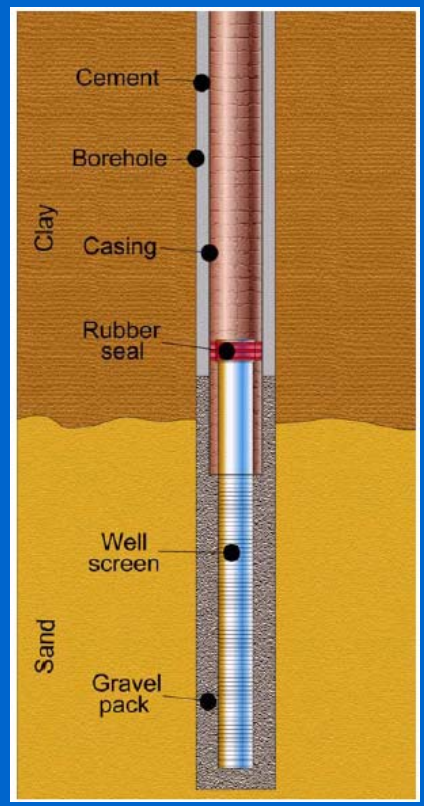
Pumping tests

Interference tests

Types of Test

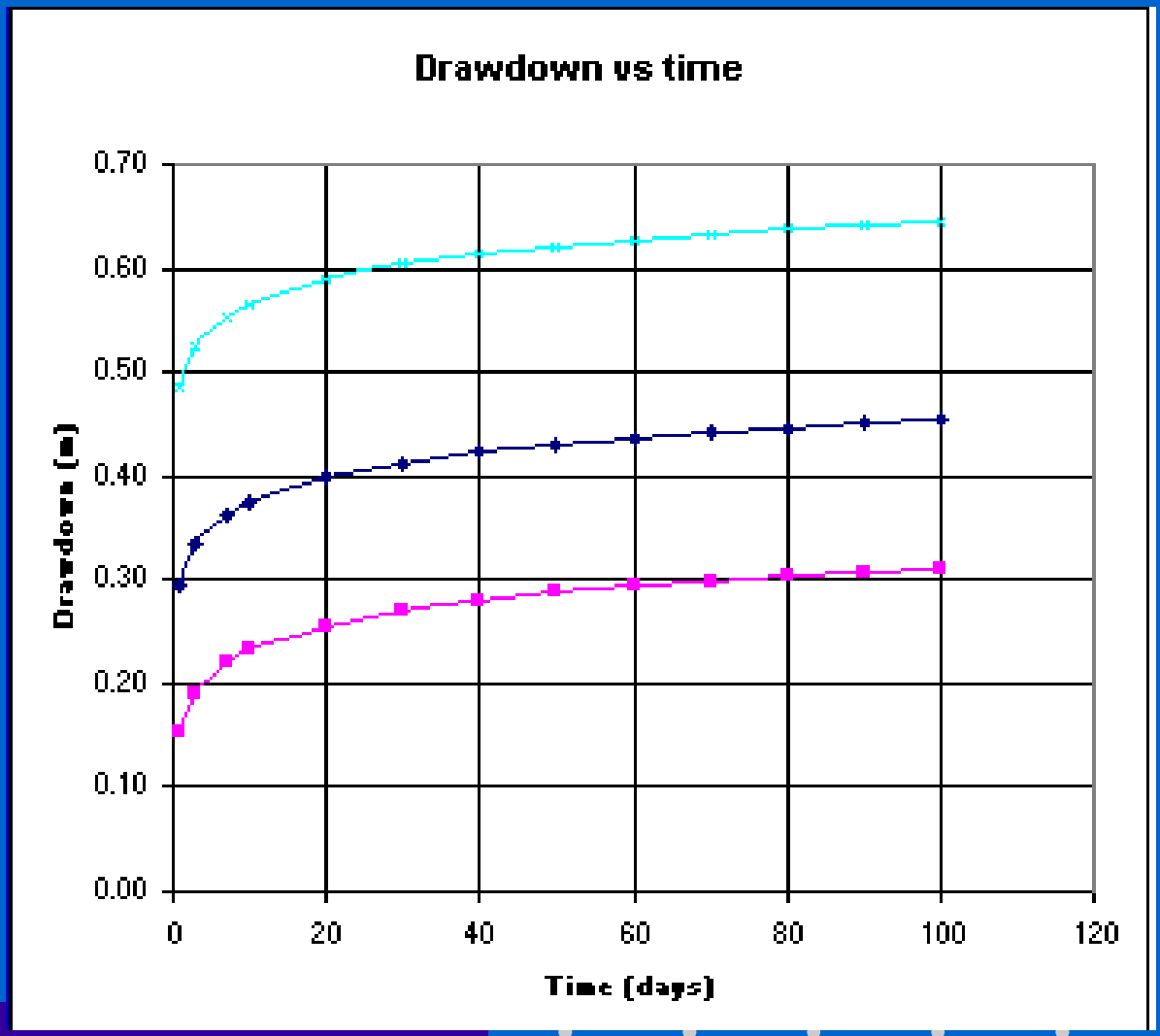
- Single well tests
  - Slug tests
  - Pumping tests
    - Specific capacity
    - Step drawdown
  - Largely measure well properties
- Multiple well tests
  - Require observation wells
  - Measure aquifer properties
    - Permeability, storage, aquifer type



