

INTISARI

Pada tanggal 28 September 2018, bencana likuefaksi terjadi di Sibalaya, Kabupaten Sigi, Provinsi Sulawesi Tengah. Bencana yang dipicu oleh gempa bumi berkekuatan $7,5 M_w$ ini merusak saluran irigasi, lahan, dan jalan seluas 51,2 ha. Penyebab likuefaksi adalah peningkatan tekanan air pori tanah, sehingga rasio tekanan air pori (r_u) dianalisis dalam penelitian ini. Nilai r_u tersebut dijadikan acuan untuk menentukan kerawanan likuefaksi. Kerawanan Sibalaya terhadap likuefaksi menjadi latar belakang diperlukannya mitigasi untuk mencegah kejadian serupa. Pada studi ini dilakukan evaluasi efektivitas pembangunan *release wells* sebagai bentuk mitigasi likuefaksi di Saluran Irigasi Gumbasa segmen Sibalaya. *Release wells* dirancang dengan cepat menghilangkan peningkatan tekanan air pori tidak normal yang mungkin terjadi selama gempa bumi.

Analisis dilakukan menggunakan data Uji Penetrasi Standar (SPT) dan uji laboratorium dari empat lubang bor hasil investigasi tanah tahun 2021 dengan kedalaman maksimal 20 meter serta data mikrotremor kedalaman sampai dengan batuan dasar hasil pengujian tahun 2023. Analisis likuefaksi menggunakan pendekatan respons situs nonlinier satu dimensi, model GQ/H+PWP, dengan program DEEPSOIL V.7. Pemodelan yang dilakukan dalam penelitian ini berdasarkan data SPT dan uji laboratorium, serta penampang melintang Saluran Irigasi Gumbasa segmen Sibalaya. Simulasi numerik yang dilakukan menggunakan integrasi software Geostudio 2022.1 yaitu QUAKE /W dan SEEP /W.

Hasil analisis menunjukkan bahwa beberapa lapisan yang terdapat pada lubang bor memiliki r_u lebih dari atau sama dengan 0,8. Hal ini menunjukkan bahwa daerah Sibalaya masih rawan terhadap likuefaksi. Hasil simulasi menunjukkan bahwa terjadi peningkatan tekanan air pori akibat gempa bumi 0.5 g selama 55 detik dan *release wells* mampu mendisipasi kenaikan tekanan air pori tersebut. Oleh karena itu, pembangunan *release wells* direkomendasikan sebagai upaya mitigasi terhadap likuefaksi.

Kata Kunci : Likuefaksi, Gempa Bumi, *Release wells*, Disipasi tekanan air pori

ABSTRACT

A catastrophic event took place in Sibalaya, Sigi District, Central Sulawesi Province on September 28, 2018. The catastrophe was initiated by a seismic event with a magnitude of 7.5 on the richter scale. An area of 51.2 hectares has been affected by the destruction of an irrigation canal, land, and roads. The occurrence of liquefaction is attributed to an elevation in the pore water pressure within the soil. Therefore, this study focuses on analyzing the pore water pressure ratio (r_u). This value r_u is used as a reference to determine the susceptibility of factional changes. The susceptibility of Sibalaya to liquefaction serves as the basis for the necessity of implementing mitigating measures to avert comparable occurrences. This study conducted an assessment to determine the efficacy of constructing release wells as a means of mitigating liquefaction in the Gumbasa Irrigation Canal within the Sibalaya segment. Release wells are specifically engineered to rapidly mitigate aberrant surges in pore water pressure that may arise during seismic events.

The study utilized data obtained from four boreholes excavated in 2021 specifically for soil research purposes. These boreholes reached a maximum depth of 20 meters. Additionally, the study incorporated results from Standard Penetration Tests (SPT) and laboratory tests. Additionally, it examined data pertaining to the depth of microtremors and the results of bedrock tests conducted in 2023. The liquefaction analysis will be conducted using the DEEPSOIL V.7 program, which employs a one-dimensional nonlinear site response technique known as the $GQ/H+PWP$ model. The modeling used in this study relies on SPT data, laboratory experiments, and cross-sections of the Sibalaya segment of the Gumbasa Irrigation Canal. Geostudio 2022.1 software integration, specifically $QUAKE/W$ and $SEEP/W$, was utilized to conduct numerical simulations.

The study results indicate that the pore water pressure ratio r_u at multiple layers within the borehole is greater than or equal to 0.8. This indicates that the Sibalaya region remains susceptible to factional shifts. The modeling findings indicate that the earthquake with a magnitude of 0.5 g caused a rise in pore water pressure for a duration of 55 seconds. However, the release wells effectively mitigated this increase in pore water pressure. Hence, the establishment of release wells is advised as a measure to alleviate factional unrest.

Keywords: liquefaction, earthquake, release wells, dissipation of pore water pressure