Trial calculating impacts on maintenance costs and river environments at the river improvement stage and applying the results to river course design

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1. River improvement and maintenance and the importance of harmony with the river environment

In the future, river improvement guidelines must be enacted nationwide and specific river improvement methods such as river course excavations and tree felling etc. must be established. When that is done, it will be important to specify concrete improvement considering harmony between flood control and the river environment in addition to river improvement and maintenance intended to ensure flood control safety. The River Division has, by introducing the concept of a margin as sediment deposition space, developed a method of uniformly evaluating the cost of river improvement and maintenance, and proposed a method of minimizing the total cost of river management[1]. It will be a particularly useful method on river courses where sediment tends to be deposited at segment change points and at the river mouth. As a result, it was possible to deal with improvement and maintenance as a single activity, but as pointed out under Neo-Natural *River* Reconstruction, it is more important to strive to improve a river to its form several decades in the future than to its present condition. To do so, change of the river course must be predicted to assess its indirect impact on the river environment, then concrete improvement measures must be established.

2. Evaluating the impact on living organisms of change of the physical infrastructure

River improvement and maintenance directly alter the physical infrastructure, so for this study, instead of preparing a complex ecosystem change model including competition between living organisms, a living organism response model in conformity with the change of the physical infrastructure is prepared and its impact on the river environment is evaluated. Specifically, the riverbed change calculation model which considers the advance and retreat of vegetation, and a living organism model which responds to change of the physical infrastructure were linked to prepare a river ecosystem change prediction model capable of evaluating the indirect impact after a flood discharge in addition to the direct impact of river improvements (below called the “change prediction model”). The concept of flow capacity margin was added to this to perform integrated evaluations of flow capacity, impact on living organisms, and maintenance costs under the guidelines to river management, multiple drafts of which had been provided. The change prediction model was prepared for the Kita River on the Gokase River System, where large-scale river course excavation had been executed about ten years earlier forming a research field for river ecology research. With the focus on the crab, Deiratonotus japonicas, the fish, Sicyopterus japonicas, and the raccoon dog, which are typical life on the Kita River, the response of these living organisms to the river improvements were evaluated. For example, in a case where a high water channel has been excavated to conserve the underwater environment, it is relatively difficult to evaluate its indirect impact on living organisms, and there are even cases where flood discharge after the improvement greatly changed the water route or riverbed materials, resulting in the sharp deterioration of the underwater environment.

3. Directions of studies to establish concrete improvement methods

Calculations to reproduce the short-term change of the physical infrastructure, which was subjected to several flood discharge processes, were done to evaluate their impact on the decline of flow capacity and the living organisms. To decide on concrete river improvement methods, conditions for a study extremely varying its impact on the target living organisms should be set. Long-term calculations are done to totally evaluate the cost flow capacity, and impacts on living organisms in a case where, for example, excavation of dry land was the main improvement, where underwater excavation was the main improvement and where the necessary river section was ensured by combining excavation of dry land with underwater excavation. Therefore, the key to practically applying the change prediction model is how precisely the indirect impacts of river improvement on living organisms can be predicted.

[Reference]

1) Takeuchi et al.: Concepts and specific methods for management to provide a margin to flow capacity, NILIM Report 2011