The ideal

- Initial conditions
  - Ideally in equilibrium
  - Monitor background trend
- Impose a known stress
  - Ideally a constant pumping rate
  - Monitor drawdown response
    - In pumped well
    - In observation wells
    - In wells beyond pumping influence
- Cease pumping
  - Monitor recovery

Idealized drawdown response



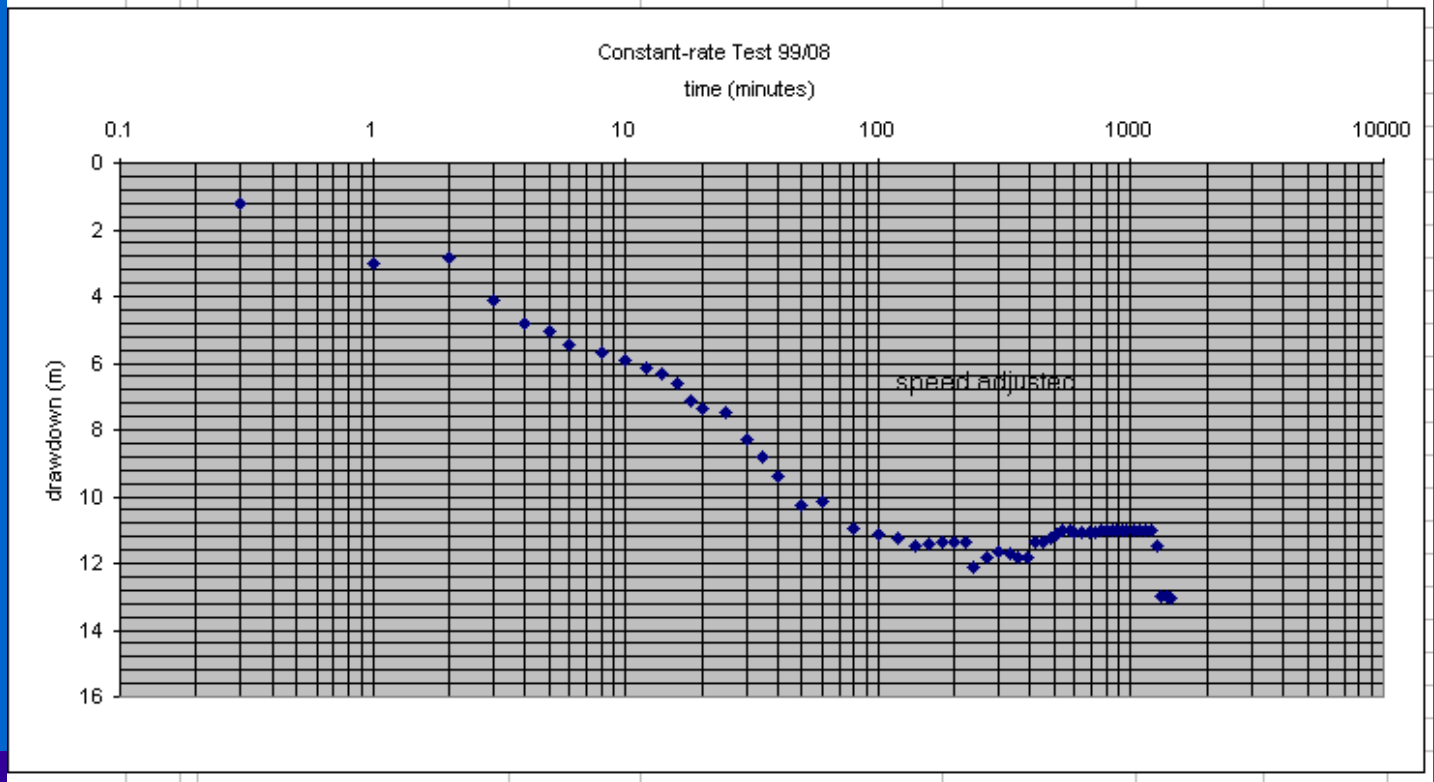
The reality

- Initial conditions
  - Normally unsteady
  - Tidal, barometric & other pumping effects
- Impose a known stress
  - Pumping rate varies or pump breaks down
  - Monitor drawdown response
    - Often no observation wells available
    - Measurement difficulties
- Whatever happens
