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An evaluation of the economic viability of mining bench 7B at Grootegeluk Colliery

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ABSTRACT

The profitable exploitation of a resource is the aim of any mining operation. Grootegeluk coal mine (GCM) extracts coal reserves from the Volksrust and Vryheid Formations within the Waterberg coalfield. These Formations are sub-divided into mining benches for practical exploitation. Each mining bench is unique in its average thickness, quality and optimal extraction characteristics. Considering the thickness of the coal bench, the stripping ratio, the expected yield and quality, it may not be profitable to exploit all the coal benches defined at GCM.

The purpose of this research project was to investigate if the mining of Bench 7B at GCM is profitable as this bench was being mined intermittently. Specific questions that the research aimed to answer are: (1) What effect does dilution have on coal product yield and quality? (2) What is the effect of yield on profitability? (3) Is there any economic benefit to mining Bench 7B at GCM?

Coal quality analysis data from mining blocks representing a five (5) year window of exploitation was collected from GCM. This data was obtained from Bench 7B, Bench 7A and Bench 8 which lie directly above and below Bench 7B. The mining costs and the expected revenues associated with exploiting Bench 7B were also obtained from the finance department at GCM. Lastly the coal quality specifications were obtained from Eskom. These specifications were used to compare the mine's resultant coal qualities to Eskom's quality penalisation and rejection limits.

A minimum yield cut-off for the profitable exploitation of Bench 7B was determined to be 27.68% using the yield cut-off function. This yield cut-off was compared to the resultant yield when Bench 7B is processed at different relative densities (RD's) of 1.8g/cm^3, 1.9 g/cm^3 and 2.0g/cm^3. The yield achieved for each wash RD were 52%, 62% and about 69%. These achieved yields are significantly higher than the minimum yield cut-off. This is an indication that this bench is potentially profitable if Eskom's quality specifications are met.

The coal product qualities realised after processing were compared to Eskom's coal requirements to ensure that they were within specification. Dilution scenario testing were undertaken by adding incremental amount of Bench 7A or Bench 8 to Bench 7B. This was done to determine the effect of dilution on yield, yield cut-off and coal qualities. The results confirmed that it is possible for Bench 7B to be diluted to a maximum of 1.5 m of Bench 7A before the yield cut-off is reached

when beneficiating at a RD of 1.8 g/cm^3. At a beneficiation RD of 1.9 g/cm^3, the yield cut-off is reached when 1.2 m of dilution material from Bench 7A is added. The results further confirmed that at a beneficiation RD of 2.0g/cm^3, it is not possible to tolerate any dilution material from Bench 7A. However, the results indicated that it is not practical to dilute Bench 7B with material from Bench 8 because it does no contribute to the overall yield of the product.

It was established that qualities also have an impact on profitability as they can result in the penalisation or rejection of products that are delivered to the customer. If the product qualities do not meet the Eskom qualities they can be rejected. This means that there will be no revenue realised and therefore mining will be conducted at a loss.

When mining, the impact on qualities must be considered in conjunction with yield cut-off. In some of the evaluated dilution scenarios the resultant yield is above the yield cut-off, whilst the resultant ash qualities exceed Eskom's quality specification of 33%. Therefore, in these instances, the coal product would be rejected or in some cases incur penalties.

Lastly, the research has indicated that the variables that are inputs to the yield cut-off function all impact profitability differently. The selling price was found to be the most sensitive to change. The results obtained from the research project indicate that the exploitation of Bench 7B is profitable when mined without any dilution. In addition, certain amounts of the Bench 7A and Bench 8 can be added to Bench 7B whilst profitability and product specifications are maintained. Based on these results, it is recommended that Bench 7B be mined as it is profitable. It is further recommended that this mining should be undertaken with little to no dilution be included to Bench 7B. The material obtained from this Bench should be mined at a wash density that is less than 2.0 g/cm^3.