Evaluation Report:

Kangaluwi Open-pit Copper Mine in the Lower Zambezi National Park

Lower Zambezi Tourism Association
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EXECUTIVE SUMMARY

Purpose

This report was prepared to inform discussion and decision-making around the proposed Kangaluwi Mine open-pit copper project ('the Project") within the Lower Zambezi National Park in Zambia ("LZNP").

The Project proposal sets a precedent for international large scale mining inside national parks in Zambia, and at the time of this report was the subject of a High Court appeal. Communities, stakeholders and independent experts have expressed concerns that bring into question the legitimacy of the Project proposal, and whether it is in the best interests of Zambia for the Project to proceed.

Open-pit mining is incompatible with biodiversity conservation; the only question is one of spatial and temporal scale. Natural values are inarguably impacted by mining activities at the mine site, but the full scale of mining impacts are likely to be specific to each project and require individual evaluation.

While both the Mines and Minerals Development Act (2008) and the Zambia Wildlife Act (1998) allow for mining inside national parks, there is no policy or legislative framework to guide implementation, monitoring and mitigation of impacts, or to ensure full site rehabilitation as is outlined by the Mineral Resources Development Policy (2013) and the Mines and Minerals Development Act. There are also no criteria set by which to evaluate whether each mine proposed within a protected area should be permitted.

This report aims to consolidate the available information to assess whether the proposed Project is likely to benefit Zambia, and whether sufficient capacity exists to ensure it does not negatively impact the health and wellbeing of communities, or the biodiversity values for which protected areas are set aside. The implications of this mining proposal and the precedent it sets for mining within protected areas in Zambia are also discussed.

Key Findings

i. Flawed documentation process: The documentation supplied by the mine proponents, Zambezi Resources Limited ("ZRL" or the "Company", and incudes as relevant its Zambian subsidiary company Mwembeshi Resources Ltd), was independently reviewed by Zambian and international mining experts and scientists and found to be fundamentally flawed.

- The data presented in the Environmental Impact Statement (EIS) and subsequent documentation were insufficient to meet EIS requirements and objectives; they failed to detail the scope of the mine, the life of the mine, or its potential social, economic and environmental impacts. This finding strongly reinforces the decision of the Zambian Environmental Management Agency to reject the mine proposal.

- Critically, all community and stakeholder concerns remain unaddressed.

- Of particular concern is that since the EIS submission in 2012, the nature of the underlying copper resource has been changed from copper sulphide to copper oxide, yet no new EIS documents have been supplied nor any announcements made to Zambian authorities or stakeholders.

ii. Flawed underlying economics: Based on the limited information available to date, including that supplied by the mine proponents, there is no sound economic argument to support the Project proceeding.

- Modeling figures suggest that the Project is not economically viable, will result in a net loss of jobs for local communities, and will generate a financial loss over the first seven years of operation of a minimum of US$13 million.

- The EIS contains vague references to a much larger scope project within the Mine License area but that scope was not assessed within the EIS or any other available documentation, and such a project would have vastly greater impacts on the LZNP and Zambezi River water catchment.

- Given the low grade copper resource and dubious figures presented in the EIS it is still highly unlikely that a larger mine would be economically viable, particularly if sufficient environmental safeguards were put in place and processing was carried out off-site outside of the National Park.

iii. Likely negative tourism industry impact: Based on survey data, any mining projects such as this inside Zambia's flagship national parks are likely to significantly and negatively impact the sustainable nature-based tourism industry. This is also likely to affect other industries such as agriculture, which supplies the tourism industry.

iv. Broader economic risk: The economic risk created by mining is exacerbated in protected areas due to potential impacts on community development programs as well as sustainable tourism, and this should be carefully considered in the mine assessment process.

- Locally, the Project would risk a minimum of US$5 million of NGO investment in community development programs that align with protected area management.

- In broader terms there is great potential for mining inside protected areas to have a negative effect on international aid investment, upon which Zambia is heavily reliant and receives over $1 billion annually. This issue should be thoroughly explored during the formulation of any policy and legislation that considers mining inside protected areas.

- Additionally, there are important implications for Zambia's National Development Plan (2011-2015) in regard to tourism and natural resources, as well as the evolving Zambia Wildlife Sector Policy. Both mining and tourism sectors can continue to grow, but are likely to be mutually exclusive if mining occurs in protected areas where natured-based tourism is present.

v. Long term damage considerations: The Project poses considerable risk of long term damage beyond the life of the Project to the health and wellbeing of communities, wildlife and the environment.

- The requirement of the Mines and Minerals Development Act (2008), the Mineral Resources Development Policy (2013) and Zambia Wildlife Act are not met by this Project. There is no evidence provided by the Company that would ensure the preservation of air, water, soil, fauna, fish and fisheries, or the protection of human health.
- Independent expert review of the EIS revealed a high likelihood of contamination events that were not considered by the Company and to date have not been addressed. Natural resources, ecosystem services and biodiversity are put at significant risk by the Project.
- The risks are amplified since the Project involves the largest shared water resource in the SADC region, the Zambezi River, and therefore carries cross-border implications. This includes impacts on local fishing as well as cross-border fisheries, due to the high likelihood of contamination events.

vi. Questionable Company management capacity/expertise: All data indicate that the Company lacks the expertise and competence to undertake responsible mining practices within a sensitive ecological environment and important water catchment.

- The extremely poor quality of the data provided by the Company has prompted questions from independent mining experts about whether the contradictory and vague information presented is intentionally misleading, or demonstrates gross incompetence.
- The Company's track record also demonstrates a clear lack of commitment to Corporate Social Responsibility and community development.

vii. Legislative & Policy deficiencies: This case has highlighted critical gaps in both legislation and policy for properly evaluating and managing mining within protected areas in Zambia. While the Mines and Minerals Development Act (2008) allows for mining in protected areas, there is a lack of policy and legislation by which to evaluate:

- Whether a proposed mine within a protected area should proceed and under what conditions;
- How potential impacts should be evaluated, monitored and mitigated; who is accountable for those activities and costs;
- Whether responsible parties have the capacity to deliver on obligations to ensure the preservation of the environment and the protection of human health.

There are strengths in the Zambian legislative process including compulsory expert review of Environmental Impact Statements by the Zambia Environmental Management Agency. However, of particular concern in the license permitting process is the subsequent ability of a single Minister to overturn a decision made by ZEMA, based on their technical expertise, without any requirements to share the information that formed the basis of the Minister's decision. The current mining license application process therefore lacks transparency and is open to exploitation.

viii) Key criteria for assessing mining projects

Applying the key criteria to the Project:

1. *Should the Project proceed at the proposed site?* The evidence overwhelmingly indicates that the project should not proceed.

2. *If the Project does not proceed what are the alternatives?* In the absence of mining the nature-based tourism industry is sustainable and growing and already provides benefits to communities along the south-western edge of the LZNP. Alternative community developments are already underway for communities on the north-eastern edge of the LZNP and have the potential to generate sustainable benefits for communities to improve livelihoods, as well improve protected area management.

Key Recommendations

1. The Project be rejected: Based on the available information including consultation with communities, stakeholders and international experts, the conclusion of this report is to strongly recommend the Project be rejected.

In the specific case of the Project, there is no evidence to support mining activities within the LZNP. To the contrary, information indicates that there is high and long-term risk to the health and wellbeing of communities, wildlife and the environment from this Project, as well as cross-border implications from the shared Zambezi River water resource. A lack of economic viability together with impacts on the tourism industry indicate there will be overall negative impacts for local communities.

2. Develop national evaluation, monitoring and managing framework: If Zambia intends to permit large scale mining activities inside protected areas, both policy and regulations should first be developed that clearly set criteria for the evaluation of whether each mining project should proceed, and if so how that project should be monitored, evaluated and managed. As identified in the Mineral Resources Development Policy (2013), resource allocation to ensure capacity to deliver is a critical issue, as is clear accountability.

3. Consider broader economic policies: Beyond the Mines and Minerals Development Act (2008), broader economic policies should be considered in this case. The National Development Plan (2011-2015) lists both mining and tourism as important growth sectors, yet available data indicate that mining inside protected areas will significantly and negatively impact nature-based tourism. Prohibiting mining in protected areas where there is a growing nature-based tourism industry is likely to ensure that growth in both sectors continues, and would also align with policies for economic diversification. Due to the significant potential impact on tourism of mining inside protect areas, together with ZAWA the Zambia Ministry of Tourism and the Arts and relevant stakeholders should be involved in further policy development for mining in protected areas.

4. Apply international best practice standards: If appropriate legislative safeguards are put in place and sufficient resources are available to ensure responsible management and site rehabilitation, there may be a case for mining inside some protected areas in Zambia, particularly outside of the four important flagship national parks which have a growing tourism industry. In that case, as part of policy and legislation review, Zambia

should adhere to international best practice and recommendations for mining inside protected areas and water catchments, including those of the IUCN and ICMM.

5. Support and develop broader economic programs: Alternative models of community development provide longer term social and economic benefits than mining and are compatible with conservation of the values for which protected areas are legally set aside, including the preservation of biodiversity and ecosystem services, and reducing the impacts of climate change. We recommend these community development programs should be supported and further developed. Further, broader economic assessment should be undertaken of the potential impacts of mining inside protected areas on international aid investment, particularly investment in community development initiatives in and around protected areas that focus on sustainability.

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This document has been prepared as background information to inform debate around a proposal to open-pit mine inside one of Zambia's four most economically important national parks. The report was commissioned by the Lower Zambezi Tourism Association (LZTA). The report consolidates information supplied by a range of contributors including independent experts and the content and opinion presented does not necessarily represent the views of the LZTA or the consultant who prepared the document. Where possible, the content of reviews by independent experts has been included in Appendices to allow further evaluation of the proposed mining Project.

ACKNOWLEDGEMENTS

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LIST OF ACRONYMS AND ABBREVIATIONS

EIA:	Environmental Impact Assessment – the process that leads to preparation of an EIS.
EIS:	Environmental Impact Statement. Required to be submitted to relevant authorities in each country for evaluation of any mining project proposal,
EHS:	Environmental, Health and Safety Guidelines.
ESHS:	Environmental, Social, Health and Safety Guidelines.
GARD:	Global Acid Rock Drainage Guide.
GDP:	Gross domestic product
GMA:	Game Management Area
HIV/AIDS:	Human immunodeficiency virus infection and acquired immune deficiency syndrome.
ICMM:	International Council on Mining and Metals
IFC:	International Finance Corporation
IUCN:	International Union for the Conservation of Nature
KCM:	Konkola Copper Mines Plc
LZTA:	Lower Zambezi Tourism Association
LZNP:	Lower Zambezi National Park
LML:	Large Scale Mining License
NGO:	Non-Governmental Organisation
Project:	ZRL's proposed Kangaluwi Mine open-pit copper project within the LZNP
Project EIS:	the Project's EIS (2012, produced by Petterson]
REDD+:	Reduced Emissions from Deforestation and Forest Degradation.

SADC:	Southern African Development Community
TSF:	Tailings Storage Facility
UNESCO:	United Nations Educational, Scientific and Cultural Organisation
USAID:	United States Agency for International Development
US EPA:	United States Environmental Protection Agency
ZAWA:	Zambia Wildlife Authority
ZEMA:	Zambia Environmental Management Agency
ZMW:	Zambian Kwacha currency
ZRL:	Zambezi Resources Limited, Project proponents. In the context of this report this term also includes ZRL's wholly owned Zambian subsidiary company Mwembeshi Resources Ltd.

1. INTRODUCTION

1.1 General Background

Zambia is in the process of setting an important precedent for the future development of its mining sector; that of mining inside protected areas. The precedent is being set by consideration of an application for an international mining company to undertake an open-pit copper mining project inside one of Zambia's four most visited and economically important national parks. Although small-scale local artisanal mining has previously occurred in protected areas in Zambia (Ashton et al. 2001), this would be the first project involving large scale mining by a foreign-owned company inside a national park.

Under both the Wildlife Act (1998) and the Mines and Mineral Development Act (2008) in Zambia, there is allowance for mining inside protected areas. However, the ability of current policy and legislation to effectively regulate mining inside national parks is much less clear. This case has raised the question of whether Zambia has a policy and legislative framework in place that enables 1) a proper evaluation of circumstances under which mining should occur inside national parks and 2) subsequent management and mitigation of such projects should they occur.

At the time of this report, a High Court case is underway to decide whether or not the proposed copper mining Project, the Kangaluwi Mine, will go ahead inside the boundaries of the Lower Zambezi National Park. The proposal has provided a case study to evaluate the potential positive and negative impacts of open-pit mining inside important protected areas in Zambia. The mine proponents are Australian exploration company Zambezi Resources Ltd ("ZRL" or "the Company") and its wholly owned Zambian subsidiary company Mwembeshi Resources Ltd. The bulk of information about the Kangaluwi mining proposal has so far come from these proponents. However, local stakeholders, communities and international experts have raised questions about the viability of the Project proposal and the technical quality and transparency of the information being shared by the Company.

Despite Zambian legislative requirements for submission of an Environmental Impact Statement (EIS) for such proposals, the Company has failed to provide a robust assessment of the potential social, environmental and economic impacts of the Kangaluwi Mine. The EIS dated February 2012 produced by Petterson et al on behalf of the Company was rejected in September 2012 by the Zambia Environmental Management Agency (ZEMA) based on technical grounds. However, an appeal by the proponents was successful; the then Minister for Lands, Natural Resources and Environmental Protection, the Honourable Harry Kalaba, overturned ZEMA's decision and in February 2014 ZEMA subsequently gave permission for the Project to proceed. However, due to insufficiencies in the submitted EIS, there remains a critical lack of information to address concerns about the potential impact of the Project.

This report intends to address the lack of information and evaluate the potential impact of the Project, based on the information available to date. It aims to provide information to decision makers to examine whether this Project is in the national interests of Zambia, and if the short-term benefits from the Project outweigh the potential risks and justify allowing it to proceed. The political arguments for the Project have so far focussed on potential jobs for local communities. Yet there has been no

evaluation of the overall potential net gain or loss of employment considering the growing local sustainable tourism industry, nor the potential impacts of the Project on the health and livelihood of local communities.

A broad range of factors intrinsic to open-pit mining in an ecologically sensitive protected area are considered here, including the potential for long-term harm to the health of Zambian people and the environment, an evaluation of financial viability of the Project and net gain or loss of jobs for local people, and potential impacts on Non-Governmental Organization (NGO) investment into Zambian communities. In light of the considerable potential risks of a project of this nature, the report also explores questions around the capacity of the Project proponents to undertake responsible mining practices in a sensitive protected area and major water catchment.

The report synthesizes information from a range of stakeholders and independent experts, and also includes original data, content from peer reviewed scientific literature as well as grey literature in the form of consultancy reports, working papers and other relevant informally published materials. Interviews and consultations were held with stakeholders in Lusaka during June 2014 and included: senior managers and technical staff from one of the four largest mining companies in Zambia, tourism operators, community representatives, a range of community-based and wildlife-based NGOs, and staff from foreign embassies that contribute substantial funding to community development and environmental programs in Zambia.

1.2 Mining in Zambia

Mining has played a critical role in the development of the Zambian economy. Since 1995 to 2011 the mining sector contributed 9% of GDP accompanied by relatively low tax contributions at 1.1% of GDP, with large-scale mining companies benefitting from incentives and small-scale mining owned by Zambians making a negligible contribution (Ministry of Mines, Energy and Water Development, 2013). Mining, construction and tourism are Zambia's fastest growing industries, and together with high copper prices have been largely responsible for Zambia's economic growth ranking above the sub-Saharan average in recent years (Sichilongo et al. 2012)

Mining has been dominated by the four largest copper mines that together account for 70% of current copper production in Zambia; these are the Konkola Copper Mines (KCM) and Mopani Copper Mines in the Copper Belt, and the First Quantum Minerals Ltd Kansashi Mine and Barrick Lumwana mines in North-Western Province (ICMM 2014).

Mining will undoubtedly continue to play an important role in the Zambian economy. Despite policies of economic diversification (NEPAD-OECD 2011) dependency on mining is increasing with the proportion of total tax revenue received from the mining sector increasing from 16% in 2008 to 25% in 2012 (excluding PAYE; ICMM 2014) Several reviews, including external reviews by the ICMM and World Bank as well as internal mining policy reviews within Zambia, have emphasized the need for improved governance and capacity building to ensure that mining results in greater poverty reduction, social investment, and regional development for Zambia (ICMM 2014; Mwitwa et al. 2012; World Bank 2014; Ministry of Mines Energy and Water Development 2013)

While many developing nations are dependent on mining as a key pillar of their economy, mining does not always result in positive progress for broader economic growth and social development (ICMM 2014). Studies have outlined the important role of governance in ensuring that broader benefits are derived from mining (Mwitwa et al. 2012; ICMM 2014) which can otherwise co-occur with poverty and environmental degradation. Despite rapid economic growth in Zambia in the last decade, partly driven by a rise in copper prices, there has been little evidence of significant poverty reduction with most of the benefits of growth going to those already above the poverty line (World Bank 2014).

Social development as result of mining has a largely unsuccessful history in Zambia. During the period of nationalization of mining, Zambian Consolidated Copper Mines were tasked with providing mine workers with public good and social services, which failed due to falling copper prices and high costs, while during the following re-privatization period these responsibilities were not taken over by the majority of private investors and therefore fell to local government who did not have the capacity to deliver (ICMM 2014).

In contrast to positive social development, recent policy review has revealed that problems associated with mining development in Zambia include low revenues from the mining sector to Treasury, a high impact of HIV/AIDS in the mining sector, poor infrastructure development in mining areas, and low levels of ownership and participation by Zambians (Ministry of Mines Energy and Water Development 2013). Recent press has outlined conflict between the mining industry and the Zambian Government, with the Government withholding VAT refunds and considering higher mineral royalty rates in an effort to ensure that a larger proportion of mining revenue stays in Zambia (Reuters 2014a). In response one mining company, Glencore, revealed plans to cut jobs and halt operations, which the Minister of Mines, Energy and Water Development claimed was illegal (Reuters 2014b).

The previous failures of the mining sector to deliver broad social development and poverty alleviation for Zambia are highly relevant to this case. It is important to consider the likelihood of this mining Project to generate significant community and social benefits, when weighing up against the Project's potentially harmful impacts to both communities and Zambia's natural heritage. The same issues are relevant for the precedent this Project sets for international exploitation of mineral resources within other legally protected areas in Zambia.

1.3 Policy Guidance

The most recent Mineral Resources Development Policy (2013) of Zambia recognized previous problems arising from mining development and, alongside encouraging investment and growth in the sector, provided policy guidance to address them. The policy first recognized that "*mining activities always have negative impacts on safety, health and environment of communities which in turn affects the potential for long-term sustainable development*". By its very nature open-pit mining is destructive to the environment, rather than beneficial. Therefore the key considerations for this Project are whether there are sufficient social and economic benefits to justify such activities inside a national park, and whether adequate legislation and resources are in place to mitigate Project impacts and ensure full site rehabilitation. The proposed Kangaluwi

Mine in this case occurs in both a sensitive protected area and a major water catchment, therefore the checks and balances required to ensure responsible mineral resource exploitation are particularly applicable. The 2013 Mineral Resources Development Policy outlines several key guiding principles and objectives that are highly appropriate to this case:

Relevant Guiding principles from the policy include**:**

"1. Government commitment to ensure sustainable exploration of mineral resources for the maximum benefit of Zambians

3. The application of modern principles of transparency, checks and balances, and accountability in administration of mining laws and regulations.

