

Effects of Groundwater Level on Slope Stability of Open Pit Coal Mine

Eko Santoso^{1, a)}, Rexy Fernando^{1, b)}, M. Zainal Kahfi^{2, c)}

¹ Mining Engineering, Universitas Lambung Mangkurat, Jl. Ahmad Yani Km 35.5 Banjarbaru, Indonesia

² Geology & Geotech Supervisor PT Arutmin Indonesia Site Asam-Asam, Jl. A Yani Km 121, Asam-Asam, Indonesia

^{a)}Corresponding author: eko@ulm.ac.id

^{b)}rexy.herawati@gmail.com,

^{c)}zainalkahfi@gmail.com

Abstract. The coal mine slopes in the Warukin formation consist mostly of sandstone and claystone. Moreover, those stones are part of sedimentary rocks. One of the factors that influence the instability of sedimentary rock slopes was the presence of the groundwater level because it can reduce the internal strength of the slope and increase the slope load. The essential job of a geotechnical engineer is to know the presence, type, and level of groundwater. The purpose of this study was to determine the effect of the groundwater level variation on slope instability. Characterization of groundwater parameters in this study used the slug test and seepage mapping. The slug test was used to determine the value of soil hydraulic conductivity, and the seepage mapping was used to determine the distribution pattern of the seepage point in the study area. From the slug test, the hydraulic conductivity values ranged from 10^{-5} to 10^{-6} m/s. It means that the aquifer layer in the study area was identified as fine sandstone aquifer. The seepage mapping activities showed that the most seepage was found in the sandstone layers with a percentage of 60%. The results of the slope stability analysis obtained the value of the safety factor (SF) for cross-section A-A' 1.56 at the low wall and 1.42 at the high wall. In cross-section C-C', the SF value was 1.77 at the low wall and 1.26 at the high wall. Linear correlation between the safety factor and the groundwater level were obtained in this study after analyzing slope stability with groundwater level variations. The slope safety factor decreases when the groundwater level increases; however, the safety factor increases when the groundwater level decreases.

INTRODUCTION

PT. Arutmin Indonesia was located in Kalimantan which is near the equator with a tropical climate which receives abundant high rainfall. This condition makes the application of open pit coal mining in Kalimantan even more complicated. The main problem of slope stability is not only related to the geological conditions but also the groundwater conditions [4].

Problems associated with slope stability can be of vital importance to the working and profitability of open pit mining operations [3, 13 and 16]. The groundwater is one of the critical factors in the slope stability. The effect of a groundwater on slope stability by reducing the strength of the rock or soil, changing the mineral elements in the rock through chemical reactions or dissolving, changing the density of the rock or soil, and causing erosion. [1, 8, 10 and 18]. The more groundwater level rise, the more pore water pressure increase. This means reducing the shear resistance of the slope mass, especially in soil material. [3, 15]

The groundwater level affects slope stability not only by reducing the internal strength of the slope but also increasing the slope load [11]. This study examines the stability of slopes at low and high walls where both locations are very crucial for the continuity of the production process. This paper presents an approach to the effect of groundwater level on mine slope stability.

The groundwater parameter characterization begins by calculating the hydraulic parameter values in the aquifer system and describing the seepage distribution pattern in the study area. Both processes are fundamental in identifying groundwater conditions [2, 6 and 9].