  - Carefully record what and when!

MRD drawdown measurements

Drawdown Phase Borehole 01/11

Project	*Muaivuso GW Drilling*	S.W.L	*10.86*	*m*
Location	*Muaivuso*	Pump Setting	*37.13*	*mb datum*
Borehole Number	*BH01/11*	Discharge rate	*54.432*	*m3/day*
Date of test	*21/06/01*		*0.63*	*L/s*
Type of pump	*Electric Submersible*	Change s1	*3.34*	*m*
Transmisivity T(Jacob's method)	*30 m2/d*	Change s2	*3.69*	*m*
T2	*26 m2/d*			

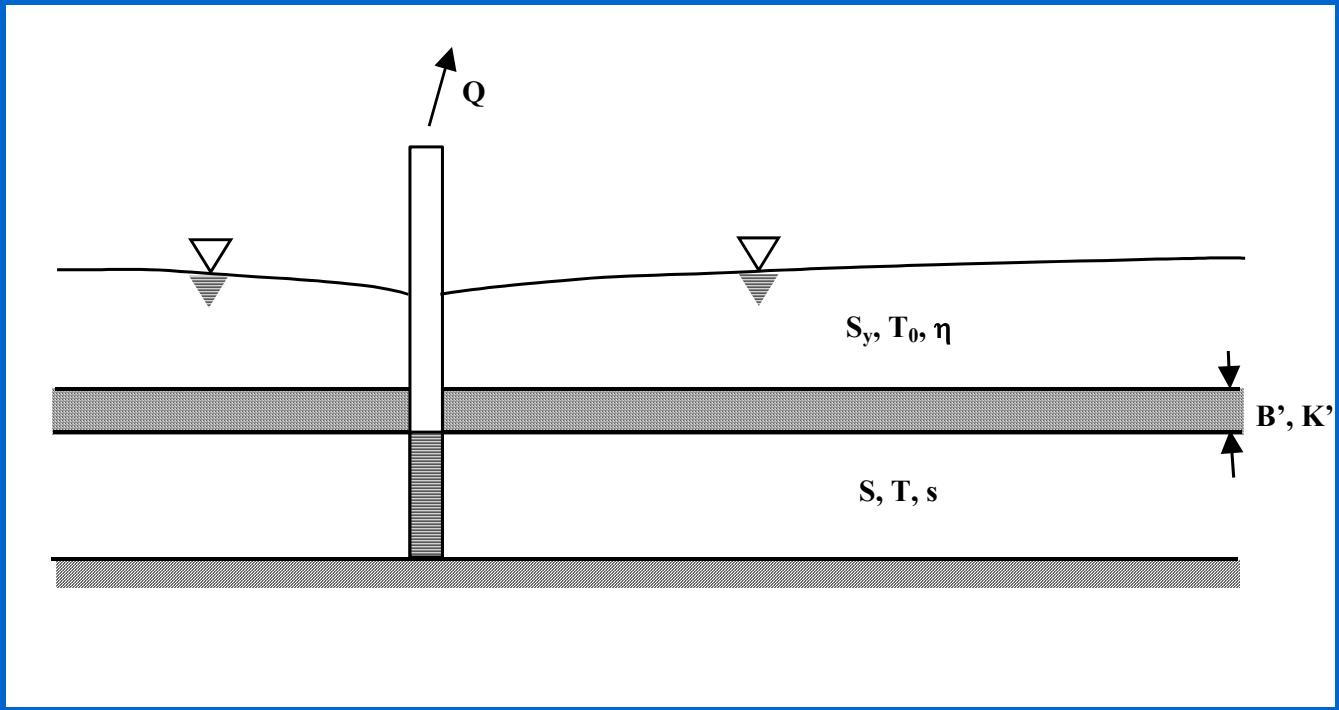


Analysis

- Typical assumptions
  - Homogeneous aquifer
  - Infinite extent
  - Water released from storage instantaneously
  - No well storage
- Parallels with ER interpetation
  - Layered models
  - Trial and error approach