4. Adherence to regional and international conventions and other instruments that are relevant to mining and to which Zambia is a party or signatory"

Relevant Policy objectives include**:**

"6. achieve a socially and internationally acceptable balance between mining and the bio-physical environment and to ensure that acceptable standards of health, safety, and environmental protection or observed by all participants in the mining sector

8. ensure transparency and accountability in the management of mineral resources in the country"

Policy measures and strategies state clearly that:

"7.4e Exploration and mining in protected areas will only be allowed when rehabilitation has been guaranteed"

The key objectives of this report are to evaluate, based on the available information, if:

1. *it is in the national interests for this mine Project to proceed inside one of the four most economically important national parks in Zambia*
2. *there are alternatives for community development should the mine Project not proceed.*

1.4 The Kangaluwi Mine Project

The mine site is located within the boundaries of the Lower Zambezi National Park, elevated in the escarpment and within a major water catchment that flows into the Zambezi River (Petterson et al. 2012). It is approximately 13km from the northern boundary of the National park at its closest point, and 19km from the Zambezi River, the southern boundary of the National park.

A World Heritage Site, comprising the Mana Pools National Park and Sapi and Chewore Safari areas, lies directly across the River in Zimbabwe and shares the Zambezi River boundary (UNESCO 2014). Any water quality impacts from the mine have the potential to affect communities and wildlife in Zimbabwe as well as Mozambique, which lies approximately 80km downstream.

Figure1. Location of the Kangaluwi Mine within the Lower Zambezi National Park. Site location was taken from the Environmental Impact Statement submitted by Zambezi Resources Ltd (Petterson et al. 2012), and confirmed via a ground-truthing site visits and recording of GPS coordinates (Garmin GPSMap 62s). (Imagery from ESRI maps.arcgis.com)

The Zambezi Basin is considered one of the most important natural resource systems in Africa. The Zambezi River is the largest river in the SADC region (Shela 2000) and Zambia makes the largest contribution of catchment area to the Zambezi Basin compared to the other 7 SADC states, at 42% (Ashton et al. 2001). Zambia has 70% of its population living within the Basin (Ashton et al. 2001) and the section of river downstream from the mine location supports thousands of people dependent on it for subsistence agriculture and fishing.

Figure 2 shows that the central exploration site of the Kangaluwi Mine is located in a steep section of the escarpment, only 3.5km from the valley floor where wildlife activity is concentrated (see Section 3). The Project site is drained directly into the Zambezi River by several tributaries (Figure 3).

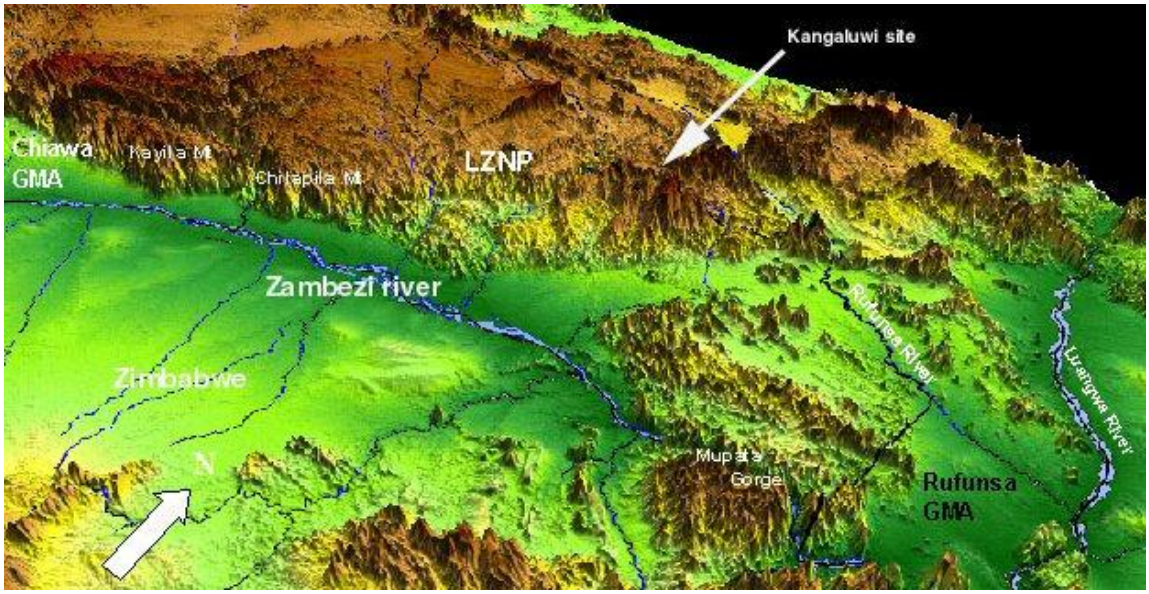


Figure 2. Topographical illustration of the geographical location of the Kangaluwi Mine site in the Zambezi escarpment; showing its elevation in the catchment and immediate proximity to direct tributaries to the Zambezi River (image taken from Petterson et al. 2012).

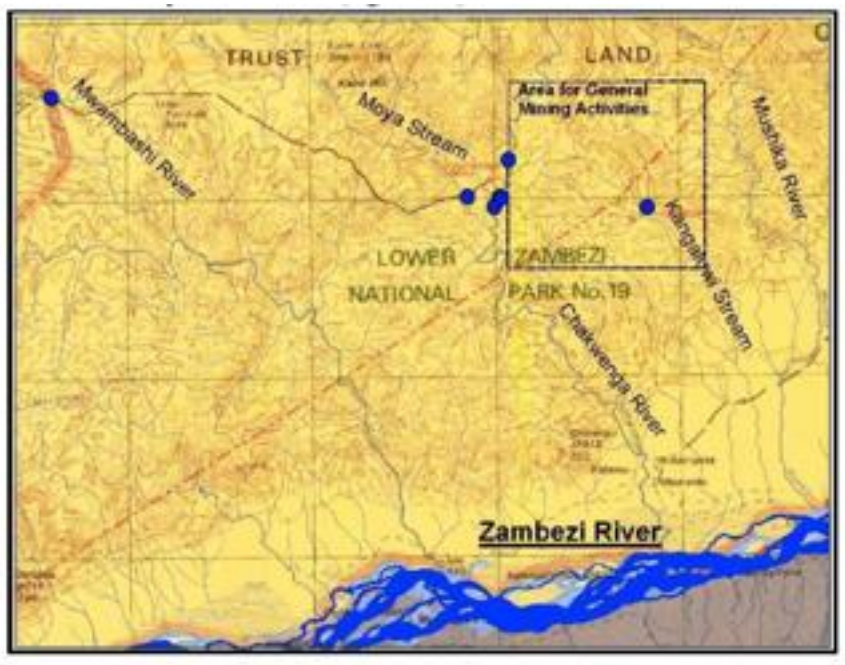


Figure 3. Map of the main rivers and streams draining the Project site. The watershed within the license area lies between the Chakwenga and Mushika Rivers that drain directly into the Zambezi River. (image taken from Petterson et al. 2012).

2. ECONOMIC IMPACT OF THE PROPOSED KANGALUWI MINE

There are several economic factors to consider in evaluating the costs and benefits of the Kangaluwi mine Project proposal. The first is the expected economic benefit to Zambia and to local communities from the mine Project itself. The second is the impact of the mine Project on existing sustainable industries, specifically, nature-based tourism. The third involves consideration of alternative models for community development, utilizing activities that are compatible with the values for which legally protected areas as set aside; primarily the preservation of biodiversity.

2.1 Financial Viability of the Kangaluwi Mine.

2.1.1 Employment

The main political argument in support of the Kanguluwi Mine, circulating in ZRL press releases and announcements, is that of jobs for local community members particularly those living in the Luangwa town region. The number of jobs promised by the Company has varied but best maximum estimates available to date are for 300 employees as stated in its Project EIS (Petterson et al. 2012). While the Project EIS outlines that local Zambians will be employed, it also clarifies that "*Whilst the philosophy commences with engaging personnel from the local and regional communities, it is acknowledged that this will not be possible or feasible in all cases."* This leaves options open for the Company to employ skilled workers from other areas, since a philosophy is not a clear commitment.

Unlike underground mining, open-pit mining is dependent on heavy machinery and technically skilled labour in all stages of the mining process from use of explosives, through to heavy moving equipment for hauling ore and chemical processing. This is likely to limit the number of people that are employed from local communities (Tsuma 2010). The breakdown of expected employment opportunities listed by ZRL is outlined below (Table 1). The Mining Contractor is not yet identified and may not share ZRL's hesitantly qualified commitment to local employees, and the contracting process potentially removes a level of accountability from ZRL in this regard. The argument for local jobs therefore remains unsubstantiated, and importantly the mine's potential impacts on the existing natured-based tourism industry is likely to result in overall job losses for local Zambians (see section 3.2).

Although making a substantial contribution to economic growth, employment from mining is typically low with only 6% of overall employment in Zambia attributed to industry (including mining) versus 9% for services (including tourism)(Sichilongo et al. 2012).

Table 1. Expected Kangaluwi Manpower Summary (from Petterson et al 2012, Table 3.10)

Total Manpower Estimate	
General, Admin and Technical	60
Process	90
Mining Contractor	150
Total Estimated Manpower	**300**

Many large and responsible mining companies undertake training programs for unskilled workers, employing them and progressing them up to more skilled positions. However, this is much less feasible for smaller companies where extra staff and resources are required for training, and for mines with a short expected life of mine where there is limited time for employees to progress, thereby undermining the incentive of the company to invest in training. Together with ZRL's demonstrated lack of commitment to Corporate Social Responsibility (see Section 3), the small company size, it's inexperience in the field and the short expected mine life (see below) it is reasonable to conclude that employment and training opportunities from this mine for local communities are likely to be minimal and of limited duration.

2.1.2 Projected income – based on Project EIS (2012)

In broader economic terms, the projected income from the Kangaluwi mine is unclear at best, and the viability of the Project is highly questionable. A critical problem in evaluating any economic benefit from this Project is the conflicting and inadequate information supplied by the Company in relation to the size and scope of the mine, the expected life of the mine, and more recently the type of ore being mined. Several highly experienced independent mining experts, including a senior technical expert from one of the largest mining companies in Zambia, have reviewed the available data and their detailed comments are included as Appendices 1 & 2 to this report. The Zambian expert reviewer has requested to remain anonymous due to political concerns around this case, but has over 30 years senior technical experience in the mining industry. Qualifications for the international reviewer are included in the Appendix 1. The following section contains a summary of the key issues outlined by the independent expert reviewers, in reference to documentation supplied by ZRL.

The core purpose of a Project's EIS is to outline the Project scope and subsequently assess its expected impacts (Environmental Management Act, 2011). Therefore the Project EIS is expected to contain the best available information to hand as at its date. This information has been supplemented by subsequent brief Company announcements and presentations many of which continue to supply further information which is often confusing, inaccurate and/or contradictory.

The title of the Project EIS clearly indicates it is intended to cover all activities under the mining license (LML) "*The Kangaluwi Project comprises the Large Scale Mining License 15547-HQ-LML*". The Project EIS states that as well as the Kangaluwi open-pit site, that open-pit operations are likely to be undertaken at 3 other satellite sites; Kalulu, Chisawa and Imboo. However, in all the critical estimates in regard to potential impacts the Project EIS covers only the Kangaluwi and sometimes the Chisawa open pits and central infrastructure. It does not include resource statements, mine plans or consideration of tailings, waste rock, haul roads or other infrastructure from the potential expansion to the other open pit sites. The Company has therefore failed to include the full scope of the project in the Project EIS, significantly understating the potential impacts from the mine. Separate EIS should be submitted for the Kalulu, Chisawa and Imboo pits before any development of these pits can be properly considered. This is discussed in more detail in Section 6 on potential environmental impacts, however the same issue complicates any attempt to value the Project and estimate any potential economic benefits to Zambia.

The Project EIS contains inconsistent estimates for the expected life of the mine that range from 3-4 years, 8 years, 20 years to more than 25 years, referring to one pit, two pits or up to 4 pits. The stripping ratio varies from 3:1 to 6:1, which greatly impacts the production rate and expected amount of waste rock (from the 75 million tonnes (Mt) figure used in the Project EIS to a potential 450Mt). The time period allowed for technical studies and construction varies at either 2 years (Project EIS Project Schedule; pp 5) or 4 years (pp 15) which affects the value estimation. Similarly "implementation time" from the date of approval of the Project EIS is estimated at 130 days (pp 13); the meaning of implementation is unclear since a professional Definitive Bankable Feasibility Study would take longer than 130 days, normally between 1 to 2 years. Studies undertaken in a shorter time period would be extremely unlikely to be of a high enough standard to attract finance.

The ZRL cost estimate for the mine (USD $494,600,000) has been reviewed by independent mining experts and was found by them to be unrealistic. The capital expenditure costs were viewed as inflated while the cash cost of production (USD1.329/lb copper) was considered to be unrealistically low since a large low grade copper mine such as Lumwana had current costs of around USD2.08/lb i, while KCM and Mopani underground mines ran at around USD3.00/lb Cu at the time of this report (expert reviewer estimates).

The Annual Average Production Rates section in the Project EIS contains additional contradictory figures and is of grave concern. Production rates for Years 4-8 state 3Mt copper (Cu) concentrate @ 28% Cu = 840,000t contained Cu per year**.** That is a higher rate of copper production than the rest of the copper operations in Zambia combined. There is inadequate smelter capacity in Zambia to process this 3Mt/year and concentrate export attracts a 10% export levy (royalty) that would make it uneconomic to export. The Company would most likely have to build a smelter inside the National Park to reduce transport costs. A 3Mt smelter would be one of the biggest in the world and cost over USD$1.5bn to build and consume at least 150MW of power.

However, the massive estimate above of 840,000t contained Cu per year is completely unfounded. The design criteria in the Production Rates section of the EIS use figures of 3,000,000 tonnes per annum (tpa) of ore and a head grade of 1.5%. In calculations, 3Mt ore at 1.5% TCu equals 45,000t contained Cu at 100% recovery. 45,000t Cu from 28% concentrate gives only 160,714t of concentrate/year at 100% recovery, not the 3Mt of concentrated Cu used in the Company's figure above.

The head grade value of 1.5% used in ZRL's calculations is also questionable since the global grade is given as 0.89% while cut-off resource grade is given as 1.08% TCu. A further problem based on these still dubious figures of 160,714t of Cu concentrate each year, is that the Project EIS previously states the Company will only be trucking out 58,400t per year (Project EIS pp i). Despite these early estimates of 58,000t per year being removed from the site, the EIS then goes on to state that "*Once the Kangaluwi Mine Project is operational, it is expected to be producing 15 million tonnes of copper per annum. Based on the results MRL will be paying taxes to government every year*" (pp 190). That would put Kangaluwi ahead of Chile as the world's number one producer of copper, it would require approximately 1,370 thirty tonne trucks carrying concentrate to leave the mine each day, and a workforce of over 100,000 people. Based on a copper

price of USD8000/tonne, ZRL would be paying in the order of USD25-30 billion in taxes per year.

These estimates are demonstrably lacking in any credibility, as is the Project EIS. The extraordinarily broad Project EIS production estimate range from 325t Cu/year to 15Mt Cu/year, demonstrates gross incompetence by the Company, who might arguably have presented similar figures if they had picked random numbers to populate its Project EIS. As per comments from an expert reviewer in the mining industry:

"The technical mining aspect of the report in terms of project scope is so vague and contradictory it is not possible to discern whether this has been done intentionally to mislead or whether it is a result of incompetence on the part of the authors".

While it is technically acceptable to mention extending the project scope at a later date, the interim resource model provided by ZRL for a maximum of two pits (EIS, Resource Section; pp 12) defines the scope of the Project EIS. Any material deviation from this, such as the two additional pits, requires submission of an additional EIS and approval by ZEMA. Mining projects usually have a degree of uncertainty attached to their lifespan and it is for this reason that it is important to define the scope of the project covered by the Project EIS and differentiate the Project scope from forward looking statements based on unsubstantiated expectations. The sections of the Project EIS dealing with mining and resources fail to do this. The result is that the true impact of the mine is not quantified, undermining the Zambian EIS approval process and grossly increasing risk.

In summary, the Project's EIS is lacking in any credibility and on any objective basis no reliance can be placed upon it.

2.1.3 Projected income – based on new ZRL investor model (2013)

Most importantly, since the Project EIS was submitted a Company Investment Report from ZRL's Australian website (Carville et al. 2013) showed a sudden change by the Company to the "Kangaluwi Oxide Copper Project", whereas the 2012 Project EIS clearly details a copper sulphide ore project with the Project Description stating "*The deposits for the project have simple ore mineralogy that will enable a high grade sulphide concentrate to be produced*". All subsequent infrastructure, exploration and processing activities in the EIS refer to sulphide ore mining. The extraction and processing techniques for copper oxide ore are quite different to copper sulfide ore and independent mining industry experts from the largest mining companies in Zambia have advised that such a dramatic change in the Project proposal requires another EIS submission, or major revisions at the very least. Sulphide ore mining focuses on higher quality concentrations of copper, while oxide ores are lower grade deposits that typically involve a greatly increased mine surface area ie greater removal of vegetation and top-soils (Toovey 2011).

To our knowledge, no new EIS or updated submission has been made by the Company to ZEMA, nor has any formal notification or announcement of the change been made to stakeholders or agencies in Zambia. The Company's failure to notify Zambian authorities of this change in the Project raises serious questions about the Company's commitment to abiding by Zambian legislative processes and regulations.

The change to copper oxide mining is possibly an admission by the Company of their original overly ambitious expectations for mining copper sulphide. However, the economic estimates based on the new information from the 2013 Investor Report are no better than those in the Project EIS. According to best estimates using the information available from the Company and realistic market prices, the mine is likely to have a negative net present value (NPV) with an internal rate of return (IRR) of 8% over the first 4 years and is therefore unlikely to attract investment, particularly since the Company has no proven record of successful mine development or operation.

The tables below show calculations of the Kangaluwi Mine value, based on figures provided so far by ZRL. Two models are provided; one at the copper price current for June 2014 (Table 2), and one at the copper price used by ZRLs (Table 3). ***Both models indicate a loss based on 2 years of construction followed by 5 years of operation, as proposed by ZRL in their value models, with a minimum negative NPV of US$13 million.***

In conclusion, there are number of critical unanswered questions around the economic value of this Project, its full scope, and its potential impacts. Due to the extremely poor quality and inconsistency of the information provided by the Company to date, there is no convincing nor even coherent economic argument for allowing this mine to proceed. The quality of documentation provided also raises serious questions about the capacity of the Company to manage a mine in a sensitive protected area.

Table 2. Kangaluwi Value Model based on market copper prices at June 2014 (US$).

