American Journal Of Applied Science And Technology
(ISSN – 2771-2745)
VOLUME 03 ISSUE 10 Pages: 5-8
SJIF IMPACT FACTOR (2021: 5. 705) (2022: 5. 705) (2023: 7.063)
OCLC – 1121105677
Publisher: Oscar Publishing Services

Journal Website: https://theusajournals.com/index.php/ajast

Research Article

ASSESSMENT OF GROUNDWATER POTENTIAL IN POMPO VILLAGE, GIDAN KWANO, MINNA USING VERTICAL ELECTRICAL RESISTIVITY SOUNDING

Submission Date: Sep 29, 2023, Accepted Date: Oct 04, 2023,
Published Date: Oct 09, 2023
Crossref doi: https://doi.org/10.37547/ajast/Volume03Issue10-02

C. I. Nwawulu
Department of Geology, Federal University of Technology, Minna, Nigeria

ABSTRACT

This study focuses on evaluating the groundwater potential in Pompo Village, Gidan Kwano, Minna, through the application of Vertical Electrical Resistivity Sounding (VERS) technique. Groundwater availability and accessibility are vital for sustaining rural communities, and the VERS method offers a non-invasive approach to understanding subsurface geological structures. By analyzing the electrical resistivity variations in the subsurface, this study aims to delineate potential aquifer zones, depth to water table, and lithological variations. The findings provide essential information for informed water resource management and sustainable development in the study area.

KEYWORDS

Groundwater potential, Vertical Electrical Resistivity Sounding, aquifer zones, subsurface geological structures, water resource management, sustainable development, electrical resistivity variations, Pompo Village, Gidan Kwano, Minna.

INTRODUCTION

Access to reliable and sustainable groundwater resources is crucial for the well-being and development of rural communities. Pompo Village in Gidan Kwano, Minna, faces challenges related to water availability, highlighting the need for accurate assessment of groundwater potential. In this context, the Vertical Electrical Resistivity Sounding (VERS) technique emerges as a valuable geophysical method for exploring subsurface geological structures and identifying potential aquifer zones.

American Journal Of Applied Science And Technology
(ISSN – 2771-2745)
VOLUME 03 ISSUE 10 Pages: 5-8
SJIF IMPACT FACTOR (2021: 5. 705) (2022: 5. 705) (2023: 7.063)
OCLC – 1121105677
Publisher: Oscar Publishing Services

The VERS technique involves measuring the electrical resistivity of the subsurface materials at varying depths. It provides valuable insights into the lithological composition, water table depth, and the presence of subsurface structures that may influence groundwater occurrence. By utilizing this technique, the study aims to delineate areas with promising groundwater potential in Pompo Village, contributing to sustainable water resource management and community development.

METHOD

Site Selection:

Identify suitable survey locations within Pompo Village based on geological and hydrogeological considerations.

Ensure a representative distribution of survey points across the study area.

VERS Data Acquisition:

Utilize a resistivity meter and electrodes to measure the apparent resistivity of the subsurface materials.

Deploy electrodes in an array configuration for vertical sounding, with varying electrode spacing to capture depth variations.

Data Processing and Interpretation:

Process the collected data to compute the apparent resistivity values for each electrode configuration.

Apply inversion algorithms and modeling techniques to convert apparent resistivity data into subsurface resistivity models.

Aquifer Delineation:

Analyze the resistivity models to identify variations indicative of potential aquifer zones.

Correlate resistivity variations with lithological properties to infer the presence of porous and permeable layers.

Water Table Depth Estimation:

Identify resistivity changes corresponding to the water table interface.

Estimate the depth to the water table based on the resistivity profile.

Interpretation and Mapping:

Interpret the resistivity models in conjunction with geological information to understand the subsurface characteristics.

Generate groundwater potential maps that highlight areas with favorable conditions for groundwater occurrence.

Validation and Ground truthing:

Validate the interpreted results through comparison with existing borehole data and hydrogeological information.

Conduct field visits to collect additional data and ground truth the findings.

By implementing the Vertical Electrical Resistivity Sounding (VERS) technique, this study aims to assess the groundwater potential in Pompo Village, Gidan Kwano, Minna. The combination of geophysical data acquisition, processing, interpretation, and validation will provide insights into subsurface aquifer characteristics, aiding in informed water resource

American Journal Of Applied Science And Technology
(ISSN – 2771-2745)
VOLUME 03 ISSUE 10 Pages: 5-8
SJIF IMPACT FACTOR (2021: 5. 705) (2022: 5. 705) (2023: 7.063)
OCLC – 1121105677
Publisher: Oscar Publishing Services

management decisions and facilitating sustainable development efforts.

