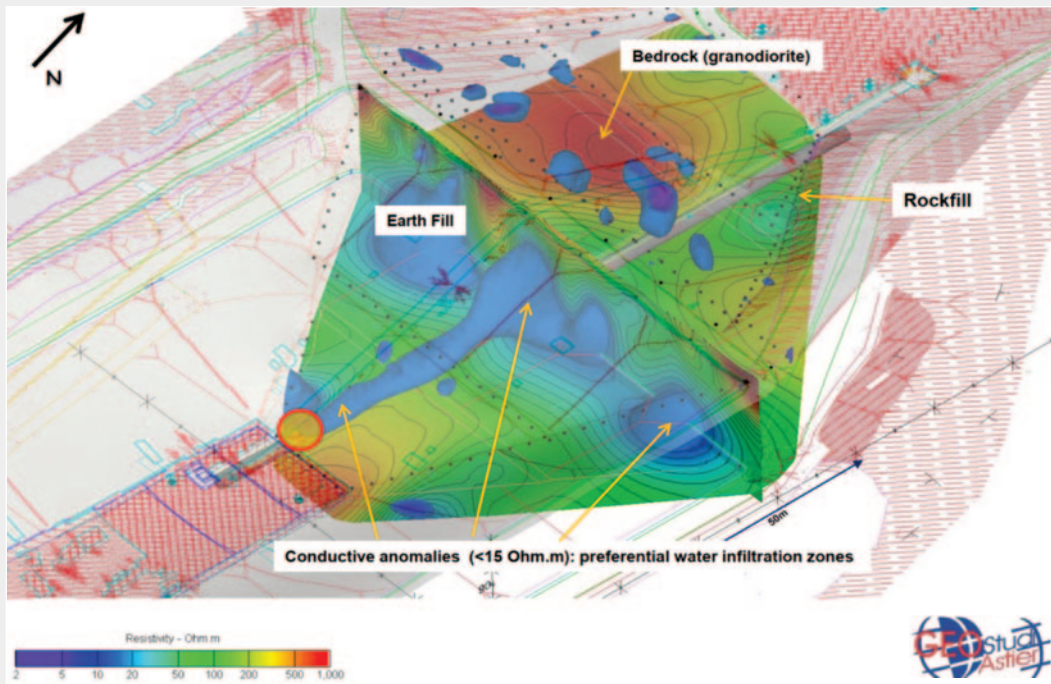


3D ERT investigation for seepage detection

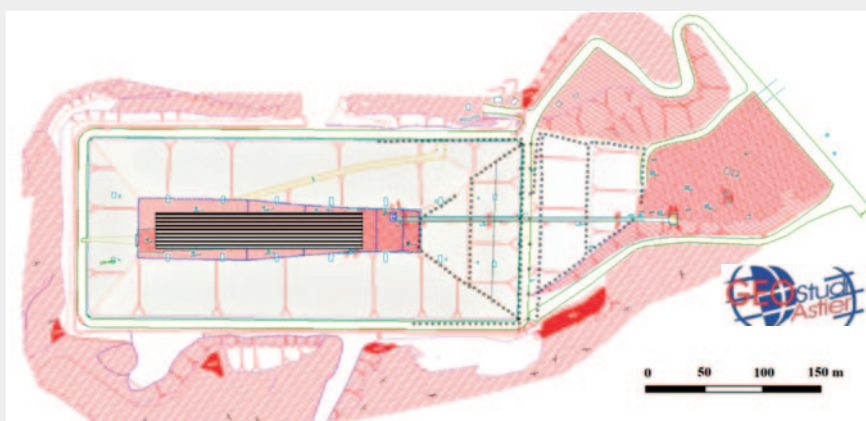
SYSCAL PRO for 3D electrical resistivity tomography

CASE STUDY



Dam managers are often hesitant to order 3D studies because they fear a significant increase in the cost of the intervention. However, a 3D visualization of the conductive zones inside, beneath and laterally of the infrastructure brings key information to the understanding of the seepages phenomena within the dam. Service work operators, when provided with reliable instruments, can master the methods of deploying devices to lead to 3D imaging almost effortlessly.

