

AHW026-P09

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## Estimation of Groundwater Recharge from Low-Discharge and Gravelly River by Synoptic Survey using Handheld ADV

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Synoptic survey, performing stream gauging at a number of stream cross sections over a short period, is often applied to estimate how and where the groundwater recharge in an alluvial fan occurs. But the complex and variable distribution of depth and velocity due to gravelly riverbeds cause the unacceptable uncertainty of river discharge.

In the Toyohira River, which flows through the center of Sapporo city, Japan, the rate of water loss is estimated to be about 1 to 2 m<sup>3</sup>/s. If so, it is afraid to influence the well pumping and the river environment by the losing. Although many synoptic surveys were performed in past times, they were inconsistent and incoherent because of the uncertainty of the measurement.

In this study, the improved synoptic survey are applied, which uses Handheld ADV(Acoustic Doppler Velocimeters) , "Flow-Tracker" designed by Sontek/YSI. And vertical measurement points of velocity were arranged densely so that the river discharge in each subsection is less than 5 to 10% of the total. In result, the distribution of discharge and the rate of water loss are able to be estimated more correctly. In addition, the measurements by the propeller velocimeter and by ADCP are compared to assess the adequacy of each method.

The synoptic surveys were performed at some of 10 gauging sites and 2 tributaries several times in which the variation in water level are small, from September, 2010 to December 2010. It was revealed that the discharge losing section located between 16 to 17 km from where the Toyohira River and the Ishikari River join together. In the measurements, the rate of water loss between the two gauging stations, the Moiwa st. and the Kariki st., was constant at about 0.2 m<sup>3</sup>/d and was independent on both the river discharge, ranged between 3 to 15 m<sup>3</sup>/d, and the temperature of surfacewater, ranged between 1 to 21 degrees Celsius.

The rating curves of the Moiwa st. and the Kariki st. are estimated for considering the losing statistically. The groundwater recharge from the Toyohira River is probable to be decreasing in decades. The factor is thought to be the long term decline in water table around the river owing to the increased well pumping and the urban developments such as the subway construction, drainage and so on.

Keywords: alluvial fan, groundwater recharge, synoptic survey, ADV, ADCP, rating curve