Kangaluwi OXIDE PROJECT value model based on figures from the April 2013 Investor Presentation and estimated realistic mining & processing costs								
INPUT VARIABLES					**OUTPUT VARIABLES**			
Reserves	7,530,000	mt ore		**Capital investment (mine construction)**		45,014,340	$	
Grade	0.7%	Cu			**Project IRR**	-40%		
Strip ratio, 1 ore to	3.3	waste			**Project NPV**	-34,569,534	$	
Projected life of mine	5	years (max value = 20)			**Ore processing**	125,500	mt/month	
Plant capital intensity	6,100	$ per annual mt of Cu output capacity			**Cathode produced**	615	mt/month	
Plant processing opex	15	$/mt headfeed						
Plant % recovery	70%							
Mining opex	4.00	$/mt excavated & hauled						
Copper selling price	**6735**	$/mt	Today's price=US$3.06/lb		Zambezi model price = US$3.50/lb= US$7,714/tonne			
Investment discount rate	12%	per year						
Year	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
	construction<<		**>>production**					
Reserves b/f (mt)			7,530,000	6,024,000	4,518,000	3,012,000	1,506,000	0
Reserves depleted (mt)			1,506,000	1,506,000	1,506,000	1,506,000	1,506,000	0
Reserves c/f (mt)			6,024,000	4,518,000	3,012,000	1,506,000	0	0
Waste moved (mt)			4,969,800	4,969,800	4,969,800	4,969,800	4,969,800	0
Mining opex ($)			25,903,200	25,903,200	25,903,200	25,903,200	25,903,200	0
Processing opex ($)			22,590,000	22,590,000	22,590,000	22,590,000	22,590,000	0
Total opex ($)			48,493,200	48,493,200	48,493,200	48,493,200	48,493,200	0
Copper cathode (mt)			7,379	7,379	7,379	7,379	7,379	0
Revenue ($)			49,700,259	49,700,259	49,700,259	49,700,259	49,700,259	0
Capital investment	22,507,170	22,507,170	0	0	0	0	0	0
Project cash flow	-22,507,170	-22,507,170	1,207,059	1,207,059	1,207,059	1,207,059	1,207,059	0
Project cash balance	-22,507,170	-45,014,340	-43,807,281	-42,600,222	-41,393,163	-40,186,104	-38,979,045	0

Table 3. Kangaluwi Value Model based on optimistic ZRL copper price estimates from Investor Report 2013 (US$).

Kangaluwi OXIDE PROJECT value model based on figures from the April 2013 Investor Presentation and estimated realistic mining & processing costs								
INPUT VARIABLES					**OUTPUT VARIABLES**			
Reserves	7,530,000	mt ore			**Capital investment (mine construction)**		45,014,340	$
Grade	0.7%	Cu			**Project IRR**		-2%	
Strip ratio, 1 ore to	3.3	waste			**Project NPV**		-13,808,642	$
Projected life of mine	5	years (max value = 20)			**Ore processing**		125,500	mt/month
Plant capital intensity	6,100	$ per annual mt of Cu output capacity			**Cathode produced**		615	mt/month
Plant processing opex	15	$/mt headfeed						
Plant % recovery	70%							
Mining opex	4.00	$/mt excavated & hauled						
Copper selling price	**7714**	$/mt	Today's price=US$3.06/lb		Zambezi model price = US$3.50/lb= US$7,714/tonne			
Investment discount rate	12%	per year						
Year	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
	construction<<		**>>production**					
Reserves b/f (mt)			7,530,000	6,024,000	4,518,000	3,012,000	1,506,000	0
Reserves depleted (mt)			1,506,000	1,506,000	1,506,000	1,506,000	1,506,000	0
Reserves c/f (mt)			6,024,000	4,518,000	3,012,000	1,506,000	0	0
Waste moved (mt)			4,969,800	4,969,800	4,969,800	4,969,800	4,969,800	0
Mining opex ($)			25,903,200	25,903,200	25,903,200	25,903,200	25,903,200	0
Processing opex ($)			22,590,000	22,590,000	22,590,000	22,590,000	22,590,000	0
Total opex ($)			48,493,200	48,493,200	48,493,200	48,493,200	48,493,200	0
Copper cathode (mt)			7,379	7,379	7,379	7,379	7,379	0
Revenue ($)			56,924,692	56,924,692	56,924,692	56,924,692	56,924,692	0
Capital investment	22,507,170	22,507,170	0	0	0	0	0	0
Project cash flow	-22,507,170	-22,507,170	8,431,492	8,431,492	8,431,492	8,431,492	8,431,492	0
Project cash balance	-22,507,170	-45,014,340	-36,582,848	-28,151,357	-19,719,865	-11,288,374	-2,856,882	0

2.2 Potential Impact on the Sustainable Nature-based Tourism Industry.

An important potential economic impact of the Kangaluwi Project, and of other mining projects inside national parks in Zambia, is a negative economic impact on the sustainable nature-based tourism industry. Tourism is a fast growing sector internationally that results in increased foreign exchange, employment opportunities, and triggers overall economic growth, particularly in sub-Saharan countries where it is most strongly associated with increasing GDP (Lee & Chang 2008; Fernández 2010).

Not all national parks in Zambia have associated tourism development, but the LZNP is one of several important national parks that do (Ministry of Tourism Environment and Natural Resources 2004). Additionally, the LZNP is one of only four Zambian parks making up 96% of income for wildlife management from photo-tourism and making up over 50% of the national parks network, and is therefore considered a "flagship" national park for Zambia (Lindsey et al. 2014). Additional income from surrounding Game Management Areas, including photo-tourism, hunting revenue, and community-based wildlife programs, are also largely dependent on the integrity of source populations of wildlife within the adjacent national parks for their sustainability (Tembo 2009; Balakrishnan & Ndhlovu 1992; Fernández 2010).

The presence of large scale open-pit mining within national parks has the potential to negatively impact the tourism sector and result in flow-on negative effects on local communities. Direct impacts from the mine, such as contamination events and their effects on health and wellbeing of communities and wildlife, are dealt with in subsequent sections. Mining in Australia has been demonstrated to be have a negative effect on employment in the tourism sector (Pham et al. 2013), however the likely economic impact of the mine on tourism in Zambia is more difficult to establish using existing data. Regardless of contamination and pollution events, the perception of the presence of a mine within a national park has the potential to deter visitation by tourists. To quantify this relationship, we carried out a survey of local, regional and international tourists to evaluate whether the presence of an open-pit mine would affect their likelihood of visiting national parks in Zambia.

2.2.1 Survey: potential impact of mining inside protected areas on nature-based tourism.

A short ten-question survey was developed and disseminated through tourism operators in the Lower Zambezi and South Luangwa National Parks, which together contain the highest number of safari-based tourism operations in Zambia (> 50 camps and lodges). The survey was completed using cloud-based online software (SurveyMonkey Inc 2014). Operators were asked to randomly sample a minimum of 20 tourists visiting their facilities in August-September 2014, and ensure that only one member of a group or couple completed the survey so that samples were independent. The survey was also disseminated through travel agents that sell safaris to Zambia, via their email mailing lists and via Facebook.

Only tourists were targeted as respondents, the survey was not circulated amongst conservation groups. The results were filtered so that only responses from genuine tourists who had visited Zambia at least once and would consider visiting Zambia again for nature-based tourism were included in the data analyses. In accordance with

human survey ethics participation was voluntary, respondents gave their informed consent before participating in the survey and were free to withdraw at any time. A total of 393 respondents participated, 45 were removed because they either had not visited a Zambian national park as a tourist in the last ten years, or would not consider visiting a Zambian national park in the future. Respondent age was the only demographic characteristic surveyed and responses to this question followed a normal distribution, suggesting successful random sampling of this category (see response frequency histogram, Appendix 3, Question 9).

Geographically, the majority of respondents were international tourists (69%), followed by responses from Zambians (17%) and regional African visitors (14%). There were no significant differences in the responses from the different visitor groups, with Zambians, regional Africans and international visitors responding in the same way to questions around visitation of protected areas with and without mining (<10% variation between groups).

The results were conclusive, with over 95% of respondents stating that they were either unlikely to visit a national park containing an open-pit mine (38%), or would not visit a national park containing an open-pit mine (58%). In contrast, a vast majority of 96% of respondents were extremely likely (85%) or very likely (11%) to visit a National park that was protected from mining.

A majority of 92% felt that the combined environmental and social impacts of allowing mining inside national parks would be either quite negative (16%) or extremely negative (76%), while a similar proportion believed that the impacts of nature-based tourism on protected areas was moderately (24%) or extremely positive (65%).

Based on these results, it is reasonable to conclude that the presence of a large scale mining project within a Zambian national park is highly likely to significantly and negatively impact the nature-based tourism industry, and subsequently to result in job losses for local communities.

The top four most important qualities for attracting tourists to national parks were: abundant wildlife (95%); beautiful scenery (87%%); a high quality condition of the natural environment ie pristine or intact ecosystems (88%); and a lack of noise, air, water and visual pollution (84%); respondents could select more than one quality for this question therefore percentages total more than 100%. Critically, these are all qualities that are likely to be detrimentally impacted by the physical activities of an open-pit mine, as well as any contamination events (see Section 3). Significantly, these aesthetic and environmental qualities link to a “sense of place”; a similar precedent case in South Africa rejected a strip mining proposal for the Greater St Lucia area based on the perceived violation of sense of place, together with uncertainty around predicted impacts and mitigation, even though the mine would take up less than 0.5% of the Greater St Lucia area (Kruger et al. 1997).

Our survey size was limited by time constraints and we recommend larger sample sizes and repeated temporal sampling for more detailed analysis. However, none of the results were borderline or unclear, each of the survey questions aimed at evaluating mining impacts on visitation received strong concordant responses (80% or more

majority for two adjacent preferences combined eg "very likely" and "extremely likely"), therefore increased sample size from the same target market is not expected to alter the findings. Additionally, there was no apparent bias in results, age demographics were normally distributed and the geographic distribution of survey respondents included 23 countries corresponding to a similar distribution of international visitor nationalities listed in the Tourism Sector Profile (ZDA 2013) with the majority of respondents from the United Kingdom (29%), Europe (21%), United States (19%) and Australia (12%).

Thus we believe the survey contains a representative randomized sample. Our results indicate that nature-based tourism could potentially be reduced by more than 80% due to the presence of mining inside National Parks, resulting in local industry collapse and loss of over 600 jobs in the Lower Zambezi National Park. Based on an average household size of 5, over 3000 people would be affected by the job losses (Central Statistical Office Zambia 2012a). Critically, these are long-term jobs from a sustainable industry, not limited to a 4 or even 25-year duration, as would be case for mining jobs. Mine closure can have significant impacts on communities and the environment and these factors are dealt with in Section 3 of this report.

2.2.2 Employment and income from tourism

The annual contribution to GDP from tourism in Zambia is 5.7% and growing (World Data Atlas 2014). Just over half of the annual tourism income is from leisure travel including nature-based or safari holidays, with the remaining 49% comprising business and non-holiday visits (Dixey 2005; ZDA 2013), however nature tourists are recognized as making a substantial contribution to the national economy (Sichilongo et al. 2012). When assessing economic contributions in direct and indirect terms, nature tourism contributed 16% of exports, 6.5% of GDP, <6% of wages, 7% of Government revenue and almost 10% of formal sector employment (54,000 jobs, more than mining at 46,000; Sichilongo et al. 2012).

In terms of the value of specific safari destinations, data are generally lacking. Economic assessment of the value of holiday visitors to South Luangwa National Park estimated that the value of tourism at approximately US$6 million annually, although that figure is likely to have substantially increased since 2005 (Pope 2005).

The tourism industry in the Lower Zambezi National Park and adjoining Chiawa Game Management Area (GMA) is small but growing. Despite the industry's small size, on a per annum basis it employs approximately double the amount of Zambians than the Kangaluwi mine Project expects to employ, and does so on a sustainable basis and in a non-extractive and non-consumptive way that is compatible with wildlife conservation in the protected areas.

Approximately 650 Zambians are employed by nature-based tourism operators in the Lower Zambezi area, with a mean monthly wage of ZMW 1,413 (LZTA unpublished data). While the majority of camps operate for 12 months of the year, employment is at its maximum for 9 months of the year and is reduced during the wet season when camps inside the National Park, and close to it, run with a minimum staff due to inaccessibility caused by the rains.

In addition to direct employment, the industry supports a range of related sectors focused on wildlife conservation and community development, which adds value to the sector well beyond the contribution to GDP. Table 4 below (LZTA unpublished data) shows the associated benefits generated by the tourism industry in the Lower Zambezi National Park and Chiawa GMA, including income to ZAWA and voluntary contributions to NGO-based wildlife conservation and community development. These added values are typical of the sector which is also known for contributing to local development and infrastructure (Dixey 2005). The table gives conservative estimates, extrapolated from a limited number of respondents. When comparing the approximated income generated for ZAWA in 2013 to actual ZAWA income records (Table 5, ZAWA unpublished data) the estimate closely matches the 2012 ZAWA contribution. The amount is likely to have increased a little over the 12 month period, but based on this comparison the figures appear to give a reasonable albeit conservative indication of actual contributions.

Tourism operators also founded Conservation Lower Zambezi (CLZ), a well-established non-for-profit organization that assists ZAWA with anti-poaching and wildlife conservation efforts. CLZ receives annual core funding of approximately US$110,000 per year from the local tourism sector, and contributes approximately US$500,000 per year to wildlife conservation and community education programs in the Lower Zambezi area (Stevenson & Harvie 2013). Similar NGO initiatives exist in the other flagship National Parks, particularly in South Luangwa National Park which has a long history of tourism development and has well established, successful model programs in community development and wildlife conservation (Dixey 2005; Balakrishnan & Ndhlovu 1992). All of these programs are intrinsically linked to sustainable tourism (and sustainable wildlife management), and would be heavily impacted by any reduction of tourism growth due to the mining sector. The full potential impact of mining inside National Parks in Zambia on community development initiatives is discussed further in the following section.

If, despite the substantial Project inadequacies mentioned above, the Project EIS best-case estimates for the ZRL Kangaluwi Mine were to eventuate and the Project employed 300 people (Petterson et al. 2012), the damage caused to the local tourism industry by the presence of the mine could result in losses of up to 650 jobs, causing a net loss of over 300 jobs as a result of the Project.

Compounding this problem is the fact that jobs from mining are not necessarily additive; in Australia mines are reducing the ability of the tourism sector to find and retain employees (Pham et al. 2013).

Comparing job creation over a longer term, if we conservatively use best estimate figures from the Project EIS of 300 jobs per year for 25 years, the Kangaluwi Mine would create a total of 7,500 annual jobs over a 50 year period, and would only operate for half of that period. In comparison, the tourism industry would create 32,500 annual jobs (650 jobs for 50 years) over the same 50 year period, because it is a sustainable industry. *It is critical therefore to consider log-term implications for both communities and the environment when considering non-renewable mineral exploitation operations with protected areas.*

Both the mining and tourism sectors are important economic growth sectors for Zambia, and are focus areas in the 6th National Development Plan (Government of the Republic of Zambia 2011). Agriculture is also an important growth sector and local and regional agriculture has a substantial role in supporting tourism operations. Growth in the tourism industry is likely to create growth in agriculture, while similarly a decline in tourism is likely to negatively impact agriculture.

It is worth noting that according to a study by Simasiku et al (2008), only 3 GMAs in Zambia have developed any meaningful tourism infrastructure and capacity (>200 available beds) for non-consumptive , nature-based tourism. These are the Chiawa GMA in the Lower Zambezi and the Lupande and West Zambezi GMAs, of which Chiawa has the highest capacity (>220 beds). Risking such significant investment and existing infrastructure, by allowing mining Projects such as this one, appears to be at odds with the stated national development objective of growing tourism in Zambia.

Therefore, the growth of mining inside protected areas is not compatible with growth in other sustainable industries, and would come at a potentially high cost for Zambia.

Table 4: Estimate of the spin-off benefits provided by tourism operations in the Lower Zambezi National Park and Chiawa GMA. Data compiled from a voluntary survey of LZTA members in 2013. Mean values are based on figures for 4 lodges within the LZNP, 2 Lodges close to the LZNP and 2 Lodges distant to the LZNP but within the Chiawa GMA. Total figures are based on 17 commercial members of the LZTA of which 14 utilise the park regularly. Note this constitutes a minimum contribution and does not include similar contributions by non-members and private, non-commercial camps.

	ZAWA[i]	Other licences and fees[ii]	Conservation[iii]	Public Infrastructure[iv]	CSR[v]	Local spend[vi]
Mean for Park respondents (n = 4)	626 293	19 619	10 000	26 563	8 750	21 786
Mean for respondents close to LZNP (n = 2)	317 000	14 650	13 500	22 500	22 500	10 000
Mean for respondents distant to LZNP (n = 2)	36 900	4 641	41 000	23 750	20 000	30 000
Estimated total for LZTA operators who utilise the LZNP and Chiawa GMA. (4 within park, 6 close to LZNP, 7 distant to LZNP)	**4 274 673**	**208 873**	**380 500**	**406 250**	**312 500**	**337 144**

i. **Annual Monies paid directly to ZAWA, includes operator fees, bed levies, park entry fees and guides licences**
ii. **Includes various other annual fees and levies including angling licences, operator licences and other applicable licence fees and levies**
iii. **Annual voluntary contributions made to conservation either through direct support to ZAWA operations, fundraising and donations or support of conservation NGOs**
iv. **Annual voluntary contributions towards the development and maintenance of infrastructure within the LZNP and Chiawa GMA. Includes roads, airstrips and school buildings.**
v. **Includes voluntary donations, and Corporate Social Responsibility activities such as support to schools, clinics and community projects.**
vi. **Amount spent annually on sundry goods and services from local suppliers or small businesses.**

Table 5: Revenues (KR) accrued from to ZAWA from phototourism, for the four most economically important National Parks in Zambia between 2010 and 2012 (ZAWA unpublished data).

Year	South Luangwa NP	Mosi-oa-Tunya NP	Lower Zambezi NP	Kafue NP
2010	9,401,028	5,690,093	2,685,381	2,178,403
2011	10,581,456	15,826,344	2,915,317	3,834,619
2012	13,158,898	6,986,274	4,178,117	4,344,078

2.3 Potential Impact on Alternative Models for Community Development.

Employment from the tourism sector in the Lower Zambezi region is concentrated in the Chiawa GMA to the south-east of the National Park, and communities at the north-western end of the Park in the Luangwa District derive little benefit from the protected area. Therefore, alternative models for employment and poverty alleviation are necessary for these communities, and this situation is reflected in many of the GMA's throughout Zambia. Several such initiatives are underway.

USAID has recently invested US$14 million in community development projects, including approximately $5 million in the Lower Zambezi REDD+ Project, implemented by BioCarbon Partners (BioCarbon Partners 2014). On the north-eastern boundary of the Lower Zambezi National Park, The REDD+ Project covers over 120,000ha of land adjacent to the National Park boundary, and involves approximately 8,300 community members. The focus of the project is to conserve forests, alleviate poverty and dependence on charcoal production (which has resulted in an extremely high deforestation rate), through global carbon markets. The project involves over 20 types of community initiatives to reduce deforestation by improving livelihoods and land management practices.

The REDD+ Project is a pilot project and likely to be scaled out into other GMAs in Zambia. The pilot already represents substantial social investment, well beyond the scale of any expected contributions from the Project should it reach the stage of financial viability. In fact the Project does not define the scale of its expected commitment to Corporate Social Responsibility (CSR) at all. However, there is some track record available that demonstrates ZRL has consistently failed to deliver on the few small-scale CSR projects that they have promised during the exploration stage (see Section 3).

More importantly, the increased infrastructure of roads and regular transport passing through the REDD+ Project area due to the Project is likely to facilitate increased deforestation, and create substantial investment risk to the REDD+ Project. Studies in the copperbelt have shown that mining has negative impacts on forests, from direct deforestation due to mine site development through to increased pressures from mining towns (Mwitwa et al. 2012). The presence of the Project has the potential to undermine the entire REDD+ Project and impact the initial $5 million pilot commitment plus future investments (BioCarbon Partners pers. comm.) As per sustainable tourism, community development projects that align with protected area management appear to be mutually exclusive to mining in the same areas. The economic risk created by mining is therefore multiplied in and around protected areas and this should be carefully considered in the mine assessment process.

