

APPLICATION OF GEOPHYSICAL METHOD FOR DETERMINING SEAWATER INTRUSION IN COASTAL AQUIFER

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ABSTRACT

A study of seawater intrusion has been proposed in the coastal area of Pahang. Electrical resistivity tomography (ERT) is a geophysical technique that used in this study. The survey was conducted at UMP, Tanjung Batu and Nenasi using Wenner-Schlumberger protocol. Electrical resistivity profile obtained from the survey indicates an area with low resistivity value (<5Ωm) associated with the resistivity value of seawater.

INTRODUCTION

Groundwater resources are reliable source of freshwater in many parts of the world. One of the major problems of groundwater aquifer in the coastal area is seawater intrusion. An investigation using electrical resistivity tomography was conducted at the coastal area of Pahang in order to identify of seawater migration into the coastal groundwater aquifer

OBJECTIVES

1. To identify subsurface profile using Electrical Resistivity Tomography (ERT)
2. To determine seawater intrusion area using electrical resistivity value

MATERIALS AND METHODS

1. ABEM Terrameter SAS 4000 and a switcher unit were used to control the induction of current and potential readings from electrodes connected by multicore-cable along the survey line. A resistivity survey line with length 400 meters was setup by using Wenner-Schlumberger protocol, where spacing between each electrode was 5 meter
2. Resistivity data were interpreted and analyzed by using RES2DINV software



Figure 1: ABEM Terrameter SAS4000, electrode selector, multicore cables, clips, electrodes and battery

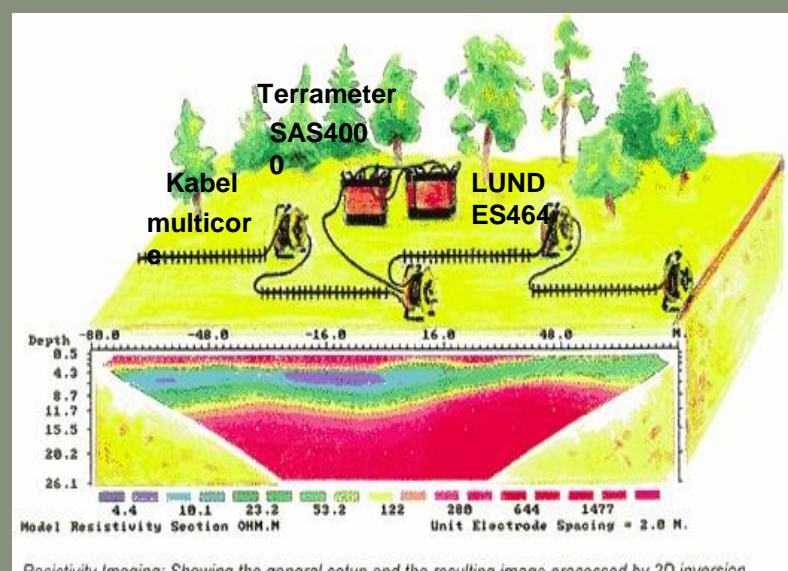
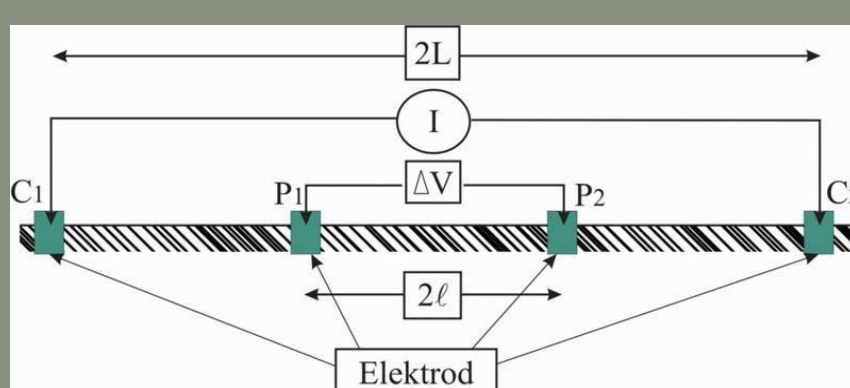


Figure 2: Arrangement of equipment on survey line



C= Current electrode P= Potential electrode
 Resistivity (R) = $\Delta V / I$

Figure 3: Werner-Schlumberger electrode configuration for ERT survey

RESULTS AND DISCUSSION

1. The low resistivity value is associated to seawater intrusion. The resistivity value below than 4.0 Ωm gave significant impact of the presence of saline water in aquifers (Oyeyemi,2015).
2. The two dimensional (2D) resistivity profiles obtained from the survey have a range of resistivity value between 0 – 1,500Ωm and for the interpretation, this value will be divided into three ranges based on established resistivity value by Loke 1999.

Table 1: Resistivity and conductivity value of selected soils and water . Modified after Loke 1999.

