Environmental Scoping Report for Zambezi Regional Council's Proposed Up-Earthing of the Embankment on Muzii Combined School Platform located on the eastern floodplain of the Zambezi Region, Namibia

September 2020

Final Report

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EXPERTISE AND DECLARATION OF INDEPENDENCE

I.N.K Enviro Consultants cc is the independent firm of consultants that has been appointed by Zambezi Regional Council to undertake the Environmental Impact Assessment process.

Immanuel N. Katali, the EIA Lead Practitioner holds a B.Arts (Honors) in Geography, Environmental Studies and Sociology and has over 5 years of experience in conducting EIAs in Namibia.

The consultant herewith declare that this report represents an independent, objective assessment of the environmental impacts associated with the activities of the proposed project.

EXECUTIVE SUMMARY

1. INTRODUCTION

1.1 Objectives of the Study and Opportunity to Comment

This Scoping Report has been compiled and submitted to the Zambezi Regional Council (hereinafter referred to as ZRC) for review and comment on the EIA process that is being undertaken for the up-earthing of Muzii Combined School Platform. The comments and input received for this report will be incorporated and updated to a final EIA report for submission to the Ministry of Environment, Forestry and Tourism (MEFT) for decision-making.

This Report summarises the EIA process being followed and provides an overview of the affected environment. It includes an identification of potential environmental impacts that the activities are likely to have and sets out the consultants' recommendations. The proposed management and mitigation measures relating to the construction activities will be documented in an Environmental Management Plan (EMP), to be compiled as an appendix to the final EIA Report.

1.2 Introduction to the Proposed Project

The Zambezi Regional Council intends on obtaining an Environmental Clearance Certificate (ECC) for up-earthing of the embankment on the Muzii Combined School Platform, in order to allow learners and their parents to relocate to such a higher ground during flood times as a permanent solution to the flooding problem. Furthermore, raising the embankment aims to raise the platform of the school in order to increase the carrying capacity and prevent damage and disruptions of classrooms due to flooding.

The embankment project is proposed to be located approximately 120 km east of Katima Mulilo town on approximately 70 km earth road during dry season and 120 km river transport on the Zambezi River.

Prior to commencement of the construction activities, an Environmental Clearance Certificate (ECC) is required on the basis of an approved Environmental Impact Assessment (EIA). It is with this background that, I.N.K Enviro Consultants cc (I.N.K) an independent firm of consultants, was appointed to undertake the Environmental Impact Assessment process for this project.

2. PROJECT MOTIVATION (NEED AND DESIRABILITY)

Education forms the foundation of any society. The children of today are gearing up to become adult citizens of tomorrow and this growth is parallel to the future of our country, reflected through quality of the present education system. School is the foremost fountain of knowledge children are exposed to. It gives a chance for them to acquire knowledge on various fields of education such as people, literature, history, mathematics, politics, and other numerous subjects. It is responsible for the economic, social, and political growth and development of society in general.

The school learners at Muzii Combined School experience educational hardships and challenges each year due to the flooding problem. As part of the Zambezi Regional Council's attempts to improve the situation at the school, it was deemed necessary to up-earth the school platform in order to allow learners to attend classrooms throughout the year without any disruption and in order to allow learners to become productive members of society in the future.

3. PROJECT DESCRIPTION

3.1 Introduction

The buildings at Muzii Combined School are built with cement and brick, on an elevated piece of land, 200m x 70m next to a stream western side and very low natural ground level on the eastern side. The stream on the western side looks to be quite large. At this school, the aprons have also started to collapse and intervention is needed.

3.2 Fill area

The area where the school is constructed is quite firm but it started to dilapidate and require attention. Considering the service this school provides to the surrounding community, it was decided by the Regional Council to extend the embankment to 200m x 200m.

3.3 Fill Quantity

There is sufficient space available for elevation of the site to the eastern side of the school. This targeted area is very low and in some places the height of the elevated bank will be 3m. It is thus recommended to elevate the entire area 40000m2 as indicated, to 600mm above the highest recent recorded flood level. A calculated volume compacted fill of 126880m3 will be needed to accomplish this task.

3.4 Source Material

The source where the material will be obtained from is approximately 900m east south east from the school at bearing 115 degrees. It is directly accessible without over haul.

3.5 Site preparations for infrastructure

Site preparation includes the demarcation of the footprint of the proposed project, and the laydown area to be located ±15 m from the proposed site, for the storage and partial assembly of the project material or equipment to be used during construction. The proposed sites for the up-earthing will require minimum disturbance i.e. land clearing as the sites are all in relatively open grassland areas.

3.6 Waste Management

Relatively small quantities of waste will be generated during the construction phase. All general waste should be transported to the nearest waste disposal site.

3.7 Water Supply

Water supply for construction purposes and human consumption will be stored in mobile water storage tanks.

3.8 Power supply

During construction, power will be supplied from the existing power source at Muzii Combined School.

3.9 Access Roads

The proposed project is located along paths of existing roads. No new roads will be constructed.

3.10 Employment and Housing

Upon completion of the EIA process, the ZRC will appoint several contractors for the construction phase. These contractors will be required to make priority to locals during the recruitment stages. Due to the distance between Muzii and the nearest town, contractors will be expected to be accommodated on the school grounds of Muzii Combined School in temporary structures.

3.11 Sanitation

Portable toilets with associated septic tanks will be used. The septic tanks will be emptied on a regular basis ensuring no spillages in the proposed sites of construction. The effluent shall be disposed of at a licenced facility.

Due to health and safety concerns, personnel may not relieve themselves in the surrounding environment.

3.12 Timing

The construction will commence as soon as all relevant certificates, permits and funds are in place.

3.13 Rehabilitation of Temporary Construction Sites and Laydown Area

The removal of all temporary construction equipment will be undertaken at the end of construction activities. This will be done as per Environmental Management Plan recommendations.

4. PROJECT ALTERNATIVES

4.1 Alternative Site Locations

No alternative site has been identified because the Muzii Combined School is one of the most flood affected schools in the Region.

4.2 Alternative Area Fill

The area where the school is constructed is quite firm but it started to dilapidate and require attention. Considering the service this school provides to the surrounding community, it was decided by the Regional Council to extend the embankment to 200m x 200m.

An alternative is reducing the fill area to 100 m X 100 m but this may only be a temporary solution to hold back the water from flooding the school.

4.2 Alternative Source Material

The soil condition in the area comprises of clay soil and sandy soil, which serves as the best mixture to compact the ground to higher levels. The soil is readily available in the area, allowing for emergency refill due to possible embankment collapse and regular maintenance, thus no other alternative has been identified.

4.3 The "no project" option

With reference to section 1.3, Education forms the foundation of any society. The children of today are gearing up to become adult citizens of tomorrow and this growth is parallel to the future of our country, reflected through quality of the present education system. School is the foremost fountain of knowledge children are exposed to. It gives a chance for them to acquire knowledge on various fields of education such as people, literature, history, mathematics, politics, and other numerous subjects. It is responsible for the economic, social, and political growth and development of society in general.

The school learners at Muzii Combined School experience educational hardships and challenges each year due to the flooding problem. As part of the Zambezi Regional Council's attempts to improve the situation at the school, it was deemed necessary to up-earth the school platform in order to allow learners to attend classrooms throughout the year without any disruption and in order to allow learners to become productive members of society in the future.

Therefore, the challenge facing the project proponent is its contribution towards achieving these goals while at the same time preventing and/or mitigating potential negative social and environmental impacts. Due to the serious potential direction change in natural water flow, the proponent will have to ensure that the identified mitigation measures and commitments to address change in water flow direction will appropriately be implemented and adhered to.

Without the implementation and adherence of the commitments in the EMP, the project will be a “fatal flaw”.

5. CONCLUSIONS

The environmental aspects associated with the proposed project have been successfully identified as part of this EIA Scoping process. Mitigation measures to promote the positive impacts of the project, as well as to avoid / minimise the negative impacts to acceptable levels will be developed as part of the final report for submission to MEFT.

6. WAY FORWARD

The way forward for the EIA phase is as follows:

- MEFT review the final Scoping (including impact assessment) Report; and
- MEFT provide record of decision.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF ACRONYMS, ABBREVIATIONS AND UNITS

BID	Background Information Document
DEA	Department of Environmental Affairs
EAPAN	Environmental Assessment Professionals of Namibia
EAPs	Environmental Assessment Practitioners
ECC	Environmental Clearance Certificate
EIA	Environmental Impact Assessment
EMA	Environmental Management Act
EMP	Environmental Management Plan
FAO	Food and Agriculture Organisation
I&APs	Interested and Affected Parties
I.N.K	I.N.K Enviro Consultants cc
M^2	Square Meters
M^3	Cubic Meters
MEFT	Ministry of Environment, Forestry and Tourism
NHA	Namibia Hydrogeological Association
OKACOM	Okavango River Basin Water Commission
ZAMCOM	Zambezi Watercourse Commission
ZRC	Zambezi Regional Council

1 INTRODUCTION

This section discusses the aims and objectives of the study and provides a brief introduction on the up-earthing of Muzii Combined School Platform.

1.1 Introduction to the Proposed Project

The Zambezi Regional Council intends on obtaining an Environmental Clearance Certificate (ECC) for up-earthing of the embankment on the Muzii Combined School Platform, in order to allow learners and their parents to relocate to such a higher ground during flood times as a permanent solution to the flooding problem. Furthermore, raising the embankment aims to raise the platform of the school in order to increase the carrying capacity and prevent damage and disruptions of classrooms due to flooding.

The embankment project is proposed to be located approximately 120 km east of Katima Mulilo town on approximately 70 km earth road during dry season and 120 km river transport on the Zambezi River (Refer to Figure 1).

Prior to commencement of the construction activities, an Environmental Clearance Certificate (ECC) is required on the basis of an approved Environmental Impact Assessment (EIA). It is with this background that, I.N.K Enviro Consultants cc (I.N.K) an independent firm of consultants, was appointed to undertake the Environmental Impact Assessment process for this project. More details regarding the EIA process that was followed are presented in Section 1.4.1.

