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Groundwater Study in Makassar Region With Using Geoelectricity Resistant Type

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ABSTRACTS

One area that has the potential to experience problems with the management and utilization of groundwater is the Makassar area. Several locations in Makassar are experiencing drought, while groundwater is abundant in other parts. In some places, groundwater availability is quite good, but it isn't easy to obtain in others. Of course, this cannot be separated from the hydrogeological conditions in the Makassar area. The purpose of this research is to identify and map the distribution of groundwater in Makassar City. The research uses the resistivity method, with data including potential values, currents, span length, and rock types found in the research location. Based on the resistivity section, there are two types of groundwater: fresh and brackish. The water is brackish in GL1, with a resistivity range of 2.14 – 22.7 Ohm.m. In GL2, with a resistivity range of 0.1 – 728 Ohm.m, the water is Brackish - Fresh, and in GL3, with a resistivity range of 4.47 – 40.1 Ohm.m. The characteristics of the aquifer in the Makassar area are intermittent based on the depth level.

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INTRODUCTION

One area that has the potential to experience problems with the management and utilization of groundwater is the Makassar Region (Anwar et al., 2022; Muhlis, 2016). Several locations in Makassar are experiencing drought, while in other parts, groundwater is abundant. In some places, groundwater availability is quite good, but it takes work to obtain in others. This, of course, cannot be separated from the hydrogeological conditions of the Makassar Region (Jafar et al., 2022; Shabiruddin et al., 2022).

Geomorphologically, Makassar is a catchment area with volcanic cones that surround and extend along the north-south path past the peak of Mount Lompabang (Nashrullah et al., 2018; Rusdin et al., 2021). Based on this, the Makassar area should have a large groundwater potential. However, along the west coast (including Makassar) is a lowland consisting mostly of swamp and tidal areas (Sukamto and Supriatna, 1982).

As the gateway to Eastern Indonesia, Makassar City has experienced a drastic increase in hotel occupancy growth (Bakri, 2016; Muh Yazid Amsah, 2017; Nashrullah et al., 2018). According to the Association of Indonesian Hotels and Restaurants, in 2016, the growth in the number of hotel rooms in Makassar City in the last three years averaged 69.04%. This figure shows that groundwater exploitation has also increased to meet the basic needs of housing, which must also be large (Nawir and Umar, 2018).

The geoelectric method is a method that injects an electric current into the earth, and then its electrical properties are observed on the earth's surface; the electric current is injected into the earth through two current electrodes (Husain et al., 2022). Then the potential difference that occurs is measured through two potential electrodes. The variation in the resistivity value of each layer below the measuring point can be derived from current and potential differences for each electrode distance. The maximum depth achieved with the resistivity method is between 300 and 600 meters (Bakri & Umar, 2016).

This geoelectrical prediction is intended to obtain an overview of the subsurface soil layers and the possibility of the presence of groundwater and minerals at a certain depth (Wakila et al., 2022). This

geoelectric prediction is based on the fact that different materials will have different resistivity when electrified. Groundwater has a lower resistivity than mineral rocks (Azhar, 2004).

Therefore the authors conducted research in Makassar City, South Sulawesi Province, to identify and map the distribution of groundwater in Makassar City using geoelectric resistivity (Thamsi et al., 2019). This study aimed to determine groundwater distribution (aquifer) using the geoelectrical resistivity method and to analyze groundwater quality using geologic resistivity based on resistivity values.

METHODS

The methodology used in this research is as follows (Bakri, 2015; Prasetyawati Umar & Agung Setiawan, 2017):

1. Preparation Stage; The preparation stage is carried out before leaving for the research location, which consists of the administration stage, the research proposal preparation stage, and the literature study
2. Data Collection; The data collection stage is essentially a method of carrying out fieldwork which includes:
   a. Field orientation is to make direct observations in the field.
   b. Observation and data collection
   c. Photo documentation).
   3. Data Processing

   The data obtained will be processed using several software:
   a. Create an observation table.
   b. Make a map of observation locations and stretch directions.
   c. Make a stacking chart and digitize it.
   d. From the results of digitization, then input to Res2DInv.
4. Data Analysis; Analyze groundwater quality by adjusting the geoelectrical resistivity results with the resistivity table. The resistivity table is used to compare the results of geoelectrical data processing, in this case, a 2D cross-section.

RESULTS AND DISCUSSION

In GL1 it is in the Tamalanrea area, to be precise on the Polytechnic Campus, with a stretch length of 500 m, aquifer thickness of 96 m, aquifer thickness of 25 m, and a resistivity range of 2.14 – 22.7 Ohm.m. GL2 is in the Daya area to be precise at Tanah Field Terminal Daya, with a length of 300 m, aquifer thickness of 63.7 m, aquifer thickness of 25.5 m and a resistivity range of 0.1 - 728 Ohm.m. GL3 is in the Urip Sumohardjo area, on Campus II UMI with a stretch length of 500 m, aquifer thickness of 96 m, aquifer thickness of 50 m, and a resistivity range of 4.47 – 40.1 Ohm.m.

