

2-DIMENSIONAL GEORESISTIVITY SURVEY AT SANTO TOMAS, ISABELA



SMART WATER INFRASTRUCTURE AND MANAGEMENT R&D CENTER

PHYSIOGRAPHY

The municipality of Santo Tomas comprises of 27 barangays with a total land area of 80.58 square kilometers which is 0.62% of total area of Isabela. Its center is located at approximately 17° 24' North and 121° 46' East in the island of Luzon. Elevation at these coordinates is estimated at 34.9 meters or 114.5 feet above mean sea level. (PhilAtlas). Its terrain is relatively flat making it suitable for agriculture and infrastructure settlements.

LOCAL GEOLOGY

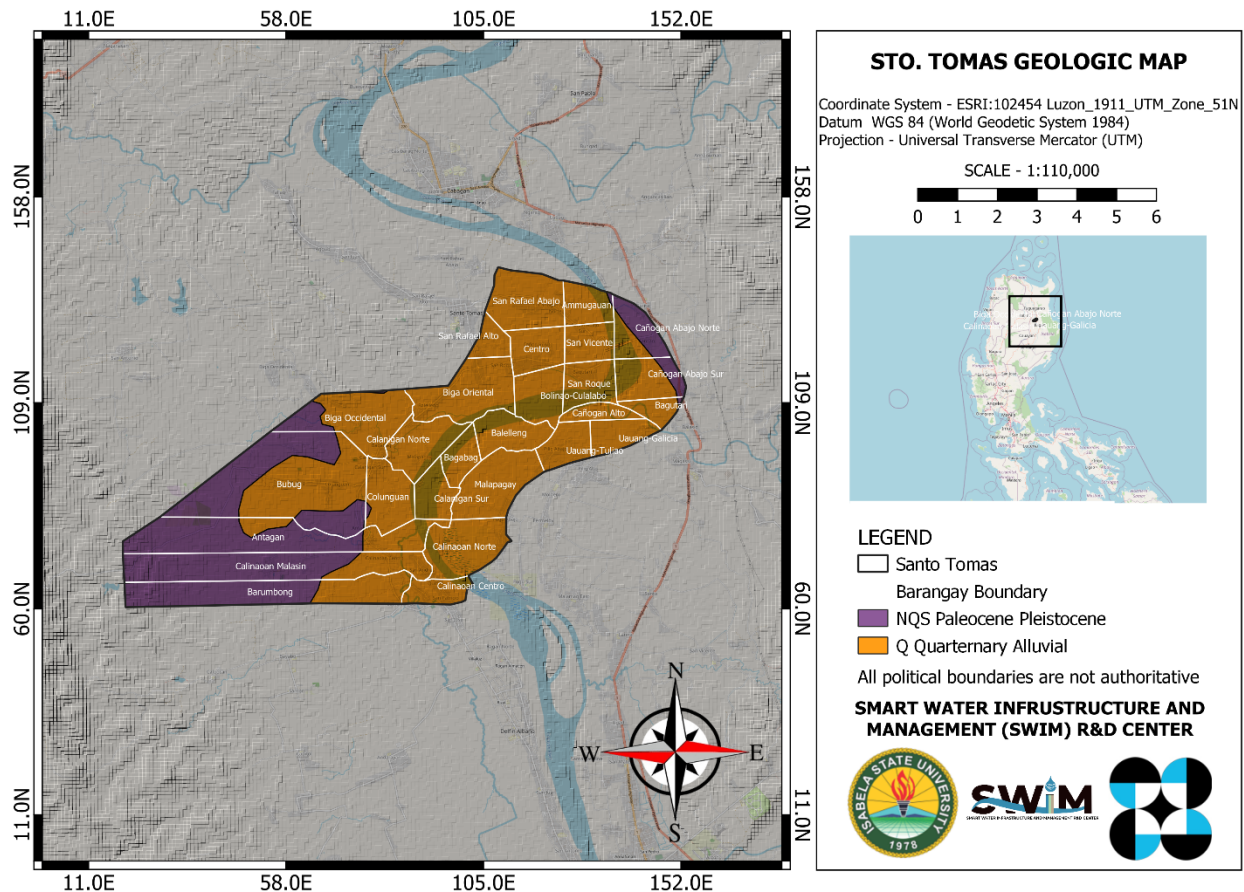


Figure 1. Geologic Map of Santo Tomas

The geologic map of Santo Tomas, Isabela shows the distribution of two major geological formations across the municipality which is the NQS Paleocene to Pleistocene formations (purple) and the Quaternary Alluvial deposits (orange). The NQS units, typically composed of older consolidated sedimentary rocks, dominate the western and northwestern areas of Santo Tomas, particularly around Barangays like Bubug, Antagan, and Callangan Malasin. These areas are geologically older and may have limited aquifer potential compared to younger formations. The central and eastern parts, covering the majority of the barangays such as Biga, Calanacan, Malapagay, and San Rafael, are primarily underlain by Quaternary Alluvial deposits. These are younger, unconsolidated sediments often composed of sands, silts, and clays—ideal for groundwater infiltration and storage, making them more favorable for water extraction. In terms of terrain and topography, the map indicates relatively flat to gently undulating

landscapes, with some minor elevation variation. This topographic character is typical of floodplains and riverine environments, which aligns with the dominance of alluvial deposits. The presence of a major river running along the southeast boundary further supports the area's potential for shallow aquifers, especially in low-lying barangays like Calanacan Centro and Baunumbong.