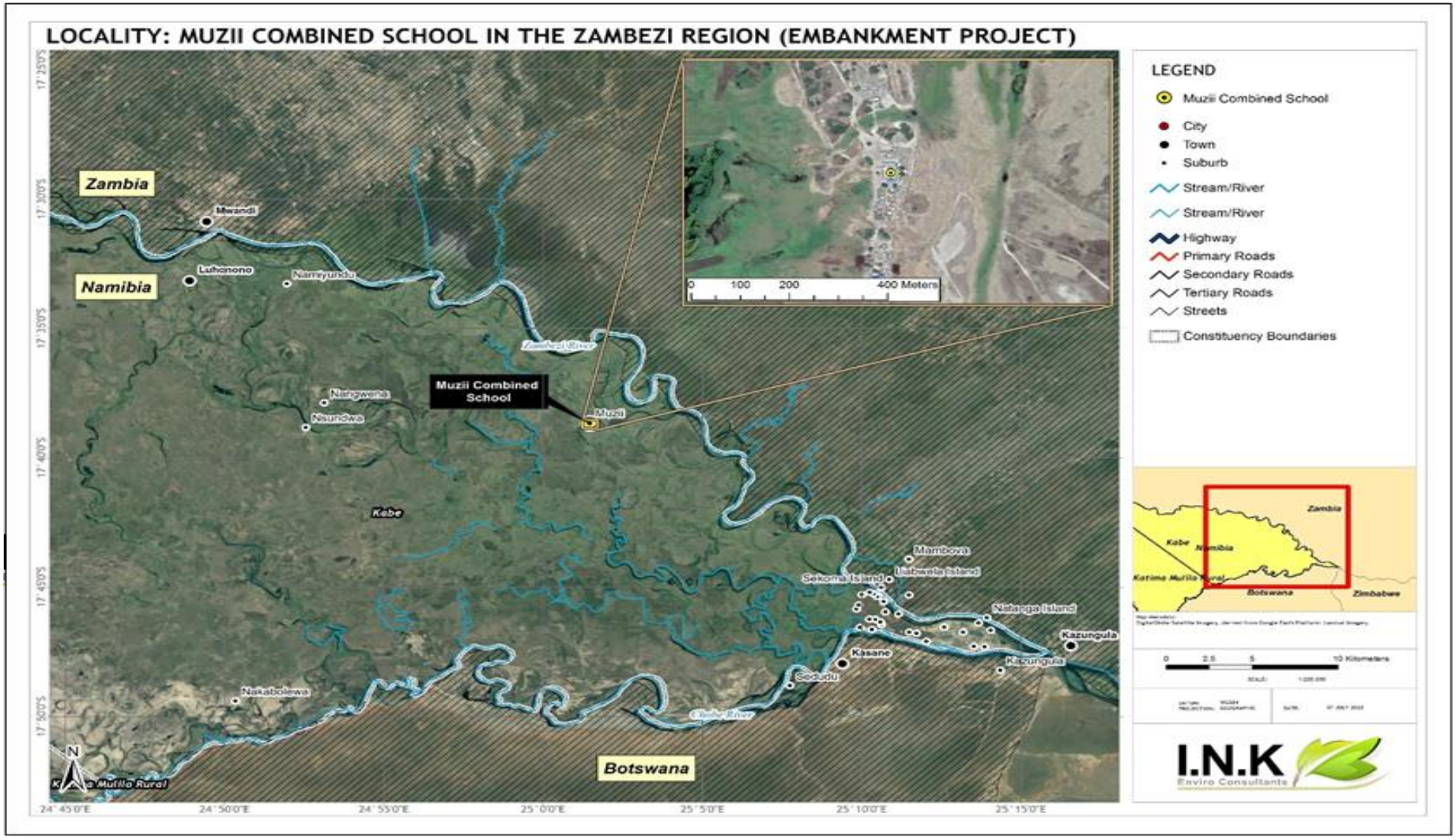

Figure 1: Location of the proposed Up-Earthing of Muzii Combined School Platform

1.2 Project Motivation (Need and Desirability)

Education forms the foundation of any society. The children of today are gearing up to become adult citizens of tomorrow and this growth is parallel to the future of our country, reflected through quality of the present education system. School is the foremost fountain of knowledge children are exposed to. It gives a chance for them to acquire knowledge on various fields of education such as people, literature, history, mathematics, politics, and other numerous subjects. It is responsible for the economic, social, and political growth and development of society in general.

The school learners at Muzii Combined School experience educational hardships and challenges each year due to the flooding problem. As part of the Zambezi Regional Council's attempts to improve the situation at the school, it was deemed necessary to up-earth the school platform in order to allow learners to attend classrooms throughout the year without any disruption and in order to allow learners to become productive members of society in the future.

1.3 Introduction to the Environmental Impact Assessment

Environmental Impact Assessments are regulated by the Ministry of Environment, Forestry and Tourism (MEFT) in terms of the Environmental Management Act, 7 of 2007. This Act was gazetted on 27 December 2007 (Government Gazette No. 3966) and enacted on 6 February 2012. The Environmental Impact Assessment Regulations: Environmental Management Act, 2007 (Government Gazette No. 4878) were promulgated on 6 February 2012.

1.3.1 EIA Process

Table 1: EIA Process

Objectives	Corresponding activities
Project initiation and Screening phase (May 2020)	
• Initiate the screening process • Initiate the environmental impact assessment process.	• Site Visit • Identify Key Stakeholders • Early identification of environmental aspects and potential impacts associated with the proposed project.
EIA Phase with combined Scoping and Assessment (May - September 2020)	
• Notify the decision-making authority of the proposed project • Identify interested and/or affected parties (I&APs) and involve them in the scoping process through information sharing.	• Notify government authorities and I&APs of the project and EIA process (telephone calls, e-mails, faxes, newspaper advertisements and site notices). • Investigations by technical project team. • Compilation of draft scoping report.

Objectives	Corresponding activities
• Identify potential environmental issues associated with the proposed project. • Consider alternatives. • Identify any fatal flaws. • Determine the terms of reference for additional assessment work.	• Distribute scoping (including assessment) and EMP reports to authorities and I&APs for review. • Forward the final scoping (combined assessment) and EMP reports and I&APs comments to MEFT for review. • MEFT review and Record of Decision.
• Provide a detailed description of the potentially affected environment. • Assessment of potential environmental impacts. • Design requirements and management and mitigation measures. • Receive feedback on application.	

Within this framework, the required components of the scoping report are discussed in more detail as part of the scoping methodology in Section 2 below.

EIAs are influenced by national legislation and a range of guidelines. The legislation applicable to this project and the EIA process is discussed further in Section 3 below.

1.3.2 EIA Team

I.N.K Enviro Consultants cc is the independent firm of consultants that has been appointed by the Zambezi Regional Council to undertake the environmental impact assessment and related processes.

Immanuel N. Katali, the EIA project manager and lead practitioner holds a B.Arts (Honours) Degree in Geography, Environmental Studies and Sociology and has over five years of relevant experience in conducting/managing EIAs, compiling EMPs and Socio-Economic Studies. Immanuel is certified as an environmental practitioner under the Environmental Assessment Professionals Association of Namibia (EAPAN).

Ms. Fredrika Shagama, the project Hydrogeology Specialist has over five years of experience and holds a BSc. Geological Engineering, and MSc. Geological Engineering (cum laude) with primary focus in Hydrogeology, obtained from VSB - Technical University of Ostrava, Czech Republic. Fredrika is a member of the Namibian Hydrogeological Association (NHA).

1.3.3 Opportunity to Comment

This EIA Scoping Report (including impact assessment) and EMP were distributed for a 14-day review period from 14 July to 31 July 2020 in order to provide registered IAPs with an opportunity to comment on any aspect of the proposed up-earthing of the embankment and the findings of the EIA process. Hard copies of the report were available at the Zambezi Regional Council offices and was distributed via the

Councillor of the Kabbe South Constituency to be made available at the Muzii Combined School. An electronic copy of the report was provided on request to I.N.K.

2 SCOPING MEFTHODOLOGY

2.1 Information collection

I.N.K used various information sources to identify and assess the issues associated with the proposed project. These include:

- Site visits by I.N.K;
- Consultation with Project Technical Team (ZRC) and relevant information shared by ZRC;
- Consultation with MEFT via online application system;
- Consultation with I&APs;
- Atlas of Namibia;
- Google Earth; and
- Internet sources.

2.2 Scoping Report

The main purpose of this Scoping Report is to indicate which environmental aspects relating to the proposed project might have an impact on the environment, to assess them and to provide management and mitigation measures to avoid or minimise these impacts.

Table 2 outlines the Scoping Report requirements as set out in Section 8 of the Environmental Impact Assessment Regulations that were promulgated in February 2012 in terms of the Environmental Management Act, 7 of 2007.

Table 2: Scoping report Requirements stipulated in the EIA regulations

Requirements for a Scoping Report in terms of the February 2012 regulations	Reference in report
(a) the curriculum vitae of the EAPs who prepared the report;	Section 1.4.2
(b) a description of the proposed activity;	Section 4
(c) a description of the site on which the activity is to be undertaken and the location of the activity on the site;	Sections 4 & 6
(d) a description of the environment that may be affected by the proposed activity and the manner in which the geographical, physical, biological, social, economic and cultural aspects of the environment may be affected by the proposed listed activity;	Sections 6, and 7
(e) an identification of laws and guidelines that have been considered in the preparation of the Scoping Report;	Section 3
(f) details of the public consultation process conducted in terms of regulation 7(1) in connection with the application, including - (i) the steps that were taken to notify potentially interested and affected parties of the proposed application;	Sections 2.3, 2.4, 2.5

(ii) proof that notice boards, advertisements and notices notifying potentially interested and affected parties of the proposed application have been displayed, placed or given; (iii) a list of all persons, organisations and organs of state that were registered in terms of regulation 22 as interested and affected parties in relation to the application; and (iv) a summary of the issues raised by interested and affected parties, the date of receipt of and the response of the EAP to those issues;	
(g) a description of the need and desirability of the proposed listed activity and any identified alternatives to the proposed activity that are feasible and reasonable, including the advantages and disadvantages that the proposed activity or alternatives have on the environment and on the community that may be affected by the activity;	Sections 1.3 and 5
(h) a description and assessment of the significance of any significant effects, including cumulative effects, that may occur as a result of the undertaking of the activity or identified alternatives or as a result of any construction, erection or decommissioning associated with the undertaking of the proposed listed activity;	Sections 7
(i) terms of reference for the detailed assessment; and	Section 7
(j) a management plan, which includes - (i) information on any proposed management, mitigation, protection or remedial measures to be undertaken to address the effects on the environment that have been identified including objectives in respect of the rehabilitation of the environment and closure; (ii) as far as is reasonably practicable, measures to rehabilitate the environment affected by the undertaking of the activity or specified activity to its natural or predetermined state or to a land use which conforms to the generally accepted principle of sustainable development; and (iii) a description of the manner in which the applicant intends to modify, remedy, control or stop any action, activity or process which causes pollution or environmental degradation remedy the cause of pollution or degradation and migration of pollutants.	Section 8

2.3 Public participation process

The public participation process for the proposed project is conducted to ensure that all persons and/or organisations that may be affected by, or interested in the proposed project, were informed of the project

and could register their views and concerns. By consulting with relevant authorities and I&APs, the range of environmental issues to be considered in this Scoping Report has been given specific context and focus.

Included below is a summary of the I&APs consulted, the process that was followed and the issues that were identified.

2.4 Muzii Combined School I&APs

The following table (Table 3) provides a list of persons, group of persons or organisations that were informed about the project and were requested to register as I&APs should they be interested and/or affected.

Table 3: Muzii Combined School Stakeholders

IAP Grouping	Organisation
Government Ministries	▪ Ministry of Environment, Forestry and Tourism (MEFT); • Department of Environmental Affairs (DEA); ▪ Ministry of Agriculture, Water and and Land Reform; • Department of Water Affairs.
Local Governance	Kabbe Constituency
Nearby Residents	Muzii Village
Media	Newspaper adverts: Die Republikein and The Namibian Sun
Other interested and affected parties	Any other people with an interest in the proposed project or who may be affected by the proposed project.

2.5 Steps in the consultation process

Table 4 sets out the steps that were followed as part of the consultation process:

Table 4: Consultation process with I&APs and Authorities

TASK	DESCRIPTION	DATE
Notification - regulatory authorities and I&APs		
Notification to MEFT	I.N.K submitted the Application Form (online system) to MEFT.	30 June 2020
IAP identification	A stakeholder database was developed for the proposed project and EIA process. Additional I&APs will be updated during the EIA process as required.	May 2020 - throughout the process

TASK	DESCRIPTION	DATE
Distribution of background information document (BID)	BIDs were made available to all I&APs on the project's stakeholder database and were available at the scoping meetings. Copies of the BID were available on request to I.N.K. The purpose of the BID was to inform I&APs and authorities about the proposed project, the EIA process, possible environmental impacts and means of providing input into the EIA process. Attached to the BID was a registration and response form, which provided I&APs with an opportunity to submit their names, contact details and comments on the project.	June 2020 – throughout the process
Site notices	A site notice was placed on the premises of Muzii Combined School.	June 2020
Newspaper Advertisements	Block advertisements were placed as follows: ▪ Die Republikein (11 and 18 June 2020) ▪ The Namibian Sun (11 and 18 June 2020)	June 2020
Public meeting and Focus Group meetings and submission of comments		
Scoping Meetings	Several consultations were made with I&APs. This included meetings and telephonic conversations. A public meeting was held on the 23rd of February at the Muzii Combined School.	June 2020
Review of Preliminary Report		
ZRC review of Scoping Report	The Scoping Report is submitted to the ZRC for comments and input which will be incorporated to update to a final EIA report for submission to the Ministry of Environment, Forestry and Tourism (MEFT) for decision-making.	July 2020
MEFT review of Scoping Report and EMP	A copy of the final Scoping (including assessment) Report, including authority and I&AP review comments, will be submitted to MEFT on completion of the public review process via the online application system.	September 2020

2.6 Summary of issues raised

All issues that have been raised to date by I&APs are as follows:

- Change in natural water flow direction;
- Noise impacts on people; and
- Relocation of the residents and school hostel during construction.

