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Long-term Transition of Pumping Rate and relationship with Confined Head in Kanto Groundwater Basin

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At the alluvial lowland of Tokyo metropolitan area, intensive drawdown of groundwater head due to excessive pumping caused the considerable land subsidence in the past times, and on the contrary, remarkable rise of the confined groundwater head depending on the regulation of groundwater withdrawal has brought adverse affect on many important infrastructures such as underground railway stations in late years. In order to understand such behaviors of the groundwater, it is essential to clarify actual conditions of the regional groundwater flow system within the Kanto plain. Primary specific approaches are to analyze such basic data as pumping amount and also to put groundwater indexes such as groundwater head in order. Since those data will be utilized conclusively for numerical simulation of regional groundwater flow system, it is required to estimate long-term pumping rate backward until the period of very few groundwater usage in order to improve the precision of the simulation quantitatively.

For several years, authors have attempted to reconstruct the long-term transition of hydrogeological conditions in the whole Kanto groundwater basin. In this conference, we will demonstrate method and result of the backward estimation of the pumping rate before the second world war, and relationship between the reconstructed pumping rate and the confined groundwater head actually observed.

As it was considered that both use of submersible pump and the land subsidence in the Kanto plain started with the 1920's (Taisho Era), the estimation was extended back to the 1920's. On the other hand, data on pumping rate after around the 1970's are available in case of the Kanto groundwater basin. After a process of trial and error, it is clarified that there is a clear correlation between GNP and the total pumping rate. Therefore, the pumping rate before around the 1970's was principally estimated adopting the correlation except for 1945, the year of war end, where the pumping rate was assumed to be 0.

As for the groundwater head monitoring, observation of the confined groundwater head at the alluvial lowland of Tokyo metropolitan area had been commenced at the beginning of the 1950's. The confined groundwater head continuously descended till the middle of the 1960's, then ascended rapidly in reversal until the middle of 1980's. After then, the confined groundwater head has ascended slowly until now. Whereas the long-term transition of the pumping rate is quite concordant with the long-term variation of the confined groundwater head, the estimation of the pumping rate before around the 1970's is considered to be sufficiently valid.

At the alluvial lowland of Tokyo metropolitan area, on the other hand, the pumping rate of surrounding area has close relation with the confined groundwater head in case after the middle of 1980's. According to the relation, it has been possibly predicted that the confined groundwater head will ascend more if the pumping rate will decrease in future.

Keywords: Kanto groundwater basin, Regional groundwater flow system, Pumping rate, Confined groundwater head