments; and the integration of traditional and indigenous knowledge has consequently been neglected.

Another major weakness in the treatment of biodiversity issues is that the timing of biodiversity specialist input occurs late in the EIA process to influence proposals. In this

study, all the respondents indicated that the timing of biodiversity specialist input in mining EIAs has partially improved. All the respondents further indicated that the information provided in biodiversity specialist reports and/or biodiversity sections of the EIA reports has partially improved since 2013. This shows that there is still room for improvement in biodiversity inclusive-EIA for mining projects in Mpumalanga Province.

It is widely believed that the mitigation measures provided in BIAs and EIAs tend to be vague and incomprehensive (DEAT, 2002). As discussed in section 2.10.6, mitigation measures in EIAs are poorly addressed; and they need to be improved. Most respondents indicated that the consideration of mitigation measures has not improved since 2013 (67%). Clearly, there is still a need to capacitate the EAPs and biodiversity specialists, in order to ensure that they provide comprehensive and effective mitigation measures in mining projects. This is very crucial; because these mitigation measures are used to mitigate any potential negative impacts of mining activities on biodiversity. All the respondents further indicated that the Biodiversity Assessments are still being conducted during inappropriate seasons. However, one of the respondents indicated that this is usually due to short EIA timeframes. This needs to be addressed; and Biodiversity Assessments should be conducted in both dry and wet seasons.

One of the weaknesses in BIAs is that the implications of uncertainty, gaps in information and risks are not made explicit in terms of the irreversibility of impacts or the irreplaceable loss of resources. In this case, all the participants agreed that this situation has not changed since 2013. Biodiversity specialists and EAPs need to understand the importance of providing adequate information on the irreversibility of the impacts on biodiversity; because these are crucial when determining mitigation measures.

It is well documented in the literature that EIAs tend to fail to incorporate environmental thresholds to assess the significance of any impacts on the biodiversity (De Villiers *et al.*, 2008; Hallatt *et al.*, 2015; Slootweg, 2005; Swanepoel *et al.*, 2019). Environmental thresholds are known as “points or zones, at which relatively rapid change occurs from one ecological condition to another” (Huggett, 2005: 302). The respondents indicated that the consideration of environmental thresholds has not improved since 2013. An effort should be made to ensure that the EAPs and biodiversity specialists are able to incorporate the environmental thresholds, in order to assess the significance of any impacts on the

biodiversity. Another major weakness is that Biodiversity Assessments often fail to assess the broader landscape-scale effects on ecosystems and processes; the focus is mainly on affected site and at species-level. The results from all the respondents show that this has not improved since 2013.

4.6 Conclusion

This chapter has highlighted a number of weaknesses and strengths in mining BIAs conducted in Mpumalanga Province. Biodiversity stakeholder consultation and sensitivity mapping were amongst the areas most poorly performed in many BIA reports. Most BIA reports complied with the requirements of the NEMA EIA regulations. Faithful representation of the biodiversity specialist input was also well-performed in most EIA reports. However, a number of weaknesses were highlighted; and some recommendations and suggestions are provided in Chapter 5.

CHAPTER 5: CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

The main aim of this study was to analyse the treatment of biodiversity impacts in mining EIAs – before and after 2013 – using Mpumalanga Province as a case study. A summary of the findings of this study and the recommendations are provided in this chapter, in order to improve any areas of weakness in the treatment of biodiversity impacts in mining EIAs. This chapter is divided into 5 sections; it provides the key strengths and weaknesses of BIAs in mining EIAs, limitations of the study, some concluding remarks, recommendations, and areas of further research.

5.2 Key weaknesses and strengths of BIAs in mining EIAs

5.2.1 Key weaknesses of BIAs in mining projects

- The lack of independence of EAPs and biodiversity specialists was highlighted as one of the major challenge in BIAs for mining projects. From the questionnaires undertaken for this study, the independence of the EAPs and the biodiversity specialists was highlighted – as being the major weakness in mining projects. It is therefore clear that there is a need to emphasise the independence of EAPs and biodiversity specialists, in order to ensure that they provide an objective assessment that could assist the decision-making process.
- Rigidity of timeframes in the EIA regulations is one of the weaknesses of BIAs in mining projects. As discussed in Chapter 4, the rigidity of timeframes in the EIA regulations does not allow for proper biodiversity assessments. BIAs need to be conducted in different seasons (wet and dry season etc.). However, the EIA timeframes do not allow biodiversity specialists to conduct these studies in different seasons. Consequently, the assessments that are usually conducted do not provide concrete evidence on how the proposed mining project would affect the biodiversity and the associated ecosystems.
- BIAs tends to be conducted during inappropriate seasons. As discussed above, this is mostly linked to the rigidity of the South African EIA timeframes. In certain cases, biodiversity specialists are being requested to conduct their assessment under tight deadlines; and this does not allow them to conduct any additional surveys.

- Project description tends to be neglected in most BIAs. As discussed in Chapter 4, this was one of the review areas that were poorly described in most mining BIA reports. The results of this study show that only 17% and 39% of the reports managed to describe the project before and after 2013, respectively.
- Poor consideration of cumulative impacts was identified as one of the weaknesses in mining EIAs. As shown in Appendices C and D, cumulative impacts on biodiversity were poorly attempted in most cases. This was also evident in the analysis of the questionnaires; as a number of respondents indicated that the cumulative impacts on biodiversity tend to be neglected in mining EIAs.
- Sensitivity mapping was identified as one of the weaknesses in this study. As shown in Chapter 4, this review area managed to receive a satisfactory score of 35% and 49% - before and after 2013, respectively (see Table 4.1 and 4.2). Furthermore, sensitivity mapping was poorly attempted by EAPs, when they were integrating the specialist input in the main EIA report, as shown in Appendices E and F. This clearly shows that there is a need to improve sensitivity mapping in mining EIAs.
- Poor consideration of alternatives was identified as one of the weaknesses in this study. From the review of the mining BIAs, this review area failed to receive a satisfactory score of 60% or above (before and after 2013), as shown in Appendices C and D. Biodiversity specialists should assess a number of alternatives, including the no-go alternative; however, it appears that so far, this important review area has not received the attention it deserves from the biodiversity specialists and the EAPs.
- Biodiversity stakeholder consultation was the most poorly performed review area, as shown in Tables 4.1 and 4.2. This review area was poorly performed before and after 2013 – with only 4% and 9% satisfactory scores, respectively. In order to improve the consideration of biodiversity issues in mining EIAs, there is a need to improve biodiversity stakeholder consultation.
- Monitoring programmes managed to receive satisfactory scores of 48% and 52%, before and after 2013, respectively. This was highlighted as one of the weaknesses in this research.

5.2.2 Major strengths of BIAs in mining projects

- Where mining operations are planned in critical biodiversity areas, threatened ecosystems, or protected ecosystems, this is always raised as a concern in EIAs. In

that way, controversial mining projects are at least transparent about their potential impact on the environment.

