Courses:

- ***GW Flow and Contaminant Transport Modeling (Msc in EnvE &HgE)***
- ***Geothermal Systems and Transport Modeling (MSc in PGE)***

Homework #2/2019: The effects of pumping test of two wells on a well field

Hydrogeological conditions

There are two distinguished reservoirs (aquifers) on the study area signed by A & B. The leaky layer between the aquifers is referred as AB, meanwhile the over- and underlying ones called 0A and B0. Please find the aquifer properties in the table below.

Code	Formation type	Elevation Top [m asl]	Elevation Bottom [m asl]	Thickness [m]	Horizontal Hydraulic Conductivity [m/s]	Vertical Hydraulic Conductivity [m/s]	Effective Porosity [%]	Specific Storage [-]	Spec Yield [%]
0A	Overlying layer	-754	-864	110	5,00E-08	5,00E-08	7,5	0,0001	6
A	Aquifer/reservoir	-864	-937	73	5,00E-05	1,00E-05	12	0,00001	9,6
AB	Leaky layer	-937	-964	27	5,00E-08	2,50E-08	6	0,0001	4,8
B	Aquifer/reservoir	-964	-1000	92	3,00E-05	1,00E-05	10	0,00001	8
B0	Underlying layer	-1000	-1090	90	5,00E-09	4,00E-09	4	0,0001	3,2

There is a regional groundwater flow characterized by a given horizontal and vertical hydraulic gradient and the depth of GW level from the surface on the middle of the modeling area.

The flow regime characteristics can be freely chosen by the student in the following interval and range: horizontal hydraulic gradient: 0.5 - 2.5 m/km, vertical hydraulic gradient: 2 mm/m – 5 mm/m, horizontal direction: any

There are several wells operating screened to the layers A, B.

The problem to be investigated:

There are two wells W15 and W6 tested after each other, having 3 weeks of recovery period between the tests. The test of each well takes as follows: 1/3·Q (for 3 weeks), 2/3·Q (for 3 weeks) and Q (for 3 weeks), 3 weeks recovery, and cyclic testing Q, recovery, Q recovery, Q (for 1 weeks each scenario), where Q is the normal production rate of the well (see table below).

To have a clear picture about the time schedule of the test consult the attached figure! Your task is to determine the GW level fluctuation due to testing in the existing wells. See well data and map of the locations in HW2_2019_DATA.ZIP

Well data:

Well ID	Local X [m]	Local Y [m]	Prod. Rate [m^3/d]	Layer
W10	102351	53408	852	A
W11	102558	53866	936	A
W14	106033	53248	860	A
W15	**103998**	**52520**	**1096**	**A**
W17	105446	51627	860	A
W19	103431	53007	1160	A
W8	101805	52971	1308	A
W1	105445	54191	1284	B
W12	104458	52922	1240	B
W20	105985	54438	1316	B
W3	104798	52285	1164	B
W4	102331	53752	808	B
W5	103498	54160	1324	B
W6	**103862**	**52395**	**1344**	**B**

Subtasks:

Subtask1. Building of a transient model of the existing well field

Subtask2. Establish monitoring wells to determine the effects of well testing

Subtask 3. Determination of the transient potential field in all the aquifers and charting the GW fluctuation in monitoring wells

Subtask 4. Comparison of the potential vs. time curves of different monitoring wells in the aquifers

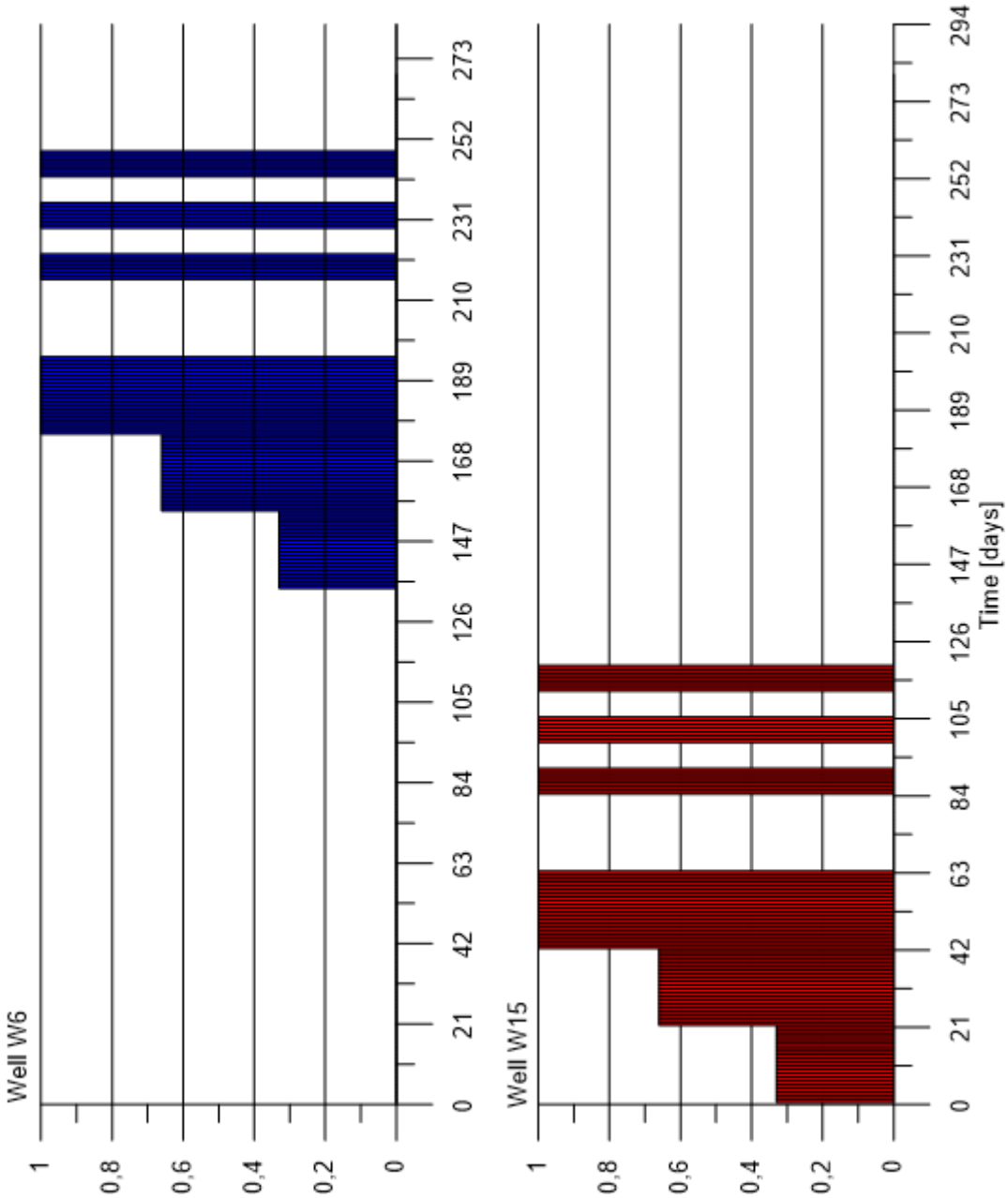
Deliverables:

In printed form a short report of the problem with

- the details of the chosen data
- graphic presentation of potential fields, potential vs time curves (each monitoring well and each tested well, comparative graphs of wells screened to the same layer)
- the description and evaluation of results

Digitally (only at the end of semester)

- report in document form
- full dataset of the model
- plots in graphical form



Time schedule of pumping [relative pumping rates to the maximal pumping rate]