FINAL YEAR PROJECT REPORT

FACULTY OF ENGINEERING

DEPARTMENT OF MINING ENGINEERING

TITLE: DESIGN AND MODELLING OF AN UNDERGROUND MINE

CASE STUDY: BUKANA GOLD MINES

BY

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DEDICATION

We dedicate this report to our Parents, our dear lectures, fellow students and friends.

ACKNOWLEDGEMENT

We would like to extend our sincere gratitude to the almighty GOD who has given us life to reach this milestone in our academic journey.

Sincere thanks to our fellow students and other lecturers for their continuous generous support.

Special thanks to our supervisors Mr. Kidega Richard and Mr. Nasasira Michael Bakama for their continuous guidance towards the development of this idea.

May the good lord bless you!

APPROVAL

This is to certify that this final project proposal report has been written under the guidance of our supervisor and it is to be handed in to the department of Mining Engineering Busitema University.

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DECLARATION

I **MWALO EDWARD, KADHANA SHAFIC, ATWINE EMMANUEL**, hereby declare that this final year project proposal report is our own research work and has not been previously submitted to any institution of higher learning for any kind of award to be achieved.

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ABSTRACT

Underground mining is the method employed in extraction of minerals which prove to be infeasible to mine by surface mining. This is because the stripping ratio is greater than the break-even stripping ratio. The mining of minerals by underground methods requires a better understanding of the deposit in terms of geology, mineralogy, geotechnical, hydrogeological and technological factors.

A poor mine design can lead to low productivity of the ore and reduced safety due to high probability of mine collapse. Mining in Bukana in Namayingo district is done mostly by underground mining and many miners start mining without a better understanding of their deposit due to limited access to geological data and expertise in geological, and hydrogeological modelling hence the miners end up abandoning these mines which leads to a decline in economic growth.

A field study was conducted and the relevant data was obtained (both primary and secondary), which included the collar, survey, assay, topographical and geology data. Samples were also picked to analyze the uniaxial compressive strength and the indirect tensile strength. Results obtained in the laboratory indicated that; samples picked at a depth further from the surface have greater rock strength compared to those picked from the near surface. The current state of the mines in Bukana was determined and the acquired information was used in the Mine sight 3D software to develop a geological model using the triangulation.

Mining method selection was based on a numerical ranking system of Nikolas' method where each mining method was ranked on various attributes for suitability using different attributes in geometry and grade distribution for example deposit shape, dip and grade distribution and rock mechanical properties of the footwall, hanging wall and the ore body. It was determined that cut and fill mining method had the highest rank of 36 and it is the method that we selected.

In an underground mine, access ways are extremely important for they serve as aid self-escaping by directing miners to the escape routes during an emergency and serve both as a way to transport ore or waste, and move people, equipment or supplies. Being that they are such an important component of an underground mine they require to be designed following engineering principles that have been tested before and can be applied improving factors like safety and better production.

Mining companies face a problem of ground water inflow into the mines which poses a challenge to mine production as this water accumulates, blocks the mine entries to passage of air and haulage,

interrupts production, damage to the mine, loss of life due to inrushes of water, increased costs caused by the need to remove water, causes suspension of operations, promotes deterioration of roof rocks and reduces the stability of mine rock structure. Bukana Gold mine currently is facing the same problem and operations were suspended. The water entering the mine is from ground water which contributes the greatest capacity of inflow, precipitation and surface runoff.

A suitable dewatering system was selected to solve this problem. To select the dewatering system, a Field study was conducted and the Geology of Bukana and Hydrogeology data of Bukana site was obtained from Namayingo District Headquarters from the District water office availed by the District Water Engineer. The data included the type of Aquifer and its hydrogeology in which some Aquifer parameter values were calculated from the data using the applied standard formulae and these parameters include Hydraulic heads, coefficient of transmissivity, storativity, porosity. These parameters were fed in to Mod flow software to determine the hydraulic head distribution in the Aquifer system and as well as the flow rate of water into the mine. The rainfall data of the past twenty years was obtained and the average rainfall intensity was calculated and this helped to calculate the amount of direct rainfall into the mine. In addition, surface runoff water in to the mine was also calculated using the rational method and the obtained data. The mine dimensions were measured and the amount of water present in the mine was 38400litres the water level in the mine was also measured and recorded and a sample of the water was collected from the mine and tested for its quality where parameters, P^H, temperature, salinity, Electrical conductivity, Total Dissolved solids were tested from Busitema University laboratory and recorded.

A suitable Dewatering System was selected using Atlas Copco pump sizing calculator software which required inputs which were calculated and include (Flow rate =350L/Min, total pipe length=33m, suction head=13m) the software returned the sizing results which included the friction head of 9.3m, design velocity of 2.97m/s, total dynamic head of 22.3m, power of 1.95kw, and efficiency of 96%. The software also gave a recommended p^H of

(6-8) and water temperature of 75^{o}F which matched the water test results hence proving to be the suitable Dewatering System. The type of flow in the pipe was determined using Reynold number and limits and was turbulent flow, and the economic Analysis of the pump was calculated.

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List of acronyms

FW **FOOTWALL**

HW **HANGING WALL**

S.R **STRIPPING RATIO**

UCS **UNIAXIAL COMPRESSIVE STRENGTH**

FOS **FACTOR OF SAFETY**

NPV **NET PRESENT VALUE**

PH **HYDROGEN POTENTIAL**

1.0 CHAPTER 1.

1.1 INTRODUCTION

1.1.1 BACKGROUND

The extraction of minerals from the earth is called mining. Mining is of two types, surface and underground mining methods. (Balusa & Singam, 2018) Each mining method is specified by the layout, procedure, equipment, and system involved. Moreover, its application is strongly related to the geologic, physical, economic, environmental, and legal conditions (Hartman et al., 1992)

The surface mining becomes infeasible when the overburden that is needed to be stripped per ton of the ore becomes too much making the mining company saving less or no from the ore that is extracted. No company needs to make such losses hence the mining companies need to plan well to overcome losses that would arise from stripping the overburden (Hartman et al., 1992)

Underground mining methods if planned and done well can be more selective and the cost that is mainly incurred comes from development of mine openings, ventilation, supporting and material handling, dewatering and tailings management.

Poor design of the underground mine can also culminate into challenges like mine collapses due to rock movement arising from poor geotechnical considerations, suffocation of the miners due to poor ventilation methods, low recovery that comes from poor underground mine selection and technology among others.(Yuan, 2012)

Many mining projects in the world that have had a low record of mine accidents is due to having a good underground mine design. And those with a poor mine design may fail to run the mine up to its estimated life of the mine. Coal mine fatality rates, for me example, have dropped almost a thousand-fold since their peak in 1908. (Coleman & Kerkering, 2007)
Good software's are available for development of geological models and this provides a better understanding of the ore to be mined. Geotechnical conditions such as rock strength need to be incorporated into the design software to get a better and optimized design.

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