- Credible data recorded can be useful in the decision-making process. The company has no defence if compliance issues should arise. The ‘polluter pays principle’ can be applied.
- Expertise and professional conduct of the specialist. This is the information that is readily available from the biodiversity specialists. The NEMA EIA regulations require the specialists to include the qualifications, experience and the declaration of independence, etc. All the reports performed well in this review area, as was discussed in Chapter 4.
- Communication of results in mining BIAs was identified as one of the strengths. As shown in Appendices C and D, this review area managed to score 78% and 87% before and after 2013, respectively. From the results of the review criteria, it is clear that this is not a problem area in mining BIAs.

5.3 Limitations of the study

The following limitations were encountered during the study:

- During the data collection stage of this study, it was anticipated that the mining EIA reports and their BIA reports were to be accessed from the DMR. A formal request was made to the DMR; however, no reports were obtained until the data gathering stage of this research. As a result, alternative sources were approached. The reports were accessed from the MTPA.
- In this study, 15 questionnaires were submitted by emails to key biodiversity stakeholder. However, only 6 questionnaires were returned to the researcher. This was noted as a major limitation in this study.

5.4 Concluding remarks

The principal aim of this research was to analyse the treatment of biodiversity impacts before and after the publication of the South African Mining and Biodiversity Guideline. To achieve this aim, a customised review package was developed and employed to review a total of 46 mining BIA reports and their mining EIA reports. The research highlighted a number of inadequacies regarding the treatment of biodiversity impacts in mining EIAs. For instance, 77 % of the review areas (before 2013) failed to receive a minimum satisfactory grade (C/60%).

Prediction of impacts, monitoring, consideration of alternatives, and project description were among the areas of inadequacy. The most poorly performed review area was the consultation of biodiversity stakeholders, with a satisfactory score of 4%. This clearly shows that the biodiversity stakeholder consultation processes have been neglected in most mining BIAs. Biodiversity stakeholder consultation is regarded as a precondition for effective EIA (DEA *et al.*, 2013); this aspect of the EIA process needs to be improved, in order to improve the treatment of biodiversity impacts in mining EIAs.

A total of 54% review areas failed to obtain a minimum satisfactory score of 60% for mining BIAs conducted after 2013. Although this can be seen as an improvement when compared with the 77% failure obtained before 2013, most of the areas of inadequacy that were highlighted in mining BIA reports prepared before 2013 were still prevalent in mining BIA reports prepared after 2013. For instance, biodiversity stakeholder consultation, prediction and assessment of impacts, sensitivity mapping, and monitoring programmes were also poorly considered in mining BIAs conducted after 2013. This shows that there is little to no improvement from these review areas. Description of the baseline environment and recommendations for management are the only review areas that have managed to show some level of improvement since 2013.

The research further assessed the compliance of mining BIA reports with the NEMA EIA regulations, according to the requirements of the specialist studies. A number of mining BIA reports complied with these minimum requirements. However, these mining BIA reports failed to provide a reasoned opinion as to whether a proposed activity should be authorised or not, in terms of biodiversity and an ecological point-of-view. This was one of the inadequacies; because the biodiversity specialist is required to provide an input, based on the findings of the BIA, and the associated impacts, on whether the proposed mining project should go ahead or not. The information regarding the biodiversity stakeholder consultation was also missing. Biodiversity stakeholders provide a meaningful input in the BIA process by ensuring that potential biodiversity impacts are addressed by the biodiversity specialist.

Faithful representation of biodiversity specialist input in the main mining EIA report was poorly performed in the reports prepared before 2013. These reports received a satisfactory score of 52%. However, the reports prepared after 2013 showed a great improvement, by receiving a satisfactory score of 78%. From the analysis of the results, it was noted that the

faithful representation of biodiversity specialist input is not a problem area; since most EAPs managed to properly integrate the biodiversity specialist input into the main mining EIA report. However, it is important for one to note that sensitivity mapping was the only review area that was poorly performed. The EAPs should provide a composite sensitivity map, including the size and location of the sensitive areas; and they should superimpose the project footprint map upon the sensitivity map. Sensitivity mapping in BIA and EIA needs to be improved.

The review criteria level for mining BIAs and EIA prepared after 2013 showed some degree of improvement on the satisfactory grades. However, as discussed above, most of the review areas and mining BIA reports failed to obtain a satisfactory score of 60% and above. This research revealed that there is little to no improvement in the treatment of biodiversity impacts in mining EIA's after the publication of the Mining and Biodiversity Guideline. Although this guideline is perceived to be a valuable tool in the integration of biodiversity in the mining industry, this guideline has not been successfully implemented; and it did not receive the attention it deserved from the biodiversity specialists and the EAPs. The following section provides some recommendations on how the treatment of biodiversity impacts in mining EIAs could be improved.

This research showed that biodiversity is poorly considered in mining BIAs and EIAs in general. The results obtained in this study might have been influenced by a number of factors. Considering that South Africa is a developing country, poverty is rampant; and mining is seen as one of the sectors that contribute significantly to the economy of the country. Therefore, socio-economic issues tend to outweigh those of the environment. Although South Africa is one of the countries with strong Environmental Legislation, and a number of guidelines have been published, it is evident that these are not making any difference in terms of prioritising the environment over the prevailing socio-economic issues.

This shows that there is a need to improve the quality of EIAs and the associated BIAs for mining projects, in order to ensure that these studies provide adequate information for the Competent Authority to make an informed decision and promote sustainable development.

5.5 Recommendations

The DEA and their provincial departments, DMR, including the professional bodies, such as the South African Council for Natural Scientific Professions (SACNASP), Environmental Assessment Practitioners Association of South Africa (EAPASA), and the South African affiliation of the International Association for Impact Assessment (IAIAsa) should promote capacity building for biodiversity specialists and EAPs (involved in mining projects), in order to ensure that they are equipped with latest information on biodiversity-inclusive EIA. This could include training on best-practice guidelines in BIA and EIA. In addition, professional bodies can play a significant role by embodying the requirements required to comply with best-practice guidelines, such as the Mining and Biodiversity Guideline in their code of conduct. The biodiversity specialists would then be able to conduct their studies in accordance with the guidelines; and thereby ensure that biodiversity impacts are assessed properly.

Although the Mining and Biodiversity Guideline is perceived as a practical tool that can be used to promote the consideration of biodiversity impacts in mining projects, the guideline is not legally binding. From the results obtained in this study, it is evident that this guideline has not received the attention it requires, particularly in the impact-assessment community. For this guideline to be successfully implemented and accepted by the impact-assessment community, there is a need to include a clause in the EIA regulation for EAPs and specialists to refer specifically to this guideline and other best-practice guidelines, when assessing the potential impacts of a proposed mining project on biodiversity.

The DEA has also published a draft national minimum-information requirements guideline for preparing EIAs for mining activities that require environmental authorisation (DEA, 2017). It is recommended that the biodiversity specialists and the EAPs involved in mining projects should also consider these guidelines.