Material	Resistivity (Ohm-m)	Conductivity (Ohm-m) ⁻¹
Soil and water		
Clay	1-100	1-0.01
Alluvium	10-800	1.25 X 10 ⁻³ - 1.7 X 10 ⁻³
Fresh water	10-100	0.01-0.1
Sea water	0.15	6.7

Table 2: Interpretation of resistivity value for the study area

Resistivity Value	Material	Mark
< 5 Ωm	Seawater	Dark blue colour
10 - 100 Ωm	Fresh water	Turquoise – green colour
> 1000 Ωm	Hard layer (rock)	Red – purple colour

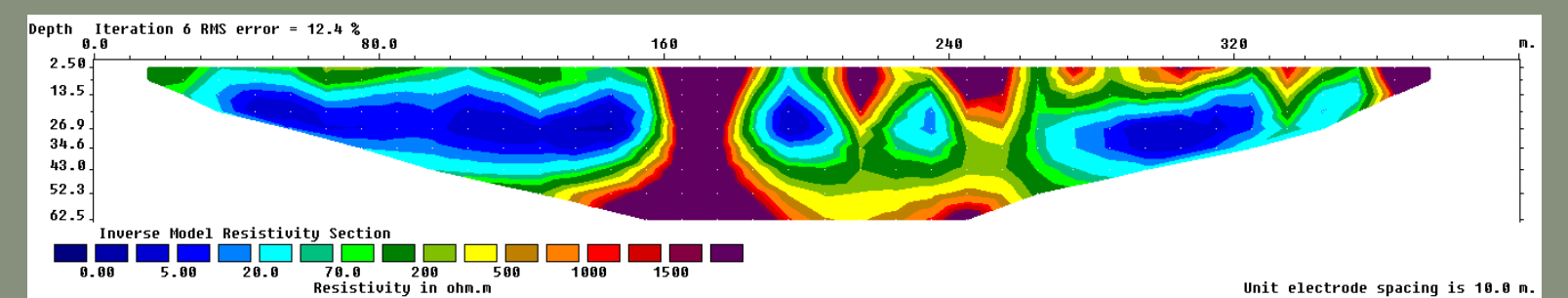


Figure 4: 2D electrical resistivity profile for UMP

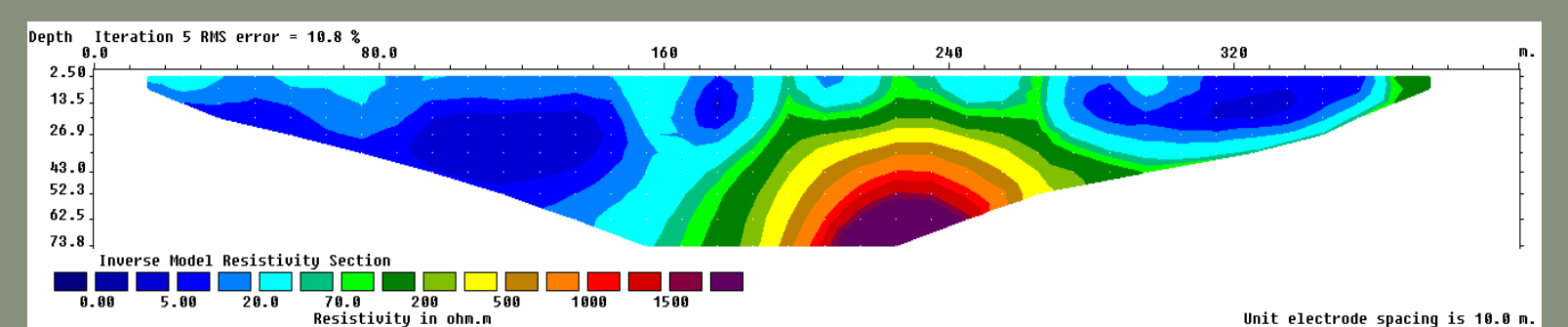


Figure 5: 2D electrical resistivity profile for Tanjung Batu

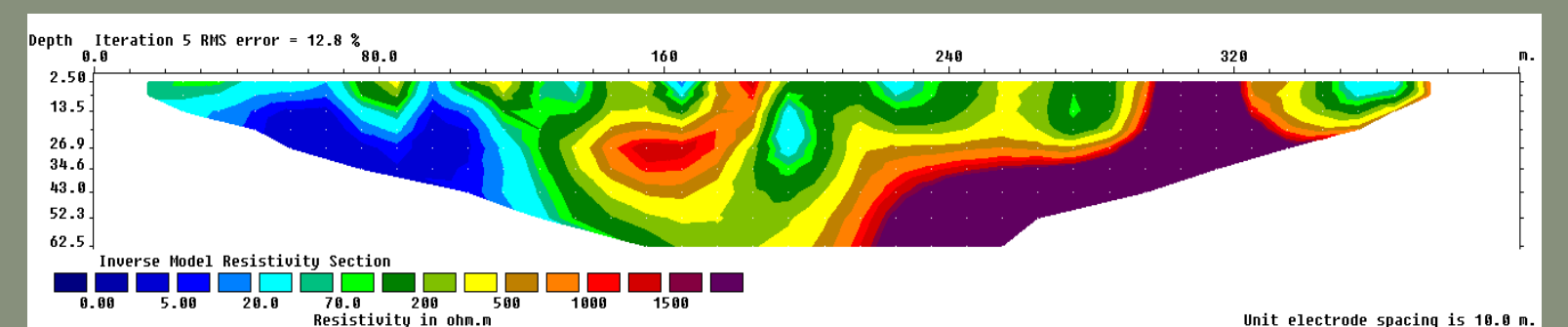


Figure 6: 2D electrical resistivity profile for Nenasi

CONCLUSION

Electrical Resistivity Tomography (ERT) is a geophysical method that can be used to identify the subsurface profile. Modelling of data from electrical resistivity imaging technique produced two dimensional (2D) electrical resistivity profile for UMP, Tanjung Batu and Nenasi. The low resistivity value (<5 Ωm) identified in the electrical resistivity profile is the indicator for determining seawater intrusion in the study area.

REFERENCES

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