

2 Aquifer Testing

2.1 Define the Test Objectives

- scientific vs engineering objectives
 - identification of system behavior
 - estimation of system parameters
- scale of interest
 - local vs regional test
 - short-term vs long-term effects
- hydraulic vs transport effects
 - average or extreme behavior
 - fluid vs solute migration

2.2 Define the Conceptual Model

- Define state of knowledge of area
 - Type of aquifer
 - Type of geologic media, homogeneous/heterogeneous, isotropic/anisotropic
 - Geometries of aquifers and confining units
 - Recharge and discharge areas
- Inventory existing wells in area for baseline (reference) data
 - Find local and regional flow gradients, horizontally and vertically
 - Use the ground and surface water chemical characteristics to indicate of flow system

2.3 Design the Physical Installation

- Pumping well:
 - Type of gravel or sand pack
 - Depth of well
 - Well and borehole diameters
 - Length of screened interval and screen integrity
 - Depth of pump, pumping capacity, and previous pumping records
 - Measurement of pumped water rate and duration
 - Location of discharge
- Observation wells:
 - Number and location (distance from well and depth):
 - Barometric pressure
 - Precipitation
 - Nearby surface water levels
 - Reference ground water levels
- Aquifer test data:
 - Discharge sampling (flow meter, weir, bucket, etc) and control (valves, voltage)
 - Manual (steel tape, electrical sounder) vs automated (pressure transducer, float)
 - Analog (strip charts) vs digital (computer)
 - Water level sampling rates and duration
 - Well effects (cascading water, water quality changes)

2.4 Interpret the Aquifer Test Data

- Removing background effects
 - Loading effects due to barometric pressure, rainfall, oceanic and earth tides
 - Trends (seasonal or short-term)
 - Fluid column density effects (salinity, temperature, dissolved gasses)
- Identifying aquifers type
 - confined aquifer (leaky, double porosity, fractured rock)
 - unconfined aquifer (delayed yield)
- Identifying other effects
 - well bore storage (and excessive pumping rate)
 - partial penetration
 - boundaries
- Standard plots
 - horizontal-axis: $\log t$ or $\log(t/r^2)$
 - vertical-axis: s or $\log s$
- Derivative plots
 - horizontal-axis: $\log t$ or $\log(t/r^2)$
 - vertical-axis: $\Delta s/\Delta t$ or $\Delta s/(\Delta \log t)$