3 ENVIRONMENTAL LAWS AND POLICY

This section discusses and describes the governing laws, policies and acts that are relevant to the environmental impact assessment for the proposed project.

The Republic of Namibia has five tiers of law and several policies relevant to environmental assessment and protection, which includes:

- The Constitution
- Statutory law
- Common law
- Customary law
- International law

Key policies currently in force include:

- The EIA Policy (1995).
- Namibia's Environmental Assessment Policy for Sustainable Development and Environmental Conservation (1994).

As the main source of legislation, the Constitution of the Republic of Namibia (1990) makes provision for the creation and enforcement of applicable legislation. In this context and in accordance with its constitution, Namibia has passed numerous laws intended to protect the natural environment and mitigate against adverse environmental impacts.

3.1 Applicable Laws and Policies

In the context of the proposed irrigation project, there are several laws and policies currently applicable. They are reflected in Table 5 below.

Table 5: Relevant Legislation And Policies

YEAR	NAME	Natural Resource Use (energy & water)	Emissions to air (fumes, dust & odours)	Emissions to land (non-hazardous & hazardous	Emissions to water (industrial & domestic)	Noise	Visual	Impact on Land use	Impact on biodiversity	Impact on Archaeology	Socio-economic	Safety & Health
1990	The Constitution of the Republic of Namibia of 1990	X	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**
2007	Environmental Management, Act 7 of 2007	X	X	X	X	X	X	X	X	X	X	X
2012	Regulations promulgated in terms of the Environmental Management, Act 7 of 2007	X	X	X	X	X	X	X	X	X	X	X
1976	Atmospheric Pollution Prevention		X	X					X		X	X

	Ordinance 11 of 1976											
1995	Namibia's Environmental Assessment Policy for Sustainable Development and Environmental Conservation	X	X	X	X	X	X	X	X	X		X
2003	Agricultural (Commercial) Land Reform Amendment Act										X	
2004	National Heritage Act									X		
2013	Water Resources Management Act, 11 of 2013	X			X						X	

3.1.1 Legal Framework for Water Resources Management and Protection

The project's operational primary purpose entails the manipulating the natural water flow at site through the up-earthing of the Platforms. This will in some way not only potentially, at minimum affect water quality and quantity (during up-earthing) but also the dynamics of the rain (flood) water flow in the long run. It is therefore necessary to consider the legislations and legal requirements governing the water management and protection.

The main legal framework presented herein is that of Namibia for the relevant project component under the scope of this document. The chapter also presents a summary of the relevant international legislations and agreements to protect the water resources, specifically the Transboundary Water Resources (Zambezi River).

3.1.2 General National (Namibian) Water Legislations

The Namibian legislations that govern the use, management and protection of water resources and related activities are as follows:

- **Water Act No. 54 of 1956**: To consolidate and amend the laws relating to the control, conservation and use of water for domestic, agricultural, urban and industrial purposes; to make provision for the control, in certain respects, of the use of sea water for certain purposes; for the control of certain activities on or in water in certain areas; for the control of activities which may alter the natural occurrence of certain types of atmospheric precipitation; for the control, in certain respects, of the establishment or the extension of townships in certain areas; and for incidental matters.
- **Water Resources Management Act No. 11 of 2013:** This Act (Government Gazette 5367) has been passed by Parliament, but it has not yet been brought into force. The Regulations have been passed in December 2016 but have not yet been promulgated. Therefore, the Regulations of the 1956 Water Act still apply. The objectives of this Act are to ensure that the water resources of Namibia are managed, developed, used, conserved, and protected in a manner consistent with, or conducive to, the fundamental principles set out in relevant Sections.
- **Environmental Management Act No. 7 of 2007 and its 2012 Environmental Impact Assessment (EIA) Regulations:** The Act aims at promoting sustainable management of the environment and use of natural resources. The Environmental Management Act (EMA) is broad; it regulates land use development through environmental clearance certification and/or Environmental Impact Assessments. The Act provides for the clearance certification for ''***construction of canals and channels including the diversion of the normal flow of water in a riverbed and water transfer schemes between water catchment and impoundments (Regulation 8.4) and construction and other activities in water courses within flood lines (regulation 8.8)".***

- **Soil Conservation Act No.76 of 1969:** The Act makes provision for the prevention and control of soil erosion and the protection, improvement and conservation of soil, vegetation and water supply sources and resources, through directives declared by the Minister.
- **The Water Policy:** National Water Policy White Paper, August 2000 (this laid the basis for the new Water Resources Management Act).

3.1.3 Zambezi River Legal Framework

The main international (inter-governmental) agreement pertaining to this project site is the Zambezi Watercourse Commission (ZAMCOM). As mentioned earlier, the ZAMCOM is a river basin management organisation that was established in 2014 that brings together 8 Riparian states that share the Zambezi River Basin, as stipulated in the 2004 ZAMCOM Agreement and in accordance with the revised SADC Protocol on Shared Watercourses of 2000. The Riparian States to the Zambezi River Basin are: the Republic of Angola, the Republic of Botswana, the Republic of Malawi, the Republic of Mozambique, the Republic of Namibia, the Republic of Tanzania, the Republic of Zambia and the Republic of Zimbabwe (Zambezi Watercourse Commission, 2019).

3.1.4 International Relevant Water Legislations, Policies and Guidelines

The international conventions and Treaties relevant to the use and management of the International (Transboundary) Watercourses according to Hiddema and Erasmus (2007) includes:

- United Nations Convention on the Law of the Non-Navigational Uses of International Watercourses, 1997 (has not yet entered into force).
- SADC Protocol on Shared Watercourses 1995.
- SADC Revised Protocol on Shared Watercourses 2000 (has now entered into force)
- Agreement between Angola, Botswana, and Namibia on the establishment of a Permanent Okavango River Basin Water Commission (OKACOM) 15 September 1994; and
- Agreement between South Africa, Botswana, Lesotho, and Namibia on the establishment of the Orange-Senqu River Commission (ORASECOM).

4 PROJECT DESCRIPTION

This section discusses and describes the proposed project and associated construction activities.

4.1 Introduction

The buildings at Muzii Combined School are built with cement and brick, on an elevated piece of land, 200m x 70m next to a stream western side and very low natural ground level on the eastern side. The stream on the western side looks to be quite large. At this school, the aprons have also started to collapse and intervention is needed.

4.2 Fill area

The area where the school is constructed is quite firm but it started to dilapidate and require attention. Considering the service this school provides to the surrounding community, it was decided by the Regional Council to extend the embankment to 200m x 200m.

4.3 Fill Quantity

There is sufficient space available for elevation of the site to the eastern side of the school. This targeted area is very low and in some places the height of the elevated bank will be 3m. It is thus recommended to elevate the entire area 40000 m^2 as indicated, to 600mm above the highest recent recorded flood level.
A calculated volume compacted fill of 126880 m^3 will be needed to accomplish this task.

4.4 Source Material

The source where the material will be obtained from is approximately 900m east south east from the school at bearing 115 degrees. It is directly accessible without over haul.

4.5 Site preparations for infrastructure

Site preparation includes the demarcation of the footprint of the proposed project, and the laydown area to be located ±15 m from the proposed site, for the storage and partial assembly of the project material or equipment to be used during construction. The proposed sites for the up-earthing will require minimum disturbance i.e. land clearing as the sites are all in relatively open grassland areas.

4.6 Waste Management

Relatively small quantities of waste will be generated during the construction phase. All general waste should be transported to the nearest waste disposal site.

4.7 Water Supply

Water supply for construction purposes and human consumption will be stored in mobile water storage tanks.

4.8 Power supply

During construction, power will be supplied from the existing power source at Muzii Combined School.

4.9 Access Roads

The proposed project is located along paths of existing roads. No new roads will be constructed.

4.10 Employment and Housing

Upon completion of the EIA process, the ZRC will appoint several contractors for the construction phase. These contractors will be required to make priority to locals during the recruitment stages. Due to the large distance between Muzii and the nearest town, contractors will be expected to be accommodated on the school grounds of Muzii Combined School in temporary structures.

4.11 Sanitation

Portable toilets with associated septic tanks will be used. The septic tanks will be emptied on a regular basis ensuring no spillages in the proposed sites of infrastructure construction. The effluent shall be disposed of at a licenced facility.

Due to health and safety concerns, personnel may not relieve themselves in the surrounding environment.

4.12 Timing

The construction will commence as soon as all relevant certificates, permits and funds are in place.

4.13 Rehabilitation of Temporary Construction Sites and Laydown Area

The removal of all temporary construction equipment will be undertaken at the end of construction activities. This will be done as per Environmental Management Plan recommendations.

5 PROJECT ALTERNATIVES

This section discusses and identifies alternatives to the proposed project, to have the best working models that may have none or those that have the least minimal effects.

5.1 Alternative Site Locations

No alternative site has been identified because the Muzii Combined School is one of the most flood affected schools in the Region.

5.2 Alternative Area Fill

The area where the school is constructed is quite firm but it started to dilapidate and require attention. Considering the service this school provides to the surrounding community, it was decided by the Regional Council to extend the embankment to 200m x 200m.

An alternative is reducing the fill area to 100 m X 100 m but this may only be a temporary solution to hold back the water from flooding the school.

5.3 Alternative Source Material

The soil condition in the area comprises of clay soil and sandy soil, which serves as the best mixture to compact the ground to higher levels. The soil is readily available in the area, allowing for emergency refill due to possible embankment collapse and regular maintenance, thus no other alternative has been identified.

5.4 The "no project" option

With reference to section 1.3, Education forms the foundation of any society. The children of today are gearing up to become adult citizens of tomorrow and this growth is parallel to the future of our country, reflected through quality of the present education system. School is the foremost fountain of knowledge children are exposed to. It gives a chance for them to acquire knowledge on various fields of education such as people, literature, history, mathematics, politics, and other numerous subjects. It is responsible for the economic, social, and political growth and development of society in general.

The school learners at Muzii Combined School experience educational hardships and challenges each year due to the flooding problem. As part of the Zambezi Regional Council's attempts to improve the situation at the school, it was deemed necessary to up-earth the school platform in order to allow learners to attend classrooms throughout the year without any disruption and in order to allow learners to become productive members of society in the future.

Therefore, the challenge facing the project proponent is its contribution towards achieving these goals while at the same time preventing and/or mitigating potential negative social and environmental impacts. Due to the serious potential direction change in natural water flow, the proponent will have to ensure that the identified mitigation measures and commitments to address change in water flow direction will appropriately be implemented and adhered to.

Without the implementation and adherence of the commitments in the EMP, the project will be a "fatal flaw".

6 DESCRIPTION OF THE CURRENT ENVIRONMENT

This section discusses and describes the receiving and baseline environment from a local, regional and national context to determine potential positive and negative environmental issues/impacts that will require further assessment in detail.

This section was compiled utilising the following sources of information:

- Visual observations during a site visit by I.N.K
- Google Earth
- Atlas of Namibia
- Internet sources

6.1 Climate

According to Enviro Dynamics (2014), the Zambezi Region receives more than 600mm annually, has average maximum temperatures between 32 and 35°C and average minimum temperatures between 2 and 4°C. The area receives summer rainfall (October to April). Rainfall is highly variable and is often received in intense bursts characteristic of convectional rainfall.

Lushetile (2009, 2015) further states that the highest rainfall is received in eastern Caprivi with an average annual rainfall of about 700 mm in contrast to the lowest totals of about 50 mm in the south-west. There is also a great variation in the temperature across the country. Lushetile further stated that Mendelsohn et al. (2002) argued that this is affected by latitude, altitude, cloud-cover, and proximity to coast. The highest temperatures (43.5°C) have been recorded in the Namib Desert whereas the lowest was recorded in the southern part of the country (Lushetile, 2009, 2015).

The potential evaporation in the project area is in the range of 2400 to 2600mm/a as indicated on the map in Figure 2 below – as shown by the enclosed area of Katima Mulilo on the far Eastern part of Namibia.