It has emerged from this study that biodiversity stakeholder consultation and participation have proven to be a challenge in BIAs conducted before and after 2013. As highlighted in the Mining and Biodiversity Guideline, biodiversity stakeholder consultation is a precondition for an effective Environmental Assessment. There is a need to develop best-practice guidelines for biodiversity stakeholder consultation and participation, in order to provide guidance on how biodiversity specialists can involve biodiversity stakeholders in their

assessments. This can also include guidelines on how to integrate traditional and indigenous knowledge in BIAs.

The contents of the specialist report (NEMA EIA regulations) do not stipulate any explicit requirements regarding the stakeholder consultation or consultation process in general. The regulations should provide a requirement for specialists to undertake a consultation process for their studies. For Biodiversity Impact Assessment, the biodiversity specialist should provide evidence of any consultation with key biodiversity stakeholders, such as the provincial conservation agencies. This could also include consultation with local communities, in order to understand their dependence on biodiversity, ecosystem services and how their livelihoods will be affected by the proposed mining project. This is in line with principle 10 of the Rio-Declaration, which states that “Environmental issues are best handled with the participation of all concerned citizens, at the relevant level” (UN, 1992:3).

This can also promote the consideration of indigenous knowledge in biodiversity assessment, which was noted to be a challenge in this research. This needs to be addressed, in order to achieve sustainable development goals, as highlighted in Rio-Declaration (principle 22), “Indigenous people and their communities and other local communities have a vital role in environmental management and development because of their knowledge and traditional practices” (UN, 1992:4).

The analysis of the results in this study revealed that most biodiversity specialists fail to assess the impact on the ecosystems and their related processes; but, that they tend to focus on individual species. A solution to this problem is the phenomenon called the ‘ecosystem approach’, which includes the assessment of biodiversity at genetic, species and ecosystem levels. This is very crucial, especially in mining projects; since they have the potential to impact negatively on terrestrial and aquatic ecosystems through Acid Mine Drainage (AMD). Biodiversity specialists should refer to the best-practice guidelines, such as those developed by Ezemvelo KZN Wildlife (2013) and Brownlie (2005), when conducting their studies, in order to incorporate the ecosystem approach.

The rigidity of EIA timeframes has proven to be a challenge, especially in biodiversity assessments. BIAs need to be conducted in different seasons, such as growing, dry and wet seasons. For this to be possible, the EIA timeframes need to be adjusted, in order to

accommodate the BIAs. Conducting a BIA for merely fulfilling of the requirements of the Environmental Authorisation, without considering the dynamics of the ecosystems, is of no value. The EIA timeframes should be revised, in order to accommodate these biodiversity studies.

There is a need to develop a specific guideline on sensitivity mapping. The available guidelines, such as those developed by Ezemvelo KZN Wildlife (Ezemvelo KZN Wildlife, 2013) and Gauteng Department of Agriculture and Rural Development (GDARD, 2012) included a section on sensitivity mapping; but these tend to be too general; and they were developed to be used in KwaZulu Natal and Gauteng Provinces, respectively. Therefore, specific guidelines on sensitivity mapping would assist the biodiversity specialists, when undertaking their assessment and EAPs, when integrating the specialist input in the main mining EIA report. Furthermore, the proper use of GIS and other spatial databases should be encouraged. For instance, some BIA reports reviewed in this study failed to provide good GIS maps. The specialists and EAPs should seek the assistance of a qualified GIS specialist, when performing sensitivity mapping in cases where the specialist or the EAP has no expertise in this field.

Mitigation and monitoring programmes can be improved by following the mitigation hierarchy, as described in the Mining and Biodiversity Guideline (DEA *et al.*, 2013). Biodiversity specialists should provide effective mitigation measures and monitoring programmes, in order to minimise the impact of the proposed project on the biodiversity and the ecosystems. The guidelines developed by the ICMM (2006) should also be employed by the biodiversity specialists, when providing the monitoring programmes for mining-related projects.

5.6 Further research

This research focused mainly on various BIA reports, including fauna, flora, wetland, and aquatic studies. Further research can focus specifically in one of the BIA reports, for instance they can focus on wetland assessments, rather than assessing various types of BIA reports. This will help in identifying those BIA reports that are poorly conducted in mining EIAs. Furthermore, a research can be conducted by comparing the considerations of biodiversity impacts in mining EIAs (this research) and the EIAs for other sectors. This will provide a

clear indication on how the biodiversity impacts are considered in EIAs in general and how they compare in various sectors.

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APPENDICES

Appendix A: Mining BIA report review package (review topics)

Review Area 1: Expertise and professional conduct

- 1.1. Does the BIA report contain the details of the Biodiversity Specialist who prepared the report and is the Biodiversity Specialist professionally registered with the relevant professional body?
- 1.2. Does the BIA report contain details of the qualifications, experience and expertise (curriculum vitae) of the Biodiversity Specialist to compile a specialist report?
- 1.3. Has a declaration of independence been provided?
- 1.4. Has the specialist confirmed the validity of the information included in the report?

Review area 2: adequacy and sufficiency of information

- 2.1. Has the specialist provided sufficient information for decision-making purposes in terms of the level of detail and reliability of findings?
- 2.2. Does the specialist report contain the Terms of Reference (TOR)?
- 2.3. Does the TOR link explicitly to the biodiversity issues that were raised during scoping phase?
- 2.4. Are the TOR adequate and explicit, and to what extent has the specialist met all the requirements of the TOR for the specialist input?
- 2.5. Where appropriate, has traditional or indigenous knowledge, pertaining to biodiversity, been incorporated into the study?
- 2.6. Are there any uncertainties, gaps in knowledge or low levels of confidence in the assessment or evaluation? Are these uncertainties and confidence levels clearly stated?
- 2.7. Is the degree of confidence in the impact assessment prediction clearly specified and explained?

Review area 3: clarity of the report

- 3.1. Has a clear, non-technical summary been provided?
- 3.2. Is the date and season of the site investigation and the relevance of the season to the outcome of the assessment provided? These need to be adequately motivated.
- 3.3. Are the sources of information clear and explicit, and has the specialist included a list of references?
- 3.4. Has a description of the methodology adopted in preparing the report or carrying out the specialised process been given?
- 3.5. To what extent does the specialist explain the purpose and scope of the study undertaken?
- 3.6. Are opinions or statements justified and adequately motivated?
- 3.7. Are conclusions derived from the findings of study logically consistent?

3.8. Is a summary impact assessment table included, using the defined impact assessment and significance rating criteria to evaluate different alternatives both with and without management actions?

3.9. Is a description given of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives, on the environment?

Review area 4: description of the project

4.1. Has the purpose and need for the proposed project been clearly stated?

4.2. Is there adequate description of the proposed project and alternatives to allow effective identification and assessment of potential direct, indirect and cumulative impacts (e.g. location, siting, routing, scheduling, activities, inputs and outputs, labour, buildings and structures, infrastructure and operating scenarios)?