NGOs have long played a significant role in supporting wildlife conservation in Zambia, and new policy initiatives suggest that this will continue, along with an increased focus on community partnerships and community participation in the governance of natural resources to increase both effectiveness and sustainability (Sichilongo et al. 2012). Zambia is highly dependent on international development aid, having received over

US$1.3 billion in 2009, and much of it is channeled through NGOs (OECD 2011). The proportion of aid going to communities living in or near protected areas is not known, however there is great potential for mining inside protected areas to have a devastating effect on international aid investment. This issue should be thoroughly explored during the formulation of any policy and legislation that considers mining inside protected areas. It has important implications for Zambia's National Development Plan (2011-2015) in regard to tourism and natural resources, as well as the evolving Zambia Wildlife Sector Policy (Sichilongo et al. 2012)

3. POTENTIAL HEALTH AND ENVIRONMENTAL IMPACTS OF THE MINE

A major area of concern around the Project proposal is the risk to community health, to the wildlife and ecosystems of the LZNP, and to one of Africa's most important rivers.

The Zambian legislative instrument that is in place to ensure that such risks are addressed and mitigated is an EIS, which is required to be submitted to ZEMA by all mine project proponents as stated in Zambia's Environmental Management Act (2011). The Project EIS submitted by the Company fails to address these risks in every respect; it does not define the scope of the Project or properly consider environmental impacts and contamination risks, nor does it even attempt to address mitigation methods or costs should any of the risk scenarios occur. It also fails to budget for full site rehabilitation (see below), in violation of the very clear conditions outlined in the Mineral Resources Development Policy (2013) that "7.4e …*Exploration and mining in protected areas will only be allowed when rehabilitation has been guaranteed*".

National Parks are typically set aside for i) the preservation of the ecosystem services they provide that also serve as a buffer to climate change impacts, ii) for preservation of biodiversity that also ensures ecosystem function and the subsequent provision of ecosystem services, and iii) for watershed protection (Sichilongo et al. 2012). National Parks and GMAs in Zambia are legally protected areas and therefore any consideration of proposed mining projects within these areas should be given increased scrutiny compared to other land use zones.

Unfortunately the current Mines and Mineral Development Act (2008) does not contain any substantial provisions to guide the implementation of mining in protected areas and therefore the mine licensing system is open to exploitation, particularly by foreign investors like ZRL who face much more robust legislation in their own countries. It is important to note that had the Project proposal for mining inside a national park been submitted in Australia (where ZRL is registered in the stock exchange) it would not have been licensed, due to gross inadequacies in the Project EIS (more of which are outlined below). Mining within National Parks in Australia is prohibited; the only exceptions require consent from both houses of Parliament (Australian National Parks and Conservation Act 1975). A project of this extremely poor quality would not pass the even the initial assessment phases under any Australian state legislation, such as the NSW Environmental Planning and Assessment Act (1979).

3.1 Evaluation of EIS assessment of risks based on scope of the Project

The true potential impact of this mine is extremely difficult to assess due to the lack of transparency in the information supplied by the Company. However, the gross lack of robust information presented in the Project EIS for evaluation purposes is in itself very significant and all independent reviewers have agreed would normally result in outright rejection of a Project proposal of such poor quality. This aligns with the decision by ZEMA to reject the Project EIS. These recommendations also align with the precautionary principle used in risk management, which is focused on protecting the public and the environment from harm and under this principle no project should be undertaken where the negative social and environmental impacts are not known.

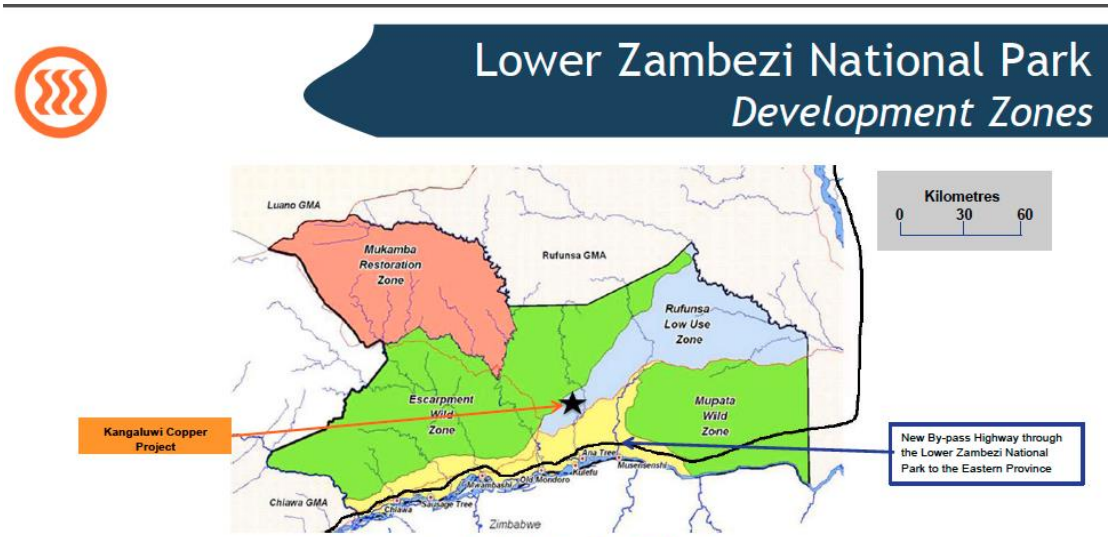
Some of the major flaws in the Project EIS are outlined in this section, full details can be found in the Appendices 1 & 2 attached to this report.

As detailed in Section 2.1 above, the Project EIS failed to define the scope of the Project in terms of geographical scale and expected copper production. The Project EIS addresses the impact of only 2 mining pits, and does that insufficiently, while mentioning a possible total of 4 pits; the extra pits would carry with them requirements for overburden dumps and waste rock processing, transport and storage requirements. The potential waste rock and tailings from all four pits are not quantified in the EIS.

In addition to uncertainty around the number of pits, the size of the mining license itself is in question (Large scale Mining License 15547-HQ-LML). The Project EIS refers to Figure 1.1 for the license area (pp 3) however there is no Figure 1.1. If the Project EIS was meant to refer to Figure 3.1 then the area shown does not match the area on official record at Mining Cadastre; the official record outlines a larger area.

Contradictions around the scope of the Project continue throughout the documentation. The Mining Quantity section of the Project EIS (pp35) states "*The Kangaluwi Project will result in physical disturbance of the landscape (approximately 100 hectares or about 0.2% of the Lower Zambezi National Park)*", see Figure 4a below. However, this is only likely to cover the Kangaluwi pit, not the satellite pits with haul roads and their own tailings and waste rock – independent experts estimate 80 km^2 would be needed for mining activity of that scope. In another section (pp 16) of the Project EIS states "*The total land surface directly affected by project development is approximated at 7-10 km^2*" an order of magnitude difference in area estimation. This raises questions around why a license area of 246km^2 is required for only 100ha of disturbance.

The Project EIS openly states that many geophysical targets are yet to be evaluated, that only one quarter of the strike length has been drilled to date and maps out several identified prospects distributed over a much larger area While acknowledging the potential for expansion, there is no accompanying acknowledgement or assessment of the full potential impact of the larger mine area on the National Park and water catchment; on the contrary the potential impact is downplayed to the minimum area and activity proposed. A critical issue that is not discussed is that regardless of the mine size the disturbance caused by open pit mining, in an elevated position in a water catchment with high rainfall and documented weathering processes, carries substantial environmental risk that is likely to impact areas well beyond the geographic area and lifespan of the mine itself.



Lower Zambezi National Park: 4.092 km²
Kangaluwi Copper Project Mining Area: 10.5 km²

Description	Area (in km²)	% of the total mine area (245 km²)	% of the total area of the park (4092km²)
Kangaluwi Mine Operation Area	10.5	4.09	0.24
Power Line	0.8	0.33	0.02
Road Construction	0.7	0.29	0.02
Total Area	11.5	4.69	0.28

Figure 4a

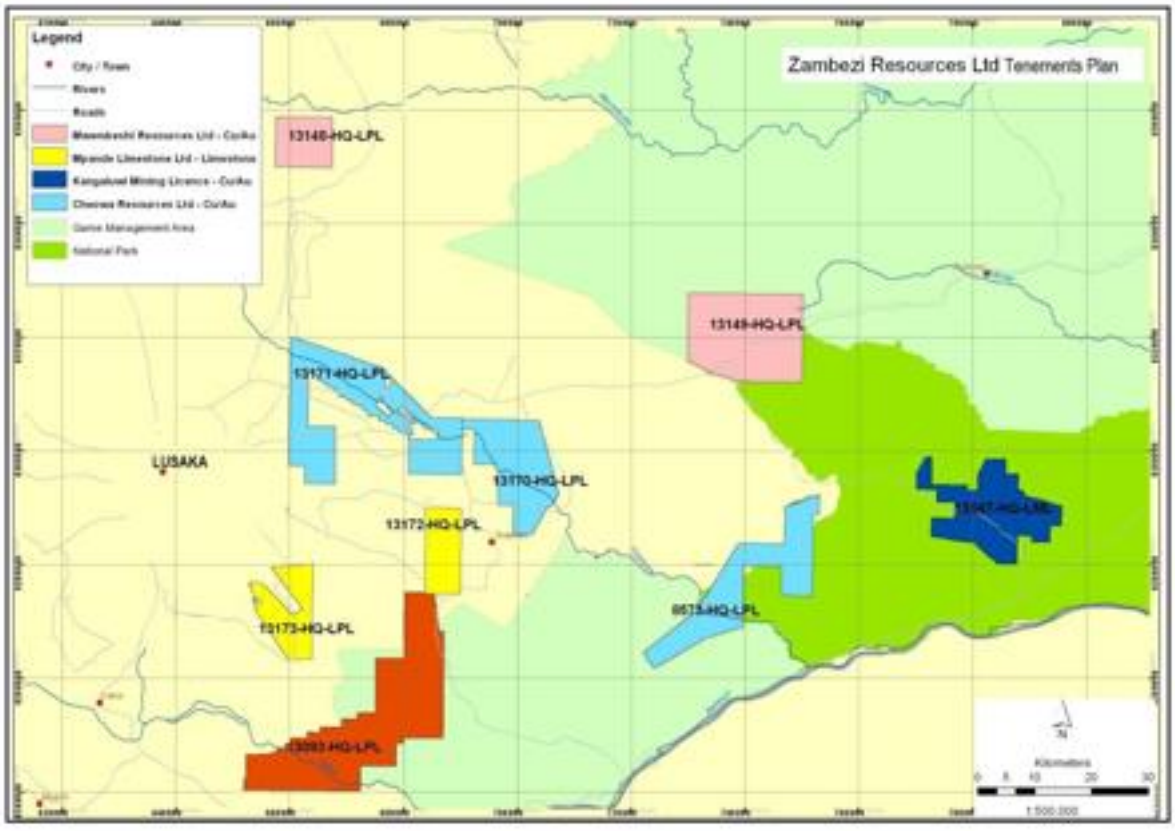


Figure 4b

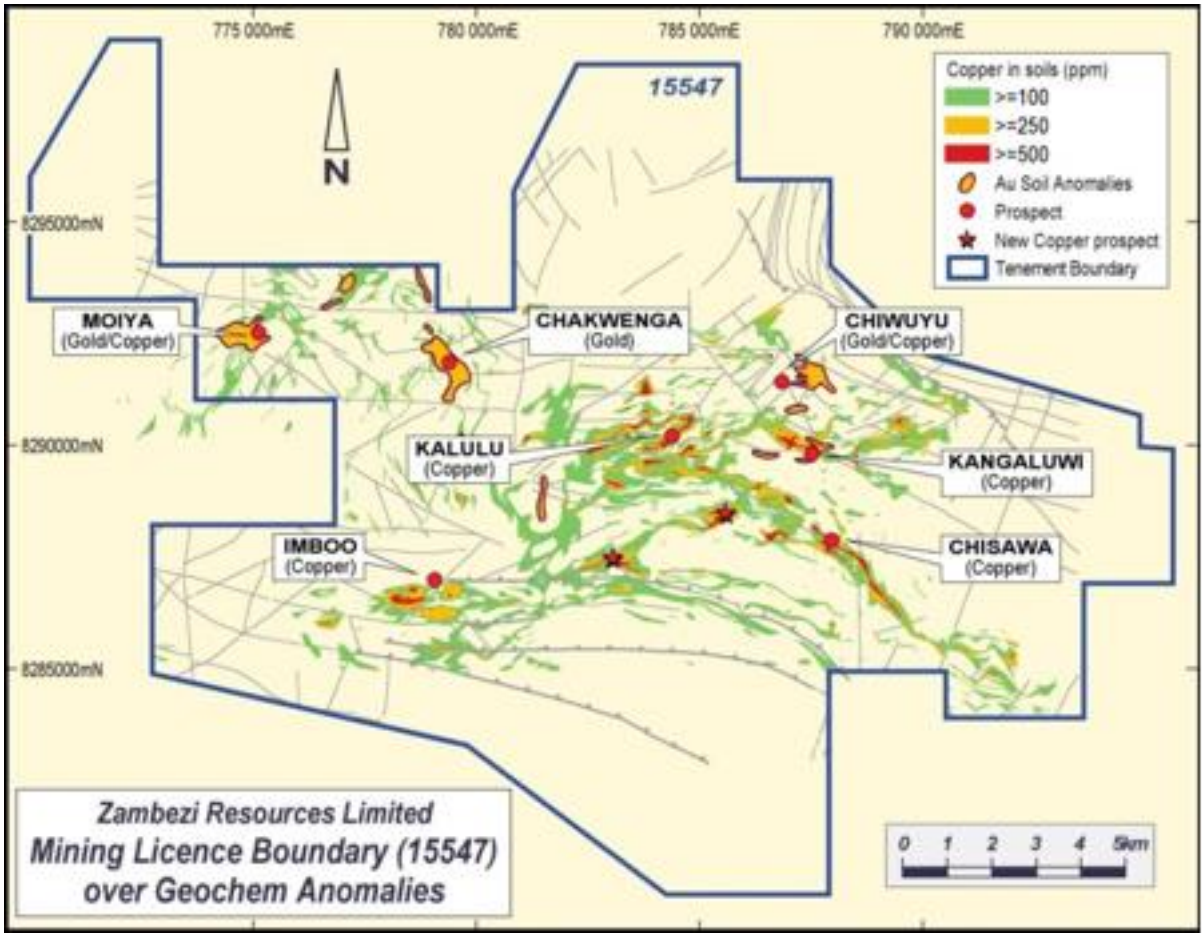


Figure 4c

Figure 4a outlines the location of the Kangaluwi mine and estimates the percentage of the National Park area that the mine will occupy at 0.24%. Subsequent Figures 4b and 4c show the full potential extent of the mine with prospects distributed over the license area and occupying a much larger proportion of the National Park. (Images from Zambezi Resources Ltd 2014; Carville et al. 2013)

In relation to other estimates of quantity and area, the suggested tailings storage area outlined in the Project EIS is insufficient. Based on the maximum mine life of 25 years that the Project EIS occasionally refers to (pp 22), the estimated 3Mt of tailings per annum would result in a total of 75Mt of tailings, approximately 30 million cubic meters (m^3) in volume. At the stated strip ratio of 6:1 there would be 450Mt of waste rock. The Company's plans to deal with this volume of waste and tailings is not mentioned in the text of the Project EIS. By failing to address fundamental storage concerns for tailings and waste rock, substantial environmental risk is not dealt with.

Independent experts have indicated the topography of the mining license area does not look suited to long term storage of this volume of tailings and expressed concerns that, according to the specifications provided, the tailings storage facility (TSF) would have to be 50m high and that this may be an impossible engineering feat in the escarpment environment. Therefore an inference of the Project EIS may be that the mining license would have to be extended in the future or otherwise damming might have to be undertaken, but neither of these options is addressed in the Project EIS.

Furthermore, page 25 of the Life of Mine section in the Project EIS describes a TSF facility with maximum capacity of 700,000 m^3 and states *"The target storage capacity will be adequate for the 1st year of the new operation*" despite referring to a potential 25 year life of mine and potential for 30 million m^3 of tailings. Thus the Company has completely failed to address requirements for TSF facilities for the Project, which form one of the highest potential environmental risk factors for a project of this type. In the same section the Project EIS states:

"*There is no knowledge of the hydrogeological environment in the region of the storage. This could be important with respect to seepage management. Likewise the storage must be designed to contain the wet season rainfall runoff and a detailed hydrology study will be required*."

Expert review views this as further confirmation of the "extremely inadequate nature of the EIS"; that no technical studies have been performed yet these are required for a competent assessment. In general, this section of the Project EIS clearly outlines that ZRL have not properly planned for the TSF for the life of the mine, do not know how big the mine will be, whether it is physically possible to engineer a TSF to cope with their maximum production estimates, and have no idea about its stability in the escarpment environment or how the local hydrology and high seasonal rainfall might affect the likelihood of a major contamination event. Fortunately, independent mining experts with greater expertise than ZRL have provided an assessment for the purposes of this review. They have identified substantial risks.

In addition to expert mining engineers in Zambia who wish to remain anonymous, the Project EIS was evaluated by independent international mining engineer Jim Kuipers of Kuipers and Associates LLC USA. Mr Kuipers has extensive experience in mining environmental compliance, including assessment, reclamation and closure and has provided consultancy expertise in these fields to the United States Environmental Protection Agency (US EPA). The Project EIS was evaluated against the Global Acid Rock Drainage Guide (GARD Guide), which was formulated by a network of international mining companies to reduce liabilities associated with sulphide mining. The guide provides recommendations to deal with prediction, prevention and mitigation of Acid Rock Drainage (ARD, discussed in the section below), a serious and common type of contamination resulting from copper sulphide mineral oxidation in mines of this type. A full summary of concerns outlined in that evaluation are included in Appendix 1. The independent review was available to ZEMA prior to the Agency's decision to reject the Project EIS.

Based on reviews of similar open-pit mining activities near to water sources in the USA (Kuipers et al. 2006), the independent reviewer found that there ***is an extremely high likelihood of significant water contamination resulting from ARD.*** He found the Project EIS failed to address water quality as a significant issue and also failed to demonstrate that the Company's assessment of ARD potential at the Project site adhered to GARD or any other accepted methods for this type of assessment. The Company's methods for characterization of minerals were deemed insufficient and their subsequent dismissal of the risk of ARD was incorrect. ARD risk is well established for mines of this type; one of the world's largest copper mining companies (Freeport McMoran Inc) has instituted policy that all of its copper porphyry mines are

considered ARD generating since mineralization of this type resulted in ARD 100% of the time.

3.2 Evaluation of Potential for Acid Rock Drainage

The natural oxidation of waste ore and tailings from open pit mines generates acids and metal toxins, a process called Acid Rock Drainage (or Acid Mine Drainage), which can persist for centuries (Schorr & Backer 2006). ARD releases sulfuric acid and free heavy metals into the environment, a form of pollution that can result in an inability of the ecosystem to sustain life in badly affected areas (Dudgeon 2014). Copper ore itself is a major source of this acidic contaminant making copper mines a particular source of concern for this problem. Acid Mine Drainage is a well established contamination problem around mines for soil in runoff areas, groundwater and aquatic systems (Levings et al. 2004; Dai et al. 2007; Khalil et al. 2008). Acid Mine Drainage has been found to disrupt the structure and function of aquatic ecosystems, and affects not only the water column and fish but sediment and associated species, groundwater (Sola et al. 2004; Battaglia et al. 2006) and results in long-term contamination of these systems (Dai et al. 2007). Remediation of Acid Mine Drainage is extremely difficult to implement (O'Halloran et al. 2008; Haferburg et al. 2007; Kalin et al. 2006; Jennings et al. 2008)

If gold mining is included in the Project then tailings may also include cyanide which is a highly toxic potential environmental contaminant (Logsdon et al. 1999). Gold was a focus of the initial exploration carried out by the Company at several sites in the region including the Chiawa GMA and LZNP, and gold mineralisation at Kangaluwi is mentioned in a ZRL Corporate Presentation from 2012 (Zambezi Resources Limited 2012). The potential for gold mining and associated impacts is not addressed in the Project EIS.

