

INTRODUCTION

Pakistan Council of Research in Water Resources (PCRWR), an autonomous body, is functioning under the administrative control of Ministry of Science and Technology. The main objectives of the council are to promote, conduct, coordinate and organize research in the water resource sector.

The Council has established Groundwater Management Cells (GWMCs) at its Head Office Islamabad, Regional Office Lahore, Drainage and Reclamation Institute of Pakistan Tandojam and Water Resources Research Centre Quetta. The Cells provide services to public as well as private sectors in the field of groundwater investigations and development.

The groundwater is a hidden resource of water and is unique because the porous media, in which it occurs, influence its flow, storage and chemical constituents. Groundwater engineering is an art and science of investigating, developing and managing ground water for the beneficial consumption of the mankind.

The Cells are providing technical assistance to public, private and industrial sectors in groundwater and geotechnical disciplines on payment basis. The brief description of equipment and its use in Groundwater is described in this brochure.

Groundwater Investigations

Geophysical methods are very effective tools in the search for groundwater resources. The appropriate geophysical program should be designed to meet the geological objective and the expected stratigraphic section. When combined with other available geologic and borehole information, geophysical data can refine the conceptual model of the subsurface geology and provide additional detail to the geologic interpretation. Several geophysical techniques commonly applied in groundwater exploration and geotechnical investigations are; electromagnetic, both frequency-domain and time-domain, seismic refraction, seismic reflection, DC resistivity and induced polarization. The facilities available with PCRWR are as under:

Electromagnetic Survey

Time Domain Electromagnetic

Time domain systems are now routinely employed for general geological exploration such as freshwater aquifers in bedrock fractures, and mapping groundwater contaminant plumes.

Electromagnetic methods induce small electrical currents in the ground. These currents flow more rapidly in conductive earth materials than in resistive strata. Sand or gravel aquifers tend to be much more resistive than silts and clays.

The time domain electromagnetic method employs a transmitter that drives an alternating current through a square loop of insulated electrical cable laid on the ground. The measurement of these currents by a receiver and study of their behavior in the ground can deduce the location of resistive strata (aquifers). The method is useful in areas where fresh groundwater is overlain by the saline water and DC resistivity cannot transmit to the deeper horizons.

The TEM57-MK2 available with PCRWR is the perfect mid-range power transmitter for sounding depth, thickness and conductivity of layers down to 500 meters for a wide variety of application as given below:

Field Applications

- Groundwater investigations.
- Stratigraphic mapping.
- Geothermal energy
- Permafrost mapping
- Mineral explorations.



Time Domain Electromagnetic (Protem 57)

Electrical Resistivity, Induced Polarization and Self Potential Survey

PCRWR is equipped with ABEM SAS 4000 electrical resistivity, induced polarization and self potential measurement systems. These electrical methods are widely used in groundwater and related scientific disciplines as mentioned below.

Field Applications

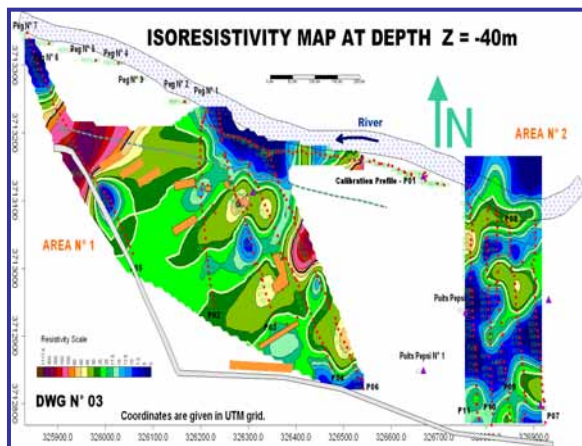
- Mapping and monitoring of contaminated groundwater
- Geotechnical investigations



- Geological mapping
- Prospecting of natural resources
- Sub-bottom mapping at sea and lakes
- Mapping of permafrosts
- Archaeology



Electrical Resistivity Survey by ABEM Terrameter



3D Resistivity Survey output in Pepsi Compound, Islamabad.

Geophysical Logging

Calibrated borehole geophysical logs provide an objective, repeatable continuous profile with depth of rock and fluid properties. Data is displayed in real-time, as the probe is raised, for immediate analysis. This allows investigators in the field to make decisions about the location and attributes of geological formations. This data is easily archived for later study. PCRWR is equipped with MGX2 well logging system along with necessary probes for

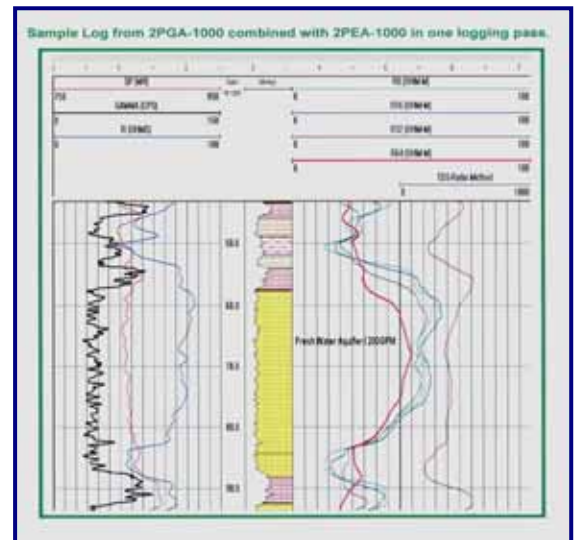
use in groundwater, geotechnical engineering and environmental studies. Numerous field applications are as under:

Field Applications

- Hydrogeology
- Environmental engineering
- Non-metallic minerals
- Shallow Oil & Gas
- Geotechnical exploration
- Coal exploration and development
- Uranium exploration and development



MGX2 Well Log



Geophysical Well Log

Seismic Survey

Seismic techniques use a small explosive or mechanical energy source to impart a seismic pulse to the ground. The seismic waves travel through the soils to the bedrock or other competent layers below. There, the seismic waves are both reflected back to the surface and refracted along the bedrock surface for some distance before they return to the earth's surface. Seismic refraction is commonly used for

engineering and groundwater applications. The most common objective is to map the bedrock surface (i.e., determine the depth to bedrock, and variations in depth, along the survey line). Seismic reflection can provide higher resolution of overburden stratigraphy and the bedrock surface, but at substantially higher cost. The reflection technique involves acquiring more field data, and processing data more intensively than seismic refraction. In some applications higher resolution may justify the higher survey costs, depending on the expected geologic conditions and the objectives of the exploration program.

Field Applications

- Location of voids and sinkholes
- Mapping of bedrock configuration
- Lactation of faults, fractures
- Weathered zones mapping
- Testing of elastic properties of sediments and bedrock (geotechnical applications)
- Mapping of pathways of groundwater flow

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ABEM Seismograph for groundwater investigations

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