Review area 5: description of the baseline environment

5.1. Is there adequate description of the key characteristics of the affected socio-economic and biophysical environment (as relevant to the specialist domain) including baseline conditions, sensitive receptors or resources, uses/users, anticipated trends and pressures, and future scenarios?

5.2. Are off-site as well as on-site characteristics adequately described to provide the broader context within which the development is proposed, where it is clear that impacts of the proposed project would extend beyond the immediate site?

5.3. Are clear and accurate maps, plans and possibly photographs, of the project and affected environment provided?

5.4. Is baseline information sufficient enough to enable reliable identification of biodiversity priority areas? Proper assessment and evaluation of potential significant impacts on biodiversity and ecosystem services should consider any background trends that might be affecting the conservation status and integrity such as proposed mining in areas where there is increase settlement, illegal poaching, or/and land conversion for other purposes.

5.5. To what extent does baseline information describe key ecological process or functions and important special components of ecological processes such as ecological corridors?

5.6. To what extent does baseline information highlights the conditions of ecosystems, habitat, and vegetation type and ecosystem status.

Review area 6: consideration of alternatives

6.1. Has adequate consideration been given to the identification of reasonable alternatives to minimise the impact of the activity? (See full description)

- 6.2. Have alternatives been addressed at a scale and level of detail that enables adequate comparison with the proposed project?
- 6.3. Has the specialist identified the alternative that is the best environmental option from a biodiversity perspective?
- 6.4. Has no-go alternative been considered and the reasons as to why it may be recommended or eliminated?

Review area 7: Sensitivity mapping

- 7.1. Are ecological linkages/corridors and their associated buffers at both the sites and landscape delineated as sensitive?
- 7.2. Are the levels of sensitivity determined by the biodiversity specialist? The levels should be based on the following categories: low, medium, or high.
- 7.3. Is the methodology for determining levels of sensitivity included with the map?

Review area 8: inclusion of legal aspects

- 8.1. Is the legal context of the study, in terms of biodiversity, been described and are legal requirements, including those arising from international agreements, clearly considered?
- 8.2. Is the policy and planning context of the proposal described, and clearly considered (taking into consideration international, national, provincial and local policies and plans)?
- 8.3. Have accepted standards and guidelines with regards to biodiversity been identified and clearly taken into consideration (e.g. National Spatial Biodiversity Assessment, DWA wetland delineation)?
- 8.4. Have opportunities for the proposed project to support or contribute to the implementation of policy, plans or programmes been identified?
- 8.5. Have inconsistencies, potential areas of conflict and or likely non-compliance between the proposed project and the legal, policy and planning context been clearly identified and the implications described?

Review area 9: stakeholder consultation

- 9.1. Has a description of any consultation process that was undertaken during the course of carrying out the study been provided?
- 9.2. Has a summary and copies of any comments received during any consultation process and where applicable all responses thereto been included?
- 9.3. Within the specialist's area of expertise, have key stakeholders input to the EIA process, where the proposed project could have a direct and/or potentially significant effect on their particular or mandated area of responsibility or interest, been incorporated in the study?

9.4. Where the EIA process has missed key stakeholders, and/or where additional stakeholder involvement is clearly needed to refine, or better define issues or impacts, has the specialist made adequate provision for such involvement?

Review area 10: prediction and assessment of impacts

10.1. Have plausible environmental and operating scenarios been considered in the assessment?

10.2. Has a clear description been given of the approach and methodology that have been used by the specialist to assess the impacts and has this been clearly motivated?

10.3. Have linkages to other specialist inputs been identified and taken into account where relevant?

10.4. Are clear, sufficient and explicit criteria used to assess positive and negatives impacts of different alternatives, taking into account the planned mitigation and management?

10.5. Have potential direct, indirect and cumulative impacts on important pattern, important ecological processes and associated areas (e.g. corridors), and on ecosystem goods and services (as relevant to the proposed project) on and beyond the site, been described assessed and evaluated?

10.6. Is there adequate attention to indirect effects on significant or sensitive resources?

Where potentially significant cumulative effects are possible, but cannot be addressed at the EIA level, has the need for higher order studies been clearly stated?

10.7. Are there systematic, explicit and rational links from identification of key issues, through assessment to evaluation of significance?

10.8. Are consequences of the predicted impacts made explicit?

10.9. Is there a clear indication of whether impacts are irreversible or result in an irreplaceable loss of biodiversity or ecosystem services to the ecosystem and/or society?

10.10. Have impacts been assessed, and communicated in terms of the extent to which they support or conflict with the desired future state/vision of the area and sustainable development objectives (as described in relevant policies, plans and legislation)?

10.11. Are the beneficiaries, and those who stand to lose from the proposed development, clearly identified where there are clear dependencies on ecosystem goods and/or services, highlighting vulnerable and risk-prone parties?

10.12. Does the assessment and evaluation enable differentiation between priority areas and other natural areas, and other areas where little to no natural habitat remains? The type of biodiversity priority area and natural habitat remaining is important to informed application of mitigation hierarchy.

10.13. Are cumulative impacts of mining activities on biodiversity, mainly on biodiversity priority areas and threatened species evaluated?

Review area 11: recommendations for management

11.1. Is a summary of key management actions that would fundamentally affect the significance of impacts on biodiversity if implemented provided?

11.2. Has the management of the potential positive and negative impacts been systematically and adequately addressed (i.e. has the specialist considered measures for the avoidance, mitigation, restoration, rehabilitation or compensation of negative impacts in a hierarchical fashion; and have measures for enhancing positive impacts been considered)?

11.3. Has the precautionary principle been applied to the recommendations for management and monitoring measures where there is uncertainty or high risk associated with impacts?

11.4. Are recommended management actions practical, viable and in line with best practice? Are these clearly described and motivated?

Review area 12: monitoring

12.1. Does the recommended monitoring program(es) include: the specific questions to be asked by monitoring; the frequency, season and timing for monitoring; responsibility for monitoring, analysis and implementation of responsive management actions; targets and indicators for monitoring; significance thresholds; and auditing and reporting requirements?

12.2. Is the proposed monitoring program(es) practical, viable and in line with best practice? Has it been clearly described and motivated?

Review area 13: Communications of results

13.1. Is the information on the BIA report represented so as to be comprehensible to the non-specialist? Tables, graphs and other devices should be used as appropriate. Unnecessary technical or obscure language should be avoided.

13.2. Is the BIA report unbiased? The report should be unbiased; it should not lobby for any point of view. Adverse impacts should not be disguised by euphemism and platitudes.

13.3. A reasoned opinion as to whether the proposed activity or portions thereof should be authorised. And if the opinion is that the proposed activity or portions thereof should be authorised, any avoidance, management and mitigation measures that should be in the EMP and where applicable closure plan

Appendix B: Review Procedure

The reviewer should follow the following steps in order to successfully conduct a BIA report review (adapted from: Lee *et al.*, 1999).