Additionally, copper mines are often sources of radionuclides, exposing and concentrating naturally occurring radio-active materials that occur in the ore or rock, which can then contaminate surface or groundwater (US EPA 2014).

In terms of ARD, risks from the Project appear high. According to the Project EIS (Section 3.1) the Project site shows similarities with "porphyry copper style mineralization", while according to Kuipers, copper porphyry orebodies are nearly always associated with ARD and therefore there is a high likelihood that ARD will result from the Project.

The Company presented geochemistry test results for potential ARD and metal leaching for only ten samples from different mineralized zones (Project EIS section 4.6) representing the overburden (waste rock and soil above the mineral resource, removed during mining to access the ore) and the hanging wall. No map is provided therefore is it unclear which part of the Project site was sampled, and samples were taken from only two drill core archives which suggests insufficient sampling of the project site. Only two of the ten samples were tested for their potential to form metal rich acid leachate. Sufficient sampling methods are critical for proper testing for ARD, and even when high quality testing is performed (it was not performed here) in many cases ARD still occurs (Jennings et al. 2008; Kuipers et al. 2006).

The Project EIS states that based on Net Neutralising Potential (NNP) "***Acid Rock Drainage is not likely to occur where NNP values are greater than +20kg/tonne***

$CaCO_3$". It also states it is not possible to tell if samples with NNP values between -20 and +20 are acid forming or not. ***None of the samples tested had an NNP value of over +20.*** Based on other tests, four of the ten samples had potential to become acid forming, one confirmed as "Potential Acid Generating" and three as "Indeterminate" ie the acid generating potential is not known. The Project EIS acknowledges that the "*test method merely provides an indication of the potential for acid generation. Whether or not acidic drainage will occur depends on the mineralogy (the availability of each acid generating and neutralising mineral present), the physical characteristics of the material and the environmental setting."* Yet despite the sample results and these unknown factors the Project EIS concludes that the Project "*can be considered not to generate acid drainage and should therefore not present any environmental hazards*".

In Section 6.3 the Project EIS refers to US EPA 1310a Extraction Leach Procedure to test for ARD potential from waste rock, and concludes there is negligible risk of ARD from the Project. According to Kuipers the statement indicates:

"a *gross misunderstanding of proper materials characterization as contained in the GARD Guide… No information on acid base accounting or kinetic tests are provided therefore no evaluation of risk of ARD can be considered valid with respect to this project. Method 1310a is used to determine if waste is hazardous under US EPA Resource Conservation and Recovery Act requirements to evaluate metal mobility in a sanitary landfill. It uses acetic acid as the leachate which is not appropriate for mining conditions and this test only simulates the release of existing soluble contaminants, and not contaminants that would result from oxidation of sulfide minerals.*"

Therefore the geochemical characterization methods used by the Company are inadequate. Appendix 1 details how all other statements concerning the potential for ARD and metals leaching should be considered unsubstantiated and a new EIS adhering to GARD and best practice standards should be performed.

Groundwater contamination is of particular concern since as stated in the Project EIS "*There are currently no Zambian Statutory Limits regulating the quality of groundwater*". It is recommended that given the importance of the groundwater resources, and the potential for contamination events, that the Zambian Government establishes clear guidelines by which to regulate groundwater quality.

3.3 Implications of ARD.

Critically, a recent review of ARD generating mines in the USA states that "*that no hard rock surface mines exist today that can demonstrate that ARD can be stopped once it occurs on a large scale*"(Jennings et al. 2008). As per section 3.2 above, ARD is a common and well-established contamination issue that results in serious contamination of ecosystems, specifically via waterways. It impacts all forms of wildlife and results in direct mortality as well as impacting breeding and health. Fish kills in waterways contaminated by ARD from mining waste have been documented all over the world, with the review by Jennings (2008) estimating millions or even billions of fish being killed in the USA alone.

A key concern around environmental contamination is the elevated position of the mine in the water catchment, in close proximity to valley floor and the Zambezi River. The Zambezi River Basin, include the Zambian Escarpment region around the Project

site is subjected to high rainfall and subsequent physical weathering (Ashton et al. 2001) which increases the likelihood of leaching and contamination into the water catchment. Ashton et al (2001) found that mines in the wetter regions of the Zambezi Basin are expected to have far greater impacts than those in low rainfall areas, due to weathering processes. This is largely due to moisture within the soil profile that catalyzes constant chemical changes and the available water then mobilizing the different chemical contaminants.

The Project EIS states (pp 56) "*Combining the permeable and sandy nature of the soils, with the fact that many of the hillslope gradients in the area planned for mining and particularly processing plant development are moderate to steep… the issue of vulnerability to erosion is paramount*" and acknowledges that the site undergoes intense rainfall and resultant high rate of runoff. Although the concerns are not sufficiently addressed in the Project EIS, it also admits that "*Without appropriately established risk controls and management protocols in place, leaching into the soil from tailings may possibly lead to pollution of the soils. The mapped soils are recognised as having a moderate to high permeability. Therefore, without the appropriate level of controls in place and managed accordingly this may develop into a problematic issue*." Similarly, pollution from rapid runoff or Flash Flood is acknowledged in the EIS as a rainy season risk, exacerbated by the steep gradients (pp 57).

Thus high seasonal rainfall together with erosion and the elevated position of the Project, which is drained by direct tributaries to the Zambezi River, all combine to create conditions that all but ensure any contamination event would reach well beyond the Project site and into the water catchment below. These factors are not adequately addressed by the Company in the Project EIS or any other documentation.

3.3.1 Impacts on human health

The physical environment of the Project site indicates high risk levels for pollution events, particularly compared to other mine sites in Zambia. Yet based on research at other mine sites that have more stable topography, in Zambia and internationally, there is already a well-established link between mines of this nature and negative impacts on human and environmental health. This Project has the potential to negatively impact thousands of people who depend on artisanal fishing, subsistence agriculture and animal husbandry for their livelihoods. The human population of Luangwa District is concentrated along the Zambezi and Luangwa Rivers (Central Statistical Office Zambia 2012b) therefore contamination of water catchments is a major concern, for water consumption, fisheries and contamination of trophic food chain levels.

Table 6 below contains extracts from the Project EIS, outlining some of the risk events that are acknowledged as likely to impact human health. The rankings used in the EIS to determine the "risk to human population" were low, moderate, or high (we assume "medium" which is also used in the Project EIS means "moderate"). Based on the information presented in this report on i) the potential scope of the project and the sheer volume of tailings and waste rock, ii) the steep and erosive physical environment, and iii) the lack of competence demonstrated by the Company in properly assessing and mitigating threats, we believe many of these risk to human populations in the table should be elevated to "high". Nevertheless, moderate risks are still a source of concern

and all of the risks outlined below should be considered very real threats to human and environmental health.

While the risks are acknowledged in the Project EIS there is no strategy for mitigation put in place should they occur; the Project EIS instead presents general statements about events being "unlikely" and manageable with a "sound environmental management plan" that is yet to be developed (pp 186 onwards). Based on events at other open-cut copper mines around the world, many of which operate to high international standards, major contamination events are rarely manageable and more often result in long-term damage to the environment and subsequently to human health. In terms of ARD contamination, this is dismissed by the Company as negligible and the Project EIS fails to address it, while as previously discussed independent experts rank ARD as a highly likely consequence of this Project. The omission of proper consideration of the impacts of such serious contamination events is of extreme concern, as is the failure to detail mitigation strategies to address them.

Specific impacts on human health that have been documented from other copper mining projects include increased risk of lung cancer and coronary heart disease (Adam et al. 2001; Rencher et al. 1977). Surveys of worker health at a nickel-copper mine and smelter in South Africa listed a range of health complaints attributed to fumes of sulphur dioxide, as well as dust vibrations and noise (Ekosse 2011). Complaints included heart palpitations, shortness of breath and constant chest pains, coughing and frequent headaches, diarrhea, vomiting and nausea.

There is no doubt that mining in Zambia historically corresponds with high levels of environmental contamination and subsequent risks for human health and wildlife health (Ettler et al. 2011; Nakayama et al. 2013; Tembo et al. 2006; Ettler et al. 2014; Ndilila et al. 2014; Syakalima et al. 2001; Leteinturier et al. 2001). In the Copperbelt in Zambia, studies revealed heavy metal contamination of the environment in close proximity to copper mines, and associated significantly high metal concentrations in people living in the area (measured via toenail analysis; Ndilila et al. 2014)). Arsenic and lead concentrations in water near copper mining towns exceeded World Health Organisation drinking water standards, and alongside high lead concentrations found in people, were of particular concern for health. Lead exposure and lead poisoning of adults can cause long-term damage to health and lead to heart attack and stroke, and as well as causing illness in children can impair their neurological development (NHMRC 2009).

Other studies in Zambia have evaluated levels of heavy metal environmental contamination in topsoils due to disposal and storage of mining waste as well as smelting activities, and found "enormous" levels of pollution (Ettler et al. 2011) identifying the mines as important sources of mobile and bioavailable metals. This means that the metals are available for uptake in the food chain and uptake of lead, copper, cadmium and zinc has been shown in small mammals in mining areas in Zambia (Nakayama et al. 2013). Together with arsenic, high concentrations of these metals led to Kabwe being listed among the top ten most polluted towns in the world (Blacksmith Institute 2007).

As per comments from Kuipers "*The EIS does not consider the environmental and health significance of the environmental impacts (some of them extensively hazardous) for the local communities living downstream from the project i.e. those communities living in*

Luangwa Boma on the Zambezi river further east from the project. There is no consideration of the impact that water pollutants will have on drinking water and water to be used for agricultural and other livelihoods in these communities. If as a result of the project, drinking water in local communities is polluted, this will be a breach of the UN resolution 64/292 which enshrines a fundamental human right to clean drinking water. There is no consideration of the effect that this mine may have on the housing of these local communities e.g. in the Copperbelt some housing has to be replaced on an annual basis due to acid rain resulting from the copper mines."

There is a wealth of evidence on the potential impacts of open-cut copper mining on human health, and when weighed against unsubstantiated claims for economic benefits from this Project, risks to health and livelihoods should be a primary consideration for preventing the Project from proceeding. The levels of contamination discussed above are partly due to the nature of open-pit mining and partly the result of Zambia's lack of capacity to regulate and enforce health and safety standards for mining projects. If mining inside sensitive protected areas and water catchments is undertaken before the lack of capacity and legislation is addressed, the long-term consequences for human health may be severe. The economic cost of health care as a result of illness from mining pollution is also an important consideration, as are the political implications of cross-border contamination of natural resources via the Zambezi River.

Table 6. Extracts from EIS (Table 5.2) Environmental, Social, Cultural and Economic Impact Assessment, summarizing key threats to human populations.

No	Potential Environmental, Social, Cultural and Economic Impact	Risk/ Benefit	Intensity of impact	Extent of impact	Duration of impact	Timing of impact	Frequency of impact	Likelihood of impact	Value of affected component	Risk to human population	Cumulative effect of impact
19	Dust from open pit may contaminate surface soils	Risk	Moderate	Project Area	long-term	Start of mining	continuous	Certain	High	moderate	future land use
25	Excess water from pit dewatering programmes may elevate suspended solids and dissolved metals in local steams	Risk	low	Project Area	long-term	Start of mining	continuous	unlikely	high	moderate	aquatic flora and fauna, local population
46	Oxidised sulphide minerals may be washed out by elevated groundwater levels.	Risk	High	Regional	long-term	post closure	continuous	possible	high	high	surface water
68	accidental failure of dam walls will result in contamination of nearby water courses	Risk	very high	Regional	long-term	Start of mining	occasional	unlikely	high	moderate	flora and fauna
69	contamination of surface water due to ARD generated by tailing in the dam	Risk	very high	Project Area	long-term	Start of mining	continuous	unlikely	high	moderate	soil, surface water, flora and fauna
70	contamination of groundwater due to seepage of tailings solution through the base or toe of the dam	Risk	very high	Project Area	long-term	Start of mining	continuous	unlikely	high	moderate	soil, surface water, flora and fauna
71	contamination of groundwater due to ARD generated by tailings in the dam	Risk	very high	Project Area	long-term	Start of mining	continuous	unlikely	high	moderate	soil, surface water, flora and fauna
102	sulphide minerals exposed for oxidation and leaching (ARD) may contaminate ground water	Risk	very high	Project Area	long-term	Start of mining	continuous	unlikely	high	moderate	soil, surface water, flora and fauna

No	Potential Environmental, Social, Cultural and Economic Impact	Risk/ Benefit	Intensity of impact	Extent of impact	Duration of impact	Timing of impact	Frequency of impact	Likelihood of impact	Value of affected component	Risk to human population	Cumulative effect of impact
115	sulphide minerals exposed for oxidation and leaching (ARD) may contaminate ground water via seepage through the base of the waste rock dump	Risk	very high	Project Area	long-term	post closure	continuous	unlikely	high	moderate	soil, surface water, flora and fauna
171	spilled fuel, oils and lubricants will contaminate the groundwater	Risk	high	Project Area	long-term	Start of mining	continuous	possible	medium	medium	groundwater abstractors, soil
253	influx of people from other areas of Zambia which may create ethnic tension with the local population	Risk	low	Regional	long-term	pre-mining	occasional	possible	high	medium	local population
260	mining and activities related to it are dangerous to workers, wildlife and the public	Risk	very high	Project Area	long-term	pre-mining	frequent	Certain	high	moderate	fauna, local population
261	health and safety concerns for mine workers using oils, acids and other dangerous chemicals at the mine site	Risk	very high	Project Area	long-term	pre-mining	frequent	Certain	low	medium	local population
262	health and safety concerns for mine worker operating equipment at the mine site	Risk	very high	Project Area	long-term	pre-mining	frequent	Certain	low	medium	local population
271	influx of more mobile people who may spread HIV/AIDS and other STDs within the area	Risk	Moderate	Regional	long-term	Start of mining	occasional	possible	high	medium	local population

3.4 Potential Project impacts on the environment

As per the above sections, contamination of soils, forests, water and wildlife due to mining activities in Zambia is well established. This can occur through direct contamination of dust, soils, vegetation and waterways, and via ARD. Alongside potential human health impacts, tailing dams have been shown to have negative impacts on aquatic fauna and biodiversity (Lindahl 2014).

In addition to the routes for direct contamination, a key concern is bioaccumulation of heavy metals whereby the pollutants travel up the trophic levels of the food chain and affect an increased number of different species. A study in the Kafue flats demonstrated bioaccumulation of heavy metal contaminants from mining in vegetation, fish and ungulates (Kafue Lechwe, *Kobus leche*), and raised concerns around similar impacts on cattle and humans (Syakalima et al. 2001). Bioaccumulation, and impacts on fish breeding and mortality as well as human health, has obvious implications for this Project where the mine site is drained by direct tributaries into the Zambezi River. Lethal and sub-lethal effects on wildlife would occur from ARD due to heavy metals, sulfates and low/acidic water PH, and flora and fauna are included by the Company in the cumulative impacts of from mining in Table 6 above.

Contaminants such as heavy metals can persist in the environment for hundreds of years. Given the water catchment and river systems at the Project site, stream and river sediment is likely to play a key role in ongoing pollution from any contamination events such as ARD. Contaminants in air and soil normally end up in the aquatic system via precipitation, run-off and leaching and therefore water is often the most polluted phase in an ecosystem (Issa et al. 2011). Sediments store and concentrate contaminants and release them into the environment due to water flow disturbance and changes in water chemistry, as well as releasing them into vegetation and macroinvertebrates and thereby into the food chain (Li et al. 2012; Abdel-Baki et al. 2011; Fernandes et al. 2007). The sediments therefore act as long-term contaminant sinks. These long-term contamination issues are entirely neglected in the Company's EIS.

In addition to ARD and contamination risks from the Project, there are several other factors that are likely to negatively impact wildlife in the LZNP. Open pit mining by its very nature will entail large scale deforestation since it removes all surface materials and generally expands until the resource being mined runs out. Even with best practice environmental management standards in place, deforestation and removal of surface soil and rock in the steep escarpment area is still highly likely to increase instability, erosion, siltation of tributaries and the Zambezi River, and result in further toxic water and sediment pollution. Any rehabilitation efforts post-mining could be compromised by the steep nature of the terrain being difficult to stabilize and re-vegetate.

Deforestation risks will also increase due to timber needs for mine site construction and due to direct and indirect encroachment pressure from

increased road access into the National Park, and growth of mining towns/communities in and around the National Park (Mwitwa et al. 2012). Road building and community development also increase the likelihood of illegal wildlife poaching activity. Importantly, during the exploration stages of the Project an increase in poaching near the roads to mine site was documented, which was acknowledged by the Company. Anecdotally, a substantial increase in timber felling has been observed, associated with the current construction of a road from the Chiawa Bridge to Chiawa GMA. The loss of timber was from clearing and construction of the roadworks camp and does account for the anticipated timber loss from clearing of the road reserve (pers. comm).

The potential impacts on the flora and fauna of the national park as stated in the EIS are evaluated below, and further information is then explored in section 3.5.2 of this report.

3.4.1 Review of the Project EIS assessment of impacts on flora and fauna

In terms of effectively assessing the potential impacts of the Project on flora and fauna, the Project EIS fails dramatically. One key purpose of an EIS is to provide baseline data before the Project proceeds, for relevant flora and fauna. This enables changes in species distribution, density and diversity to be measured against the baseline data so that impacts can be detected and mitigated. For changes to be measured over time, survey methods need to be scientifically robust so that statistical analysis can be performed, and methods must be repeatable. At this very basic scientific level the Project EIS fails. In the Project EIS sections 4.7 to 4.13 there are critical flaws in the methods used that undermine any conclusions drawn. A few examples are provided here.

In the Aquatic Ecology Section 4.7, the methods referred to by the Project proponents, NSW Government of Australia's "Waterwatch Field Manual, are methods used for teaching secondary schools and community groups in NSW Australia, they are not of a suitable professional standard for an EIS. Only two sites per stream are sampled for aquatic ecology assessment and no sample site locations are given, nor is the number of samples taken at each site stated – thereby making it impossible to repeat the survey or undertake any meaningful data analyses. Sampling at only two stations within 100m of each other means there is insufficient data to evaluate downstream impacts and the sample sites may even have been upstream of expected impacts. Critically, there is no analysis of stream or river sediment to create baseline data, which is where contaminants would most likely be detected, and also where contamination can have long term impacts. Sampling methods for fish and aquatic plants are even poorer quality, with no methodology details given.

For water quality analysis, a single sample was collected at each stream. There is no replication so sampling design is insufficient and there is no consideration in the survey design of seasonal effects and water flow which are vital at this site due to seasonal rainfall.

Section 4.8 on Terrestrial Ecology/Flora is of similar quality. There are no details provided on the number, length, width or placement of survey transects so methods cannot be repeated, and "Numerous stops" as used in the Project EIS is not an acceptable way to describe survey effort. No published scientific method is referred to or described; therefore results cannot be evaluated by ZEMA or anyone other parties and are largely meaningless for the purposes of an EIS. The Project EIS states rainy season sampling was not undertaken because it was "not easy", despite known seasonal changes in flora and fauna for this area. This content of this EIS section does not meet any form of minimal scientific standard.

