

Computer Workshop using Processing MODFLOW

Consider the following confined two-dimensional aquifer situation:

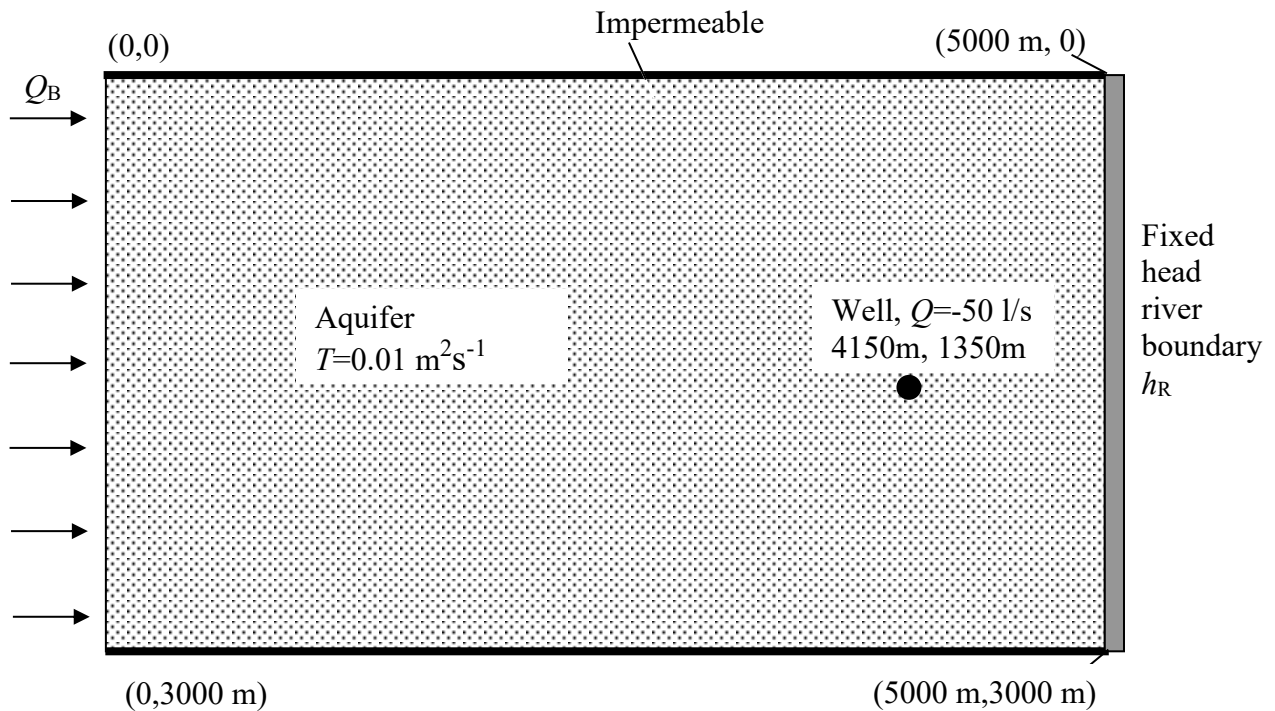


Figure 1: Aquifer situation (plan view)

Data: Aquifer top: 102 m
 Aquifer bottom: 78 m
 Fixed head boundary (river) $h_R = 100$ m
 Boundary inflow $Q_B = 12 \text{ L s}^{-1}$
 Effective porosity $\phi_e = 0.2$ (Not needed for flow, but for transport, incl. particle tracking)

- Calculate the **steady state flow field**.
- Plot the **head contours**.

Detailed guide using Processing MODFLOW (PMWIN):

Create a temporary directory on C, e.g. C:\temp. Do **not** create it on the desktop or in your documents folder. This program has troubles with long folder paths. At the end, copy the folder to your private one, otherwise you lose your data.

Run Processing MODFLOW (PMWIN) (c:\Program Files (x86)\PMWIN 5.3\pm5.exe, running the application as an administrator using the credentials provided in the classroom)

→ File

→ New Model

→ File Name (*Project name, without extension, e.g., C:\temp\GW1-EX*)

Groundwater

→ Grid

→ Mesh size

Model Dimension

→ Layers: 1

→ Columns: Number: 51
Size: 100

→ Rows: Number: 30
Size: 100

→ OK

→ Leave Editor → Save changes

→ Grid

→ Layer type

→ Type: (*Click on Type Window for change*) → Confined

→ Transmissivity: (*Click on Type Window for change*) → User specified

→ OK (*Confirm default values*)

→ Grid

→ Boundary conditions

→ IBOUND (*Grid appears; Default: Active cell with IBOUND=1*)

→ Select one cell with prescribed head BC

→ Press right mouse button

→ Set IBOUND=-1, OK

→ Switch duplication (*upper menu bar*): On (*cell gets coloured*)

→ Use keyboard arrow to set all neighbouring prescribed head cells

→ Switch duplication: Off

→ Leave Editor → Save Changes

(Note: only the prescribed head boundaries are set here (and their explicit value has to be specified elsewhere). No-flow boundaries do not need to be specified, they are assumed by default. General inflow boundaries are set as a series of wells)

→ Grid

→ Top of Layers (Grid appears)

→ Value

→ Reset Matrix → 102; → OK

→ Leave Editor → Save changes

→ Grid

→ Bottom of Layers (Grid appears)

→ Value

→ Reset Matrix → 78; → OK

→ Leave Editor → Save changes

→ Parameters

→ Time

→ OK (*Confirm default values*)

Groundwater

→ Parameters

→ Initial Hydraulic Heads (Grid appears; Also used as starting values in steady state calculation and also for the prescribed head cells)

→ Reset Matrix → 100: → OK

→ Leave Editor → Save changes

Note: We have a steady state problem and theoretically do not need initial heads. However, as we use iterative solvers we need starting values, which are taken from here. In addition, the missing information for the prescribed head boundary is taken from here.