1. Read and understand all the relevant information provided regarding the mining BIA report review package (see section 3.5).
2. Carefully go through the review topics provided (Appendix A) and understand the review areas and review criteria. It is also crucial to note the information required for these topics.
3. Briefly go through the mining BIA report noting the layout and the whereabouts of the important information.
4. Read and interpret review area 1 and its review criteria (1.1-1.4)
5. Assess each review criteria (1.1-1.4). The assessment of these review criteria will be used to assess review area 1. It is also important to note that not all the required information for a review area will be located in the same place in the report.
6. Decide which assessment symbol is appropriate for each review criteria. A review package collation sheet (Appendix C & D) should be used to record the assessment symbols (A-F/NA) for each review criteria.
7. A review criteria should be assessed as being satisfactory performed if sufficient information is provided to assist the competent authority to make an informed decision.
8. The assessments of review criteria 1.1-1.4 and any relevant information obtained from the BIA report should be used to assess review area 1. When assessing the review area, it is of pivotal importance to take note of the information provided in the report rather than taking an average of the assessments of the review criteria (1.1-1.4).
9. Proceed to next review area (2) and assess it in the same manner as review area 1 above.
10. Assess all review areas and their review criteria as described above for review area 1, following the same procedure.
11. The overall judgement of the BIA report should take place when all review areas have been assessed. The BIA report can then be assigned an assessment symbol as a whole based on the quality of information obtained in the review areas and in the report as a whole. It is advisable that the reviewer should include a brief synopsis of strength and weaknesses and whether the BIA report meets the minimum requirements, such as compliance with environmental legislation.

Appendix C: Results of the review areas and review criteria before 2013

REVIEW AREA	REVIEW CRITERIA	REVIEW TOPICS	WELL PERFORMED	GENERALLY SATISFACTORY AND COMPLETE	JUST SATISFACTORY	JUST UNSATISFACTORY	NOT SATISFACTORY	WORK IS INSUFFICIENT	REVIEW NOT APPLICABLE	% SATISFACTORY
		Quality Remarks and Symbols	Excellent (A)	Good (B)	Satisfactory (C)	Weak (D)	Poor (E)	No opinion (F)	N/A	%
Review Area 1		Expertise and professional conduct		4	10	3	5	1		61
	1.1	Details of Biodiversity Specialist	3	8	11			1		96
	1.2	Qualifications, expertise and experience of specialist		1	3	11	3	5		17
	1.3	Declaration of independence	11	1		1		10		52
	1.4	Validity of the information in the BIA report		2	11	5	1	4		57
Comments:										
Review Area 2		Adequacy and sufficiency of information	1	2	8	7	5			48
	2.1	Sufficient information for decision-making purposes	2	3	5	9	4			43
	2.2	Terms of reference (TOR) for BIA	13	3	3	2	1	1		83
	2.3	Adequacy of TOR	2	5	7	3	5	1		61
	2.4	Traditional or indigenous knowledge in BIA report				2	5	16		0
	2.5	Uncertainties, gaps in knowledge and low levels of confidence	1	6	8	6	1	1		65
	2.6	Degree of confidence in impact assessment prediction		2	6	9	2	4		35
Comments:										
Review Area 3		Clarity of the report	3	8	7	3	2			78
	3.1	Clear, non-technical summary	3	12	6	2				91
	3.2	Date and season of site investigation	2	2	11	5	2	1		65
	3.3	Sources of information	8	9	5	1				95
	3.4	Description of the methodology adopted	8	9	3	2		1		87
	3.5	Purpose and scope of the study		8	14	1				96
	3.6	Opinions and statements on BIAR	2	6	7	4	4			65
	3.7	Conclusion derived and findings	5	5	7	4	2			74
	3.8	Summary impact assessment table	10	5	1	2	2	3		70
	3.9	Description of the findings and their potential implications	2	8	4	6	1	2		61
Comments:										

REVIEW AREA	REVIEW CRITERIA	REVIEW TOPICS	WELL PERFORMED	GENERALLY SATISFACTORY AND COMPLETE	JUST SATISFACTORY	JUST UNSATISFACTORY	NOT SATISFACTORY	WORK IS INSUFFICIENT	REVIEW NOT APPLICABLE	% SATISFACTORY
		Quality Remarks and Symbols	Excellent (A)	Good (B)	Satisfactory (C)	Weak (D)	Poor (E)	No opinion (F)	N/A	%
Review Area 4		Description of the project			4	2	7	10		17
	4.1	Need and the purpose of the proposed project			5	2	6	10		21
	4.2	Description of the project and alternatives			4	2	4	13		17
Comments:										
Review area 5		Description of the baseline environment		2	10	2	9			52
	5.1	Characteristics of the affected environments		2	10	6	5			52
	5.2	Description of the surrounding environments		1	13	8	1			61
	5.3	Maps, plans and photographs	1	10	5	2	2	3		70
	5.4	Reliable identification of biodiversity priority areas		3	9	7	4			52
	5.5	Description of key ecological processes		2	6	11	2	2		35
	5.6	Environmental conditions	1	2	11	5	3	1		61
Comments:										
Review area 6		Consideration of alternatives			11	3	5	4		48
	6.1	Consideration of reasonable alternatives		6	7		7	3		57
	6.2	Adequate comparison of alternatives			11	7	2	3		48
	6.3	Identification of best alternative	1	5	6	1	4	6		52
	6.4	Consideration of no-go alternative			2	4	3	14		9
Comments:										
Review area 7		Sensitivity mapping		6	2	1	3	11		35
	7.1	Ecological linkages		4	6	1	1	11		43
	7.2	Levels of sensitivity	6		1	2	2	12		30
	7.3	Methodology for determining sensitivity	4	2	2	1	2	12		35
	Comments:									

REVIEW AREA	REVIEW CRITERIA	REVIEW TOPICS	WELL PERFORMED	GENERALLY SATISFACTORY AND COMPLETE	JUST SATISFACTORY	JUST UNSATISFACTORY	NOT SATISFACTORY	WORK IS INSUFFICIENT	REVIEW NOT APPLICABLE	% SATISFACTORY
		Quality Remarks and Symbols	Excellent (A)	Good (B)	Satisfactory (C)	Weak (D)	Poor (E)	No opinion (F)	N/A	%
Review area 8		Inclusion of legal aspects			4	7	9	3		17
	8.1	Description of legal context and requirements			5	7	3	8		22
	8.2	Description of policy and planning context		1	5	5	6	6		26
	8.3	Identification and description of guidelines and standards		1	5	7	5	5		26
	8.4	Support of policy, plans and programmes			4	6	5	8		17
	8.5	Inconsistencies, potential areas of conflict		1	3	5	9	5		17
Comments:										
Review area 9		Stakeholder consultation			1		2	20		4
	9.1	Description of any consultation process			1			22		4
	9.2	Summary and copies of any comments received			1		1	21		4
	9.3	Input from key I&As in EIA			1			22		4
	9.4	Need for additional stakeholder engagement					1	22		0
Comments:										
Review area 10		Prediction and assessment of impacts		4	6	4	5	4		43
	10.1	Consideration of plausible environmental & operating scenarios	2	6	7	3	2	3		65
	10.2	Approach & methodology used to assess impacts	3	5	4	1	1	9		52
	10.3	Linkages to other specialists input	1		8	1	3	10		39
	10.4	Criteria used to assess impacts of different alternatives	1	6	5	4	4	3		52
	10.5	Direct, indirect and cumulative impacts on ecological processes	1		8	10	1	3		39
	10.6	Indirect or cumulative effects on significant or sensitive resources		4	11	3	2	3		65
	10.7	Linkages from identification to evaluation	2	7	4	5	2	3		57
	10.8	Consequences of the predicted impacts	6	5	4	1	4	3		65
	10.9	Nature of the impact on biodiversity & ecosystem services	3	3	5	6	2	4		48
	10.10	Assessment & communication of impact in relation to future goals		2	2	7	7	5		17
	10.11	Identification of beneficiaries			1	11	7	4		4