Section 4.9 provides an Ornithological Survey but no methods are described, therefore this section cannot be scientifically evaluated and is not acceptable as an ecological study. The Project EIS appears to present only presence/absence data collected by the Zambia Ornithological Society (ZOS) Bird Atlas, raising questions about whether any actual data were collected for this Project EIS. Since there are no data on bird density and distribution, no evaluations of changes over time can be made which again undermines the purpose of the Project EIS.

The section 4.11 on Amphibians and Reptiles is of particular concern since species such as frogs are known to be sensitive to pollution and can be indicators of environmental change. As per the other Project EIS sections mentioned above, there are insufficient methods presented for any scientific evaluation of results. No descriptions are given of sampling design, the area surveyed, or level of replication. Only single season sampling was undertaken and that was prior to the main part of the rainy season, which is less than optimal for surveying amphibians. Results are descriptive, not scientifically referenced, and present only presence/absence data that is insufficient to assess the impacts of the mine on the population demographics and distribution of amphibians and reptiles.

The poor data quality trend continues for Section 4.12 on Small Mammals. A review table is presented showing a diverse array of small mammal species believed to be in the area including primates, carnivores and antelope species. Yet the only targeted surveys carried out were for rodents, and a single mist net on one night for bats. There are some opportunistic and anecdotal species sightings presented, but no distribution or abundance data for any species. Therefore it is not possible to estimate potential impacts of the mine. **Regardless of these major shortfalls, the Project EIS uses the lack of data to state "*There is little apparent evidence of any impact from prospecting and exploration operations carried out to date on the mammal fauna, either by introductions or by removal or disturbance of species.*"**

The importance of rigorous survey methods cannot be overstated; failing to find a species from low sampling effort does not in any way imply its absence from the site. Similarly, a failure to establish baseline data or detect changes in species abundance should not be used to imply there would be no impacts from the Project. The methodological approach used in this Project EIS appears to be the equivalent of sticking one's head in the sand and then stating there will be

no impacts from the Project since none were found. The survey information presented in the Project EIS, used to conclude a lack of expected impacts from the mine on flora and fauna, is grossly inadequate at the very least. It of such poor quality that it suggests the Company has not taken the Zambian EIS process seriously.

Section 4.13 on large mammals raises more questions about the intent behind the Project EIS. The limited data presented are not in any way adequate to determine the stated objectives of describing *"Animal movements within the area; Habitats / Locations of special importance, (or) Interactions between wildlife and mining operations"*. Data also appear to be intentionally misrepresented. The Project EIS cites a study by Leigh (2005) on endangered African wild dogs (*Lycaon pictus*) and states that the home range of African wild dogs is restricted to the valley floor, implying the species will not be impacted by the mine in the escarpment. However the figures in the Project EIS, copied from Leigh (2005), show home ranges that include the escarpment. Importantly, the 2005 study states clearly that the escarpment is used as a breeding refuge by this species, when packs are most sensitive to disturbance, but the Project EIS fails to mention this.

The Project EIS acknowledges a lack of data in some cases, but does not propose to undertake or resource any further studies. It is not the role of this Project EIS to recommend further studies, it is the responsibility of the Project EIS authors to provide sufficient data to verify any conclusions drawn. Instead the lack of data is used to conclude "*Since the location of the proposed mine area is not on the Valley floor but in the centre of the Park, with little presence of wildlife (low in abundance but diverse), its operations will not influence dispersal systems already established between Lower Zambezi National Park and its adjacent protected areas*." This section of the Project EIS is flawed in all respects.

3.4.2 Additional evaluation of impacts on flora and fauna

The Lower Zambezi National Park is an area of international conservation significance. Although ecological studies are lacking, it is known that several Red Listed species occur inside the potential mining impact area. These are listed in Table 7 below (IUCN 2014b). The table includes only the species which are listed under IUCN "threatened" species categories, all of which already face a high to extremely high risk of extinction in the wild; ie those that are critically endangered (CR), endangered (EN) or vulnerable (VU). On a landscape scale, the LZNP lies opposite the World Heritage Site containing Mana Pools National Park, Sapi and Chewore Safari Areas. Contrary to the Project EIS which states the Project will be downstream from the World Heritage Site, it lies directly opposite and shares a common water resource, the Zambezi River. Any major contamination events such as ARD are likely to impact the World Heritage Site. Mana Pools was also designated as a wetland of international conservation significance under the Ramsar Convention on Wetlands in 2013, emphasizing the importance of the regional water resources.

Table 7. List of known IUCN Red List threatened species occurring in the Lower Zambezi National Park

Common Name	Scientific Name	Red List category and criteria (ver 2014.2)
African lion	Panthera leo	VU A2abcd
African wild dog	Lycaon pictus	EN C2a(i)
Hippopotamus	Hippopotamus amphibious	VU A4cd
African elephant	Loxodonta africana	VU A2a
Lappet-faced vulture	Torgos tracheliotos	VU C2a(ii)
White-headed vulture	Trigonoceps occipitalis	VU C1+C2a(ii)
Threespot tilapia	Oreochromis andersonii	VU A3e
Kariba tilapia	Oreochromis mortimer	CR A2ae

In February 2014 the Company put out a press release, claiming they would deliver the "*world's greenest copper mine*" (Vanspeybroeck 2014). This is an ambitious claim for a company with no track record in copper mining and one that has presented an EIS of the quality they submitted to ZEMA. In the press release, ZRL claim "*The mine site is in a remote, inaccessible and sparse part of the park, on the upper escarpment, more than 35 kilometres away from the Zambezi River, with no surface water and consequently very few animals*".

Firstly, the Project EIS has clearly demonstrated that the Company has no scientific data on the abundance of animals at the site, nor any concept of the potential impacts on animals downstream from the Project. Secondly, their estimate of the location of their own Project is incorrect. According to the Company's own Project EIS maps, and the physical ground-truthed location of the main exploration site, the mine is 19km from the Zambezi River. If it were 35km back from the Zambezi River it would be outside the northern boundary of the National Park. More importantly, the edge of the exploration site is only 3.5km from the valley floor, where wildlife populations are concentrated (Figure 5). Figure 6 shows an aerial photograph taken from above the exploration site, looking along the Kangaluwi Stream that drains into the valley floor and Zambezi River.

Lastly, the line of sight geographic distance from the Zambezi River is not nearly as significant as the fact that the mine is elevated in a water catchment and all contaminants would eventually flow downstream into tributaries, the valley floor and the Zambezi River. This contaminant dispersal is likely to be rapid during the seasonal heavy rains.

The waterways draining the Project site, the Chakwenga and Mushika Rivers and the Kangaluwi Stream, are direct tributaries to the Zambezi River and available for wildlife use both in the escarpment and the valley floor. Contrary

to comments by the Company, the Project will impact significant wildlife areas. It is also notable that tourism operators have lodges or camps near the confluences where the Chakwenga and Mushika Rivers meet the Zambezi River.

The section of valley floor lying only 3.5km from the exploration site is part of a wildlife corridor joining the Lower Zambezi National Park with South Luangwa National Park. Few detailed ecological studies of fauna have been undertaken in the Lower Zambezi National Park, however studies of endangered carnivores such as the African wild dog have revealed that the valley floor stretching from the Zambezi River up through the Rufunsa GMA, following the Luangwa River, is an important corridor for gene flow and for ensuring population viability (Leigh 2005; Leigh et al. 2012). This has been confirmed with recent sightings of African wild dogs in each GMA between the Lower Zambezi National Park and South Luangwa National Park (Zambian Carnivore Programme, pers. comm.). The area forms a natural river valley corridor, with escarpment on either side, and is comprised mainly of GMAs (see Figure 7). It is highly likely that this corridor is used by a range of mobile mammal species and is important for sustaining wildlife populations and for maintaining genetic fitness for a range of species in both National Parks. Elephants have been documented using the escarpment area and the valley floor in the vicinity of the mine (Project EIS, Figure 4.27) and are abundant in Rufunsa GMA, a key part of the corridor (Simukonda & Craig 2009). Sighting plus spoor recorded from ZAWA Wildlife Police Officer patrols in 2013 and 2014 have indicated that lions also use the wildlife corridor area (unpublished data, CLZ, see Figure 5).

Figure 5. Map showing the distance of 3.5km from the Project exploration site to the valley floor, which is discernible by the change to darker green vegetation on the satellite image. Large carnivores including endangered species African wild dogs and lions have been documented using the natural river valley corridor and moving between Lower Zambezi National Park and South Luangwa National Park. Unpublished data from anti-poaching patrols in 2013/14 is shown on the map. (Map source Google Earth).

Figure 6. Aerial photograph taken from directly above the south eastern edge of the exploration site, looking down Kangaluwi Stream and showing the proximity to the valley floor and Zambezi River. The stream drains the exploration site into the valley floor through a wildlife corridor area and into the Zambezi River. To the west it runs into the Mushika River (photo by K. Leigh).

The escarpment itself is home to a range of habitat-specific species such as Roan and Sable antelope (*Hippotragus equinos and H. niger*) that occupy the miombo woodlands (Viljoen 2013). Due to the forest cover many of these species are difficult to detect by aerial surveys, so abundance is not known. However, as discussed above, lack of data does necessarily imply low numbers of any species, and since the EIS failed to do so, rigorous survey methods should be used to establish baseline data on distribution and abundance. Based on presence absence data the EIS confirms the presence of Roan and Sable antelope in the escarpment as well as Lichtensteins' hartebeest, eland, buffalo, zebra, elephant, warthog, bushpig, greater kudu, bushbuck and klipspringer (Petterson et al. 2012 pp126). Large carnivores lion and leopard were also recorded. Data from aerial surveys and scout patrols, plus opportunistic spoor counts from a recent site visit all confirm the presence of these species (Viljoen 2013; unpublished data). Therefore the impacts of the mine could affect a diversity of large mammals and further data should be collected to establish species status in the area.

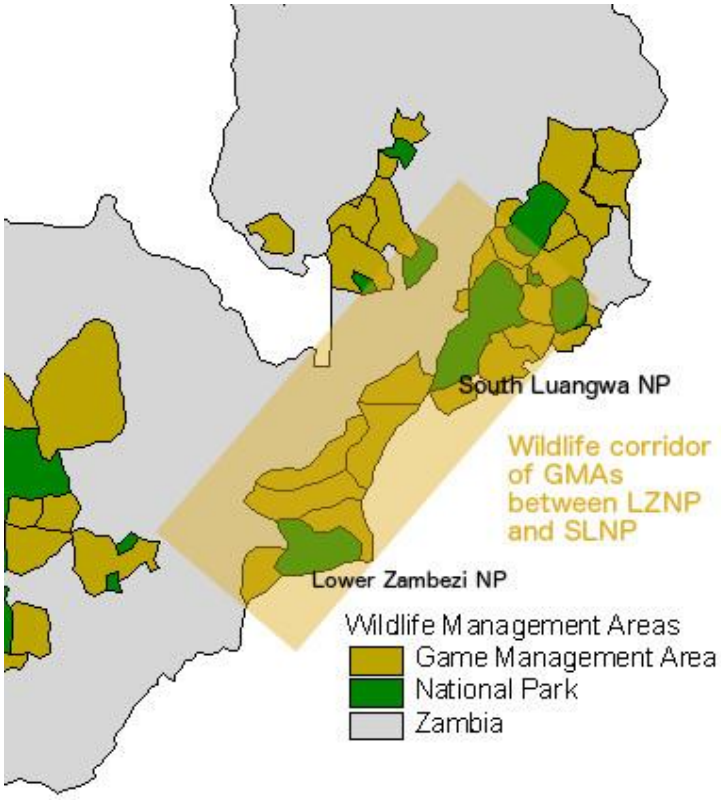


Figure 7. Map showing the wildlife corridor of GMAs running along the eastern boundary of the Luangwa River, between the Lower Zambezi National Park and South Luangwa National Park. Image modified from (Lyons & Lewis 2000)

3.5 Consideration of Alternatives

A primary aim of an EIS is to consider alternative sites for a mine, as well as alternative technologies. The Project EIS instead refers to potential technical review of alternative sites in the Bankable Feasibility Study (BFS) and completely fails to address this requirement. In terms of considering technical alternatives, the US independent reviewer states:

"*According to the EIS (Section 3.7) no substantive alternatives have been identified for the project. This fails to fulfill the purpose of an EIS as previously stated. The EIS should identify alternatives such as those dealing with seepage management (e.g. source controls and/or capture systems) for the waste rock dump and tailings disposal, in addition to key alternatives such as whether a pit lake should, or should not be allowed to form after mining ceases. The lack of any real alternatives analysis, which is the primary purpose of an EIS, would also certainly result in it being rejected by the US EPA.*"

In May 2012 a submission to ZEMA of an independent review of the Project EIS pointed out that the list of experts consulted did not include a hydrologist, and that water related issues were pivotal and the advice of water specialist's should be fundamental to assessing the environmental impact of the Proposal (Appendix 1). Kuipers stated:

"*Any proposed industrial development within a National Park should be subject to detailed scrutiny and the standard of Environmental Impact Assessment related studies, and reports thereon, should be correspondingly broad and detailed. The technical mining aspect of the EIS report falls well short of the standard of responsibility and professionalism demanded of such a development even outside a National Park*"

While recent communications from the Minister for Lands, Natural Resources and Environmental Protection have suggested that dry stacked tailings are now being considered as alternatives, no technical information in this regard has been supplied to ZEMA or stakeholders. Notwithstanding this proposed change, the fundamental flaws of the Project remain in terms of: mine scope (how many pits over what sized area), life of the mine, the nature of the underlying resource to be mined (copper oxide or sulphide?), and the volume of production and waste rock and tailings. All of this is critical information for any assessment of impacts, regardless of the tailings storage method. The extremely poor quality of information supplied by the Company to date does not allow proper evaluation and before any permits are granted all proposed changes to the project since the date of the Project EIS submission should be submitted by the Company with sufficient technical detail to allow proper evaluation.

It worth noting that dry stacked tailings systems are more costly to implement and that has further implications for the economic viability of the Project. This tailings storage technique is normally used in arid or very cold environments, and brings with it requirements for diversion of surface water away from the stack, catchment and routing of precipitation, and a collection and management system for surface water, ground water and seepage from the dry stack itself (Valance 2012). In the steep topography and high rainfall of the Project site this could be extremely challenging to implement.

3.6 Failure to budget for closure and rehabilitation of the site

The Project EIS outlines a closure cost estimate of US$259,300 (pp 300 of the Project EIS). As a comparison, typical reclamation and closure costs of a mine the size of Kangaluwi in the USA have been estimated at US$10-$50 million, with any ARD contamination increasing costs tenfold to US$100-500 million or more. (Appendix 1)

Experts note "*The extremely small amount estimated in the EIS is indicative of the extremely unprofessional manner in which this project is being proposed and the significant extent to which the EIS is inadequate*."

One example is the reference in the Project EIS (Section 6.3), which is discussed in detail in the independent review in Appendix 1. The Project EIS states "*Pit dewatering will cease at the end of the project. The pit will be allowed to flood naturally by allowing groundwater inflow and direct precipitation. This will create a new surface water resource for the surrounding wild animals that could use it, recreational facility within the Park and an aquatic nature preserve or a fish pond. The water in the pits will be monitored as part of the mine's post closure environmental monitoring program in order to evaluate water quality so that*

actions can be implemented in the event of significant water contamination." The Project EIS contains no substantiation that the pit lake would support such use. Pit lakes from mining generally contain significantly adverse water quality and are normally required to be pumped dry into perpetuity to prevent environmental contamination. Pumping and water treatment costs are typically around $1 million per annum and these costs are not considered in the Project EIS. Critically, the suggestion of allowing natural flooding during intense seasonal rainfall, together with the fact that the project site is drained by direct tributaries to the valley floor and Zambezi River, is likely to ensure long-term contamination of water resources.

The Project EIS refers to their planned adherence to World Bank guidelines for mine closure (pp 295). However, a primary recommendation of the World Bank and International Finance Corporation (IFC, a member of the World Bank Group) is for all mining projects to have a mine closure plan before mining begins, preferably in the design stage where issues to consider include the "*siting of specific components, avoidance of sensitive areas, and the establishment of financial guarantees*"(World Bank 2010). No such plan is outlined by the Company. Arguably, "avoidance of sensitive areas" would have the mine located outside of the National Park and water catchment. Important issues around mine closure include the sudden loss of employment and social services provided to the community (eg. water and power), and ongoing environmental management which is often required well beyond the life of the mine. In line with their failure to address alternatives for the mine site and choice of technologies, the company fails to adequately address any of the potential issues arising from mine closure.

World Bank Group guidelines include:

- International Finance Corporation (IFC) Performance Standards1, April 2006, which endorse planning and management of Environmental, Social, Health and Safety (ESHS) considerations as part of the entire project cycle (including decommissioning and closure);
- The IFC General and Project Specific Environmental, Health, and Safety (EHS) Standards2, April 2007, which provide general and sector specific considerations for enhanced EHS management;
- The Equator Principles III (2013), not a World Bank Group guideline but prepared with reference to the IFC Performance Standards. These Principles provide due diligence to guide investment by financial member institutions and prevent investment in socially and environmentally irresponsible projects. It is extremely unlikely that any member institutions would invest in this Project.

It is clear from the lack of consideration of the full cost and impacts of mine closure, along with a general lack of due diligence in documenting the environmental and social risks from the Project, that the Company has not abided by any World Bank guidelines.

The Project EIS section on Post Closure Mitigation and Rehabilitation Measures (Section 8) does not outline a closure plan at all, but instead states an intention to prepare one. Again this is inadequate for an EIS, since the post closure phase carries significant contamination risk and the purpose of an EIS is to address such risks. Furthermore, the stated objectives of the Company's intended Mine Site Reclamation Plan do not consider the protected area status of the national park. The Project EIS instead states the objective of "*returning the land to condition capable of supporting the former land use (woodland and agriculture)… or an alternative sustainable land use*". There is no legal agriculture occurring inside the national park. The Plan in the Project EIS also intends to ensure the safety of communities through "public consultation and warning signs", however these actions may offer little comfort or safety in the event of ARD contamination.

The Project EIS states that for the open pits (pp 288) "*there is no guarantee that failure in the future will not occur. There will be limited post-closure monitoring on the slope stabilities of the pit*". Despite the significant issues identified above of insufficient consideration of waste rock volume and storage, only a single sentence is offered in the Project EIS indicating some topsoil replacement and re-vegetation. No specifics are given on the scope of activities, there is no consideration of the significant levels of soil and water contamination that are likely to arise from the waste rock (potentially including radioactive materials, see Section 3.2 above), and the budget for this activity is grossly insufficient at a total of US$27,000. Stabilization and re-vegetation of up to 450Mt of waste rock is likely to cost millions of dollars. Based on the information provided by the Company it is extremely unlikely that the Project will meet guidelines set by the Mineral Resources Development Policy (2013) that "*Exploration and mining in protected areas will only be allowed when rehabilitation has been guaranteed*".

The remainder of the Project EIS section continues to present a similar level of inadequate information, failing to take into account the nature of the site inside a national park. This includes leaving concrete foundations in place for future buildings, and leaving transport roads and bridges in place, which is likely to increase illegal poaching pressure on wildlife (see Section 3.4).

4. EVALUATION OF THE COMPETENCY OF ZAMBEZI RESOURCES TO IMPLEMENT A RESPONSIBLE MINING OR EXPLORATION PROJECT.

The information presented above in previous sections of this report clearly demonstrates a litany of failures in the Project EIS and raises serious question about the economic viability of the Project. The available information strongly suggests that ZRL lacks the necessary competence and skills to undertake responsible mining practices in any area, let alone in an ecologically sensitive protected area and water catchment. The quality of information is so poor that several stakeholders and reviewers have raised questions about the motivation of the Company. The documentation provided by the Company suggests a complete disregard for the Zambian legislative process and questions revolve around the true purpose and scope of the Project given that copper mining appears economically unviable at the site.