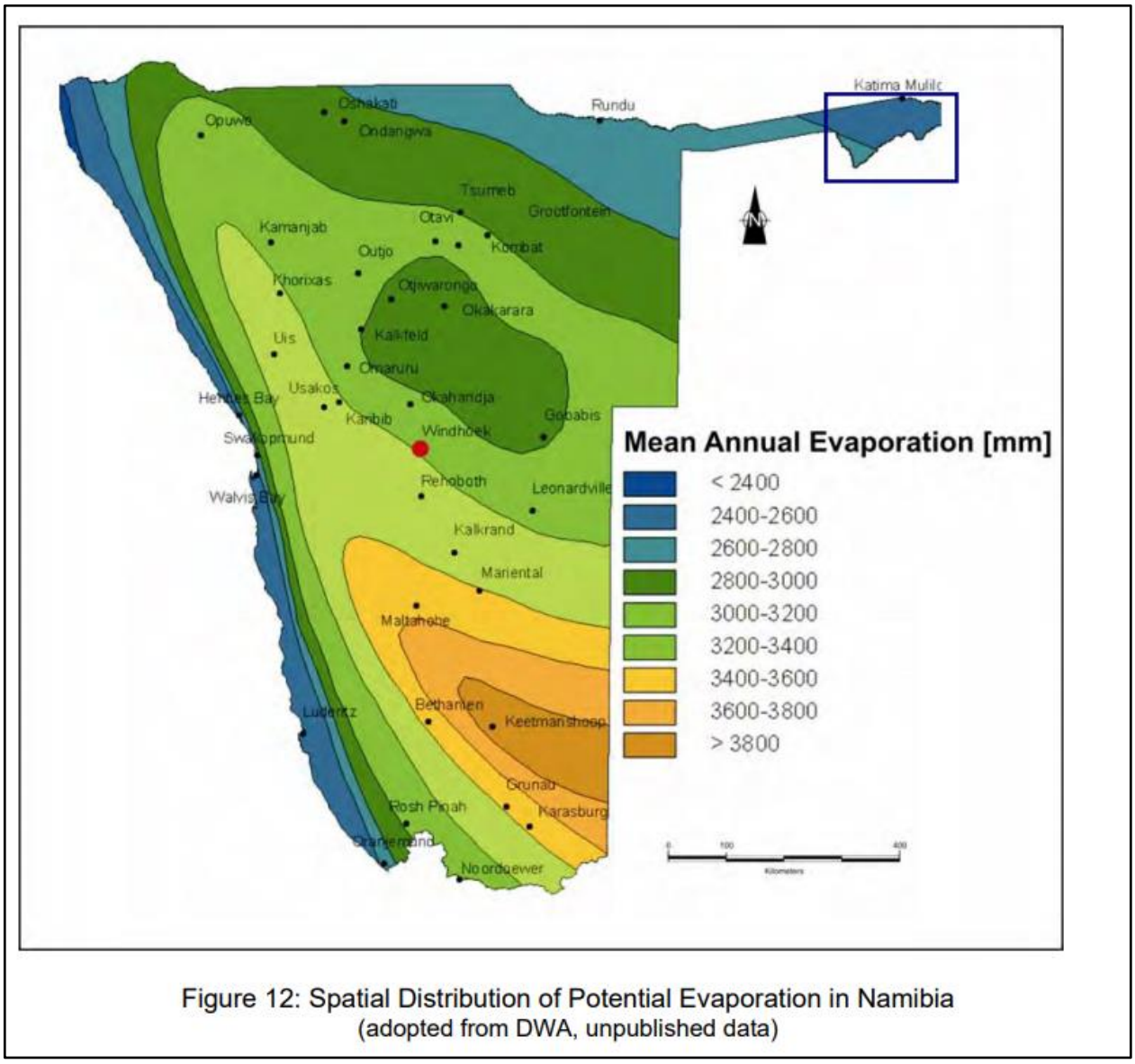

Figure 12: Spatial Distribution of Potential Evaporation in Namibia
(adopted from DWA, unpublished data)

Figure 2: The spatial distribution of potential evaporation in Namibia (after BGR, 2005)

The average rainfall and temperature recorded for Katima Mulilo area in a period of eleven (11) years, i.e. 2009 to 2020 is shown in Figure 3 and Figure 4, respectively. Please note that Katima Mulilo is closest area to the project site area (Muzii) that has available data on the World Weather Online page.

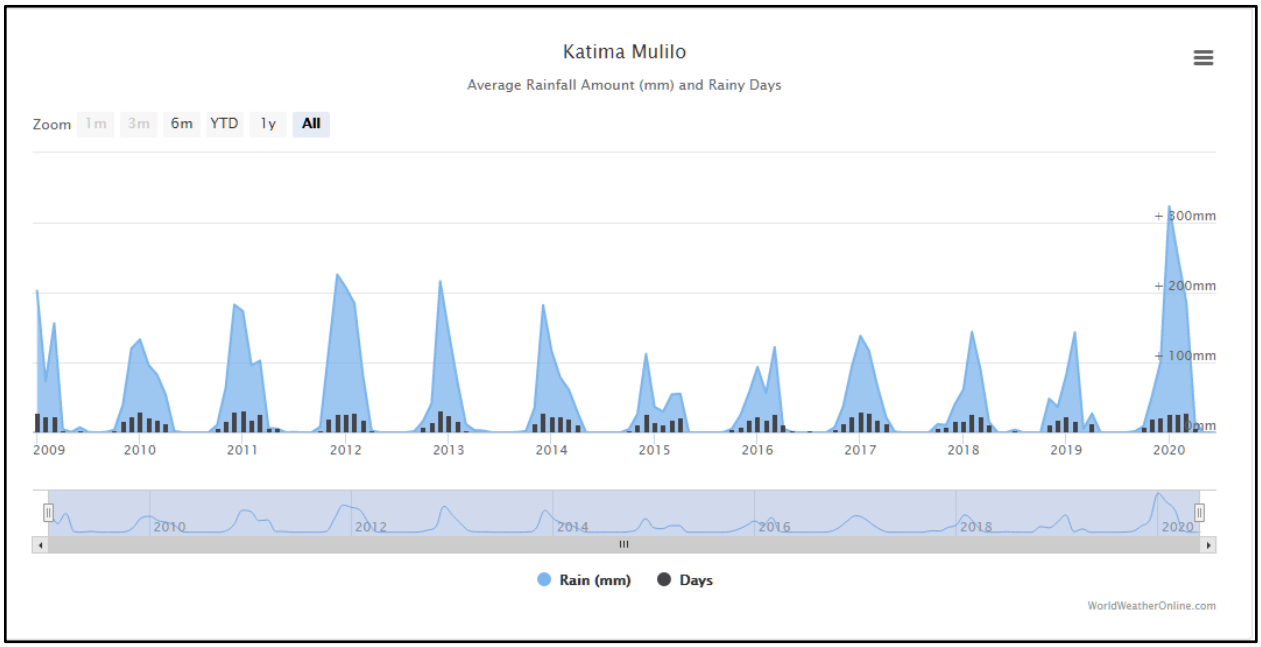

Figure 3: The rainfall patterns for the Katima Mulilo area (source: World Weather Online, 2020)

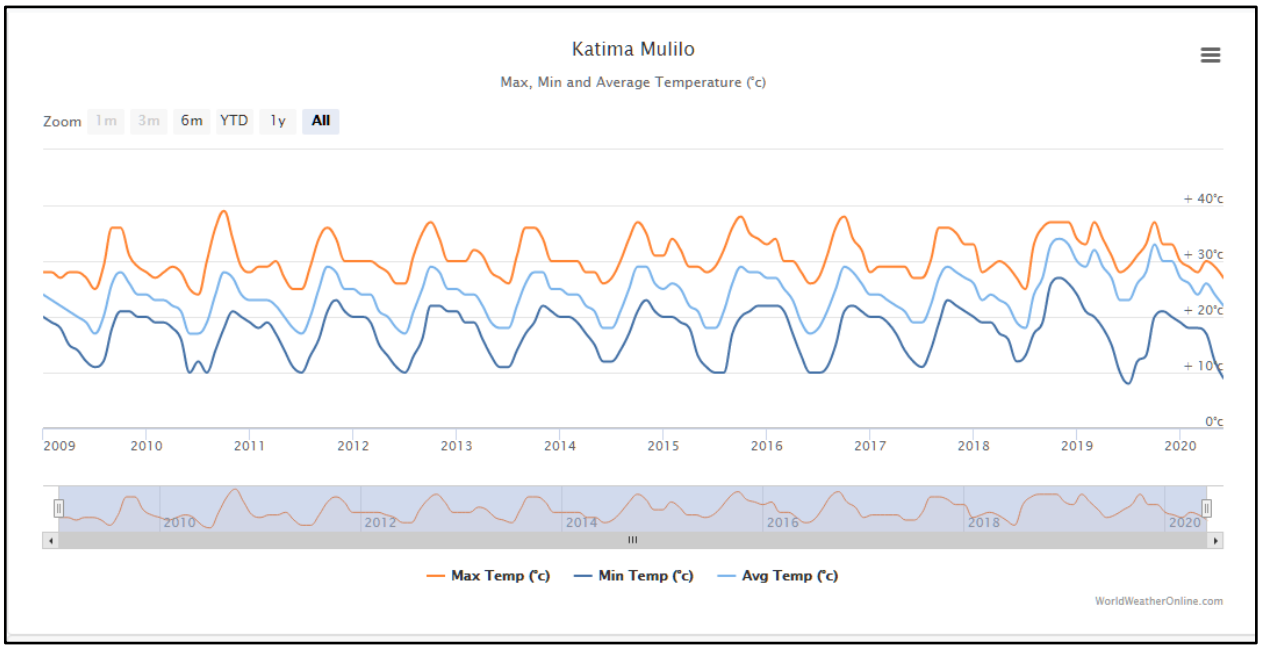

Figure 4: The maximum, minimum and average temperature Katima Mulilo area (source: World Weather Online, 2020)

6.2 Soil and Geology

The site area is covered by the sediments comprising sand and at some areas gravel. The map of soil types of Namibia by Mendelson's 2002 Atlas of Namibia shows that the project site is overlain by fluvisols. According to the Encycloaedia Britannica (2020), this soil group is one of the thirty (30) soil groups in the classification system of the Food and Agriculture Organization (FAO). Fluvisols are found typically on level topography that is flooded periodically by surface waters or rising groundwater, as in river floodplains and deltas and in coastal lowland Encycloaedia Britannica (2020).

The geology of the area is characterized by the unconsolidated to semi-consolidated sands, calcrete and gravel of the Kalahari sediments as shown in the general geology map of the Muzii School and surrounding areas in Figures 5 and 6.

