

2-DIMENSIONAL GEORESISTIVITY SURVEY AT SAN ISIDRO, ISABELA



SMART WATER INFRASTRUCTURE AND MANAGEMENT R&D CENTER

PHYSIOGRAPHY

The municipality of San Isidro has a land area of 7190 hectares which constitutes about 0.55% of the total land area of Isabela province (PhilAtlas, 2025). It has 13 barangays highlighting the barangay of Cebu as the largest. The topography is relatively flat which is suitable for agriculture and settlements of infrastructure.

LOCAL GEOLOGY

The entire municipality is primarily underlain by the NQS Paleocene to Pleistocene formation as indicated by the light pink shading on the map. This formation typically consists of older sedimentary deposits that have been subjected to varying degrees of lithification and weathering. It includes a range of lithologies such as sandstone, shale, siltstone, and occasional conglomerate layers formed from ancient river and marine environments over a broad geologic time span. This indicates that it is a stable, sedimentary geologic environment with potential for groundwater development

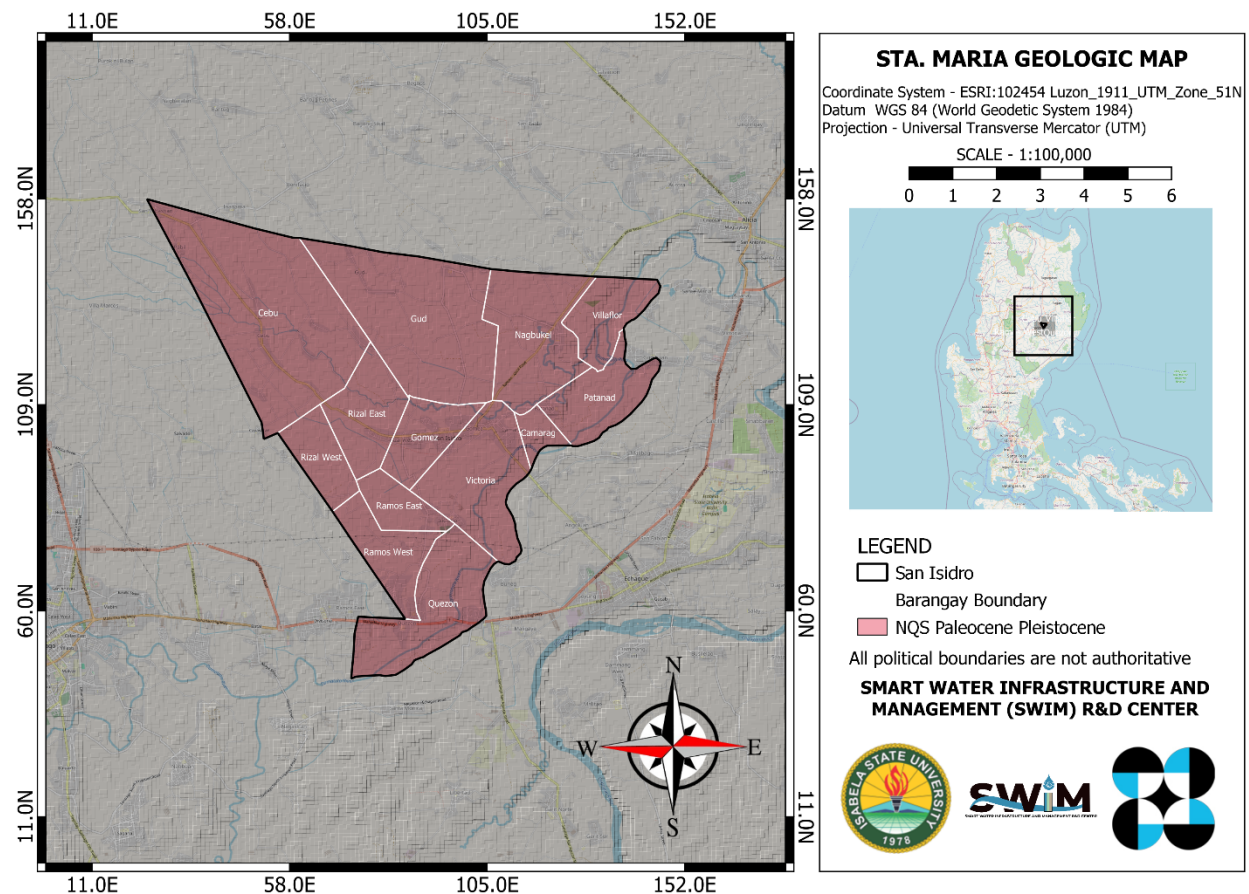


Figure 1. Geologic Map of San Isidro

GEOLOGICAL STRUCTURE

There are no perceptible geologic structures that could significantly affect the groundwater storage and flow. The only identifiable features and structures are found in the uppermost most of the soil and wells extending on the saturated zone or aquifer.

PRINCIPLES

Resistivity is a geophysical surveying technique that utilizes electrical measurements conducted on the ground surface to identify the depth and thickness of subsurface resistivity layers. In groundwater investigations, resistivity surveys help improve the understanding of underground formations and reduce the likelihood of drilling unsuccessful wells.

