

# Groundwater Investigation Using Schlumberger Vertical Electrical Sounding (VES) in Baturraden Geothermal Working Area (GWA), Central Java, Indonesia

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## Abstract

Groundwater investigation is becoming increasingly important for Indonesia. It is natural resources for sustainable development of a region. In this study, PT Sejahtera Alam Energy conducted an investigation of subsurface conditions, especially related to groundwater potential, carried out by a resistivity investigation method by means of Vertical Electrical Sounding (VES) or Geoelectricity in Embung Area, Baturaden Geothermal Project, Pandansari Village, Paguyangan Subdistrict, Brebes Regency. This method is one of the subsurface estimation methods that is considered suitable for water investigations as well as in terms of accuracy as well as in terms of low cost and faster implementation time compared to other geophysical methods.

## Introduction

Geological condition based on the geological map of the Purwokerto sheet. Location of the investigation included in the Mount Slamet Lava Formation which is composed of volcanic lava deposits, tuffs and lava.

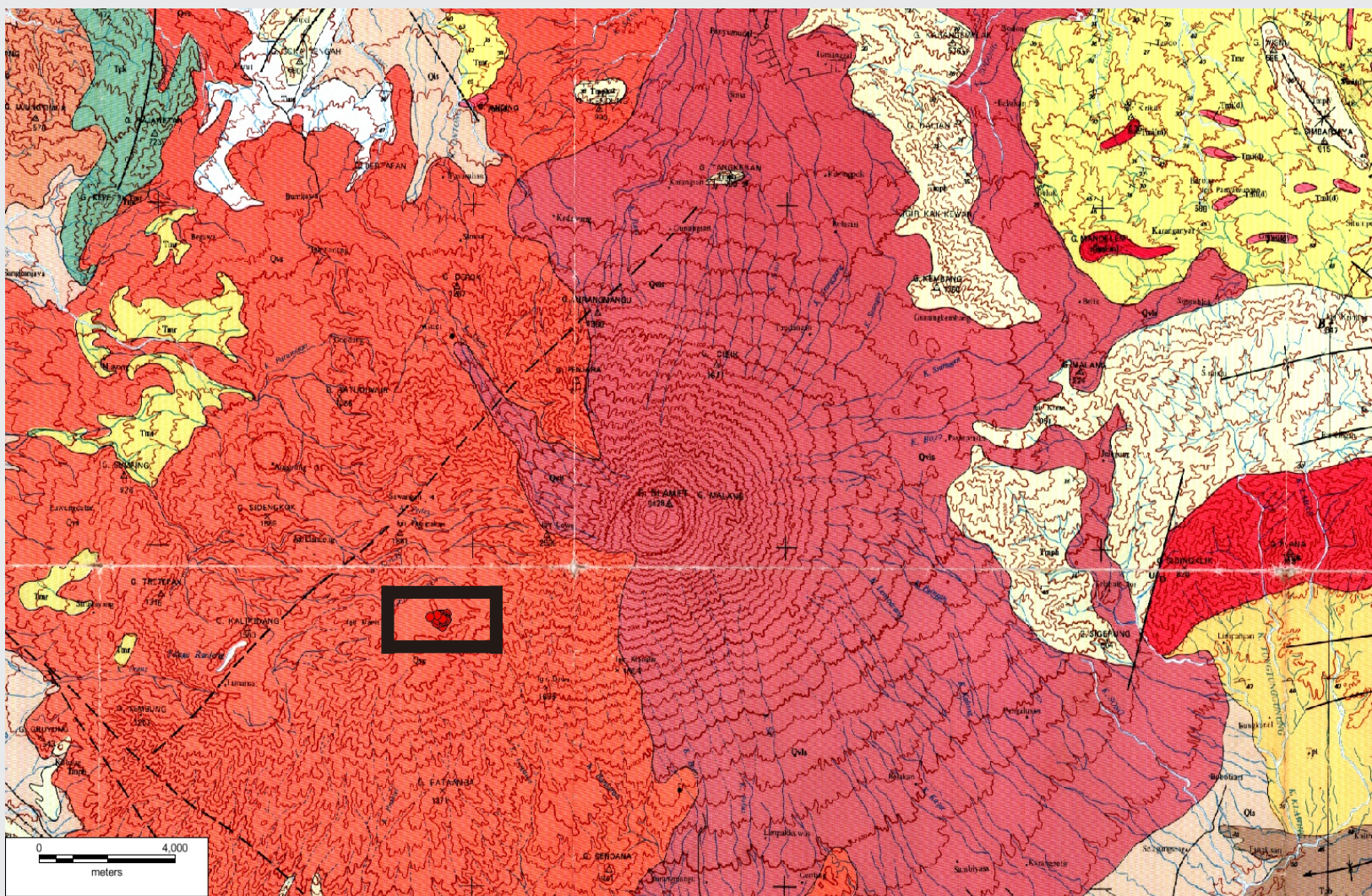


Figure 1. Geological Map of the Purwokerto Sheet (M. Djuri, H. Samodra, T.C. Amin & S. Gafoer, 1996)

The geoelectric survey work is carried out in Embung Area, Baturaden Geothermal Project, Pandansari Village, Paguyangan District, Brebes Regency with twenty five sites

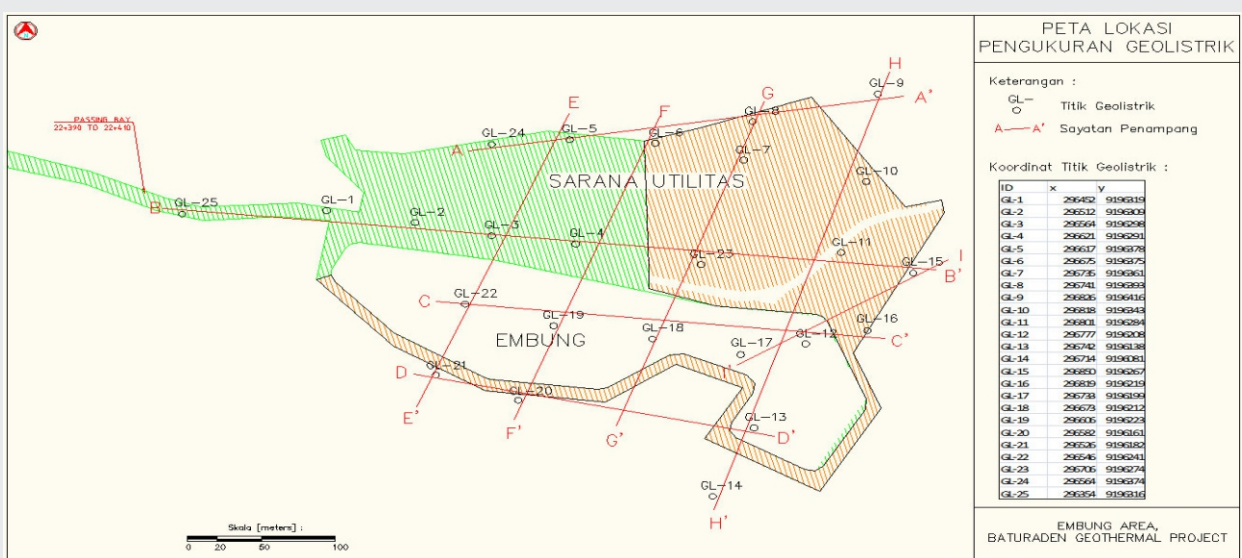


Figure 2. Geoelectric Measurement Location Map

## Methods

Electric current (direct current) is flowed through two current electrodes A and B, there will be a potential difference between the two currents. The potential difference is measured through 2 potential electrodes M and N which are then recorded by the receiver (receiver). The measurement results of the electrical values will be converted into rock types, the position of depth and thickness.