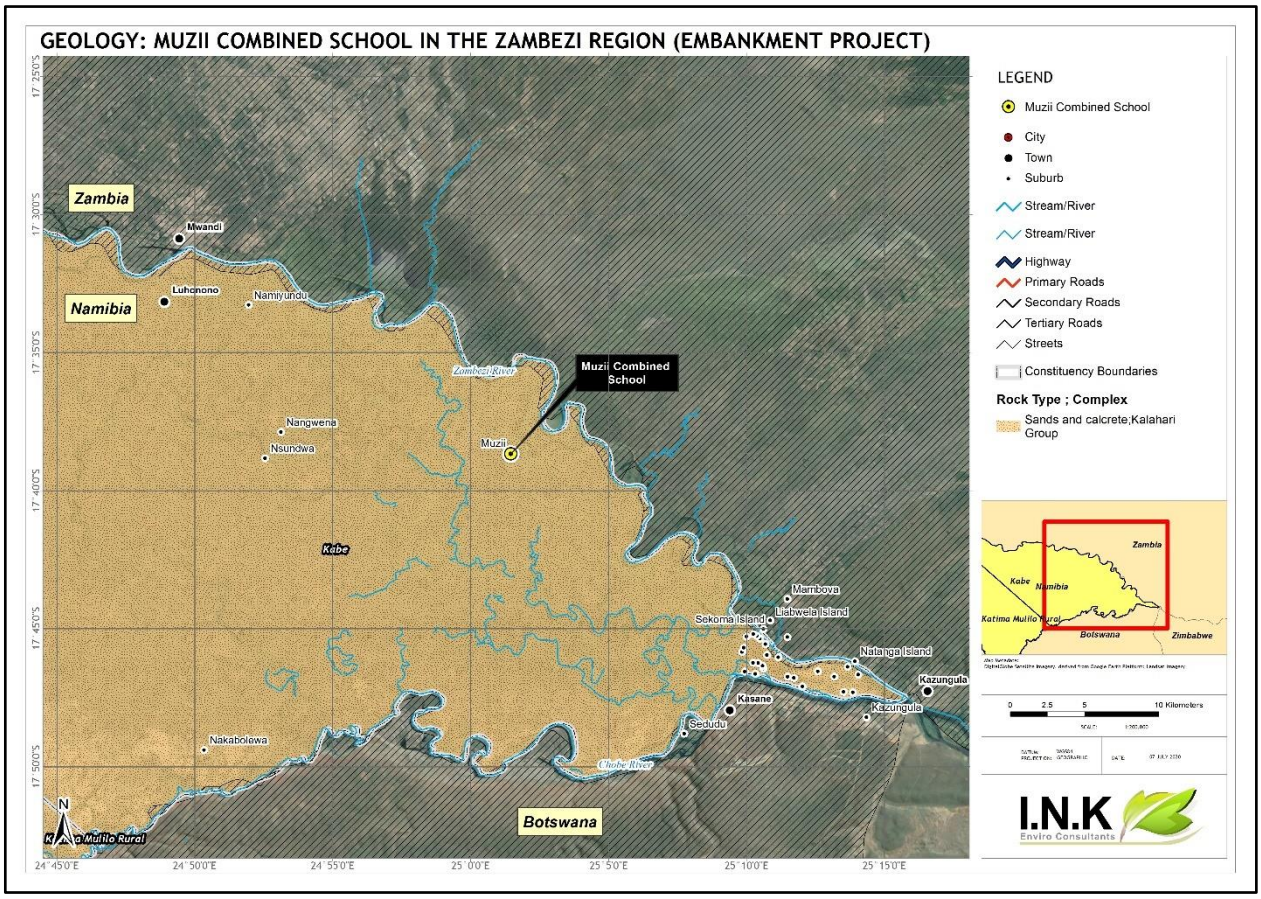

Figure 5: The geology map of the Muzii area and broader project area

6.3 Hydrogeology

Groundwater in the Zambezi (formerly known as Caprivi) is mainly tapped from the Kalahari Sequence, which displays variable groundwater properties over short distances. Fractured aquifers are absent in the Region. Recent alluvium of fluvial origin usually occurs in the floodplains of the Kwando-Linyanti- Chobe system. Coarse pebbly gravels within the upper 30m in the central area between Katima Mulilo and Ngoma, probably represent paleo-Zambezi deposits of Pleistocene age. Surficial sand of aeolian origin consisting of reworked Kalahari sediments covers almost the entire land surface of Eastern Caprivi (Christelis and Struckmeier, 2011). According to the British Geological Survey (2020), the total mean annual recharge is 15Mm³.

The Hydrogeological map of Namibia with groundwater potential of rock units is shown in Figure 6 According to the map below, the project (shown by the green arrow) has porous aquifers with a moderate groundwater potential.

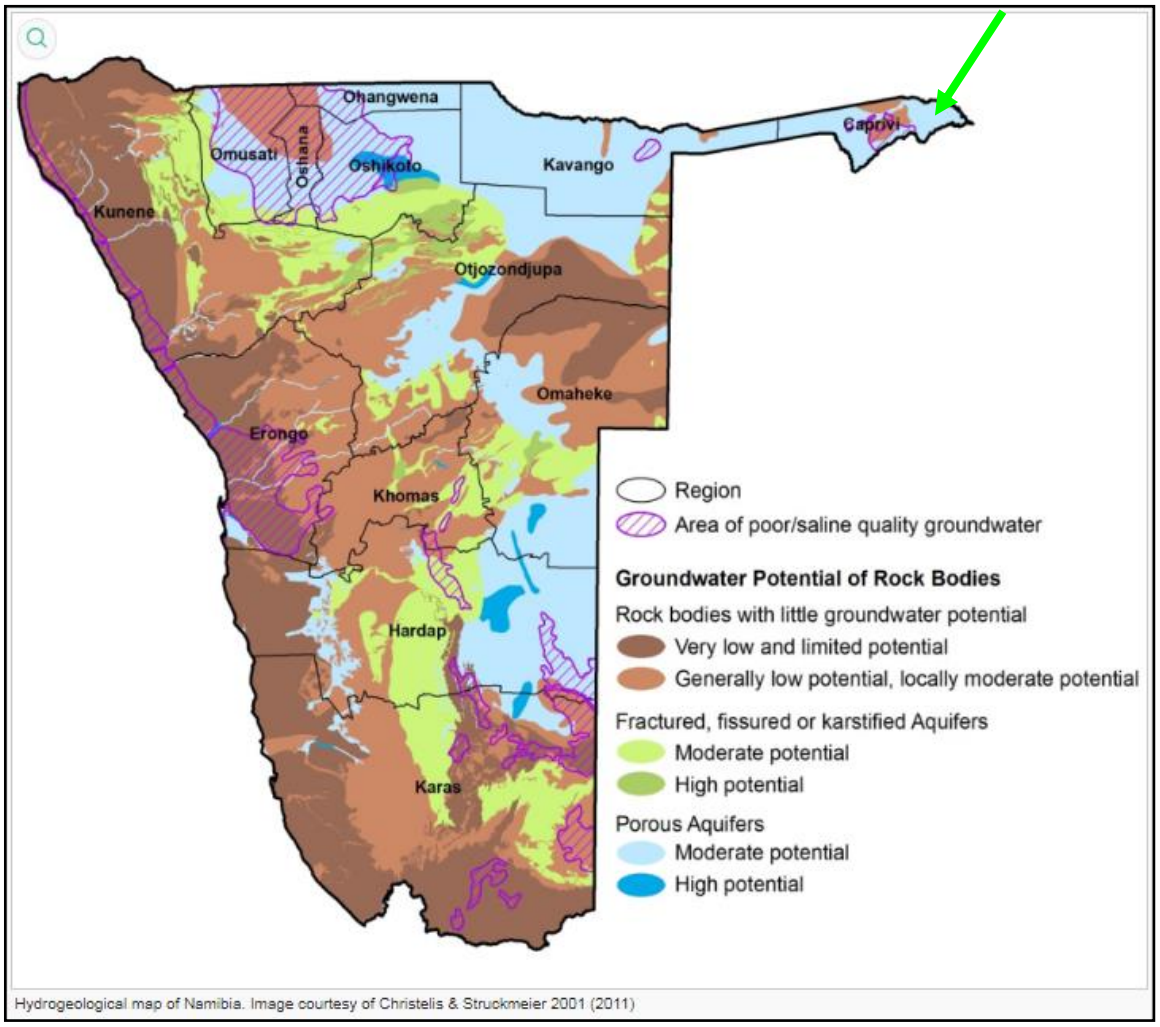

Figure 6: Hydrogeological map of Namibia with rock bodies groundwater potential with the approximate location of Muzii site in far eastern Namibia (green arrow)

6.3.1 Baseline Groundwater Levels and Boreholes Yields

Groundwater levels are generally shallow. The aquifer is confined. Variable borehole yields from less than 1 to more than 20m³/ occur. Borehole depths vary from 50 to 150m (British Geological Survey, 2020)

According an old report on the hydrogeological investigation of the Eastern Zambezi (Caprivi), by the DWA-BGR boreholes were drilled to depths of around 200-250m to successfully tap the deeper Kalahari aquifer. As observation boreholes, two were drilled next to deep boreholes into the shallow Kalahari aquifer to determine the hydraulic head difference between the two aquifers. With the exception for one of the boreholes (recommended yield: 14m³/h; due to low well efficiency) all deep boreholes were extremely successful with recommended yields ranging between 66 and 84m³/h. Electrical conductivities of the groundwater in the Lower Aquifer vary between 96 and 135mS/m (approximately 600 to 850mg/l TDS). With regards to its hydrochemical composition, the water in the Lower Aquifer at the drilling locations is of drinking water quality and for most components meets group A standards (BGR, 2005).

6.3.2 Vulnerability of Groundwater to Over-abstraction

The over-abstraction of groundwater in any aquifer does not only affect the surrounding human populations, but also the general environment (ecosystem) that rely depend on the same water resource. This is usually a main concern in areas where groundwater potentials are low. The lowering of the water table in such areas would mean a decrease in groundwater water levels for downstream water users and subsequently depriving the natural environment (ecosystem) of the water sources to function.

Furthermore, over-pumping of groundwater in areas with poor recharge will also increase salt concentrations in the aquifer, leading to poor water quality.

The water potential of the project site area, Zambezi Region and general eastern parts of Namibia is classified moderate. Long-term unmanaged water abstraction from the aquifers would make the aquifers vulnerable. However, with regards to the project site, there is no anticipated groundwater abstraction, therefore groundwater vulnerability to abstraction is none.

6.3.3 Vulnerability of Site groundwater resources to Pollution

In areas activities such as extensive agricultural, mining, waste management and industrial activities are practised with poor prior planning, groundwater pollution becomes a concern. However, as mentioned in the preceding subsection (4.4.2) poor water quality does not only come from direct pollution from the ground surface, but from over-abstraction of water from aquifers that are poorly recharged. Given the nature and duration of the proposed project activities, groundwater vulnerability to pollution is not anticipated.

With regards to surface water, pollution is also unlikely because the construction (embankment) works will be carried out during a non-rainy season (dry months) where there would be no risk of accidental spills such as oils or fuels running off into surface water bodies.

According to the Groundwater Resources Vulnerability Map of Namibia, the vulnerability of groundwater to pollution in the project area is **moderate – Figure 7.** This could be explained by the porous nature of the sediments overlying the project site and surrounding areas in the Region. Groundwater pollution would generally be a concern on such areas that are overlain by the porous sediments and alluvial (sediments) aquifers if there is a significant point source of pollution.

The vulnerability of groundwater to pollution at the site would therefore rather be low to slightly moderate (no anticipated significant amount of pollution source related to the project activities).

