EFFICIENCY OF SEDIMENT FLUSHING FOR DIFFERENT SEDIMENT MIXTURES

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Abstract Sediment flushing has been reported as an efficient measure for reservoir desiltation. However, the efficiency of flushing varies depending on factors such as bed material, initial water head and capacity of dam outlets. This study aims to assess the influence of the initial water head and of the sediment size on the flushing efficiency. Efficiency is defined as the ratio between the volume of sediments evacuated to that of water released. For that purpose, 60 laboratory experiments were conducted in a rectangular flume. Ten pairs h_s – h_w were tested for two different reservoir volumes and for three sands, so-called fine, medium and coarse. h_s and h_w stand for the initial sediment and water elevations, respectively. Measurements consisted in lateral videos to characterize the evolution of the water and bed surfaces during the experiments. The flushing efficiency decrease as the initial potential energy and the inertia of the reservoir increase, irrespective of the sediment size.

Keywords: sediment flushing, flushing efficiency, reservoir sedimentation, sediment management.

Methods

Experimental facility:

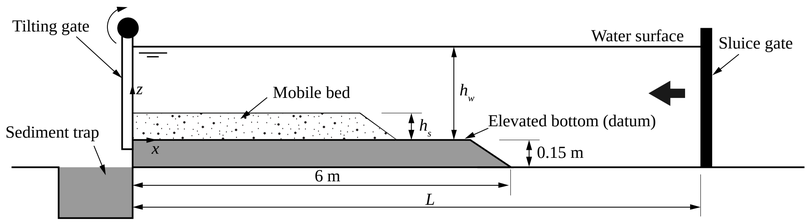

Figure 1: Sketch of the experimental facility (not to scale).

Experimental setup, 60 experiments covering:

- Three different sands:
  - Fine (d_{50} = 0.39 mm)
  - Medium (d_{50} = 0.80 mm)
  - Coarse (d_{50} = 1.54 mm)
- Ten values h_w / h_s (from 1.25 to 5.00)
- Two values of L (6.00 m and 12.05 m)

Measurements:

- Lateral videos to characterize the evolution of the bed and water surfaces during the experiments.
- Discrete monitoring of the water surface by means of ultrasonic limnimeters.
- Weighing of the sediment evacuated during the experiments.

Results

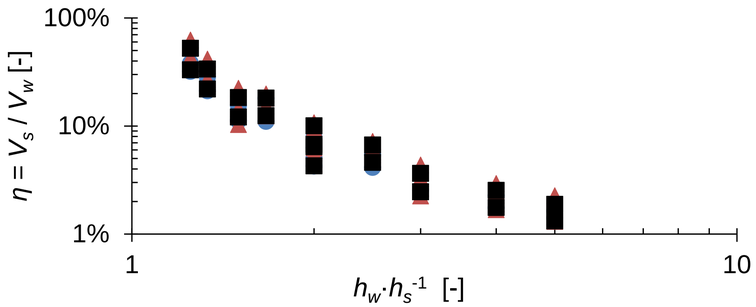

Figure 2: Flushing efficiency for different sands and for varying values of $h_w \cdot h_s^{-1}$

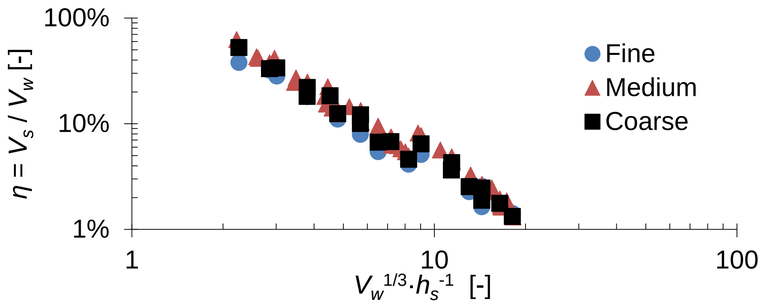

Figure 3: Flushing efficiency for different sands and for varying values of $V_w^{1/3} \cdot h_s^{-1}$

Figures 2 and 3 illustrate that the efficiency decreases as the ratios $h_w \cdot h_s^{-1}$ and $V_w^{1/3} \cdot h_s^{-1}$ increase, regardless the size of sediments. That means that the efficiency of flushing will be comparatively small for high initial water head and for large reservoirs.

Conclusions

Within the range of values adopted in this study, the initial water head and the initial height of sediments have a significant influence on the efficiency of flushing. On the contrary, the influence of the size of the sediments on the efficiency of flushing is negligible.

Also, the efficacy of flushing is observed to increase for comparatively small water heads and for comparatively small reservoirs.

Bibliography

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