Beyond the documentation presented so far, the Company has had several opportunities to demonstrate responsible practices and Corporate Social Responsibility. While the Company was active in CSR projects in 2007, as recorded in its first and only sustainability report (Zambezi Resources Ltd 2008) no activities have been apparent since then. During the exploration stages in 2008/09, the Company made two promises to stakeholders and communities in the Lower Zambezi National Park and Chiawa GMA.

The first was to build a school in Kanyangala village, as part of ZRL's Corporate Social Responsibility. Work was commenced, but after more than 5 years of waiting the school has not been completed. Only the foundations were dug, which are now overgrown. Locals say that ZRL hired local village men to dig the foundations and many have not been paid. Below is a picture of the school children and community in 2014, standing on what is left of the foundations, where their school should be (Figure 8).

Figure 8. The site of the promised school for Kanyangala village, where the Company has failed to deliver on a Corporate Social Responsibility project.

Secondly, in the same early stages of exploration, the Company's activities at a site in the Chongwe River catchment, on the border of the Nartional Park, contaminated the Chongwe River. A nearby tourism lodge downstream witnessed a red plume of water flowing down the Chongwe River, and accompanying dead fish floating to the surface. The Company promised to rehabilitate the exploration site, and according to Zambian policy and legislation should be obligated to do so, but to date no rehabilitation activities have been undertaken at this site. The impacts of the pollution plume on the Chongwe River are not known (Figure 9).

Figure 9. The Chongwe River, which was contaminated by a pollution plume during the Company's exploration activities. No exploration site rehabilitation was undertaken by ZRL. (image from www.chongwe.com)

A recent visit to the main exploration site at Kangaluwi, in June 2014, has demonstrated similar disregard by the Company for the environment of the National Park. The camp where workers were based has been left abandoned with rubbish littering the site. From the remaining structural frameworks it is clear that timber from the National Park was used in construction, reinforcing fears of deforestation impacts that are likely to result from Project development. There are numerous exploration sites around the region, most of which have initiated erosion processes and none show any signs of rehabilitation.

The failure to invest resources on even small-scale site rehabilitation, or to demonstrate any concern for the environment, is a strong indication that effective larger scale rehabilitation is unlikely and that this Project will be anything but the "world's greenest copper mine" as claimed by the Company.

There is also evidence of a fossilized forest in the area that may be of natural heritage significance and should be further investigated.

Figure 10. Rubbish left in the storage container at the main exploration site, along with building materials and native timber logged from the National Park used in construction. The plastics left on site pose a threat to wildlife.

Figure 11. Mining exploration sites have not been rehabilitated over the last five years, and have resulted in erosion processes at the top of the water catchment.

Figure 12. Fossilized wood is abundant at the main Project site and may have significant natural heritage values for Zambia.

In terms of accountability, the Company has claimed in its reports and media that it has undertaken extensive stakeholder consultation and obtained their support (Vanspeybroeck 2014)(Zambezi Resources Ltd 2014). Yet there are a great number of stakeholders opposed the Project, who have invited engagement from the Company and not received it. Opposition includes local communities, such as the Community Based Natural Resource Management Forum who are leading the High Court appeal, and the Tonga Traditional Association, which asked the government to revoke the mining license earlier this year. The Association's President said they wanted no further displacement of animals or people from the National Park and stated:

"*We are concerned as people from Southern Province about the manoeuvre by the Minister of Lands Harry Kalaba to issue a mining licence in a National Park. We are wondering in whose interest they are issuing the licence? We ask this government to revoke the licence because it is not in the best interest of the people of Southern Province and Zambia in general*" (Lusaka Times February 18 2014)

A community forum was organized at the University of Zambia in February this year by ActionAid Zambia, for the Company to engage with concerned stakeholders and share new information on the project. The forum was shared over Facebook and Twitter and the venue was full. The Company confirmed they would attend and then failed to so.

The sustainable tourism industry has been largely ignored in the consultation process, despite several attempts to obtain information from the Company. As shown in Section 2.2 of this report, the tourism industry would suffer the greatest potential impacts from the Project, and also invests considerably in wildlife conservation in the National Park.

Figure 13. Concerned community members waiting for ZRL at a forum on the mining issue, which at the last minute the Company failed to attend (images from ActionAid via https://www.facebook.com/lowerzambezi)

There is an additional area of concern that requires clarification. The Company is registered on the Australian stock market as an exploration company, not a mining company. If permission is obtained for the Project, it is likely to be sold on to other developers. At this stage, nothing is known about the company that may undertake the large scale mining.

ZRL's major shareholder and underwriter was LinQ Resources Fund, which had a majority share ownership by IMC Singapore. LinQ became Auctus Resources Fund in 2013, which is still backed by IMC. A major claim of ZRLs company profile is Australian expertise, which to date has not been apparent. The track record of any mining company that undertakes this Project long-term is highly relevant to the potential impacts of the Project, particularly given the lack documentation so far. There is a lack of transparency and accountability for the mining process that requires further investigation.

5. BEST PRACTICE RECOMMENDATIONS FOR MINING IN PROTECTED AREAS

Given the conservation significance of the area, the proposed Project in the Lower Zambezi National Park violates several international best practice frameworks and guidelines.

The proposed mining area lies within the terrestrial eco-region of Zambezi and Mopane Woodlands which supports some of the most significant wildlife populations in Africa (Estes & Greyling 2001). More specifically the region contains the Middle Zambezi- Luangwa freshwater eco-region between Kariba and Cahora Bassa damns (Dallas 2000), and downstream from Cahora Bassa through Mozambique to the Indian Ocean is designated as the Lower Zambezi freshwater eco-region (Tweddle 2000). Directly across the Zambezi River from the mine sites, in the same water catchment, lies the World Heritage Site consisting of Mana Pools National Park, Sapi and Chewore Safari Areas (UNESCO 2014).

In accordance with IUCN recommendations, the International Council for Mines and Metals (ICMM) has undertaken "*not to explore or mine in World Heritage properties. All possible steps will be taken to ensure that existing operations in World Heritage properties as well as existing and future operations adjacent to World Heritage properties are not incompatible with the outstanding universal value for which these properties are listed and do not put the integrity of these properties at risk*" (ICMM 2003). This clearly includes consideration of impacts from projects that are adjacent to or may impact the World Heritage Areas. The proximity of the mine to the World Heritage Site elevates the level of concern over this Project from a local to an international issue.

In 2000 the IUCN put forward recommendations that governments should forbid mining in Category 1-IV Protected Areas. Few governments implemented the recommendations, therefore more recently a joint policy on good practice guidelines for mining and biodiversity was produced by the IUCN and ICMM, which generally recommends no mining in protected areas but also puts thorough biodiversity assessment guidelines in place to ensure that sensitive areas are avoided and mining impacts are minimized (Johnson 2006). The Lower Zambezi National Park, and the affected GMAs, fall under the 1-IV Categories (IUCN 2014a). In the good practice guidelines the ICMM acknowledged that exploration and mining may be incompatible with the objectives for which these areas are designated for protection. That issue has not been properly addressed by this Project proposal.

Furthermore, the ICMM guidelines state that not only should World Heritage sites be "no go" mining zones, but that deliberation should also be given to areas that are currently under consideration for listing. That is the case for the Lower Zambezi National Park, which has been proposed as a World Heritage Site but approval was dependent on the absence of mining in the area.

Based on the evaluation of the Project proposal in this report, it is clearly incompatible with the objectives for which the Lower Zambezi National Park and GMA's have been designated according to the ZAWA (Zambian Wildlife Authority) Wildlife Act (1998). Even if working under standards of international best practice, due to its location and topography in the water catchment, this project is likely to have substantial impacts on the Zambezi River Basin and its inhabitants.

The Project proposal, in its Project EIS, lists several conventions that are relevant to the Project and which it claims to abide by.

Specifically the Project EIS states (pp 9):

"*World Bank Legislation Environmental Assessments according to the World Bank's Operational Procedure 4.01 are to help ensure that projects are environmentally sound and sustainable. The Environmental Assessment process is initiated as early as possible in a project and is integrated closely with the economic, financial, institutional, social, and technical analyses of a proposed project. Environmental Assessments takes into account the natural environment (air, water, and land), human health and safety, social aspects (involuntary resettlement, indigenous peoples, and physical cultural resources) and transboundary and global environmental aspects. It also takes into account variations in different projects and countries conditions, national legislation, and institutional capabilities. As a general principle the Bank favors preventive measures over mitigatory or compensatory measures, whenever feasible.*

2.9 International and Regional Conventions

Zambia is also a party to a number of international and regional conventions signed for addressing common environmental concerns. These include:

• *Statutes for the International Union for the Conservation of Nature and Natural Resources,*

• *Convention of Wetlands of International Importance especially as waterfowl habitat,*

• *Convention concerning the Protection of the World Cultural and National Heritage Agreement on the Action Plan for the Environmentally Sound Management of the Common Zambezi River System,*

• *Framework Convention on Climate Change*

To ensure that the project does not violate any international agreements on environmental protection the above conventions have been referred to. Mwembeshi Resources Ltd. is committed to comply with the above legislation, which regulates most aspects of interaction between the project, the natural environment and interested and affected parties."

As already demonstrated, the Project does not in fact consider any of these conventions or agreements. By neglecting to properly consider the social, environmental, and biodiversity impacts of the Project, and cross-border

implications, the Company contradicts all of these listed frameworks including World Bank Group guidelines, which encompass the IFC Performance Standards on Environmental and Social Sustainability (IFC 2012). By proposing an open-cut mine inside a National Park and water catchment the Project goes against IUCN guidelines, and by failing to properly consider biodiversity impacts it violates the IUCN/ICMM good practice guidelines. By risking long-term damage to an important water resource, based on dubious data and a lack of scientific process, it contradicts conventions around wetland and Zambezi River protection and management. The SADC Protocol on Shared Watercourse Systems includes the Zambezi River Basin so this is also an important legislative instrument for this case (Ashton et al. 2001), which has not been considered. By risking sustainable industry investment including BioCarbon community development projects, and by risks around deforestation and site rehabilitation post-closure, the Project defies the Convention on Climate Change.

We were not able to find any international best practice guidelines that the Project adheres to.

If the Zambian Government seeks to consider mining inside of protected areas, all of the above listed Conventions and frameworks provide international best practice standards to guide development of policy and legislation. It is unlikely any of them would align with this particular Project, even if were implemented under best practice standards, given the sensitive nature of the environment it is located in.

6. POLITICAL AND REGULATORY ENVIRONMENT

A primary concern of most stakeholders, in addition to the potential environmental and social impacts of this Project, is that the proposal to mine inside the Lower Zambezi National Park was given Ministerial approval in the face of a stark lack of policy and legislation to guide its implementation. Further problems revolve around the evaluation of the merit of the Project and the approval process, which were hampered by deficit of both policy and capacity.

A case study on the issue was presented in discussion paper at a SADC regional workshop on the extractive industries in Johannesburg in September 2014 (Kyngdon-McKay et al. 2014). The paper contains a summary of the key legislative and policy issues around this Project, which sets a precedent for mining inside protected areas in Zambia (see Appendix 4).

As outlined in the discussion paper the legal framework as it currently stands involves independent reviews of Environmental Impact Assessments/Statements by ZEMA. As part of the review process ZEMA incorporates technical expertise from a range of stakeholder groups (Zambia Environmental Management Act, 2011). Stakeholder consultation is an important part of the process, and ZEMA must publicly release the EIS to all parties potentially affected by the project.

The Mines and Minerals Development Act (2008) and the Environmental Management Act (2011) then allow for companies to undertake an appeal process against ZEMA's decision, via the Minister for Lands, Natural Resources and Environmental Protection. The shortcoming in this process is that there is no requirement for further independent review, and no requirement for the Minister to share the information that informs his/her decision. To a large degree the Ministerial appeal process thus undermines the independent review process, which is otherwise based on a wide range of technical expertise as well as stakeholder consultation.

In the case of this Project, ZEMA rejected the Project EIS on technical grounds and concern over the impact of the Project on the environment, but that decision was then overturned by the then Minister. The last step is the appeal process through the court system, which is currently underway in the High Court.

A particular concern is that ZAWA's formal position has been opposition to the Project, but ZAWA will be forced to set conditions and regulate the Project should it go ahead. The former Minister for Tourism and the Arts also spoke out against the Project after advice from ZAWA, stating that both tourism revenue and the status of the National Park as a potential World Heritage site were under threat (Lusaka Times 2014). Once a project has been given EIS approval and or approval from ZEMA after appeal to the Minister, ZAWA cannot oppose the decision. Despite then being accountable for regulation of the Project, there

are no guidelines specifically focused on evaluating and monitoring mining inside National Parks for ZAWA to refer to. ZAWA is under resourced and historically has struggled to deliver on its core business of managing National Parks and GMAs (Simasiku et al. 2008; Lindsey et al. 2014). It relies heavily on NGO support for its Wildlife Police Officer patrols in the Lower Zambezi National Park, with Conservation Lower Zambezi providing approximately $200,000 per year in direct support to ZAWA, village scout patrols and aerial surveillance (Stevenson & Harvie 2013). Placing an additional burden of responsibility on ZAWA for managing mining within protected areas, without building legislative instruments and policy, resources and capacity is likely to have dire consequences for protected areas in Zambia.

Compounding this problem is the issue that, at the date of this report, ZAWA has been without a Board of Directors since April 2014 (seven months). Therefore there are extra challenges in place that reduce ZAWA's ability to deal with complex issues such as developing capacity to regulate mining in protected areas.

The current lack of clarity on the capacity of ZAWA, its corporate structure, degree of autonomy, and its interaction with various other government bodies was a point of debate at the recently held Zambia National Conference of the Zambian Parliamentary Caucus (ZPPC) held at the Intercontinental Hotel Lusaka on October 18th 2014. Additionally, the National Wildlife Policy and Wildlife Act is currently under review. The Precautionary Principle would suggest that, while the regulating authority lacks capacity and resources, this is not an appropriate time consider encumbering the organization with additional regulatory responsibilities from large scale mining within National Parks.

As stated by an anonymous reviewer from the mining sector in Zambia; "It is well known that the Government of the Republic of Zambia and its agencies do not have the ability or capacity to enforce the laws in operation today. Until effective enforcement becomes a reality, it should be a fundamental principle that mining is not permitted in National Parks. If mineral resource extraction is to be allowed in Zambia's Parks, it will be necessary to formulate new legislation to regulate such developments"

During the process of review for this Project, there has been substantial opposition, including a Parliamentary Report (Muteteka et al. 2012) which stated:

"(i) the mining licence that Mwembeshi Resources holds was issued without following the requirements of the law and procedure and is invalid and should be revoked;
(ii) there should be no mining in the Lower Zambezi National Park which should be reserved and preserved as a conservation area and heritage for purposes of tourism development;
(iii) the Government should ensure that the issuance of mining licences follows the legal and laid down procedures; further, the work of the inter-Ministerial Committee should be strengthened."

This case has brought to light important issues that require the law to be reviewed, so that appeals to ZEMAs decision are undertaken by a tribunal with suitable technical expertise, or for the Minister to be accountable to a clear and transparent review process that incorporates consultation with technical expertise and stakeholders.

Together with the Conventions mentioned in Section 5 above, there are other documents that should be consulted as part of a legislative review, that already outline requirements for improved governance and transparency (ICMM 2014; Mwitwa et al. 2012; World Bank 2014; Ministry of Mines Energy and Water Development 2013)

It is also worth bearing in mind Zambia's ambition for economic diversification away from mining, which is reinforced in the 6th National Development Plan which includes aims of reversing deforestation, wildlife depletion and land degradation (Government of the Republic of Zambia 2011). This also aligns with Zambia's National Biodiversity Strategy and Action Plan (BSAP) of 2001.

There are currently negotiations under way between the Ministry of Mines, ZAWA and AZMEC (Association of Zambian Mineral Exploration Companies) for mining in GMAs. Under the current legislation, mining companies can explore in GMA's but they cannot extract any minerals, therefore it is not economically feasible to invest in exploration. Policy is in review for this process, under ZAWA's current reforms of the GMA system. ZAWA has recently begun the process of subdividing GMA's into various usage zones.

Some mining companies are requesting site-specific assessments that consider benefits to communities from mining in less developed GMA areas (pers. comm). This may allow for protection of important areas, such as water catchments, ecologically sensitive and highly biodiverse sites, and National parks where sustainable tourism is a viable alternative for communities, along with community development alternatives. Such assessments must be transparent, accountable and open to consultation with all stakeholders, as is emphasized in the Mineral Resources Development Policy (2013).

It is recommended that mining projects inside national parks and protected areas should not proceed until sufficient policy and regulatory frameworks are in place to ensure proper project management, the health and safety of Zambian communities, and mitigation of impacts to the environment including ecosystem services and biodiversity.

7. CONCLUSIONS

The evaluation presented in this report has clearly demonstrated many critical issues around the proposed Project for an open-pit copper inside in the Lower Zambezi National Park.

Economic Impact: Based on the available information the economic viability of the mine is highly questionable. The Project EIS is fatally flawed in meeting the objective of addressing the scope of the project; the size and duration of the Project is not defined, and the calculations used in predicting economic benefits are unsubstantiated. There is no clear economic rationale presented to justify the Project being allowed to proceed, and on the contrary it appears the Project is likely to make a loss.

The impacts on the growing and sustainable tourism industry are likely to be significantly negative, and result in job losses. Considering both the viability of the Project and the impacts on tourism, the Project is likely to result in a net loss of jobs for local communities. It is also likely to impact agriculture as a supplier to tourism, and fisheries due to likelihood of waterway contamination.

Alternative projects are underway that are focused on improving the livelihoods of communities in the Luangwa District, using sustainable forestry techniques. These projects are investing considerable finances, and are likely to result in long term community benefits. The Project puts these sustainable community development activities at risk, which are far more compatible with conserving the biodiversity values for which Zambia's national parks are set aside.

This Project sets an important precedent for Zambia, in proposing large scale international mining inside protected areas. If the Project proceeds at the expense of the tourism industry and sustainable community development projects, it may well jeopardize substantial international development aid that is received annually by Zambia, which totals over US$1 billion. Thus the broader implications of this Project should be carefully considered.

Potential Health and Environmental Impacts: The Project is proposed in a site of international conservation significance, as well as an important water catchment for one of Africa most important river systems. It contains highly diverse flora and fauna as well as several IUCN listed threatened species.

The Project EIS submitted in 2012 is the most relevant document for assessing this Project, since no further substantive information has been provided by the Company. More recent correspondence has also been reviewed but does not address valid stakeholder and community concerns. The standard of the Project EIS is extremely poor, to the extent that it raises questions about the motivation of the Project proponents, who appear to have shown complete disregard for the Zambian EIS process. It lacks both robust data and sound scientific process, and fails to properly address critical potential impacts such as Acid Rock Drainage. It also fails to consider the sensitive nature of the national park and the Zambezi River water catchment.

Considerations of alternatives and of post-mine closure site rehabilitation and risk management are not sufficiently addressed nor budgeted for, adding substantial long-term environmental risk from the Project.

The risk of environmental contamination events from the Project, including ARD, has been independently assessed as highly likely, and would have significant long-term consequences for both human health and the environment.

Due to the location of the Project and the fact it drains into a shared water resource, the Zambezi River, any contamination events would have cross-border implications with Zimbabwe and Mozambique, and impact the World Heritage Site comprising Mana Pools National Park, Sapi and Chewore Safari Areas.