Since soil and rocks generally act as electrical insulators with high resistance, electrical currents primarily pass through moisture-filled pore spaces. The resistivity of these materials is influenced by factors such as porosity, permeability, the amount of pore water, and the concentration of dissolved solids. Various soil and rock types exhibit different resistivity values depending on their composition, texture, degree of fracturing or weathering, and groundwater content. This method involves injecting a known and often constant electrical current into the ground using two electrodes, called current electrodes. This process generates a potential field (voltage), which is then recorded through another pair of electrodes known as potential electrodes. The resistance obtained from these measurements is adjusted using a geometric factor to calculate the apparent resistivity.

Resistivity surveys can be conducted to analyze the sequence of resistivity layers beneath a specific location, a technique known as vertical electrical sounding (VES). The resistivity values obtained are then interpreted to determine the possible types of rock present below the surface.

RESULT

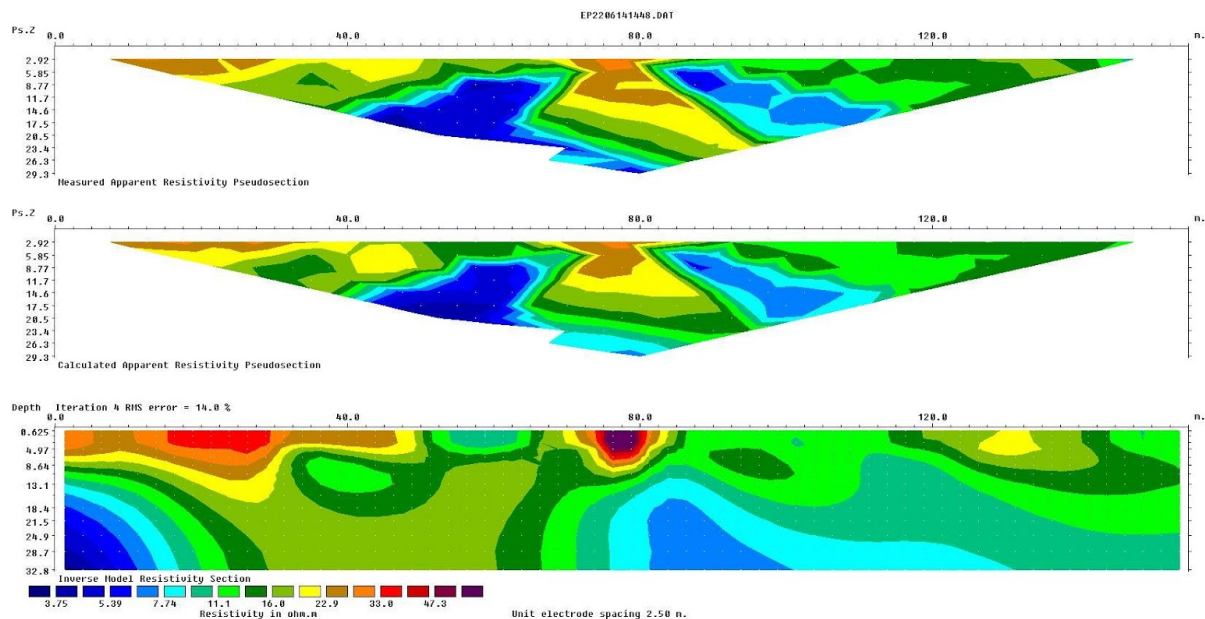


Figure 2. 2D Geo-resistivity result at San Isidro, Isabela

The presented result of the 2D geo-resistivity shows three sections which are the measured apparent resistivity pseudosection (top), the calculated resistivity pseudosection (middle), and the inverse model resistivity section (bottom). The calculated pseudosections indicate consistency between observed and computed data suggesting high accuracy with a RMS error of 14.0%. At the depth of 0.625 meters to 5 meters, high resistivity values are observed which is greater than 33 ohm.m representing a dry and compacted layer. Moreover, at the depths of 6 to 14 meters obtained a resistivity value of 11 to 16 ohm.m which could be a clayey or water-saturated material. A deeper low resistivity zone with a value of 3 to 7 ohm.m is collected at a depth 15 to 32.8 meter which suggest a potential accumulation of groundwater. Furthermore, resistivity values are not constant as you move along the horizontal profile which could result in varying composition of soil type and rock types.

CONCLUSION

Based on the result, the optimal drilling depth should be greater than 15 meters as observed at the start and central section of the horizontal distance soil profile. This area shows the lowest resistivity varying from 3.75 ohm.m to 22.9 ohm.m indicated by blue colors which suggests the possible presence of saturated layer or water bearing layers. At the depth of 0.625 meters to 5 meters, high resistivity values are observed which is greater than 33 ohm.m indicating that the soil is dry and compacted. Moreover, the depth of 6 to 14 meters could also contain water source as it is represented by low resistivity values, however, it is not an ideal water source during dry season.