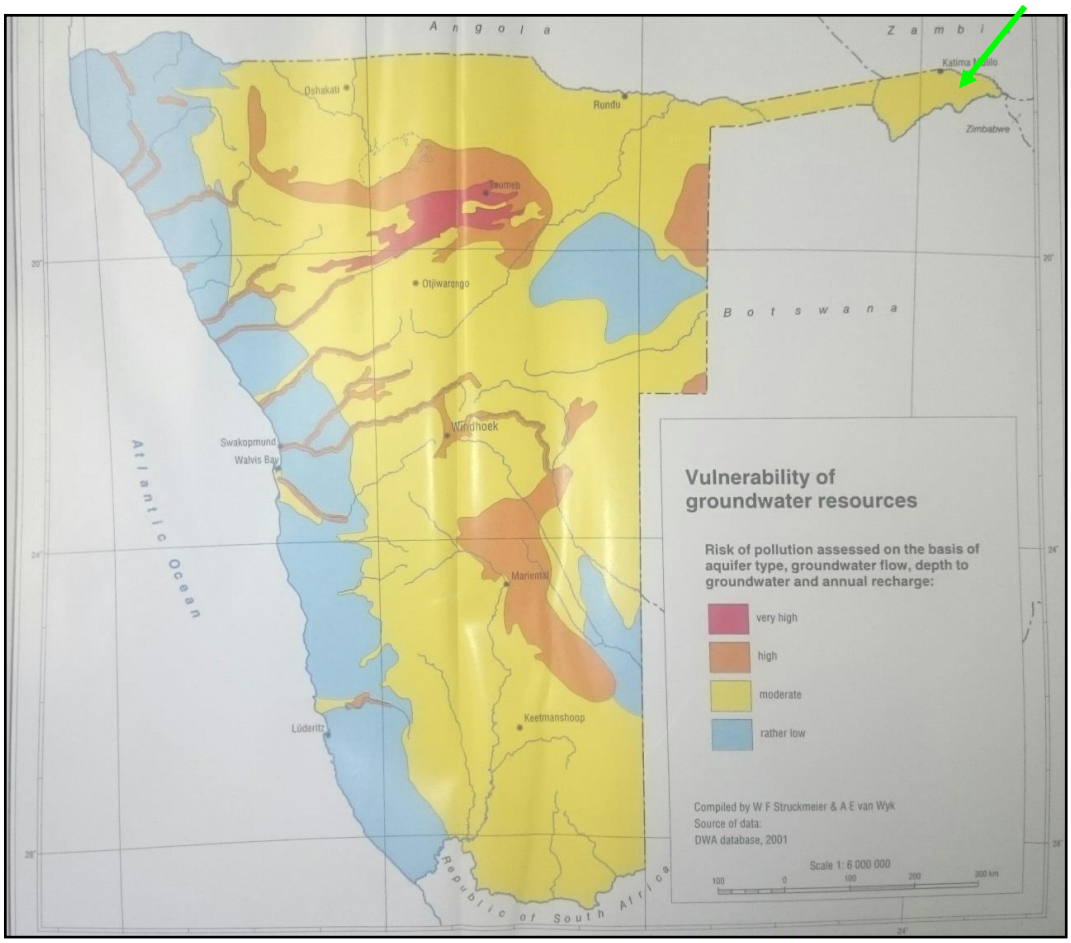

Figure 7: Vulnerability of groundwater resources to Pollution (Van Wyk et.al, 2001)- project site area shown by the green arrow)

6.4 Topography

The general Zambezi Region is characterized by Caprivi Floodplains and Kalahari Sandveld landscapes. The Region's landscape is mostly made up of swamps, floodplains, wetlands, and woodlands. There are no significant mountain ranges and inselbergs as the area is mostly flat (GCS Water & Environmental Consultants, 2018).

6.5 Hydrology and Catchments

The Zambezi Region is home to one of the four prominent transboundary perennial rivers at the Namibian borders, the Zambezi River. The River has an extensive catchment that forms a shared River Basin with seven other countries (riparian states) in the SADC region, namely the Republic of Angola, the Republic of Botswana, the Republic of Malawi, the Republic of Mozambique, the Republic of Tanzania , the Republic of Zambia and the Republic of Zimbabwe. The States manage this major river basin organization in Africa under the Zambezi Watercourse Commission (ZAMCOM) established in 2014. This ZAMCOM was established as an inter-governmental organisation that brings together 8 states that share the Zambezi River Basin, as stipulated in the 2004 ZAMCOM Agreement and in accordance with the revised Southern African Development Community (SADC) Protocol on Shared Watercourses of 2000. According to Euroconsult Mott MacDonald (2008), the River Basin occupies a total area of 1.37million km^2 extending through the eight riparian members states. The Basin is located between 9-20° South and 18-36° East in Southern Africa.

Other main surface water systems in the Region are perennial water courses include the Kwando, Chobe, and Linyati Rivers. These surface water courses in the project area are part of the Zambezi surface water catchment area.

Within the Namibian borders, the Zambezi River water is primarily used for agricultural projects (subsistence and commercial) and other purposes in areas along the River. Please refer to the table image in **Figure 8** depicting the River Basin water use types in the year 2008 and projected to 2025.

Table 2.2 Current consumptive water use and run-off

	Mm^3	%
Available run off	**103,224**	**100**
Rural domestic consumption	24	0.02
Urban domestic consumption	175	0.17
Industrial consumption	25	0.02
Mining	120	0.12
Environmental/ flood releases	1,202	1.16
Irrigated agriculture	1,478	1.43
Livestock	113	0.11
Hydropower (evaporation)	16,989	16.46
Total consumptive water use	***20,126***	***19.49***

Source: Rapid Assessment, 2007

Table 2.3 Future water use (2025)

	Mm^3	%
Available run off	**103,224**	**100**
Water demand		
Rural domestic consumption	43	0.04
Urban domestic consumption	676	0.65
Industrial consumption	85	0.08
Mining	408	0.40
Environmental/ flood releases	6,445	6.24
Irrigated agriculture (2005)	1,477	1.43
Additional under Partial Scenario (50%)	2,217	2.15
Additional under Full Scenario (100%)	4,635	4.49
Livestock	167	0.16
Hydropower	16,989	16.46
Additional under Moderate Scenario	175	0.17
Additional under Medium Scenario	1,365	1.32
Additional under Mega Scenario	7,609	7.37
Total (high development scenario)	***38,534***	***37.32***

Source: Rapid Assessment, 2007

Figure 8: Water use in the Zambezi River Basin (source: Euroconsult Mott MacDonald, 2008)

The water quality of the River water can be considered good. However, it can be prone to pollution because of different point pollution from uncontrolled and untreated discharge from urban, mining and manufacturing centres and even medium-large-scale agricultural activities in the River Basin member states.

6.5.1 Site Catchment Delineation

The project site was delineated by using ArcGIS. The digital elevation model (DEM) was used as an input to enable the delineation of a drainage system and then quantify the characteristics of that system. The tools in the extension allows the user to determine, for any location in a grid, the upslope area contributing to that point and the down slope path that would be followed by the water. This data is usually important during impact assessments.

A catchment delineation map for the Muzii site is shown in **Figure 9**. The catchment is presented in three sub-catchments displayed as A, B and C with combined surface area of 174km^2.

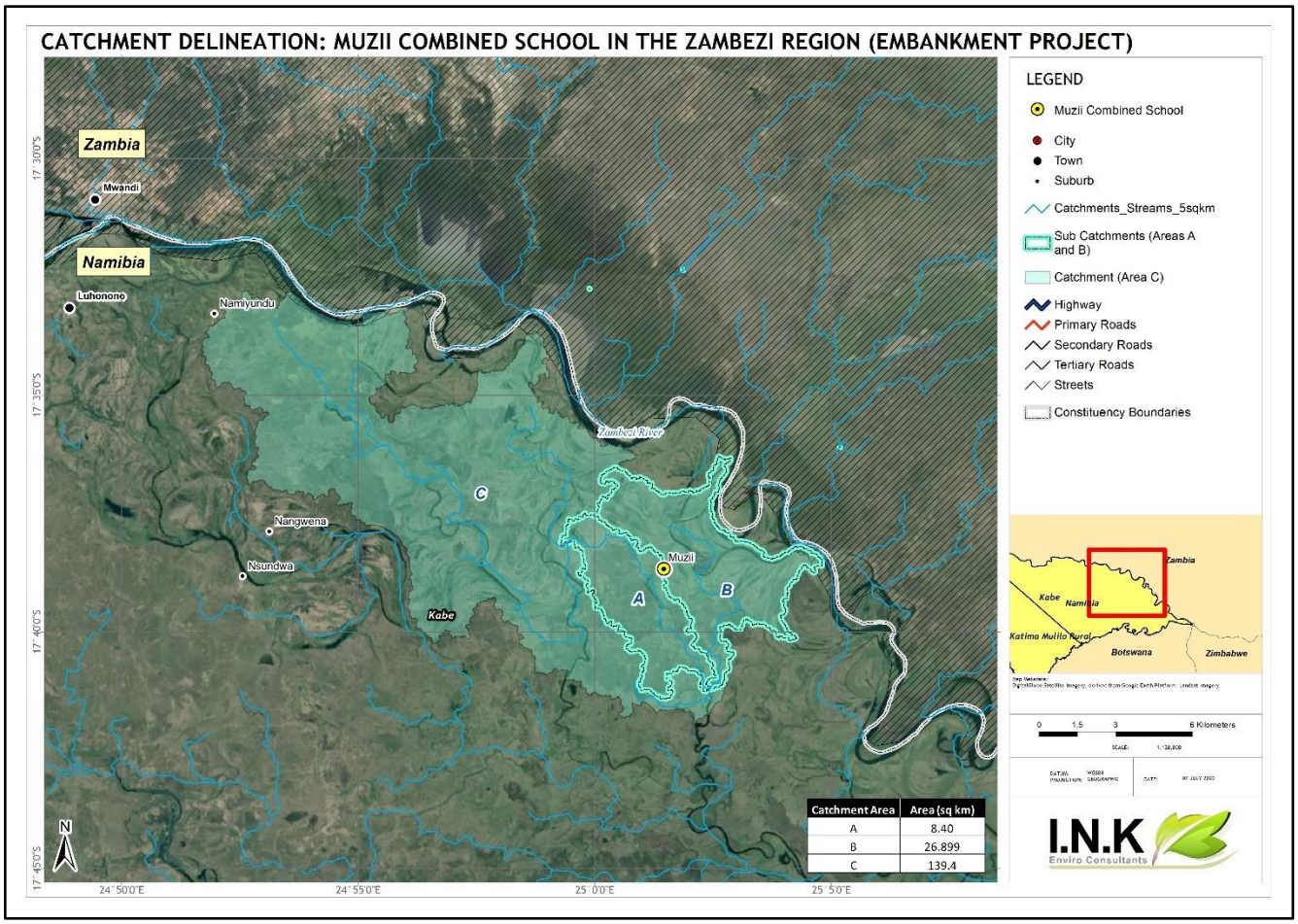

Figure 9: Catchment delineation around the Muzii Combined School site area in the Zambezi Region

6.6 Biodiversity

6.6.1 Flora

In terms of broad vegetation types, almost half of the basin is classified by White as wetter or drier miombo woodland, part of the Zambezian biome. Miombo is a type of woodland dominated by trees of the genera Brachystegia, Julbernardia or Isoberlinia with a welldeveloped grass layer. Other widespread vegetation types are mopane woodland (dominated by mopane, Colophospermum mopane), mosaics of various types of woodland, dry forest (including that dominated by Zambezi teak, Baikiaea plurijuga) with grassland, and open woodland dominated by various species of Acacia. Muzii is located on an area largely dominated by Buffalo grass and reeds

6.6.2 Fauna

The Zambezi Basin is renowned for its assemblage of large mammal species such as elephant, buffalo, giraffe, lion and, until recently, rhino. The birds of the basin are comparatively well-known. There are probably around 700 species of bird recorded (P.J. Mundy, pers. comm.), of which probably only 15-20 are endemic to the basin, including the Black-cheeked Lovebird (Agapornis nigrigenis) and the Slaty Egret (Egretta vinaceigula). Of these species about 167 are considered to be wetland-related, while birds confined to montane forests include

Swynnerton's Robin (Swynnertonia swynnertoni), Chirinda Apalis (Apalis chirindensis) and Roberts' Prinia (Prinia robertsi).

The lungfish, eels and Zambezi shark are all found only in the Lower and Middle Zambezi. Invertebrate biodiversity is not well known in the Zambezi Basin except for a few groups including dragonflies (Odonata), butterflies (Lepidoptera), freshwater molluscs, dung beetles and grasshoppers/crickets (Orthoptera). Instead, groups of particular economic interest mosquitoes, tsetse fly, locusts, ticks and agricultural pests have been the focus of detailed research. The number of species of insects and other invertebrates present in the basin is unknown, but it is likely to be tens if not hundreds of thousands (Timberlake, 1998).

6.7 Noise

Existing noise sources within and around the project site include:

- Natural sounds from wind, animals, and birds;
- villages around Muzii Combined School.

The immediate surroundings of the project site has inhabitants of the Muzii communiy. The sensitivity of noise receptors usually increases at night when conditions are quiet, and ambient noise levels are at their lowest. However, no operational activities are anticipated at night time.

7 IDENTIFICATION OF ENVIRONMENTAL ASPECTS AND POTENTIAL IMPACTS

This section discusses the environmental aspects of project activities and the resultant potential environmental impacts.

The consultation process with key stakeholders that included government authorities and I&APs allowed the opportunity to raise the issues associated with the project development. It was identified that the following aspects were needed to be further assessed:

- Hydrogeology (Potential change in water flow direction);

7.1 Information collation

I.N.K used various sources to identify both the environmental issues associated with the proposed project and the Terms of Reference for the required investigations.

