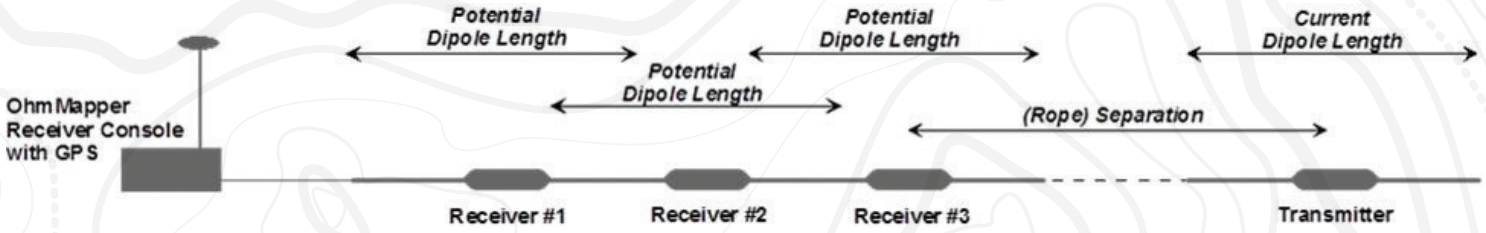
DMT Geosciences

CAPACITIVE COUPLED RESISTIVITY

Typical deployment of OhmMapper®

Geometrics OhmMapper® System

The OhmMapper®, manufactured by Geometrics Inc., is a resistivity measurement system that induces electrical current flow in the subsurface through capacitive-coupling. Resistivity measurements are recorded using a towed, five-receiver dipole system and are integrated simultaneously with GPS data.

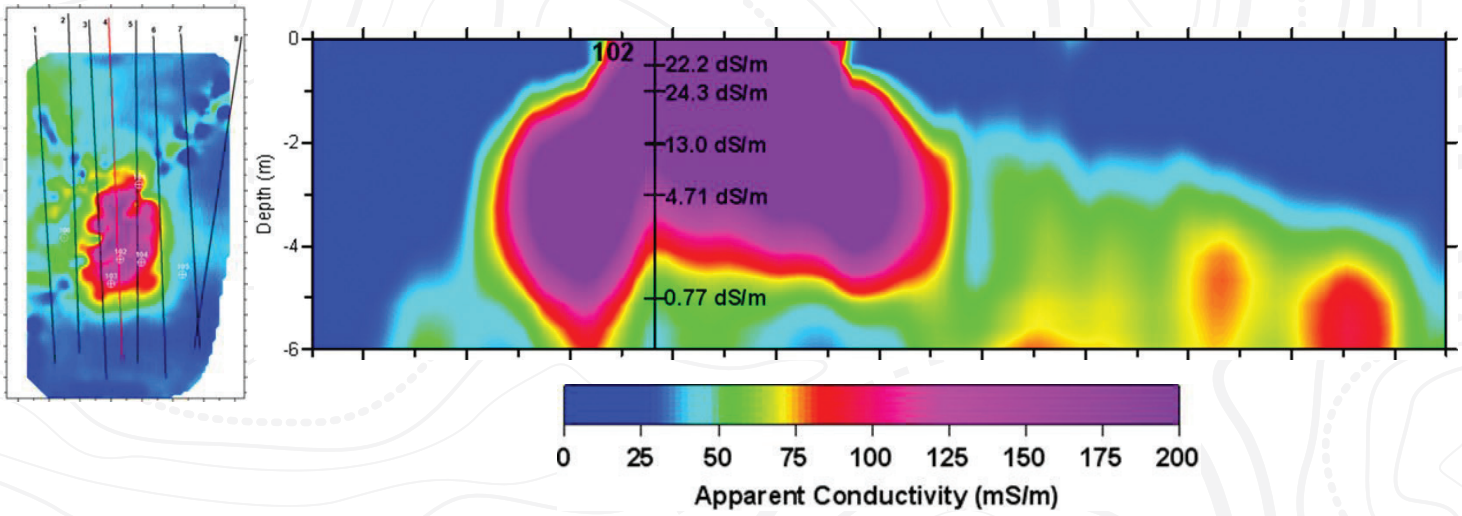


The layout of the Multi-receiver OhmMapper® TR5 system.

How It Works

The transmitter outputs a signal which is picked up by receivers at different distances from the transmitter. This process gives the resistive values for the subsurface at varying depths and resolutions, depending on the dipole and transmitter-receiver separation used in the survey. For increased resolution at a shallower depth, the dipole and transmitter-receivers distance is reduced, and for deeper penetration with less resolution these distances are increased. The system functions by imparting current to the subsurface by using the soils as the dielectric in a capacitive 'circuit' between the system and the subsurface. Voltages generated by the current flow in the sub-surface are sensed by the receiver dipoles and recorded by the data logger.

The magnitude of the receiver voltage depends on the transmitter voltage, the lengths of the dipoles, the separation of the transmitter and the receivers, and the resistivity of the subsurface. For any single measurement, the receiver voltage is converted to an apparent resistivity by assuming that the subsurface is uniform.



EM 31 plan map and OhmMapper® cross section provides an improved estimate of extent, thickness and depth of contaminated soil relative to EM alone.

Advantages

The OhmMapper® system requires a minimum of a walking trail cleared of underbrush. While conventional electrical imaging systems (i.e. electrical imaging) require the insertion of multiple electrodes into the ground, the capacitively-coupled system is towed along the surface enabling rapid data collection. The system is therefore immune to the negative effects of contact resistance that may be encountered when the ground surface is frozen during the winter months. However, in cases of extremely conductive ground and where desired depth of penetration is greater than 10 meters the OhmMapper® is no longer recommended for the best results. In these cases we recommend the use of conventional multi-electrode electrical imaging.

Frequency domain electromagnetic (FEM) methods measure the average apparent conductivity over the entire depth of investigation. FEM is useful for making interpretations in general about the conductivity of the subsurface, but the method is sensitive to the product of thickness times conductivity, providing a bulk conductivity measurement and limiting the resolution of conductive layering.

In contrast to EM, the OhmMapper® system can provide better definition of layering to enable more accurate estimates of volume of earth contaminated with conductive material and yields information that can better determine separation between natural (geologic) conductors and man-made conditions in soil. In the above figure the EM 31 plan map in the top left panel indicates a primary area of possible contamination (hot colours) with a possible plume to the north (cooler colours). The OhmMapper® cross section better defines the volume of contamination in the primary contaminated area by imaging the bottom. The apparent plume to the north is better imaged as well and subsequent interpretation suggested that the suspected plume was actually naturally more conductive rock. This suspected plume was eventually confirmed by drilling and lab tests to be unrelated to the conductive contamination.