REVIEW AREA	REVIEW CRITERIA	REVIEW TOPICS	WELL PERFORMED	GENERALLY SATISFACTORY AND COMPLETE	JUST SATISFACTORY	JUST UNSATISFACTORY	NOT SATISFACTORY	WORK IS INSUFFICIENT	REVIEW NOT APPLICABLE	% SATISFACTORY
		Quality Remarks and Symbols	Excellent (A)	Good (B)	Satisfactory (C)	Weak (D)	Poor (E)	No opinion (F)	N/A	%
	10.12	Differentiation between ecosystems		3	5	9	3	3		35
	10.13	Cumulative impacts on biodiversity priority areas and threatened species			6	5	6	6		26
Comments:										
Review area 11		Recommendations for management		4	9	4	4	2		57
	11.1	Summary of key management actions	1	11	8	1		2		87
	11.2	Management of the potential impacts		3	5	11	2	2		35
	11.3	Application of the precautionary principle		1	7	6	6	3		35
	11.4	Viability and practicability of recommended management actions		3	8	6	4	2		48
Comments:										
Review area 12		Monitoring	1	3	7	8	1	3		48
	12.1	Monitoring programmes	1	4	8	6	1	3		57
	12.2	Practicability, viability, description and motivation of the proposed monitoring programmes	1	2	7	7	3	3		43
Comments:										
Review area 13		Communication of results		6	12	3	2			78
	13.1	Comprehensibility of the report	7	7	5	2	2			82
	13.2	Statements on the report	9	4	5	4	1			78
	13.3	A reasoned opinion about the proposed project				1	7	15		0
Comments:										
Final grade for mining BIA report				3	7	5	6	4		43

Appendix D: Results of the review areas and review criteria after 2013

REVIEW AREA	REVIEW CRITERIA	REVIEW TOPICS	WELL PERFORMED	GENERALLY SATISFACTORY AND COMPLETE	JUST SATISFACTORY	JUST UNSATISFACTORY	NOT SATISFACTORY	WORK IS INSUFFICIENT	REVIEW NOT APPLICABLE	% SATISFACTORY
		Quality Remarks and Symbols	Excellent (A)	Good (B)	Satisfactory (C)	Weak (D)	Poor (E)	No opinion (F)	N/A	%
Review Area 1		Expertise and professional conduct	7	5	8	2	1			87
	1.1	Details of Biodiversity Specialist	13	3	6	1				97
	1.2	Qualifications, expertise and experience of the specialist	8	1	5	4	2	3		61
	1.3	Declaration of independence	18					5		78
	1.4	Validity of the information in the BIA report	2	4	14	3				87
Comments:										
Review Area 2		Adequacy and sufficiency of information		8	6	5	4			61
	2.1	Sufficient information for decision-making purposes	1	8	5	7	2			61
	2.2	Terms of reference(TOR) for BIA	17	2	2			2		91
	2.3	Adequacy of TOR		10	5	3	3		2	65
	2.4	Traditional or indigenous knowledge in BIA report			2	1	13	7		9
	2.5	Uncertainties, gaps in knowledge and low levels of confidence	5	3	6	9				61
	2.6	Degree of confidence in impact assessment prediction	2	3	7	7	4			52
Comments:										
Review Area 3		Clarity of the report	4	8	9	2				91
	3.1	Clear, non-technical summary	5	9	7		1	1		91
	3.2	Date and season of site investigation	2	5	7	8		1		61
	3.3	Sources of information	7	5	8	3				87
	3.4	Description of the methodology adopted	14	7	2					100
	3.5	Purpose and scope of the study	1	10	12					100
	3.6	Opinions and statements on BIAR	2	5	9	7				70
	3.7	Conclusion derived and findings	6	7	9	1				96
	3.8	Summary impact assessment table	14	6	1	1	1			91
	3.9	Description of the findings and their potential implications	3	6	11	3				87
Comments:										
Review Area 4		Description of the project		2	7	6	5	3		35
	4.1	Need and the purpose of the proposed project		3	10	5	3	2		57
	4.2	Description of the project and alternatives		2	5	7	5	4		30

REVIEW AREA	REVIEW CRITERIA	REVIEW TOPICS	WELL PERFORMED	GENERALLY SATISFACTORY AND COMPLETE	JUST SATISFACTORY	JUST UNSATISFACTORY	NOT SATISFACTORY	WORK IS INSUFFICIENT	REVIEW NOT APPLICABLE	% SATISFACTORY
		Quality Remarks and Symbols	Excellent (A)	Good (B)	Satisfactory (C)	Weak (D)	Poor (E)	No opinion (F)	N/A	%
Comments:										
Review area 5		Description of the baseline environment		7	8	7	1			65
	5.1	Characteristics of the affected environments		7	7	9				61
	5.2	Description of the surrounding environments	1	5	9	7	1			65
	5.3	Maps, plans and photographs	6	8	6	3				87
	5.4	Reliable identification of biodiversity priority areas		10	5	5	3			65
	5.5	Description of key ecological processes		3	8	11	1			47
	5.6	Environmental conditions	2	5	14	1	1			91
Comments:										
Review area 6		Consideration of alternatives		5	7	7	3	1		52
	6.1	Consideration of reasonable alternatives		6	8	7	2			61
	6.2	Adequate comparison of alternatives		5	7	9	1	1		52
	6.3	Identification of best alternative	2	4	6	7	3	1		52
	6.4	Consideration of no-go alternative	1	3	4	3	2	10		35
Comments:										
Review area 7		Sensitivity mapping	4	4	3	1	3	8		48
	7.1	Ecological linkages	1	10	1	2	1	8		52
	7.2	Levels of sensitivity	9	1	1		3	9		48
	7.3	Methodology for determining sensitivity	6	2	2	3	1	9		43
	Comments:									
Review area 8		Inclusion of legal aspects	2		4	6	11			26
	8.1	Description of legal context and requirements	2	1	5	5	7	3		35
	8.2	Description of policy and planning context	3	1	5	4	7	3		39
	8.3	Identification and description of guidelines and standards	2	2	9	6	3	1		57
	8.4	Support of policy, plans and programmes		2	1	8	8	4		13
	8.5	Inconsistencies, potential areas of conflict		2	3	8	5	5		22
Comments:										
Review area 9		Stakeholder consultation			2	3	1	15	2	9
	9.1	Description of any consultation process			5		1	15	2	22
	9.2	Summary and copies of any comments received				1	3	17	2	0