Information for the preparation of the EIA Report was sourced from:

- Project information provided by ZRC which includes:
  - Technical and process information.
  - Earthworks Investigation Report conducted in 2014
- Site visit by I.N.K;
- Consultation with the Technical Project Team;
- Consultation with I&APs as indicated above;
- Consultation with relevant authorities; and
- Atlas of Namibia.

In case of people related impacts, the assessment focused on third parties and did not assess health and safety impacts on workers because the assumption was made that these aspects are separately regulated by health and safety legislation, policies and standards.

Table 6: Environmental aspects and potential impacts associated with the proposed project

ACTIVITY / FACILITY	ASPECT	POTENTIAL ENVIRONMENTAL IMPACT	RELEVANCE (SCREENING) OF POTENTIAL IMPACT	Ref
General construction activities.	Oil and diesel spillages from vehicles and other equipment	Impact on surface water and groundwater water quality.	The project may pose the risk of contamination of water resources, mainly through accidental spills of oil and diesel etc. Due to the nature of the project, there is a low risk of big hydrocarbon spillages.	**R01**
	Noise from the proposed project	Increase in disturbing noise levels (nuisance impact to third parties)	The proposed project is located near villages and communities of Muzii. Adjacent to the proposed project on the western side, is a small settlement. However, the proposed project is likely to generate very low noise levels, therefore, there is a low risk of high noise levels. The sensitivity of noise receptors usually increases at night when conditions are still, and ambient noise levels are at their lowest. However, no construction activities are anticipated at night time.	**R02**

ACTIVITY / FACILITY	ASPECT	POTENTIAL ENVIRONMENTAL IMPACT	RELEVANCE (SCREENING) OF POTENTIAL IMPACT	Ref
	Waste management	Emissions to land, impact on biodiversity, environmental degradation and nuisance impacts.	Waste generated will be separated at source and stored in a manner that there can be no discharge of contamination to the environment.	**R03**
	Air pollution	Impact on the people and animals near Muzii	The proposed project will likely emit dust into the atmosphere during construction that could potentially impact the people and animals living in the nearby settlement. A Qualitative air pollution assessment was therefore conducted by I.N.K in section 7 of this report.	**R04**

ACTIVITY / FACILITY	ASPECT	POTENTIAL ENVIRONMENTAL IMPACT	RELEVANCE (SCREENING) OF POTENTIAL IMPACT	Ref
	Socio-Economic impacts	Impacts on local economy, villages, • Increased employment opportunities • Opportunity for skills transfers • Increased demand for basic infrastructure	It is likely that a certain number of the project's low skilled workforce will come from the nearby area. It is likely that many job-seekers will come to the area; many will not be successful but with no other prospects, they may wait in the area in the hope that a job is forthcoming. The potential economic impacts (positive and negative) have therefore been assessed as part of this EIA.	**R05**
	Biodiversity	Potential impact on fauna and flora (poaching and general disturbance and clearing of vegetation)	Site preparation activities for the construction of the proposed project may have potential impacts resulting in the general disturbance and/or physical destruction of vegetation and/or fauna. However, the site is located in relatively open grassland areas. However, due to the fact that the construction team will not be very big, potential poaching and collection of firewood impacts can easily be managed through appropriate management and mitigation measures outlined in the EMP.	**R06**
	Heritage / Archaeology	Activities could result in possible damage to/destruction of heritage resources.	No archaeological sites are expected or were identified within the perimeters of the sites.	**R07**

8 ENVIRONMENTAL IMPACT ASSESSMENT

This section discusses, provides ratings and gives recommendation on the major positive and negative potential issues/impacts identified.

8.1 Assessment Approach and Methodology

Both the criteria used to assess the impacts and the method of determining the significance of the impacts is outlined in Table 7. This method complies with the EIA Regulations: EMA, 2007 (Government Gazette No. 4878) EIA regulations.

Part A provides the approach for determining impact consequence (combining severity, spatial scale and duration) and impact significance (the overall rating of the impact). Impact consequence and significance are determined from Part B and C. The interpretation of the impact significance is given in Part D.

Both mitigated and unmitigated scenarios are considered for each impact in the EIA results.

Table 7: Assessment Methodology and Criteria

PART A: DEFINITION AND CRITERIA		
Definition of SIGNIFICANCE		**Significance = consequence x probability**
Definition of CONSEQUENCE		**Consequence is a function of severity, spatial extent and duration**
Criteria for ranking of the SEVERITY/NATURE of environmental impacts	**H**	Substantial deterioration (death, illness or injury). Recommended level will often be violated. Vigorous community action. Irreplaceable loss of resources.
	M	Moderate/ measurable deterioration (discomfort). Recommended level will occasionally be violated. Widespread complaints. Noticeable loss of resources.
	L	Minor deterioration (nuisance or minor deterioration). Change not measurable/ will remain in the current range. Recommended level will never be violated. Sporadic complaints. Limited loss of resources.
	L+	Minor improvement. Change not measurable/ will remain in the current range. Recommended level will never be violated. Sporadic complaints.
	M+	Moderate improvement. Will be within or better than the recommended level. No observed reaction.
	H+	Substantial improvement. Will be within or better than the recommended level. Favourable publicity.
Criteria for ranking the DURATION of impacts	**L**	Quickly reversible. Less than the project life. Short term
	M	Reversible over time. Life of the project. Medium term
	H	Permanent. Beyond closure. Long term.
Criteria for ranking the SPATIAL SCALE of impacts	**L**	Localised - Within the site boundary.
	M	Fairly widespread – Beyond the site boundary. Within 20 km of the site boundary.
	H	Widespread – Far beyond site boundary. Regional/ national

PART B: DETERMINING CONSEQUENCE

SEVERITY = L

DURATION	Long term	**H**	**Medium**	**Medium**	**Medium**
	Medium term	**M**	**Low**	**Low**	**Medium**
	Short term	**L**	**Low**	**Low**	**Medium**

SEVERITY = M

DURATION	Long term	**H**	**Medium**	**High**	**High**
	Medium term	**M**	**Medium**	**Medium**	**High**
	Short term	**L**	**Low**	**Medium**	**Medium**

SEVERITY = H

DURATION	Long term	**H**	**High**	**High**	**High**
	Medium term	**M**	**Medium**	**Medium**	**High**
	Short term	**L**	**Medium**	**Medium**	**High**
			L	**M**	**H**
			Localised Within site boundary Site	Fairly widespread Beyond site boundary Local	Widespread Far beyond site boundary Regional/ national
			SPATIAL SCALE		

PART C: DETERMINING SIGNIFICANCE

PROBABILITY (of exposure to impacts)	Definite/ Continuous	**H**	**Medium**	**Medium**	**High**
	Possible/ frequent	**M**	**Medium**	**Medium**	**High**
	Unlikely/ seldom	**L**	**Low**	**Low**	**Medium**
			L	**M**	**H**
			CONSEQUENCE		

PART D: INTERPRETATION OF SIGNIFICANCE	
Significance	**Decision guideline**

High	It would influence the decision regardless of any possible mitigation.
Medium	It should have an influence on the decision unless it is mitigated.
Low	It will not have an influence on the decision.

8.2 General Concept of Impact (Risk) Assessment

Generally, an environmental risk occurs when there is a hazard (e.g. process, activity, or substance) that can result in a harmful impact on the surrounding environment. The part of the environment which is, or could be, affected is known as a receptor. Receptors include humans, flora and fauna, the built environment and water resources (controlled waters).

According to SRK (2006), the presence of a hazard alone does not constitute a risk; a risk is only present if there is a means by which the hazard can impact on sensitive receptor(s). The connection between the hazard and receptor is known as a pathway, and all three elements together constitute a source-pathway-receptor (S-P-R) linkage. The three elements are briefly defined as follows:

- **Source (or hazard)**: a substance capable of causing pollution or harm.
- **Receptor (or target)**: something which could be adversely affected by the contaminant.
- **Pathway**: a route by which contaminants can reach the receptor.

The environmental risk assessment is the process whereby S-P-R linkages are identified and assessed. In the case that any of the three elements are absent, then there is no complete linkage and thus no verifiable unacceptable risk. The magnitude of a risk is a function of the consequences of risk and the likelihood that such rick will occur.

The risk/impact assessment for the three identified potential impacts that may impact the water resources during the duration of the project activities (up-earthing and operations) on site is presented under the subsections below. The subsections provide a brief description to each potential impact. The three impacts have been assessed as per the I.N.K Enviro provided criteria (for both the pre-mitigation and post mitigation scenarios). The S-P-R system assessment was applied to the first two impacts (water quantity and quality).

8.3 Water Impact Assessment (Over-abstraction)

8.3.1 Brief Impact Description – Water Quantity

In terms of groundwater abstraction and use, the project activities will not abstract nor use groundwater. The insignificant amount of water required to compact the embankment fill material will be sourced from the surface water bodies (the Zambezi River) and therefore very minimal.

In conclusion of this potential impact on water abstraction from the aquifers, its assessment is summarized as follows:

- **Source:** The source of water for the project activities (fill compaction), which is minimal will be surface water, thus no anticipated groundwater abstraction.
- **Pathway:** None
- **Receptor:** None

With that explained, there will be no abstraction of groundwater, therefore the impact of the project activities on groundwater (resources) abstraction is very low to none.

8.3.2 Groundwater Abstraction Management Plans

Water abstraction is not an issue for this project because the little amount of (unspecified) water volume required for the construction works will be sourced from the surface sources. Regardless, it is still important to manage this resource as any other. The following management action plans are recommended:

- The Proponent and or their construction contractor should avoid abstracting from the aquifers and only use surface water as planned.
- Even so (as per preceding point), water should be used sparingly through water re-use for some of the construction activities where possible. This is done to minimize the amount of water abstracted from the River or the preferred surface water source near the site.
- In a special case, should the Proponent or the contractor later realize that for some reason they cannot use surface water during the construction period and that the nearest groundwater source such as a borehole could be used instead, this source should be abstracted and water used efficiently by limiting its use to the intended project activities only. The aim is to ensure that general environmental sustainability is not compromised in terms of water supply to the social and natural environmental components that depend on this source.
- Regardless of the amount of water required for the project, the Proponent should raise awareness on the importance of water conservation and saving measures.

8.4 Water Impact Assessment (Pollution)

8.4.1 Brief Impact Description – Water Quality

A sudden decrease in groundwater quality during the project's construction period would be linked to the project as a new contributor (pollution sources) to pollution. During rainy seasons, the ground surface pollutants could be washed into nearby surface water bodies through runoff or infiltrate into the ground as recharge. However, given the nature of the proposed activity (up-earthing) and the fact that construction works will be only carried out in dry period (months) of the year, there will be very little to no water pollution related to the embankment of the School Platforms.

The only anticipated potential source of pollution to water resources from the project activities would be hydrocarbons (oil) from project vehicles, machinery, and equipment. The spills from these embankment machinery, vehicles and equipment could infiltrate into the ground and pollute the already shallow and permeable aquifers (Kalahari sediments) in the area. The spilled and uncontrolled hydrocarbons would not only affect the aquifers but also the nearby surface water bodies during rainy seasons.

Furthermore, although not significant, measured nor monitored, there could already be an existing pollution from pre-project anthropogenic activities such as wastewater/effluent from uncontrolled sewage facilities, fertilizers from subsistence agricultural activities undertaken along the Zambezi River. In addition to that, selected locations, such as towns, settlements, and agricultural lands far from the Muzii site area could also be sources of such potential pollutants on a regional scale. Groundwater pollution risk can also arise from localized pollution sources, in combination with the aquifer's vulnerability to pollution.

The potential impact of pollution arising from the proposed project is described below as per the three elements of risk/impact assessment given.

- **Source:** As mentioned above, potential sources of pollution from the project activities would be oil spillage from embankment machinery and equipment and existing pollution from anthropogenic activities such as wet waste/effluent from sewage facilities, fertilizers, pesticides, i.e. before the project. These would infiltrate into the ground through recharge and pollute shallow local alluvial aquifers and the nearest surface water bodies through runoff**. The project activities will not be using any of the above-mentioned substance, therefore the impact on groundwater from these is not anticipated, therefore none.**
- **Pathway:** Poor quality water would travel infiltrate into the ground from the potential sources of pollution on project site to the freshwater (local and eventually regional) aquifers. Pollution could be easily transported in these alluvial aquifers from site as the sediments can provide an easy pathway for polluted water. The impact would however also depend on the extent and amount of the pollution leaching from the ground surface into groundwater.