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

The figure below shows the result of the analyzed data of the 2D geo-resistivity survey at San Mariano, Isabela. This constitutes 3 section namely the measured Apparent Resistivity Pseudosection (top), the calculated Resistivity Pseudosection (middle), and the Inverse Model Resistivity Pseudosection (bottom). The measured Apparent Resistivity Pseudosection and calculated Resistivity section is close to each other with an RMS error of 9.3% meaning the data results is accurate and reliable.

The inverse model section reveals a stratified subsurface with a gradual transition from high to low resistivity values from left to right across the profile. The left side of the profile from 0 to 30 meters is dominated by higher resistivity values ranging from 14.4 to over 24.9 ohm-m, which are typically indicative of dry, coarse-grained materials such as gravel or weathered rock. As the profile moves towards the right, the resistivity gradually decreases, showing values below 10 ohm-m, suggesting the presence of more conductive, water-saturated clay or silt materials. At greater depths of 10 meters and beyond, the

resistivity further drops across the entire profile, particularly on the right side, implying the likelihood of a saturated zone or aquifer-bearing layer. This contrast may also suggest a transition between geologic materials or an underlying water table. The smooth gradient and stratified layers suggest a relatively undisturbed depositional environment with minimal structural deformation.

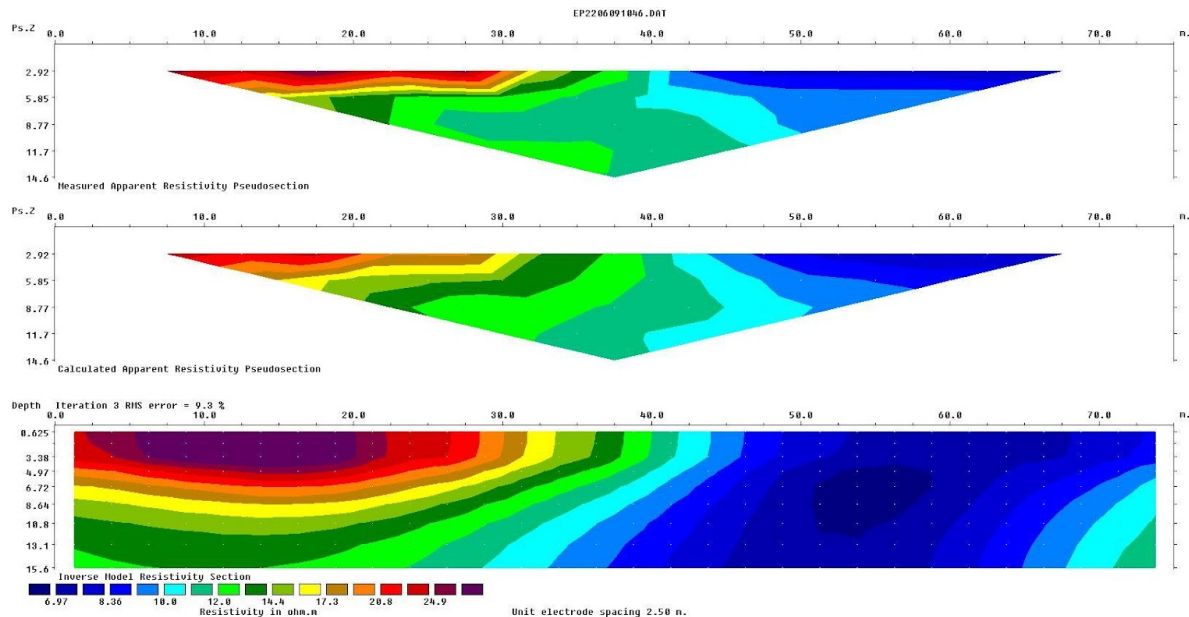


Figure 2. Geo-resistivity result of Santo Tomas, Isabela

CONCLUSION

The resistivity values along the horizontal profile varies from high resistivity at 0-30 meters and low resistivity from 30 – 70 meters. This indicates that the type of material differs horizontally from dry and coarse-grained on the western part and potentially saturated or fine-grained soil on the eastern part. In terms of depth, resistivity values are close to each other with values below 10 ohm.m. Therefore, it is ideal to have a drilling depth below 15 meters to penetrate a groundwater. Further hydrogeological verification such as test drilling or borehole logging is recommended to confirm the presence and quality of groundwater.