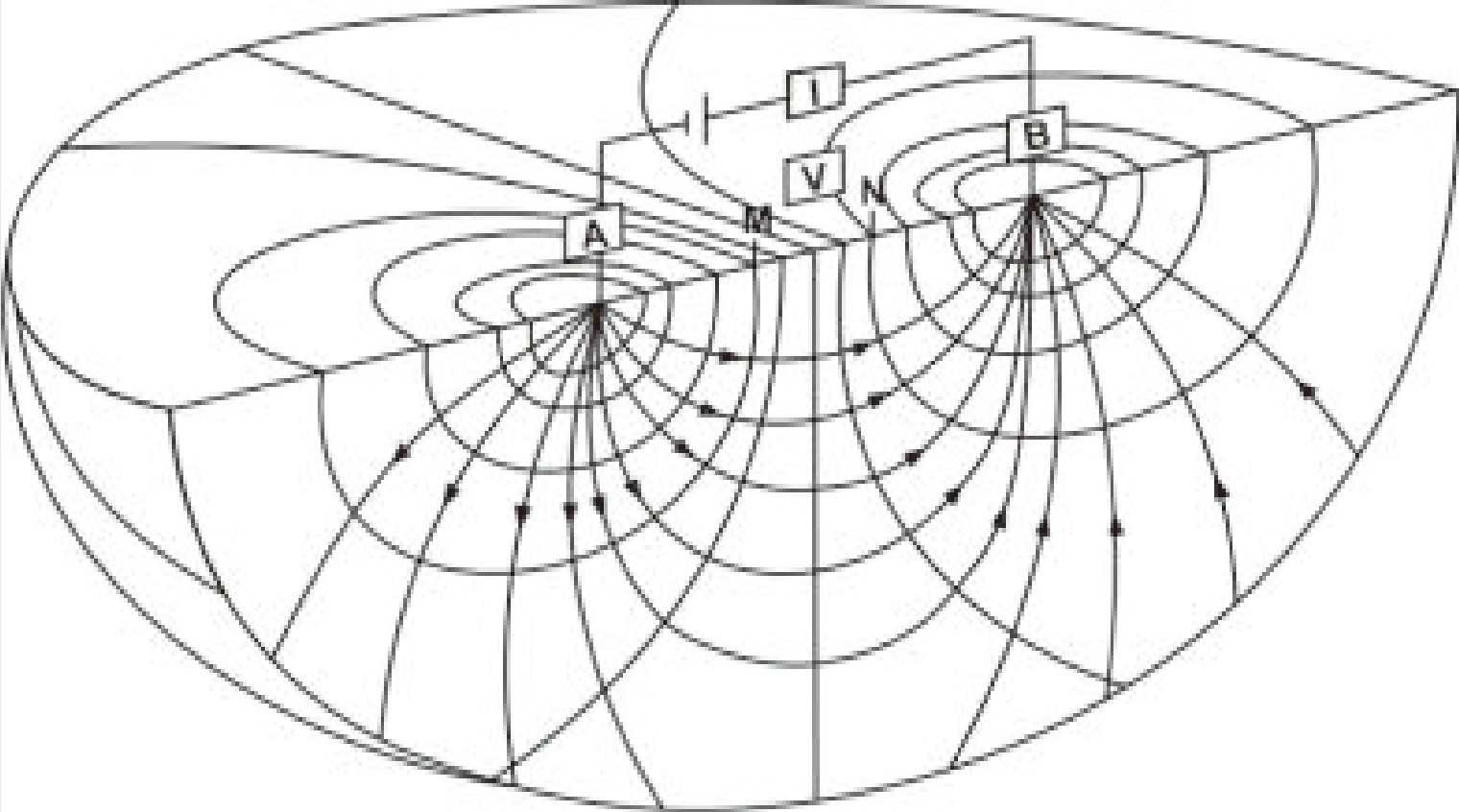


Figure 3. Schlumberger Electrodes Arrangement and Electrical Flow Patterns

In the Schlumberger configuration method the arrangement of electrodes is set with certain distance values. This configuration method of potential electrodes M and N is always placed between the current electrodes A and B. Ohm's law that is used as the basis for calculating the geoelectric probe in obtaining the resistance of the apparent type must be multiplied by the distance factor (K factor).

$$\rho_a = \pi \cdot \Delta V / I (L^2 / I - I/4)$$

$\rho_a$  = apparent resistivity (ohmmeter)

$\Delta V$  = potential difference (volt)

$I$  = current (ampere)

$L$  = half AB current electrode separation (meter)

$a$  = potential MN electrodes spacing (meter)

## Results

The results of geoelectric measurements at the Embung Area location, Baturaden Geothermal Project, found the range of resistivity values between 20.97 and 6315.50 ohmmeters. The range is divided into certain intervals and can be interpreted as lithological layers.

Table 1. The intervals resistivity and lithology of geoelectric measurements

	Resistivity ( $\Omega m$ )	Lithology
1	11 – 100	Tuffaceous-sandstone
2	100 – 1000	Mudflow deposits
3	>1000	Lava

The results of the interpretation of the spread of the resistivity value in a vertical type with a geoelectric cross-section at the study site are divided into 9 cross sections.