There are many examples in the literature of 3D studies that have saved valuable time for the dam manager. One example is of Al Ja'rana Water Reservoir, located in Makkah Al-Mukarramah Province, Kingdom of Saudi Arabia, presented at SAGEEP conference in 2017 - M. Tayyab, G. Morell and S. Kaha, 2017 (SAGEEP).



Reservoir's map and location of the electrodes (black dots) employed for the 3D ERT survey.

Hundreds of electrodes were hammered at 5 m spacing around the embankment (black dots), along the upstream and downstream slopes and on toe part of the embankment. Data have been recorded with two different electrodes designs (3D pole-dipole and 3D dipole-dipole) to covert all possible combination of readings. More than 36,000 measurements were done on two blocks of 72 electrodes.

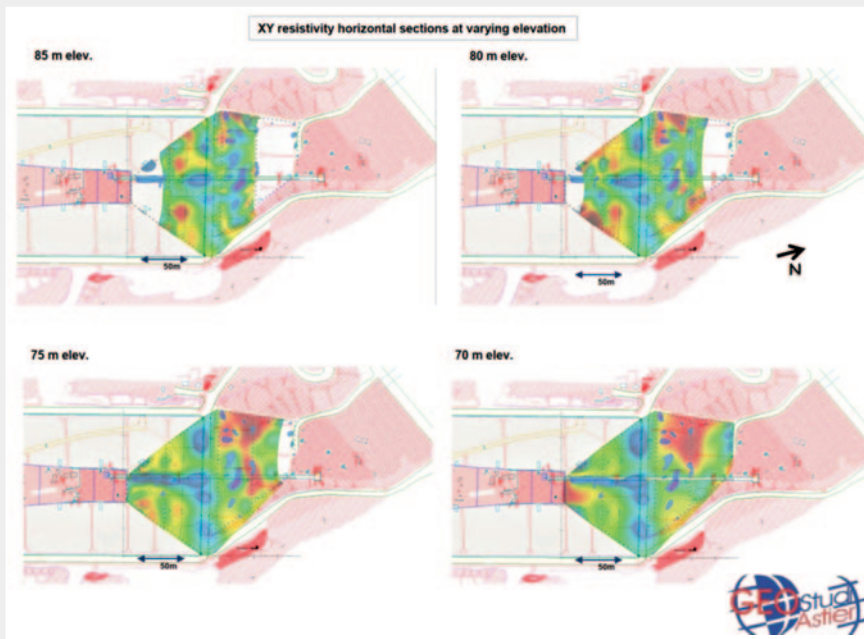
A highly conductive contrast inside the dam structure evokes infiltration of water.

The range of the electrical resistivity properties is very high, with values ranging from less than 10 Ohm.m to several 1,000. Water saturated sediments range below 15 Ohm.m which has been confirmed by geotechnical boreholes information.

3D ERT investigation for seepage detection

CASE STUDY

For such survey, time is spent for the layout design and the on field implementation of the electrodes and cables. Once this step is completed, the measurements are orchestrated by the SYSCAL PRO Switch resistivitymeter according to the selected sequences. Numerous injection and reception configurations are then carried out automatically. The third step which consists of data filtering and quality control requires attention. Finally, with an inversion software such as ERTLAB, it is possible to invert the data set to obtain a 3D representation that can be easily interpreted. This example also shows the importance of other information such as geotechnical borings to support the interpretation.



Any others information's can be brought together with the 3D image for helping the interpretation. The above image, showing the contrasts of the electrical properties at different level of the 3D block, illustrates the power of the 3D ERT for decision makers.

SYSCAL PRO SWITCH 72

SYSCAL PRO Switch 72 is a versatile electrical resistivity-meter which combines a transmitter, a receiver and a switching unit in one single casing. **It allows to simultaneously control 72 electrodes.** The output specifications are 800V (1 600V peak-to-peak) in switch mode, 2.5A, and 250W (12V battery).

The SYSCAL Pro Switch uses multi-core cables for controlling a set of electrodes connected in a line or in several lines. The 72 electrodes can be increased through a Switch Pro 72 unit.

Based on a ten channels configuration, SYSCAL PRO Switch allows to carry out up to 10 readings at the same time for a high efficiency.



The 3D resistivity model is derived from the processing using ERTLab software.
www.mptech3d.com