Analysis

- Drawdown response to pumping in an extensive confined aquifer

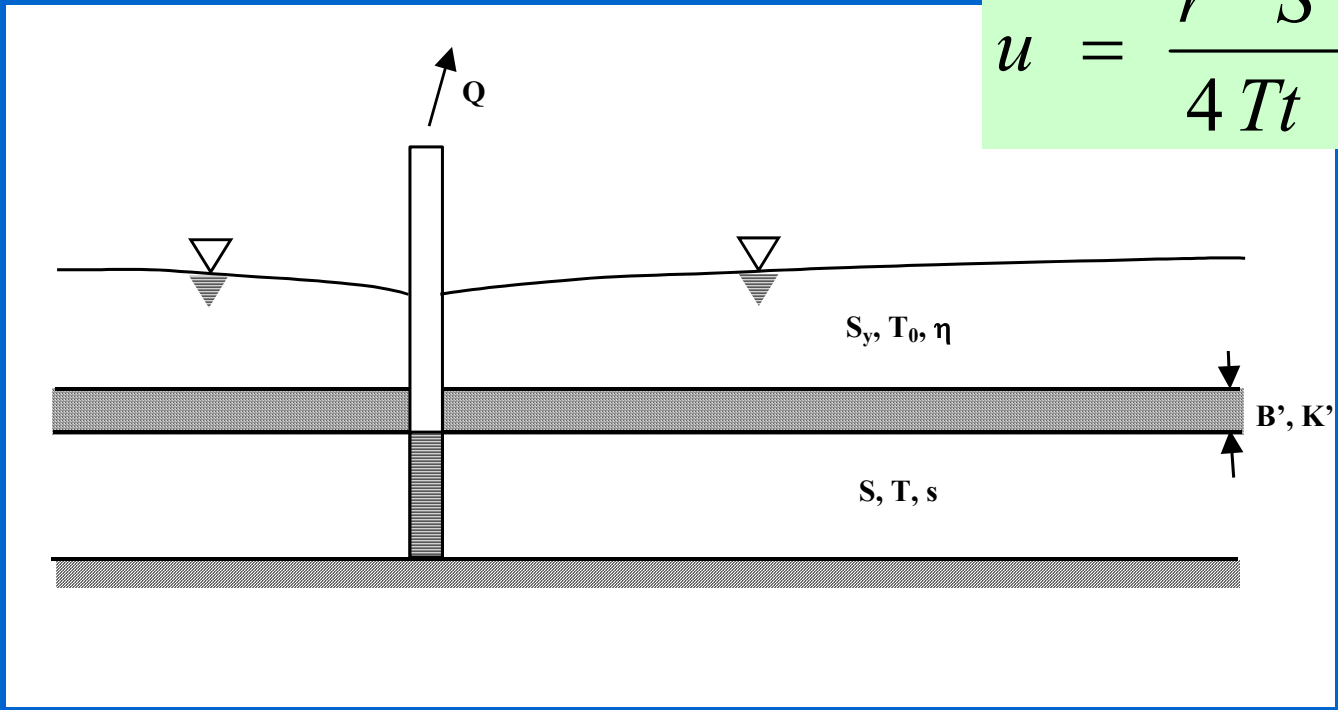


The Theis solution

Assumptions:
Infinite extent, homogeneous, fully confined

$$s = \frac{Q}{4\pi T} W(u)$$

$$u = \frac{r^2 S}{4Tt}$$



Pros and cons

- Advantages
  - Provide in-situ parameters averaged over a large volume of aquifer
  - Conductivity and storage properties measured in a single test
  - Leakage properties can be directly measured
  - Test condition closely resemble the real application (if pumping interference is a concern)

Disadvantages

- Non-uniqueness of pumping test interpretation
  - Similarity in response of leaky, unconfined and bounded systems
- Expense
  - Installation of observation wells and overheads involved in running a test
  - May be justified when done in conjunction with well development at the test site