

Pumping simulations using 3D FEM analysis on multi-pumping wells

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Abstract

In this research, we chiefly conducted on-site measurement and analysis to examine how the pumping wells influence groundwater behavior. We established a 3D model for groundwater and make suggestions for the adequate management of the groundwater by a pumping simulation analysis. As a result, it can be seen from our research that the fluctuation of water level caused by group wells has been reproduced accurately by using our model.

1. INTRODUCTION

In the management and a usage of a groundwater resource, we need to work on an accurate grasp of the current situation and to make a future vision in the region where the groundwater exploitation is active. In the past research, a common aquifer was examined in one municipality. This simulation was undertaken where the scope was expanded, the subject of which was a pumping well for water service - water levels for one pump were large. To use the groundwater resource in this region effectively, we examine the influence on peripheral groundwater properties especially where a large amount of pumping from the wells for waterworks is being practiced. We use it as a technique to maintain a surrounding groundwater environment.

2. EXPERIMENTAL PROCEDURE

First of all, we understand the influence on the fluctuation of water level by the rainfall and pumping based on long-term data concerning pump discharge and groundwater level at each pumping well in the waterworks. And, an analytical model that groundwater properties can be shown is made referring to the boring log in the object region. We do seepage flow analysis by the Finite Element Method (FEM) by using the made model. The physical properties value and the boundary condition are tested on the condition in various patterns. And, a final input parameter is decided by comparing an analytical result and the actual measurement value. The influence on the water level by pumping from two or more wells is examined based on an analytical result and passing age data.

3. RESULTS AND DISCUSSION

The analytical result of comparison with measured water level was able to reproduce the tendency to the fluctuation of water level, such a decrease of water level when pump discharge is increased and a recovery of water level when pumping is stopped. The analytical result of the pumping well in each waterworks showed the about same tendency. Therefore, it is thought that we were able to construct the model that can roughly reproduce influence on groundwater level that pumping causes in the object region.

4. CONCLUSIONS

As a result, the groundwater level fluctuation was able to be reproduced in high accuracy in the constructed stratum model. If the pumping well is newly established, using this model and the result of measurement of the water level for 20 years or more, we want to forecast its future influence on the water level. We also want to use it as a model that can propose an appropriate groundwater control for the long-lasting use of ground water in this region, and for the prevention of troubles concerning the wells, and subsidence.