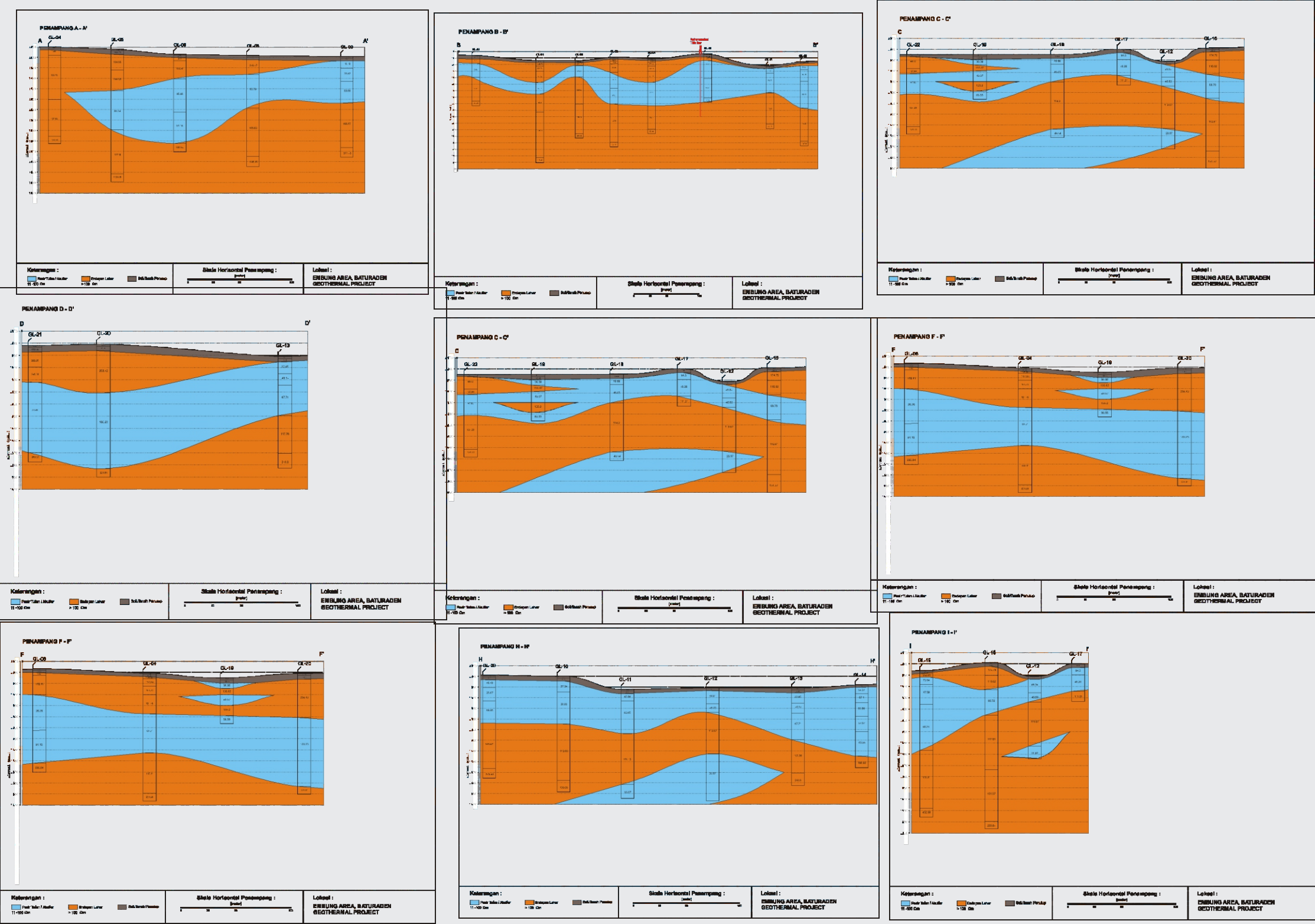


Figure 4. Geoelectrical Sections

## Conclusions

After doing data processing and interpretation of layer types from geoelectric data are supported by geological, geohydrological and field observations related to soil water aspects, so it can be concluded:  
In general, geoelectric measurements in the Embung area, Baturaden Geothermal Project (GL-01 to GL-25) obtained below-ground image are as follows:  
1. The distribution of aquifers is evenly distributed around the Embung site.  
2. The Embung Area is a groundwater basin area.  
3. The lithology condition of the Embung location area consists of soil with a thickness of about 5 meters, laying of mudflow deposits and tuffaceous-sandstone with varying depth and thickness.

## References

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