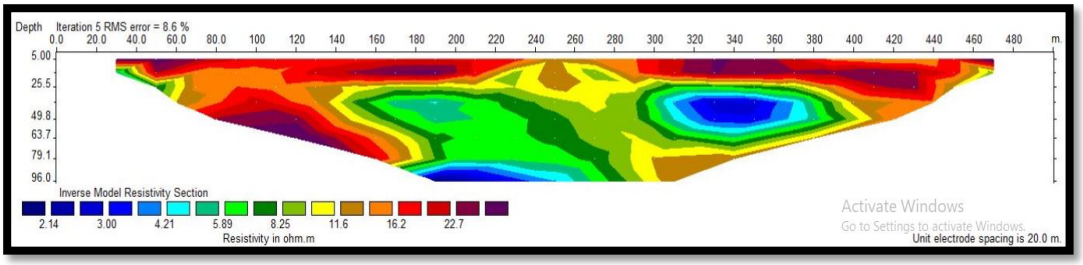

Figure 1. Cross section of GL1

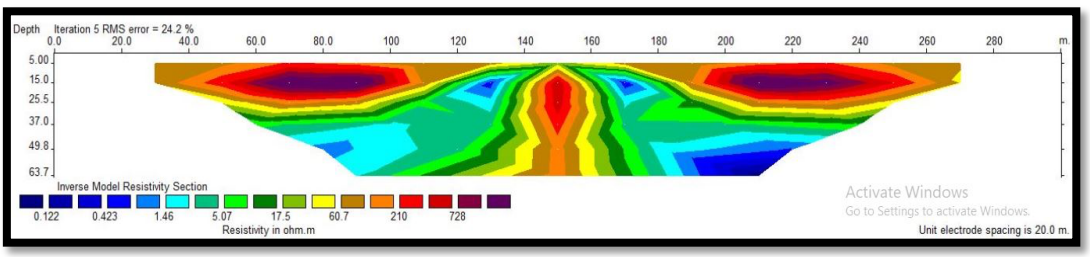

Figure 2. Cross section of GL2

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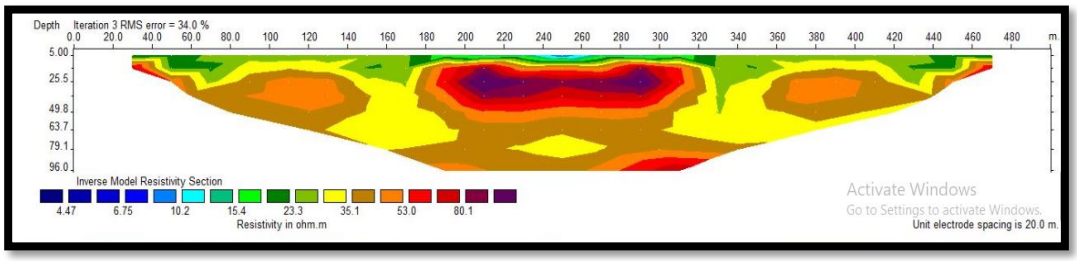

Figure 3. Cross section of GL3

Table 1. Resistivity logs

Lithology	Depth (Meters)	Resistivity Value (Ohm.m)	Description Rock	Information
	0 - 25	11, 062 – 11,064	Soil	Brackish
	25 - 50	10,2 - 90	Volcanic tuff	Brackish – Bark
	50 - 100	3,2 – 54,28	Clay	Brackish – Bark

Obtained GL1 with a stretch length of 500 m, a depth of 96 m, from a resistivity range of 2.14 – 22.7 Ohm.m, which indicates the aquifer in this area is brackish, based on resistivity values. GL2 with a stretch length of 300 m, a depth of 63.7 m, from a resistivity range of 0.1 – 728 Ohm.m, which indicates the aquifer in this area is brackish–fresh based on resistivity values. GL3, with a stretch length of 500 m and a depth of 96 m, from the resistivity range of 4.47 – 40.1 Ohm.m indicates the aquifer in this area is fresh based on the resistivity value (Loke, 2004).

CONCLUSION

Based on the resistivity section, there are two types of groundwater: fresh and brackish. The water is brackish in GL1, with a resistivity range of 2.14 – 22.7 Ohm.m. In GL2, with a resistivity range of 0.1 – 728 Ohm.m, the water is Brackish – Fresh, and in GL3, with a resistivity range of 4.47 – 40.1 Ohm.m.

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