Determination of Aquifer Potential of Toga Village, Parigi Moutong District Using Geoelectrical Method

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Abstract. This research was conducted to determine the potential of the aquifer layer in Toga village. The study used the Schlumberger configuration type obstacle geoelectric method by taking four measurement points. Data processing was carried out using progress software and combined with Corel draw for the results of the 2-section cross-section. The results show variations in the value of specific resistance, depth, and layer thickness of each rock type at each measurement point. The results showed the value of aquifers with resistivity values above 50 Ωm in the medium sand layer. The depth of the aquifer detected varies from 2-10 m bmt with an average thickness of 8 m as the surface aquifer layer and a depth of 20-85 m bmt with an average thickness of 30 m as the deep aquifer layer. From all measurement points, Toga village can be concluded to have almost even aquifer potential.

Keywords: Aquifer layer, geoelectric method, Schlumberger configuration, formation factor

1 Introduction

Toga Village is located in Ampibabo District. It has a population of 1,350 people and a population density of 637 (population/km2). Compared to other villages in Ampibabo District, Toga Village has a dense number of settlements (Ampibabo District in Figures, 2022). The existence of population density, development, and economic activities also increases the need for clean water.

The fulfillment of the community's clean water needs in Toga Village generally comes from shallow-dug wells and the Regional Drinking Water Company (PDAM). The physical condition of the dug wells used by the general public could be better, and they need a clear yellowish and mossy watercolor. Meanwhile, the Regional Drinking Water Company (PDAM) in Toga Village has not been functioning for a long time or has been damaged. To anticipate the increasing water demand, it is necessary to find clean water sources such as groundwater.

According to Herlambang [1], groundwater in rock formations traversed by water is called aquifers. The lack of data on the distribution of aquifers and the depth of the existence of groundwater is one of the problems for the community in obtaining good-

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quality water. Research needs to be done to find out the distribution of aquifer layers. One of the geophysical methods that can be used is the geoelectric method of type resistance [2], [3].

The type resistance geoelectric method is an exploration method that utilizes the resistivity properties of the medium below the earth's surface [4]. Based on the specific resistance value obtained, it can be interpreted as a layer that has the potential to be an aquifer layer, as has been done by [5], [6]. [7], [8].

This study aims to determine the rock lithology and potential aquifer layers in the Toga village.

2 Data and Method

The study used the Schlumberger configuration with as many as four line passes. The data obtained are current (I), potential difference (ΔV), and the distance between electrodes. The following equation is used to get the apparent type resistance values of the measurement results.

$$\rho_a = 2\,\pi\,K\,\frac{\Delta V}{I} \tag{1}$$

To determine the aquifer layer, we must know the resistivity value of the material. The resistivity relationship is reflected by the formation factor (F), namely:

$$\mathrm{F} = \frac{\rho}{\rho_w} = \frac{a}{\phi^{-m}} \tag{2}$$

Taib's 1999 table classifies formation factor estimation to determine the aquifer layer in sedimentary rocks [9].

3 Results

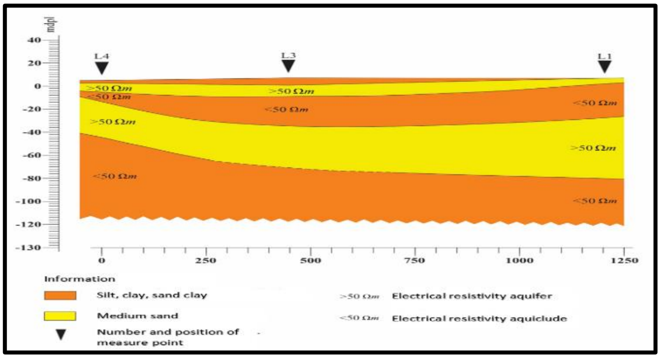

Fig 1. Correlation cross-section of L1, L3 and L4

Line 1 measurements are at the coordinates of the measuring point 00^{0}28'47 "N and 120^{0}03'13"E. Line 2 at coordinates 00^{0}28'56.6 "N and 120^{0}02'53.4"E. Line 3 at the coordinates of measuring point 00^{0}29'01.9 "N and 120^{0}03'01.6"E. Line 4 at coordinates 00^{0}29'01.9 "N and 120^{0}03'01.6"E. The results of the line correlation cross-section are shown in Figure 1 and Figure 2.

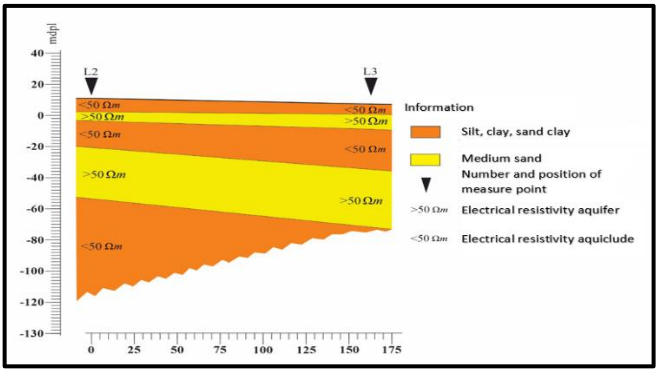

Fig. 2. Correlation cross-section of L2 and L3

4 Discussion

Line 1 (L1) lithology shows two aquifer layers: the second and fourth. Layer 2, the aquifer at a depth of 5 m bmt, has a medium sand rock type. The third layer, 35-85 m deep, is suspected to be the dominant aquifer layer consisting of medium sand or medium sand to coarse sand. The permeability of this layer is alleged to be a medium to productive aquifer layer.

Lithology Line 2 (L2) contains two aquifer layers in the second and fourth layers. The second layer, at a depth of 9-15 m bmt, is considered a surface water layer with medium to coarse sand rock types. Layer four, at a depth of 32-65 m bmt, is considered an aquifer layer with medium sand or sand rocks. This layer is categorized as formation factor type 3 which has a medium to productive aquifer layer.

Lithology Line 3 (L3), the aquifer layer, is in the second and fourth layers. The second layer of the aquifer at a depth of 6-16 m bmt is suspected to be an aquifer layer with a surface water type. The fourth layer is suspected to be the aquifer layer at a depth of 42-75 m bmt that was detected. This layer is categorized as formation factor type 3, which has a medium-to-productive aquifer layer.

Lithology Line 4 (L4), The second layer at a depth of 2.5-10 m bmt is suspected to be an aquifer layer with surface water type. Layer four is allegedly the aquifer layer at a depth of 19-50 m bmt detected. This layer is categorized as formation factor type 3, which has a medium to productive aquifer layer.

5 Conclusion

The results showed that the aquifer value is at a resistivity value above 50 Ωm, which is in the medium sand layer. The depth of the detected aquifer varies from 2-10 m bmt with an average thickness of 8 m as the surface aquifer layer and 20-85 m bmt with an average thickness of 30 m as the deep aquifer layer. From all measurement points, Toga Village can be concluded to have almost uniform aquifer potential.

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