Study on Maintenance Flow Rate Setting Procedure for Rivers in Mountainous Area

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1. Background of study

The development of renewable energy is attracting attention after the power supply shortage that followed the Great East Japan Earthquake. Since a fixed price purchasing system for renewable energy started in 2012, the purchase price of renewable energy has been rising. For small scale hydropower, one of the renewable energies, revisions to the River Law in 2013 allow providers to register instead of requiring permission for subordinate power generation using the existing water utilization system since it is not expected to have new impacts on river environments, etc. As a result, application documents and procedures were simplified and the period required to obtain water rights was significantly shortened.[1)]

In the case of new water intake, it is still required to determine the river maintenance flow rate in consideration of the impact on the river environment, etc. However, for rivers in mountainous areas where small scale hydropower is likely to be introduced, it would require much time and effort to set the river maintenance flow rate in the conventional manner since there is little data or knowledge necessary for setting the rate. Therefore, this study aims to facilitate water utilization procedures for small scale hydropower by establishing a suitable and simple approach for setting river maintenance flow rate for rives in mountainous areas.

2. Study method

This study is surveying, as model rivers, 4 rivers where small scale hydropower systems have been introduced. The study items have been limited to two considering the characteristics of rivers in mountainous area, i.e. impact of water intake on the habitats of living things and impact on landscape.

(1) Impact of water intake on habitats

By classifying the components of river channels in mountainous areas into step pool channels, cascade channels, and riffle-pool channels, and defining each of them, the effect of flow rate decrease on habitats was examined for each component of the targeted river channels. Considering that maintaining the habitats is important to reducing the impact of water intake on living things and that no significant changes in physical quantity including depth, velocity, water surface area, and water temperature is important for maintenance, we did an hydrologic accounting by modeling each component of the river channel and estimated what changes the decrease in flow rate could cause to such physical quantities (Figure).

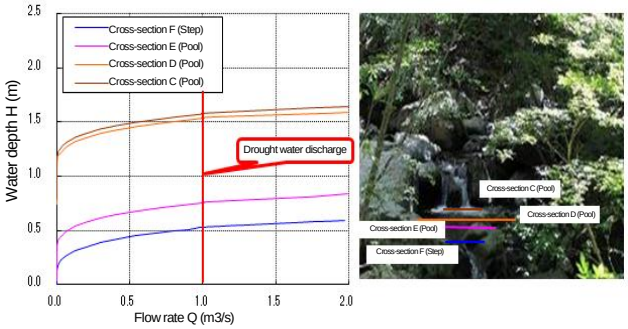

Figure: Example of Site and Hydrologic Accounting

(2) Changes in the landscape of rivers in mountainous area due to water intake

From past studies, it was found that people perceive a greater "amount of water" in areas whitened by ruffled waves caused by a drop or otherwise in the stream. Therefore, we conducted an experiment on landscape preferences to study how people perceive the "amount of water" with photos taken of an actual river with the flow rate reduced in stages using a pump, and analyzed correlations between the "perceived amount of water," scale of ruffled waves, and various quantities of river.

3. Future plan

Based on the results of this study, we plan to propose a reasonable method for setting flow rate for river maintenance in mountainous area, and verify the applicability thereof through case studies.

[Reference]

1) MLIT website
http://www.mlit.go.jp/river/riyou/syosuiryoku/index.html