- **Receptor:** The impact could be felt by communities who depend on boreholes, especially those far from the River and they would be considered potential receptors of this pollution from sources given above. From the above description of the possibility of the impact occurring, the impact significance is considered.

After assessing the area based on the available information, the impact of pollution on the water resources, this impact is considered **low**. Furthermore, the impact is short-term, i.e. will only exist during the construction period and if necessary, during the minimal maintenance of the structures in future.

8.4.2 Pollution Management Plans

It is important to note that the potential pollution from the project does not constitute the absence of current and future anthropogenic contribution to groundwater pollution in the project area. Therefore, to avoid and or minimize the potential impact of pollution stemming from the project activities, the following measures are recommended for implementation:

- Areas where hydrocarbons will be utilized, the surface should be covered with a plastic impermeable plastic liner to prevent the spillage on the soils and eventual infiltration into the ground.
- Project machines and equipment should be equipped with drip trays to contain possible oil spills when operated during construction works.
- All hydrocarbon substances and other potential pollutants associated with the project activities should be contained in designated containers on site and later disposed of at nearby approved waste sites in accordance with the municipal or urban waste discharge standards. This is to ensure that these hazardous substances do not infiltrate into the ground and affect the groundwater quality.
- In cases of accidental fuel or oil spills on the soils from site vehicles, machinery and equipment, the polluted soil should be removed immediately and put in a designate waste type container for later disposal as per the preceding bullet point. The removed polluted soil should either be completely disposed of or cleaned and returned to where it was taken from on site or can be replaced with a cleaner soil. This is to ensure that the pollutants contained int the soil does not infiltrate into the site soils and eventually reach to groundwater.
- Spill control preventive measures should be in place on site to management soil contamination, thus preventing and or minimizing the contamination from reaching groundwater bodies. The impact would be more on groundwater (aquifers) since the construction works will be done in the dry months, thus there would be no rain to trigger (polluted) runoff to surface water bodies.

8.5 Impact on the dynamics of Water Resources Flow and Recharge

The main impact that the proposed embankment will have on groundwater is the potential change in natural (pre-embankment) water flow dynamics because of the anthropogenic diversion. The change in the local landscape may affect groundwater in terms of interrupted natural runoff pathways. Interrupted or disturbed, manipulated runoff pathways may cause a change in existing recharge and discharge points of the surface-groundwater (hydrological) cycle. A significant change in the runoff route due to impervious embankment surfaces/structures may affect the amount of that usually reaches (flows to) the natural groundwater recharge points, resulting in deceased aquifer replenishment (recharge) over time. This would eventually affect the water flow to the broader local wetland ecosystems too, not just groundwater.

The impact likely to happen but it would be difficult to determine or measure the impact significance and compare the pre- and post-project water flow and recharge within the affected School areas. Measuring of groundwater recharge is already an uneasy task to do, in practice. The closest thing to determine/calculate recharge is by estimation (surface water-groundwater coupling modelling) which is out of the scope of this assessment. Therefore, the impact can be rated moderate and the implementation of mitigation measures which is proper design could see the reduce the significance rating to **low**.

The assessment outcome shows that although the embankment structure's impact on groundwater dynamics is likely, the implementation of management measures should confidently reduce the impact significance from medium to low and bring it under control.

The management measures recommended to avoid or minimize the three above-impacts are presented under the next chapter.

8.5.1 Groundwater Flow Dynamics Management Plans

The following mitigation measures could be implemented and integrated into the planning of the embarkment structure:

- To ensure that the floodwater is largely or entirely diverted from the school premises, the embankment fill material should be designed and selected on the basis that it will not retain water within its ''body'' over a long period of time. In other words, the fill material should be hydraulically good and of porous nature that it can still allow water to flow through with ease to the intended directions streams and main channels (diverted) away from the School. This is to ensure that the embankment structures do not retain water to the point that the water starts to accumulate on the unwanted sites on the School area.

- Provision should be made to allow sufficient free flow channels of floodwater from the vulnerable School sites to the main channels and streams. This is to ensure that the water can easily flow away from the School premises ''downstream'' to nearby surface water bodies (discharge/floodwater collecting points) and groundwater recharge points further from the School.

8.6 Air pollution impact on the biophysical and social environment

The emission from the construction will result in air quality-related impacts due to the dust that is emitted. This could impact the surrounding biophysical environment as well as sensitive receptors in the area.

The presence of human receptors within close proximity of the project results in a **high** severity with regard to air pollution impacts in the unmitigated scenario. This smoke could as well as result in the smothering of sensitive vegetation in the local area. The severity of this impact would be **high** in the unmitigated scenario and could be reduced to **medium** through mitigation.

The visual impact is reversible overtime therefore the duration in the unmitigated and mitigated scenarios are **medium**.

The air pollution impacts would extend beyond the site boundaries. The spatial scale is therefore **medium** in both the unmitigated and mitigated scenarios.

*T*he consequence of this impact is **medium** in the unmitigated scenario and **low** in the mitigated scenario.

The probability of the air pollution impact occurring is **high** in the unmitigated scenario and **medium** in the mitigated.

The significance of air pollution impacts is **medium** because the consequence and probability of the impacts occurring are **medium** and **high,** respectively.

8.6.1 Air Pollution Management Plans

- Implement the water sprinkling method to reduce the dust emission from the construction activities.
- Ensure liaison with the Zambezi Regional Council to relocate the school learners and surrounding residents prior to the construction activities.

8.7 Economic impact relating job creation and skills development

Employment opportunities (low and high skilled) will be created for the construction phase.

Job creation is a high priority to the Namibian government to combat widespread unemployment and disparities in income. As some of the proposed jobs created can be filled by training unskilled people, the project will make a small but useful contribution. Employment provides incomes to the employees, their immediate household members and to relatives living elsewhere in Namibia who depend on cash

remittances. As long as the jobs created do not cause the loss of jobs in the surrounding area, the impact can be summarised as having a **high positive** effect.

The contribution to skills development will be long-lasting so the duration will be **high**.

The spatial scale is **high** as employees will be sourced locally and from the neighbouring regions and nationally.

The consequence of the impact is **high positive**.

The significance of this potential impact is **high positive** and can be enhanced further. Our confidence in this rating is **high**.

8.7.1 Socio-economic Management Plans

- Have approachable person as she/he will be a key link between the community in the area and the ZRC.
- Demonstrate its efforts to recruit employees from Zambezi Region.
- Be gender sensitive and select women for interview, training and recruitment.

The recommendations and conclusions made for the overall assessment are as presented under chapter below.

9 RECOMMENDATIONS AND CONCLUSIONS

The aim of this report was to identify and assessed the potential impacts of the proposed embankment activities on the water resources, with a primary focus on groundwater. The assessment has been undertaken on a desktop level, i.e. based on information provided by I.N.K Enviro Consultants (the project Environmental Assessment Practitioner) and author's review of previous different relevant studies conducted on the project area by other consultants.

The recommendations provided to the assessment and conclusions made are presented under the following sections:

9.1 Recommendations

Given the assessment results, to manage and protect the water resources, the following management measures should be implemented:

Groundwater Use Mitigation Measures

- The Proponent and or their construction contractor should avoid abstracting from the aquifers and only use surface water as planned.
- Even so (as per preceding point), water should be used sparingly through water re-use for some of the construction activities where possible. This is done to minimize the amount of water abstracted from the River or the preferred surface water source near the site.
- In a special case, should the Proponent or the contractor later realize that for some reason they cannot use surface water during the construction period and that the nearest groundwater source such as a borehole could be used instead, this source should be abstracted and water used efficiently by limiting its use to the intended project activities only. The aim is to ensure that general environmental sustainability is not compromised in terms of water supply to the social and natural environmental components that depend on this source.
- Regardless of the amount of water required for the project, the Proponent should raise awareness on the importance of water conservation and saving measures.

Groundwater Pollution Mitigation Measures

- Areas where hydrocarbons will be utilized, the surface should be covered with a plastic impermeable plastic liner to prevent the spillage on the soils and eventual infiltration into the ground.
- Project machines and equipment should be equipped with drip trays to contain possible oil spills when operated during construction works.

- All hydrocarbon substances and other potential pollutants associated with the project activities should be contained in designated containers on site and later disposed of at nearby approved waste sites in accordance with the municipal or urban waste discharge standards. This is to ensure that these hazardous substances do not infiltrate into the ground and affect the groundwater quality.
- In cases of accidental fuel or oil spills on the soils from site vehicles, machinery and equipment, the polluted soil should be removed immediately and put in a designate waste type container for later disposal as per the preceding bullet point. The removed polluted soil should either be completely disposed of or cleaned and returned to where it was taken from on site or can be replaced with a cleaner soil. This is to ensure that the pollutants contained int the soil does not infiltrate into the site soils and eventually reach to groundwater.
- Spill control preventive measures should be in place on site to management soil contamination, thus preventing and or minimizing the contamination from reaching groundwater bodies. The impact would be more on groundwater (aquifers) since the construction works will be done in the dry months, thus there would be no rain to trigger (polluted) runoff to surface water bodies.

Changes in the Natural Water flow Dynamics

- To ensure that the floodwater is largely or entirely diverted from the school premises, the embankment fill material should be designed and selected on the basis that it will not retain water within its ''body'' over a long period of time. In other words, the fill material should be hydraulically good and of porous nature that it can still allow water to flow through with ease to the intended directions streams and main channels (diverted) away from the School. This is to ensure that the embankment structures do not retain water to the point that the water starts to accumulate on the unwanted sites on the School area.
- Provision should be made to allow sufficient free flow channels of floodwater from the vulnerable School sites to the main channels and streams. This is to ensure that the water can easily flow away from the School premises ''downstream'' to nearby surface water bodies (discharge/floodwater collecting points) and groundwater recharge points further from the School.

9.2 Conclusions and way forward

Water abstraction (use): The impact on local groundwater resources (abstraction) is very minimal to none as the project will be supplied with water from surface sources but not from the local aquifers. Therefore, no impact is anticipated on groundwater resources.

Water pollution: As it is common with every development, although minimal, ground surface pollution is anticipated from the project operations and related activities. These potential pollutants improper disposal of hazardous products such as hydrocarbons (fuel/oils) on site. Despite. The site geology (sediments) making the groundwater vulnerable to pollution from the surface, the implementation of pollution management plans will greatly aid in minimizing groundwater pollution. The impact is therefore considered minimal and according to the Groundwater Resources Vulnerability to pollution Map, the general site area has a moderate risk of pollution.

Furthermore, the potential pollution impact is short-term, as it will only be existing during the construction period and if necessary, during the minimal maintenance of the structures in future

Changes in the Natural Water flow Dynamics: the embankment fill material should be designed and selected on the basis that it will not retain water within its ''body'' over a long period of time. The fill material should guarantee easy water flow to directions (diverted) away from the School. Provision should also be made to allow sufficient free flow channels of floodwater away from the vulnerable School sites ''downstream'' to nearby surface water bodies (discharge/floodwater collecting points) and groundwater recharge points.

In conclusion, the proposed project activities will have very little to no impact on the groundwater resources in the area for water quantity and quality, both locally and regionally. A low to slightly moderate impact significance may be expect from the potential change in the water flow dynamics due to the presence of the embankment structure. Therefore, it is crucial for the Proponent and their contractors to effectively implement the recommended management measures to protect both the biophysical and social water environment. All these would be done with the aim of promoting environmental sustainability while ensuring a smooth and harmonious existence and purpose of the project structures in the environment.

The Proponent and contractors will also be required to comply with all legal obligations governing their project activities (from construction throughout to operational phase of the embankment structures).

The way forward for the EIA phase is as follows:

- MEFT review the final Scoping (including impact assessment) Report; and
- MEFT provide record of decision.

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