



Hydrogeology and Water Well Engineering

Course: Aquifer Testing, Well Design and Modelling



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Introduction:

Hydrogeology and water well engineering, covering aquifer testing, well design and modelling, is a 5-day course for hydrogeologists, well engineers, drilling supervisors and groundwater planners that ends with a Well Field Development and Abstraction Plan. Poorly interpreted pumping tests, undersized screens and unmanaged drawdown leave organisations with failing boreholes, sand pumping and deep aquifers depleted faster than planned. Nominees already site, supervise or evaluate production boreholes, and they learn through a modelling build that turns field test data into design calculations and a calibrated numerical groundwater model. CoreConcept Training Center delivers this hydrogeology and water well engineering course.

Course Objectives:

- Characterise confined, unconfined and leaky aquifers and estimate transmissivity, storativity and specific yield from field and laboratory evidence
- Plan and interpret constant-rate, recovery and step-drawdown pumping tests using Theis, Cooper-Jacob and Hantush analytical solutions
- Design production boreholes by sizing casing, screen slot openings and filter pack gradation from formation sieve analysis
- Supervise drilling, well development and rehabilitation work and diagnose losses in well efficiency and specific capacity
- Build and calibrate a finite-difference groundwater model to forecast drawdown under alternative abstraction scenarios
- Prepare a well field development and abstraction plan that sets sustainable pumping rates for a deep, slowly recharged aquifer

Target Audience:

- Hydrogeologists responsible for aquifer evaluation, test interpretation and borehole siting
 - Water resources engineers responsible for well field yield forecasts and abstraction planning
 - Drilling supervisors responsible for borehole construction quality, screen installation and well development
 - Groundwater planners responsible for long-term abstraction limits and water level surveillance
 - Asset engineers at utilities, farms and industrial plants responsible for production borehole performance and rehabilitation
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Course Outline:

Day 1: Aquifer Systems and Hydraulic Properties

- Confined, Unconfined and Leaky Aquifer Classification From Borehole Logs
- Darcy Law and Hydraulic Conductivity Estimation Methods
- Transmissivity, Storativity and Specific Yield Parameter Sheet
- Potentiometric Surface Mapping and Flow Net Construction
- Recharge Estimation and Fossil Groundwater Age Indicators

Day 2: Pumping Test Design and Analytical Solutions

- Constant-Rate Test Planning With Observation Well Layout
- Theis Type-Curve Matching for Transient Drawdown Data
- Cooper-Jacob Straight-Line Method and Distance-Drawdown Plots
- Hantush Leaky Aquifer Solutions and Partial Penetration Corrections
- Recovery Test Analysis and Thiem Steady-State Check

Day 3: Water Well Design, Drilling and Construction

- Step-Drawdown Testing, Well Loss Coefficients and Efficiency
- Formation Sieve Analysis for Screen Slot Selection
- Filter Pack Gradation and Casing String Design Calculation
- Mud Rotary, Air Rotary and Down-the-Hole Hammer Drilling Selection
- Annular Grouting, Sanitary Seal and Verticality Checks

Day 4: Well Development, Rehabilitation and Numerical Modelling

- Surge Block, Airlift and Jetting Development Procedures
- Encrustation, Biofouling and Sand Pumping Failure Diagnosis
- Chemical and Mechanical Rehabilitation Method Selection Matrix
- MODFLOW Grid, Layers and Boundary Package Set-Up
- Model Calibration Against Observed Heads and Sensitivity Testing

Day 5: Modelling Build and Well Field Abstraction Plan

- Case Well Field Pumping Test Dataset Interpretation Exercise
 - Production Borehole Design Sheet for the Case Aquifer
 - Abstraction Scenario Runs and Drawdown Forecast Comparison
 - Safe Yield Limits and Water Level Trigger Thresholds
 - Well Field Development and Abstraction Plan Completion and Review
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Skills You Will Gain:

- Aquifer Parameter Estimation
- Pumping Test Interpretation
- Well Screen and Filter Pack Sizing
- Drilling Method Selection
- Borehole Performance Diagnosis
- Groundwater Model Calibration
- Abstraction Scenario Forecasting
- Safe Yield Assessment

Why Attend This Course:

- Deliver a Well Field Development and Abstraction Plan to the water resources manager and the operations lead, with test results, borehole designs and pumping limits
- Decide whether a declining borehole should be rehabilitated, redesigned or replaced based on step-drawdown and specific capacity evidence
- Avoid sand pumping, premature screen clogging and uncontrolled drawdown that shorten borehole life and raise pumping energy costs
- Coach drilling crews and junior hydrogeologists on test procedures, screen selection and model calibration practised during the course

Conclusion:

Back at work, the participant hands the Well Field Development and Abstraction Plan to the water resources manager and the operations lead. They use it to approve new borehole designs, set pumping rates for each well and agree water level triggers that prompt a reduction in abstraction or a rehabilitation campaign. After the first season of pumping, the unit should compare observed heads with the model forecast, recalibrate where drawdown departs from prediction and revise the abstraction limits accordingly.

Frequently Asked Questions FAQ:

What should participants know before a hydrogeology and water well engineering course?

Participants should understand basic geology, units of flow and pressure, and spreadsheet calculations. Experience siting, supervising or evaluating boreholes helps. Prior numerical modelling experience is not required, as the model is built step by step during the course.

How does a hydrogeology and water well engineering course differ from a drinking water treatment course?

This course concentrates on the aquifer and the borehole: hydraulic testing, well construction, rehabilitation and abstraction modelling. A treatment course starts once water leaves the well, covering clarification, filtration, disinfection and network water quality.

Why does hydrogeology and water well engineering rely on pumping tests before modelling?

Pumping tests supply the transmissivity, storativity and boundary evidence that a groundwater model needs. Without measured parameters a model can match any water level history, so its abstraction forecasts cannot be trusted for planning decisions.

What do participants take back from a hydrogeology and water well engineering course?

Participants take back a Well Field Development and Abstraction Plan with interpreted test results, production borehole design sheets, a calibrated model, drawdown forecasts, safe yield limits and water level triggers for their organisation.