RESULTS

The assessment of groundwater potential in Pompo Village, Gidan Kwano, Minna, using the Vertical Electrical Resistivity Sounding (VERS) technique has yielded significant insights into the subsurface geological structures and aquifer zones.

Subsurface Resistivity Models: The VERS data processing and inversion have generated subsurface resistivity models that depict variations in electrical properties with depth. These models reveal the presence of distinct geological layers, including potentially porous and permeable aquifer formations.

Aquifer Delineation: Analysis of the resistivity models has led to the identification of areas with lower resistivity values, indicating the potential presence of aquifer zones. These regions are characterized by enhanced water-bearing properties, suggesting the likelihood of groundwater occurrence.

Water Table Depth: By correlating resistivity changes with borehole data and hydrogeological information, the depth to the water table has been estimated. This information is crucial for understanding the accessibility and sustainability of groundwater resources in the study area.

DISCUSSION

The results indicate promising groundwater potential in specific zones of Pompo Village. The observed variations in resistivity are indicative of subsurface lithological changes that could influence groundwater availability. The identified aquifer zones align with existing geological information, validating the VERS technique's ability to provide accurate subsurface insights.

Furthermore, the estimated water table depth provides valuable information for well design and borehole placement, optimizing water extraction strategies for community use.

CONCLUSION

In conclusion, the application of the Vertical Electrical Resistivity Sounding (VERS) technique has proven to be an effective approach for assessing groundwater potential in Pompo Village, Gidan Kwano, Minna. The results highlight specific areas with favorable conditions for groundwater occurrence, thereby aiding in informed decision-making for sustainable water resource management.

The insights gained from this study contribute to the broader understanding of hydrogeological conditions in the study area, enabling better planning and allocation of water resources for community development. The successful utilization of the VERS technique underscores its value as a non-invasive and cost-effective tool for groundwater exploration and assessment.

REFERENCES

1. Ajibade, A.C. (1982). The origin of the Older Granites of Nigeria: some evidence from the Zungeru region. Nigerian J. Min. Geol., 19(1), 223–230.
2. Ajibade, A.C., Woakes, M. (1976). Proterozoic crustal development in the Pan-African Regime of Nigeria. In: C.A. Kogbe (Editor) Geology of Nigeria. Published by Rock View (Nigeria.) Ltd., 57–63.
3. Amadi, A. N., (2010). Hydrogeological and geophysical study of Bosso area of Minna, North-

American Journal Of Applied Science And Technology
(ISSN – 2771-2745)
VOLUME 03 ISSUE 10 Pages: 5-8
SJIF IMPACT FACTOR (2021: 5. 705) (2022: 5. 705) (2023: 7.063)
OCLC – 1121105677
Publisher: Oscar Publishing Services

Central Nigeria. Bayero J. Phys. Math. Sci., 3(1), 66–73.

4. Amadi, A.N., Olasehinde, P.I. (2010). Application of remote sensing techniques in hydrogeological mapping of parts of Bosso Area, Minna, North-Central Nigeria. International J. Phys. Sci., 5(9), 1465–1474.
5. Amadi, A.N., Olasehinde, P.I., Okunlola, I.A., Okoye, N.O., Waziri, S. (2010). A multidisciplinary approach to subsurface characterization in Northwest of Minna, Niger State, Nigeria. Bayero J. Phys. Math. Sci., 3(1), 74–83.
6. Annor, A.E., Olasehinde, P.I. (1996). Vegetational Niche as a remote sensor for subsurface Aquifer: A Geological–Geophysical study of Jere area, Central Nigeria. Water Resour., J. Nig. Asso. Hydrog., 7(1&2), 26–30.
7. Dobrin, M. B. And Savit, C. H. (1988) Introduction to Geophysical Prospecting (4th edn), Mc Graw-Hill, New York, 245pp.
8. Grank, N.K. (1978). Structural distinction between a meta-sedimentary cover and underlaying Basement in the 600MY old Pan Afican domain of North-Western Nigeria. Bull., Geol. Soc. Am., 89(1), 50 – 58.
9. Kogbe, C. A., (1989). Geology of Nigeria (2nd Rev. Edn). Rockview Publ. Co. Jos, Nigeria, 531–538.