REVIEW AREA	REVIEW CRITERIA	REVIEW TOPICS	WELL PERFORMED	GENERALLY SATISFACTORY AND COMPLETE	JUST SATISFACTORY	JUST UNSATISFACTORY	NOT SATISFACTORY	WORK IS INSUFFICIENT	REVIEW NOT APPLICABLE	% SATISFACTORY
		Quality Remarks and Symbols	Excellent (A)	Good (B)	Satisfactory (C)	Weak (D)	Poor (E)	No opinion (F)	N/A	%
	9.3	Input from key I&As in EIA			2	2	3	14	2	9
	9.4	Need for additional stakeholder engagement			1	4	1	15	2	1
Comments:										
		Prediction and assessment of impacts		3	10	5	5			57
Review area 10	10.1	Consideration of plausible environmental & operating scenarios	2	9	7	5				78
	10.2	Approach & methodology used to assess impacts	7	7	6	1		2		87
	10.3	Linkages to other specialists input	4	2	8	5	4			61
	10.4	Criteria used to assess impacts of different alternatives	1	5	9	7	1			65
	10.5	Direct, indirect and cumulative impacts on ecological processes		4	9	9	1			57
	10.6	Indirect or cumulative effects on significant or sensitive resources	2	5	8	4	4			65
	10.7	Linkages from identification to evaluation	4	3	13	2	1			87
	10.8	Consequences of the predicted impacts	6	9	4	4				83
	10.9	Nature of the impact on biodiversity & ecosystem services	6	2	4	9	2			52
	10.10	Assessment & communication of impact in relation to future goals		1	5	5	11	1		26
	10.11	Identification of beneficiaries			6	8	6	3		26
	10.12	Differentiation between ecosystems		4	11	5	3			65
	10.13	Cumulative impacts on biodiversity priority areas and threatened species		3	5	6	8	1		35
Comments:										
Review area 11		Recommendations for management		4	10	8	1			61
	11.1	Summary of key management actions	3	9	11					100
	11.2	Management of the potential impacts		4	7	10	2			48
	11.3	Application of the precautionary principle		3	11	7	2			61
	11.4	Viability and practicability of recommended management actions	1	1	12	5	4			61
Comments:										
Review area 12		Monitoring	1	5	6	8	3			52
	12.1	Monitoring programmes	1	6	5	9	2			52
	12.2	Practicability, viability, description and motivation of the proposed monitoring programmes	1	4	8	3	7			57
Comments:										

REVIEW AREA	REVIEW CRITERIA	REVIEW TOPICS	WELL PERFORMED	GENERALLY SATISFACTORY AND COMPLETE	JUST SATISFACTORY	JUST UNSATISFACTORY	NOT SATISFACTORY	WORK IS INSUFFICIENT	REVIEW NOT APPLICABLE	% SATISFACTORY
		Quality Remarks and Symbols	Excellent (A)	Good (B)	Satisfactory (C)	Weak (D)	Poor (E)	No opinion (F)	N/A	%
Review area 13		Communication of results	6	5	9	2	1			87
	13.1	Comprehensibility of the report	11	6	5	1				96
	13.2	Statements on the report	9	5	6	2	1			87
	13.3	A reasoned opinion about the proposed project	7			3	8	5		30
	Comments:									
Final grade for mining BIA report				5	8	7	4			57

Appendix E: Faithful representation of the biodiversity specialist input before 2013

REVIEW CRITERIA		A	B	C	D	E	F	N/A	%
	Presentation and Layout	1	14	5	2	1			87
1.1	Presentation of information	11	5	5	2				91
1.2	Biasness of information		10	9	3	1			83
1.3	Comprehensibility of the information	1	15	5	2				91
Sensitivity mapping									
	Sensitivity mapping		1	7	3	1	10	1	35
2.1	Composite sensitivity map		4	3	2	2	11	1	30
2.2	Size and location of sensitive areas			8	3		11	1	35
2.3	Project footprint map superimposed upon the sensitivity map		3	6	1	2	10	1	39
2.4	Photographs of all biophysical characteristics		4	6	1	3	8	1	43
Alternatives									
	Alternatives		3	9	5		1	2	52
3.1	Explicit and defensive statement on the preferred alternative		3	9	5		1	2	52
Impact identification, assessment, and prediction									
	Impact identification, assessment, and prediction		6	3	6	5		3	39
4.1	Integration of biodiversity impacts	1	5	2	6	4	1	4	35
4.2	Assessment of potential biodiversity impacts		5	2	8	4		4	30
4.3	Description of residual adverse impacts	1	2	9	4	3		4	52
4.4	Cumulative impacts	3	2	6	4	1	2	5	48
4.5	Impact significance	3	3	5	2	6		4	48
4.6	Impact significance methodology	10	5	4	1			3	83
Mitigations and management									
	Mitigations and management		8	3	7	3		2	48
5.1	Integration of mitigation and management actions	1	7	4	6	3		2	52
Final grade for faithful representation			5	7	6	3	2		52

Appendix F: Faithful representation of the biodiversity specialist after 2013

REVIEW CRITERIA		A	B	C	D	E	F	N/A	%
	Presentation and Layout	10	4	8	1				96
1.1	Presentation of information	11	9	3					100
1.2	Biasness of information	7	10	4	2				91
1.3	Comprehensibility of the information	9	6	5	3				87
	Sensitivity mapping		4	8	4	3	4		52
2.1	Composite sensitivity map		3	8	2	3	7		48
2.2	Size and location of sensitive areas		5	6	4	2	6		48
2.3	Project footprint map superimposed upon the sensitivity map	3	4	6	3		7		57
2.4	Photographs of all biophysical characteristics		6	8	2	6	1		61
	Alternatives		5	13	5				78
3.1	Explicit and defensive statement on the preferred alternative		4	14	4	1			78
	Impact identification, assessment, and prediction	8	4	4	2	4	1		70
4.1	Integration of biodiversity impacts	9	5	3	1	3	2		74
4.2	Assessment of potential biodiversity impacts	6	8	3	4	1	1		74
4.3	Description of residual adverse impacts	4	7	5	4	1	2		70
4.4	Cumulative impacts	8	3	3	4		3	2	67
4.5	Impact significance	10	2	4	4		3		70
4.6	Impact significance methodology	11	5	3	1		3		83
	Mitigations and management	7	5	7	3	1			83
5.1	Integration of mitigation and management actions	8	4	6	3	2			78
	Final grade for faithful representation	3	8	7	3	2			78

