INTISARI

Telah terjadi longsor di Desa Baleagung Kabupaten Magelang pada Januari 2018 diakibatkan oleh hujan lebat di wilayah Desa Baleagung yang menyebabkan kerusakan pada rumah warga setempat. Selain itu, rekahan-rekahan juga terdapat di beberapa lokasi sekitar, dimana indikasi lereng di sekitar Desa Baleagung masih aktif bergerak. Berdasarkan peta zona kerentanan, Desa Baleagung juga termasuk zona kerentanan tinggi terhadap bencana longsor. Karena latar belakang hal-hal tersebut, penelitian ini bertujuan untuk menganalisis mekanisme gerakan tanah di Desa Baleagung pengaruh pembasahan akibat hujan.

Penelitian dilakukan dengan melakukan *back-analysis* untuk mengetahui kondisi awal muka air tanah dan pengaruh pembasahan hujan terhadap stabilitas lereng. Pemodelan menggunakan *tank model* juga dilakukan untuk mendapatkan pengaruh curah hujan terhadap fluktuasi muka air tanah. Mekanisme pergerakan tanah akan didapatkan melalui analisis model *visco-plastic*. Parameter tanah didapatkan melalui uji sampel tanah di laboratorium dan uji permeabilitas tanah di lapangan. Data hujan didapatkan dari data Satelit Himawari-8 pada tanggal 1/1/2018 – 19/1/2018 untuk *back analysis* dan tanggal 1/12/2019 – 10/3/2020 untuk parameter input analisis fluktuasi muka air tanah pada SLOPE/W dan SEEP/W Geostudio 2018 R2.

Hasil yang didapat dari *back-analysis* menggunakan SEEP/W dan SLOPE/W dari Geostudio 2018 R2 yaitu kondisi muka air tanah awal menunjukkan bahwa pembasahan akibat hujan berpengaruh terhadap penurunan nilai faktor aman. Penurunan nilai faktor aman diakibatkan oleh kenaikan tekanan air pori dan kenaikan muka air tanah. Dari hasil *back-analysis* didapatkan nilai parameter kuat geser untuk c dan φ pada *layer* 1 adalah 10,21 kN/m^2 dan 16,21° serta *layer* 2 adalah 10,14 kN/m^2 dan 13,74°. *Layer* 1 adalah susunan tanah dari elevasi 600 m sampai permukaan tanah atas dan *layer* 2 dari elevasi 540 m hingga 600 m. Tank *model* digunakan sebagai pembanding hasil analisis perangkat lunak Geostudio 2018 R2. Dari hasil analisis fluktuasi muka air tanah dengan *tank model* didapatkan kenaikan muka air tanah 20 cm dalam rentang waktu 101 hari yakni pemantauan tanggal 1/12/2019 – 10/3/2020 dengan hujan rata-rata 24,46 mm. Hasil tersebut didapatkan berdasarkan hasil prediksi pemodelan dan tidak ada validasi muka air tanah di lapangan. Analisis mekanisme gerakan tanah dapat ditentukan dengan model *visco-plastic*. Berdasarkan hasil prediksi model *visco-plastic* diperoleh hasil pergerakan tanah 61,43 mm. Untuk kehandalan prediksi perlu dilakukan pengecekan hasil pemantauan ekstensometer di lapangan pada tanggal 1/12/2019 – 10/3/2020. Hasil pemantauan di lapangan diperoleh hasil pergerakan 59,68 mm. Hasil dari model prediksi menunjukkan nilai yang mendekati hasil pemantauan, yakni dengan eror 0,03. Kecepatan pergerakan tanah yang diperoleh dari prediksi pemodelan adalah $7{,}11\times10^{-9}$ m/s, dimana termasuk tipe pergerakan tanah amat sangat lambat. Berdasarkan hasil pemodelan didapatkan kondisi lereng untuk saat ini adalah kondisi kritis dengan nilai faktor aman 1,176 dimana sewaktu-waktu bisa terjadi longsor. Rekomendasi usaha mitigasi yang sesuai adalah mitigasi nonstruktural yaitu sistem peringatan dini. Kedepannya bisa dikembangkan desain kriteria peringatan dini longsor berdasarkan intensitas hujan.

Kata kunci: kerawanan longsor, pembasahan akibat hujan, muka air tanah, stabilitas lereng, *tank model*, *visco-plastic*, mitigasi

ABSTRACT

Landslide occured in Baleagung Village in January 2018 and damaged local residency buildings. The landslide occurred because of high-intensity rainfall on the day before. Meanwhile, cracks formed in several areas that were indicated by the slope around the village were still actively moving. Based on susceptibility maps, majority of Magelang Regency is considered as intermediate and high susceptible areas against landslide. Therefore, mitigation is urgently needed to minimize the risk of further landslide movement. This study aimed to analyze the mechanism of ground movement at Baleagung Village which was affected by rainfall.

This research was conducted by using back-analysis method to determine the initial groundwater level conditions and its effect on the slope stability. Modeling using tank model is also carried out for comparasion to obtain the effect of rainfall on ground water level fluctuations. The mechanism of soil movement will be obtained through visco-plastic analysis. Soil parameters were obtained by laboratory testing and permeability tests in the field. Subsequently, rainfall data was collected from Himawari-8 Satellite from date 1/1/2018 – 19/1/2018 for back analysis and date 1/12/2019 – 10/3/2020 used as the data input parameter for numerical analysis using SEEP/W and SLOPE/W from Geostudio 2018 R2.

The results obtained from back-analysis showed that rainfall infiltration into the soil affected the degradation of safety factor value that was caused by the increase of pore-water pressure and the decrease of effective stress. The degradation of safety factor was caused by the increasing of soil saturation degree when water infiltrated into the ground. From back-analysis results, the shear strength parameter values for c and φ on layer 1 are 10,21 kN/m^2 and 16,21° and layer 2 respectively 10,14 kN/m^2 and 13,74°. Layer 1 is a soil model layer from elevation 600 m to the soil surface, and layer 2 is from elevation 540 m to 600 m. Tank model is used as a comparison for the analysis results of Geostudio 2018 R2 software. From the results of groundwater level fluctuations with tank model, it was determined that the groundwater level increased by 20 cm in a period of 101 days on 1/12/2019 – 03/10/2020 with the average rainfall of 24,46 mm. Those results were obtained based on the results of modelling predictions and there was no groundwater fluctuation validation in the field. Analysis of the mechanism of soil movement can be determined with the visco-plastic model. Soil movement results from visco-plastic model is 61,43 mm. For the reliability, it is necessary to check the results of extensometer monitoring in the field on 1/12/2019 - 3/10/2020. The results of monitoring in the field showed a movement of 59,68 mm. The results of the prediction model show a value close to the monitoring results, with an error of 0,03. The velocity of soil movement obtained from the modeling is 7,11×10^{-9} m/s, which is a very slow type of soil movement. Based on the modeling results, it is found that the slope condition for now is a critical condition with a safety factor value of 1,176 where landslides can occur any time. The recommendation given is non-structural mitigation, which is the design criteria for community-based early warning system development based on rainfall intensity.

Keywords: landslide susceptibility, rainfall-induced landslide, groundwater level, slope stability, tank model, visco-plastic, landslide mitigation.