

## Upstream Channel Responses due to Partial Removal of a Weir

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### 1. Introduction

Weir removal has garnered considerable attention over the past several decades. In general, weir removal is considered as a method either for the management of aging and/or outdated structures or for the restoration of degraded river environment. Removal of a weir triggers hydraulic and sediment transport processes that propagate both upstream and downstream, with the upstream response driving the downstream one. The changes in the flow and geographic parameters furthermore exert impacts on the biogeochemistry and stream habitat. It is hence necessary to characterize and quantify the post-removal channel dynamics and associated underlying processes.

### 2. Experiments

A series of experiments were conducted in a straight titling flume at the Ujigawa Open Laboratory, Kyoto University (see Fig.1). Two kinds of experiments were carried out: 1) partial removing the weir with various shapes and 2) movable channel bed with sediment particles of different compositions.

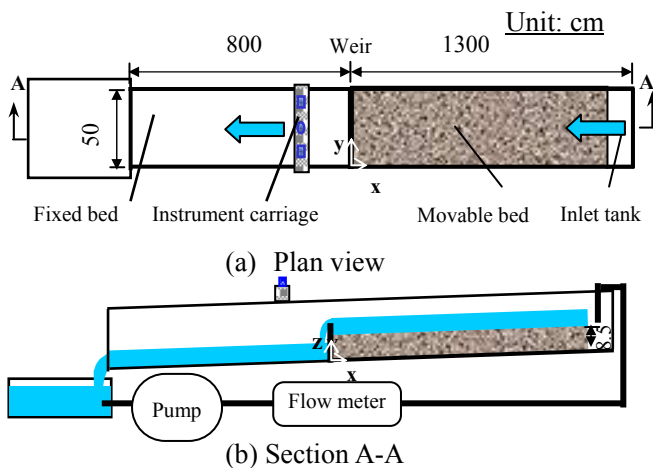


Fig.1 Experiment setup

The hydraulic conditions are kept the same in all experiments as shown in Tab.1. For each experiment, the propagation process of the sandbar front was recorded. The bed deformation and the change of the water level from the initial stage to the final quasi-equilibrium stage were measured as well. Moreover, the flow velocity in the proximity of the weir structure was surveyed in some representative cases and the change of the bed surface composition was analyzed in case of non-uniform sediment bed cases.

Table 1 Hydraulic parameters

Discharge	8.16 l/s	Grain size	0.16 cm
Bed slope	1/200	$u^*/u_{*c}$	1.40
Flow depth	4.18cm	Re. number	12,651
Mean velocity	39.04 cm/s	Fr. number	0.61

$u^*$ = friction velocity and  $u_{*c}$ = critical friction velocity.

### 3. Results

Based on the experimental results, the impacts of the removal shape of the weir and the upstream bed materials composition were emphasized in this research. The discussions were mainly focused on the temporal variation of the sandbar fronts, the evolution process of the sandbar system, the change of the water stage, the bed slope as well as the bed composition, and the characteristics of the local scouring around weirs. Suggestions were also made for weir removal decisions in actual rivers.

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