Appendix G: Compliance with NEMA EIA regulations (before 2013)

Minimum requirements for specialist reports set by NEMA	Corresponding review criteria in the developed review package	% A-C for legally motivated subcategory
Details of the specialist who prepared the report	1.1	96
The expertise of that specialist to compile a specialist report including a curriculum vitae	1.2	17
A declaration that the specialist is independent in a form as may be specified by the competent authority	1.3	52
The date and season of the site investigation and the relevance of the season to the outcome of the assessment	3.2	65
An indication of the scope of, and the purpose for which, the report was prepared	3.5	96
A description of the methodology adopted in preparing the report or carrying out the specialised process	3.4	87
A reasoned opinion as to whether the proposed activity or portions thereof should be authorised	13.3	0
A description of any consultation process that was undertaken during the course of preparing the specialist report	9.1	4
A summary and copies of any comments received during any consultation process and where applicable all responses thereto	9.2	4
A description of any assumptions made and any uncertainties or gaps in knowledge	2.6	65

Appendix H: Compliance with NEMA EIA regulations (after 2013)

Minimum requirements for specialist reports set by NEMA	Corresponding review criteria in the developed review package	% A-C for legally motivated subcategory
Details of the specialist who prepared the report	1.1	97
The expertise of that specialist to compile a specialist report including a curriculum vitae	1.2	61
A declaration that the specialist is independent in a form as may be specified by the competent authority	1.3	78
The date and season of the site investigation and the relevance of the season to the outcome of the assessment	3.2	61
An indication of the scope of, and the purpose for which, the report was prepared	3.5	100
A description of the methodology adopted in preparing the report or carrying out the specialised process	3.4	100
A reasoned opinion as to whether the proposed activity or portions thereof should be authorised;	13.3	30
A description of any consultation process that was undertaken during the course of preparing the specialist report	9.1	22
A summary and copies of any comments received during any consultation process and where applicable all responses thereto	9.2	0
A description of any assumptions made and any uncertainties or gaps in knowledge	2.6	61

Appendix I: Questionnaire

The questionnaire

University of the Free State

Faculty of Natural and Agricultural Sciences

Topic

A comparative analysis of the treatment of biodiversity impacts in mining Environmental Impact Assessments (EIAs) before and after 2013: experiences from the Mpumalanga Province, South Africa.

Researcher: Reanetsie Pohlo (Masters Student)

All responses will be treated as strictly confidential

Introduction

- How long have you been working in your organisation?
0-3 4-6 7-9 10+
- What position do you hold in your organisation?
.....
- Are you familiar with the South African Mining and Biodiversity Guideline?
Yes No
- Have you provided comments in any mining EIA report after the publication of the Mining and Biodiversity Guideline?
Yes No

The use of best available biodiversity information in mining EIAs

- The South African Mining and Biodiversity Guideline categorises Biodiversity Priority Areas (BPAs) into 4 categories based on the importance of their biodiversity and ecosystems services. Does the consideration of these Biodiversity Priority Areas in mining EIAs in line with the requirements of the Mining and Biodiversity Guideline? Indicate the level with which you agree or disagree.

Category	Biodiversity Priority Area	Strongly agree	Agree	Disagree	Strongly disagree
A -Legally protected	Protected areas (nature reserves, protected environments, world heritage sites, etc.)				
B- Highest biodiversity importance	Critically endangered and endangered ecosystems, Critical Biodiversity Areas, River & Freshwater Ecosystem Priority areas, & Ramsar sites.				
C-High biodiversity importance	High water yield areas, Protected area buffers, Transfrontier conservation areas, Coastal protection zone, & Estuarine functional zones, etc.				
D-Moderate biodiversity importance	Vulnerable ecosystems, Ecological support areas, focus areas for protected area expansion				

- One of the major weaknesses of biodiversity specialist studies in the EIA process is that these studies tend to focus mainly on species and habitat level, and fail to consider other aspects of biodiversity. A

solution to this problem is the so called ecosystem approach, which focuses on the assessment of potential impacts on ecosystem level, including ecological processes. In your own words, do you think that the ecosystem approach has been successfully incorporated in biodiversity specialist studies for mining projects?

.....

.....

Biodiversity stakeholder engagement process in mining EIAs

7. Principle number 3 of the Mining and Biodiversity Guideline promotes thorough engagement with biodiversity stakeholders in proposed mining projects. It is widely believed that the guideline has the potential to improve the consultation/involvement of relevant stakeholders. Indicate whether the following has improved in the EIA process after the publication of the Mining and Biodiversity Guideline.

Biodiversity stakeholder engagement	Strongly agree	Agree	Disagree	Strongly disagree
Consultation with biodiversity stakeholders				
Consideration of biodiversity issues raised by stakeholders				
Integration of tradition/indigenous knowledge				
Timing and scope of engagement				

8. Is there anything that you would like to explain or elaborate on regarding biodiversity stakeholder engagement in mining EIAs?
-
-

Consideration of biodiversity issues in mining EIAs

9. Below is the list of some of the major weaknesses identified in biodiversity-inclusive EIA. Has the following weaknesses improved after 2013 in mining EIAs? Indicate whether there has been any improvement regarding these weaknesses.

Weaknesses	Not improved	Partially improved	Improved	Adequately improved
Terms of Reference for many biodiversity specialist studies are often poorly defined.				
Indirect and cumulative impacts are poorly considered.				
The connection between biodiversity, ecosystems services, and human wellbeing, including the dependence on resources by vulnerable communities are seldom clearly articulated.				
The timing of biodiversity specialist input occurs late in the EIA process to influence proposals.				
The information provided in biodiversity specialist reports and/or biodiversity sections of EIA reports is not made explicit.				
The mitigation measures provided are vague and incomprehensive.				
Biodiversity assessments are conducted during inappropriate seasons.				
The implications of uncertainty, gaps in information and risks are not made explicit in terms of irreversibility of impacts or irreplaceable loss of resources.				
EIAs fail to incorporate environmental thresholds to assess significance of impacts on biodiversity.				
Biodiversity assessments often fail to assess the broader landscape-scale effects on ecosystems and processes; the focus is mainly on affected site and at species-level.				

10. In your opinion what are the key weaknesses of biodiversity impact assessments in mining projects?

11. What are the major strengths of biodiversity impact assessment in mining projects?

12. To what extent is biodiversity considered in the following stages? Tick on the appropriate box.

EIA phase	Not considered	Poorly considered	considered	Adequately considered
Project description				
Baseline description				
Alternatives				
Prediction and assessment of impacts				
Mitigation and monitoring				

Thank you for your contribution

Kindly forward all responses to:
 Reanetsie Pohlo
 Email: 2016023190@ufs4life.ac.za and/or: tarea@webmail.co.za
 Contact no. 073 095 0518