→ Parameters

→ Transmissivity (Grid appears)

→ Reset Matrix → 0.01: → OK

→ Leave Editor → Save changes

→ Parameters

→ Effective Porosity (Grid appears; Not used for flow)

→ Reset Matrix → 0.2: → OK

→ → Leave Editor → Save changes

→ Models

→ MODFLOW

→ Well (Grid appears)

→ Click on cell with coordinates (4150; 1350)

→ Press right mouse button: Recharge Rate: -0.050; → OK

→ Click on one cell with prescribed boundary inflow

→ Press right mouse button: Recharge Rate: 0.0004

→ Use Duplication Button and Arrow for all inflow boundary cells

→ Leave Editor; → Save changes

Note: the series of wells at the boundary mimic the second type boundary of a prescribed inflow.

→ Models

→ MODFLOW

→ Solvers

→ PCG2

→ Convergence Criteria, Head Change: Set 0.000001

→ OK

→ Models

→ MODFLOW

→ Run; .../modflow2v.exe (sometimes v is missing!) → OK

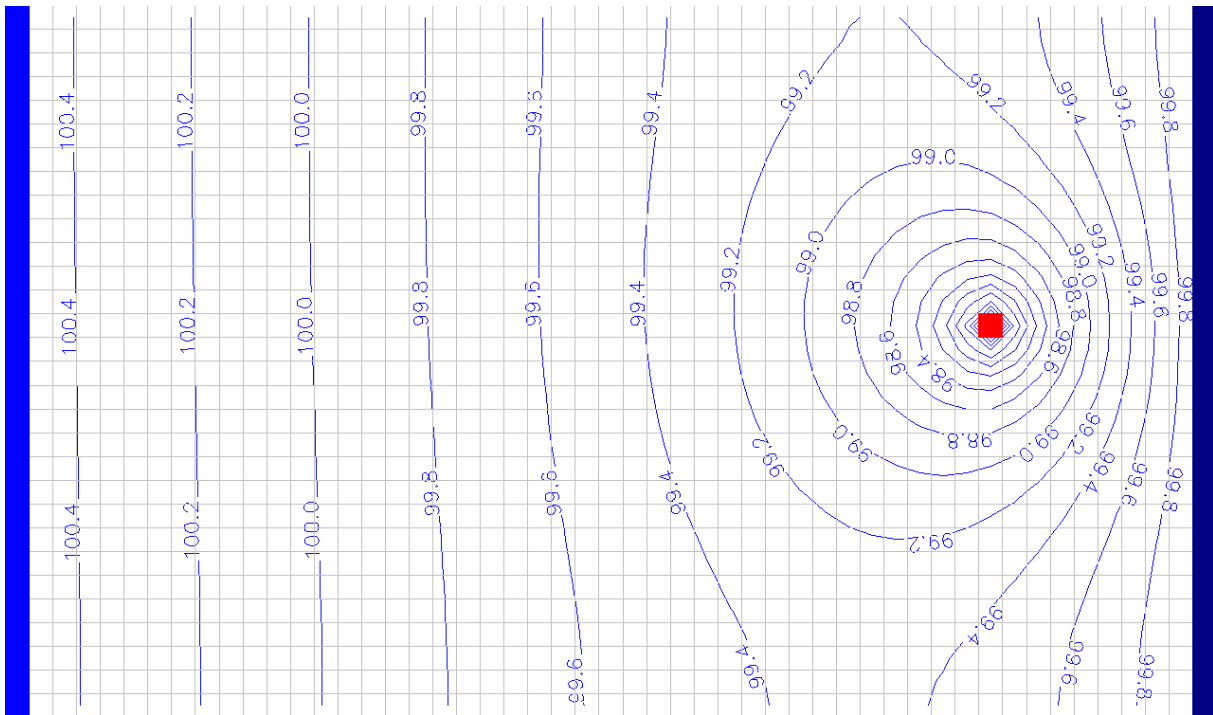
→ Check messages at the end of the calculations

→ Press any key to continue

→ Tools

Groundwater

- Presentation
 - Value
 - Results Extractor
 - Hydraulic Head;
 - Read;
 - Apply;
 - Options
 - Environment
 - Contours
 - Visible; → OK
 - Label format → fixed (1 decimal digit)
 - Click Level (*Click on title of the table, difficult to see!*)
 - Contour Levels:
 - Minimum: 96
 - Interval: 0.2 → OK



Picture: Head contours

- File
 - Save plot: as a .bmp file, use the default file name
 - OK
- Leave Editor; Save changes

File → Exit

Copy the entire folder to your private documents.