Competency of the Company: The information provided by the Company to date has been vague, contradictory and fatally flawed. Based on this information, and the Company's track record, the Company clearly lacks the skills, expertise and competence necessary to undertake a mine of this nature, at any site, let alone in a protected area and sensitive water catchment. There are also concerns about lack of accountability in the Project, and who would be ultimately responsible for its development.

Best Practice Recommendations for Mining in Protected Areas: Although the Project EIS and Company documentation refer to several conventions and frameworks around international best practice, due to the extremely poor quality of information provided and failure to properly consider social and environmental impacts, the Project fails to meet any of them. In particular, it contravenes IUCN and ICMM recommendations around "no go" areas for mining adjacent to World Heritage Areas, and for protecting Category I-IV protected areas and those with significant biodiversity conservation values. The Project also fails to adhere to World Bank Group guidelines which it claims to subscribe to.

Political and Regulatory Environment: The Project has highlighted important legislation and policy gaps around mining inside protected areas in Zambia. Despite a strong legal framework around independent review of Projects by independent experts and stakeholders under ZEMA, the process becomes flawed by the ability of a single Minister to undermine the assessment process. Additionally, although ZAWA is responsible for setting conditions and monitoring approved mines inside National Parks, there is a lack of policy or legislative guidance to inform such management, as well as a lack of resources and capacity for ZAWA to take on that role.

Based on this evaluation, it is our strongest recommendation that this Project be rejected. Furthermore, we recommend that before any further mining projects inside protected areas in Zambia are considered, that both policy and legislative instruments are put in place by which to properly evaluate each project's merit, and that outline mechanisms to ensure transparency, accountability and resources for monitoring, evaluation and mitigation of project activities.

8. BIBLIOGRAPHY

Abdel-Baki, A., Dkhil, M. & Al-Quraishy, S., 2011. Bioaccumulation of some heavy metals in tilapia fish relevant to their concentration in water and sediment of Wadi Hanifah, Saudi Arabia. *African Journal of Biotechnology*, 10, pp.2541–2547.

Adam, B. et al., 2001. The Interaction between Copper and Coronary Risk Indicators. *Japanese heart journal*, pp.281–286.

Ashton, P. et al., 2001. *An overview of the impact of mining and mineral processing operations on the water resources and water quality in the Zambezi, Limpopo and Olifants catchments in Southern Africa.* Mining, Minerals and Sustainable Deveopment Project, Southern Africa.

Balakrishnan, M. & Ndhlovu, D., 1992a. Wildlife Utilization and Local People : A Case study in Upper Lupande Game Management Area, Zambia. *Environmental Conservation*, 19(2), pp.135–144.

Battaglia, M. et al., 2006. Depauperate macroinvertebrates in a mine affected stream: Clean water may be the key to recovery. *Environmental Pollution*, 140(2), pp.132–141.

BioCarbon Partners, 2014. Lower Zambezi REDD+ Project. Available at: http://biocarbonpartners.com/lowerzambeziredd-project/ [Accessed August 24, 2014].

Blacksmith Institute, 2007. *The World's Worst Polluted Places. The Top Ten of the Dirty Thirty*. The Blacksmith Institute, New York, USA

Carville, D., McPherson, R. & Sokolov, A., 2013. *Zambezi Resources Limited Investor Presentation*. Zambezi Resources Limited. http://www.zambeziresources.com/_content/documents/997.pdf

Central Statistical Office Zambia, 2012a. Zambia 2010 Census of Population and Housing Volume 11: National Descriptive Tables. Available at: www.zamstats.gov.zm [Accessed October 1, 2014].

Central Statistical Office Zambia, 2012b. Zambia 2010 Census of Population and Housing Volume 11: National Descriptive Tables.

Dai, Z.-M. et al., 2007. Comparison of Microbial Community of Acid Mine Drainage from Dongchuan Copper Pyrite. *Progress In Modern Biomedicine*, 7(11), pp.1608–1611.

Dallas, H., 2000. *Freshwater Ecoregions of the World. 558: Middle Zambezi-Luangwa*. World Wildlife Fund and The Nature Conservancy. http://www.feow.org/ecoregions/details/middle_zambezi_luangwa

Dixey, L., 2005. *Inventory and Analysis of Community Based Tourism in Zambia*. Production, Finance and Technology (PROFIT), USAID, Lusaka, Zambia

Dudgeon, S., 2014. Metals in medicine and the environment. Copper mining: from the ground up. *University of Virginia*. Available at: http://faculty.virginia.edu/metals/cases/dudgeon3.html [Accessed October 10, 2014].

Ekosse, G., 2011. Health status within the precincts of a nickel-copper mining and smelting environment. *African health sciences*, 11(1).

Estes, L. & Greyling, L., 2001. *Zambezian and Mopane Woodlands (AT0725). Wild World WWF Full Report*. World Wildlife Fund.

http://www.worldwildlife.org/wildworld/profiles/terrestrial/at/at0725_full.html

Ettler, V. et al., 2014. Surprisingly contrasting metal distribution and fractionation patterns in copper smelter-affected tropical soils in forested and grassland areas (Mufulira, Zambian Copperbelt). *The Science of the total environment*, 473-474, pp.117–24.

Ettler, V. et al., 2011. Tracing the spatial distribution and mobility of metal/metalloid contaminants in Oxisols in the vicinity of the Nkana copper smelter, Copperbelt province, Zambia. *Geoderma*, 164(1-2), pp.73–84.

Fernandes, C., Fontainhas-Fernandes, A Peixoto, F. & Salgado, M., 2007. Bioaccumulation of heavy metals in Liza saliens from the Esomriz-Paramos coastal lagoon, Portugal. *Ecotoxicology and Environmental Safety*, 66, pp.426–431.

Fernández, A., 2010. *Wildlife Conservation in Zambia; impact of Game Management Areas on household income. Thesis submitted in partial fulfillment for the degree of Master of Science.* Michigan State University.

Government of the Republic of Zambia, 2011. *Sixth National Development Plan (2011–2015)*. Lusaka, Zambia.

Haferburg, G. et al., 2007. Biosorption of metal and salt tolerant microbial isolates from a former uranium mining area. Their impact on changes in rare earth element patterns in acid mine drainage. *Journal of Basic Microbiology*, 47(6), pp.474–484.

ICMM, 2014. *Enhancing mining's contribution to the Zambian economy and society. Mining: partnerships for development - Spotlight Series 18 April 2014*, London. International Council on Mining & Metals.

ICMM, 2006. *Good Practice Guidance for Mining and Biodiversity*. International Council on Mining & Metals.

ICMM, 2003. *Position Statement; Mining and Protected Areas. International Council on Mining and Metals*. International Council of Mining and Metals.

IFC, 2012. *IFC Performance Standards on Environmental and Social Sustainability*. International Finance Corporation, World Bank Group.

Issa, B.R. et al., 2011. Assessment of sediment contamination by heavy metals in River Orogodo (Agbor, Delta State, Nigeria). *Current World Environment*, 6(1), pp.29–38.

IUCN, 2014a. *IUCN Protected Area Categories*. International Union for the Conservation of Nature, Switzerland. http://www.iucn.org/about/work/programmes/gpap_home/gpap_quality/gpap_pacategories/ [Accessed October 10, 2014].

IUCN, 2014b. *The IUCN Red List of Threatened Species. Version 2014.2*. International Union for the Conservation of Nature, Switzerland. http://www.iucnredlist.org/ [Accessed October 10, 2014].

Jennings, S., Neuman, D. & Blicker, P., 2008. *Acid mine drainage and effects on fish health and ecology: a review*. Reclamation Research Group Publication, Bozeman, MT, USA.

Johnson, S., 2006. *Good practice guidance for mining and biodiversity.* International Council on Mining and Metals.

Kalin, M., Fyson, A. & Wheeler, W.N., 2006. The chemistry of conventional and alternative treatment systems for the neutralization of acid mine drainage. *Science of the Total Environment*, 366(2-3), pp.395–408.

Khalil, H. et al., 2008. Heavy metal contamination from mining sites in South Morocco: Monitoring metal content and toxicity of soil runoff and groundwater. *Environmental Monitoring and Assessment*, 136(1-3), pp.147–160.

Kruger, F. et al., 1997. Sustainable development and the environment: lessons from the St Lucia Environmental Impact Assessment. *South African Journal of Science*, 93, pp.23–33.

Kuipers, J. et al., 2006. *Comparison of Predicted and Actual Water Quality at Hardrock Mines. The reliability of predictions in Environmental Impact Statements*. Kuipers and Associates and Buka Environmental. Montana, USA.

Kyngdon-McKay, Y., Pearman, G. & Mitchell, P., 2014. *Discussion paper: Best practice guidelines for the exploitation of mineral and hydrocarbon resources in the SADC region.* Estelle Levin Ltd, Sydney, Australia

Lee, C.-C. & Chang, C.-P., 2008. Tourism development and economic growth: A closer look at panels. *Tourism Management*, 29(1), pp.180–192.

Leigh, K. a. et al., 2012. Loss of genetic diversity in an outbreeding species: small population effects in the African wild dog (Lycaon pictus). *Conservation Genetics*, 13(3), pp.767–777.

Leigh, K.A., 2005. *The Ecology and Conservation Biology of the Endangered African Wild Dog (Lycaon Pictus) in the Lower Zambezi, Zambia.* A thesis submitted in fulfillment of the requirements for the degree of Doctor of Philosphy, Faculty of Veterinary Science, University of Sydney.

Leteinturier, B., Baker, A. & Bock, L., 2001. Copper and vegetation at the Kansanshi Hill (Zambia) copper mine. *Belgian Journal of …*, 134(2001), pp.41–50.

Levings, C. et al., 2004. Effects of Acid Mine Drainage on the Estuarine Food Web, Britannia Beach, Howe Sound, British Columbia, Canada. *Hydrobiologia*, 525(1-3), pp.185–202.

Li, X. et al., 2012. Integrated assessment of heavy metal contamination in sediments from a coastal industrial basin, NE China. *PloS one*, 7(6), p.e39690.

Lindahl, J., 2014. *Environmental impacts of mining in Zambia. Towards better environmental management and sustainable exploitation of mineral resources.* Geological Survey of Sweden.

Lindsey, P. a et al., 2014. Underperformance of African protected area networks and the case for new conservation models: insights from Zambia. *PloS one*, 9(5), p.e94109.

Logsdon, M., Hagelstein, K. & Mudder, T., 1999. *The management of cyanide in gold extraction.* International Council on Metals and the Environment. http://www.icmm.com/document/124

Lusaka Times, 2014. Government's position on mining in Lower Zambezi is that expressed by Ministry of Lands-Kapeya. *Lusaka Times, Feb 16*. Available at: http://www.lusakatimes.com/2014/02/16/governments-position-mining-lower-zambezi-expressed-ministry-lands-kapeya/ [Accessed July 30, 2014].

Lusaka Times February 18, 2014. Tonga chiefs condemn mining in the lower Zambezi. Available at: http://www.lusakatimes.com/2014/02/18/tonga-chiefs-condemn-mining-lower-zambezi/ [Accessed March 3, 2014].

Lyons, A. & Lewis, D., 2000. Supporting Community Based Wildlife Conservation in Africa with a GIS Enabled Relational Database. *ESRI Annual Conference Proceedings*. Available at: http://proceedings.esri.com/library/userconf/proc00/professional/papers/PAP780/p780.htm.

Mfula, C., 2014. Zambia mines minister says Glencore unit lay-offs "illegal." *Reuters*. Available at: http://www.reuters.com/article/2014/10/06/glencore-zambia-idUSL6N0S11YA20141006 [Accessed October 6, 2014].

Ministry of Mines Energy and Water Development, 2013. *Mineral Resources Development Policy Zambia*. Republic of Zambia Ministry of Mines, Energy and Water Development. Lusaka, Zambia..

Ministry of Tourism Environment and Natural Resources, 2004. *A Financial and Economic Analysis of the Costs and Benefits of Managing the Protected Area Estate - Zambia Report*. Development Services and Initiatives, Ministry of Tourism, Environment and Natural Resources, Lusaka.

Muteteka, M. et al., 2012. *Report of the Committee on Lands, Environment and Tourism for the second session of the eleventh national assembly appointed on 27th September 2012*. Government of the Republic of Zambia.

Mwitwa, J. et al., 2012. Governance and sustainability challenges in landscapes shaped by mining: Mining-forestry linkages and impacts in the Copper Belt of Zambia and the DR Congo. *Forest Policy and Economics*, 25, pp.19–30.

Nakayama, S.M.M. et al., 2013. Accumulation and biological effects of metals in wild rats in mining areas of Zambia. *Environmental monitoring and assessment*, 185(6), pp.4907–18.

Ndilila, W. et al., 2014. Environmental and toenail metals concentrations in copper mining and non mining communities in Zambia. *International journal of hygiene and environmental health*, 217(1), pp.62–9.

NHMRC, 2009. *Blood lead levels for Australians. An information paper for practitioners and policy makers.* National Health and Medical Research Council, Australia.

O'Halloran, K., Cavanagh, J.-A. & Harding, J.S., 2008. Response of a New Zealand Mayfly (Deleatidium Spp.) to Acid Mine Drainage: Implications for Mine Remediation. *Environmental Toxicology and Chemistry*, 27(5), pp.1135–1140.

OECD, 2011. Aid Effectiveness 2011: Progress in implementing the Paris declaration. , II, pp.1–18.

Petterson, U., Chifunda, M. & Shikwe, A., 2012. *Environmental impact Statement for Large Scale Mining Activities under License Number 15547-HQ-LML. Owned by Mwembeshi Resources Ltd Located in Luangwa District.* GeoQuest Limited, Woodlands, Lusaka Zambia.

Pham, T. et al., 2013. *The economic impact of the current mining boom on the Australian tourism industry*. Tourism Research Australia. Canberra, Australia.

Pope, A., 2005. *Luangwa Safari Association Tourism Study*. Luangwa Safari Assocation, Zambia.

Rencher, A., Carter, M. & McKee, D., 1977. A retrospective epidemiological study of mortality at a large western copper smelter. *Journal of occupational medicine*, 19(11), pp.754–758.

Reuters, 2014a. Zambia considers simpler tax for miners as VAT row simmers. *Mining weekly - taxation, October 6th.*

Reuters, 2014b. Zambia mines minister says Glencore unit lay-offs "illegal." *Mining weekly - taxation, October 6th.*

Schorr, M. & Backer, J., 2006. Localized Effects of Coal Mine Drainage on Fish Assemblages in a Cumberland Plateau Stream in Tennessee. *Journal of Freshwater Ecology*, 21(1), pp.17–24.

Shela, O., 2000. Management of shared river basins: the case of the Zambezi River. *Water Policy*, 2(May 1997), pp.65–81.

Sichilongo, M., Mulozi, P. & Mbewe, B., 2012. *Zambia Wildlife Sector Policy: Situation Analysis and Recommendations for a Future Policy*. World Bank.

Simasiku, P. et al., 2008. *The impact of wildlife management policies on communities and conservation in game management areas in Zambia.* Natural Resources Consultative Forum. Zambia.

Simukonda, C. & Craig, C., 2009. *The elephant survey - a Country Report, Zambia*. Government of the Republic of Zambia; Zambia Wildlife Authority, Chilanga, Lusaka Zambia.

Sola, C. et al., 2004. Heavy metal bioaccumulation and macroinvertebrate community changes in a Mediterranean stream affected by acid mine drainage and an accidental spill (Guadiamar River, SW Spain). *Science of the Total Environment*, 333(1-3), pp.109–126.

Stevenson, I. & Harvie, E., 2013. *Conservation Lower Zambezi Annual Report 2013*. Conservation Lower Zambezi, Zambia.

SurveyMonkey Inc, 2014. SurveyMonkey: Free online survey software. Available at: www.surveymonkey.com [Accessed May 5, 2014].

Syakalima, O. et al., 2001. An investigation of heavy metal exposure and risks to wildlife in the Kafue flats of Zambia. *The Journal of veterinary medical science / the Japanese Society of Veterinary Science*, 63(3), pp.315–8.

Tembo, B.D., Sichilongo, K. & Cernak, J., 2006. Distribution of copper, lead, cadmium and zinc concentrations in soils around Kabwe town in Zambia. *Chemosphere*, 63(3), pp.497–501.

Tembo, G., 2009. *Household Welfare and Natural Resource Management around National Parks in Zambia*. World Bank Environment Department. http://elibrary.worldbank.org/doi/pdf/10.1596/1813-9450-4932

Toovey, L., 2011. Copper Ore Types: Sulfides versus Oxides. *Copper Investing News*. Available at: http://copperinvestingnews.com/6114-copper-ore-types-sulfides-versus-oxides.html [Accessed June 27, 2014].

Tsuma, W., 2010. *Gold Mining in Ghana: Actors, alliances and power*, LIT Verlag Munster, Berlin. pp71.

Tweddle, D., 2000. *Freshwater Ecoregions of the World. 561: Lower Zambezi*,

UNESCO, 2014. World Heritage List - Mana Pools National Park, Sapi and Chewore Safari Areas. Available at: http://whc.unesco.org/en/list/302 [Accessed September 23, 2014].

US EPA, 2014. Radiation protection. Copper mining and production wastes. Available at: http://www.epa.gov/radiation/tenorm/copper.html [Accessed October 10, 2014].

Valance, N., 2012. Not Your Father's Mine: The Rosemont Copper Mine and Dry Stack Tailings. *The Arizona Journal of Environmental Law and Policy*.

Vanspeybroeck, F., 2014. *ASX Announcement. Zambezi Resources promises world's greenest copper mine*. Zambezi Resources Ltd. www.zambeziresources.com [Accessed September 8, 2014].
Viljoen, P., 2013. *Aerial Wildlife Survey: Lower Zambezi National Park, Rufunsa and Chiawa GMAs*. Conservation Lower Zambezi, Zambia.
World Bank, 2010. *Towards Sustainable Decommissioning and Closure of Oil Fields and Mines : A Toolkit to Assist Government Agencies*. World Bank and Government of Norway.
World Bank, 2014. *Zambia Overview.* Available at: http://www.worldbank.org/en/country/zambia/overview [Accessed September 8, 2014].
World Data Atlas, 2014. Zambia -Travel & Tourism Total Contribution to GDP. Available at: http://knoema.com/atlas/Zambia/topics/Tourism/Travel-and-Tourism-Total-Contribution-to-GDP/Total-Contribution-to-GDP-percent-share [Accessed September 29, 2014].
WTTC (2014) *Travel and Tourism. Economic Impact in 2014: Zambia.* World Travel &Tourism Council, London
Zambezi Resources Limited, 2012. *Kangaluwi Copper Project, Corporate Update August 2012.* Zambezi Resources Ltd. www.zambeziresources.com [Accessed September 8, 2014].
Zambezi Resources Ltd, 2014. *Zambezi Resources Annual Report*. Zambezi Resources Ltd. www.zambeziresources.com [Accessed September 8, 2014].
ZDA, 2013. *Zambia Tourism Sector Profile*. Zambia Development Agency, Lusaka.

9. APPENDICES

Please see the attached PDFs for Appendices.

Appendix 1 – Letter containing a summary review of the Company's EIS, by independent international mining expert Jim Kuipers of J. Kuipers and Associates, Montana USA.

Appendix 2 – Full independent EIS review by anonymous senior mining expert in Zambia, all comments included.

Appendix 3 – Summary results from survey on the perceived impacts of mining inside national parks on nature-based tourism.

Appendix 4 - Kyngdon-McKay, Y., Pearman, G. & Mitchell, P., 2014. *Discussion paper: Best practice guidelines for the exploitation of mineral and hydrocarbon resources in the SADC region.* Estelle Levin Ltd, Sydney, Australia.

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