

River Alpenrhein - Scour protection for bridge piers

Client: Internationale Rheinregulierung



Initial situation:

- Improvement of flood protection, among other things through significant widening of the riverbed.
- This is associated with a more pronounced morphology (scour, banks).

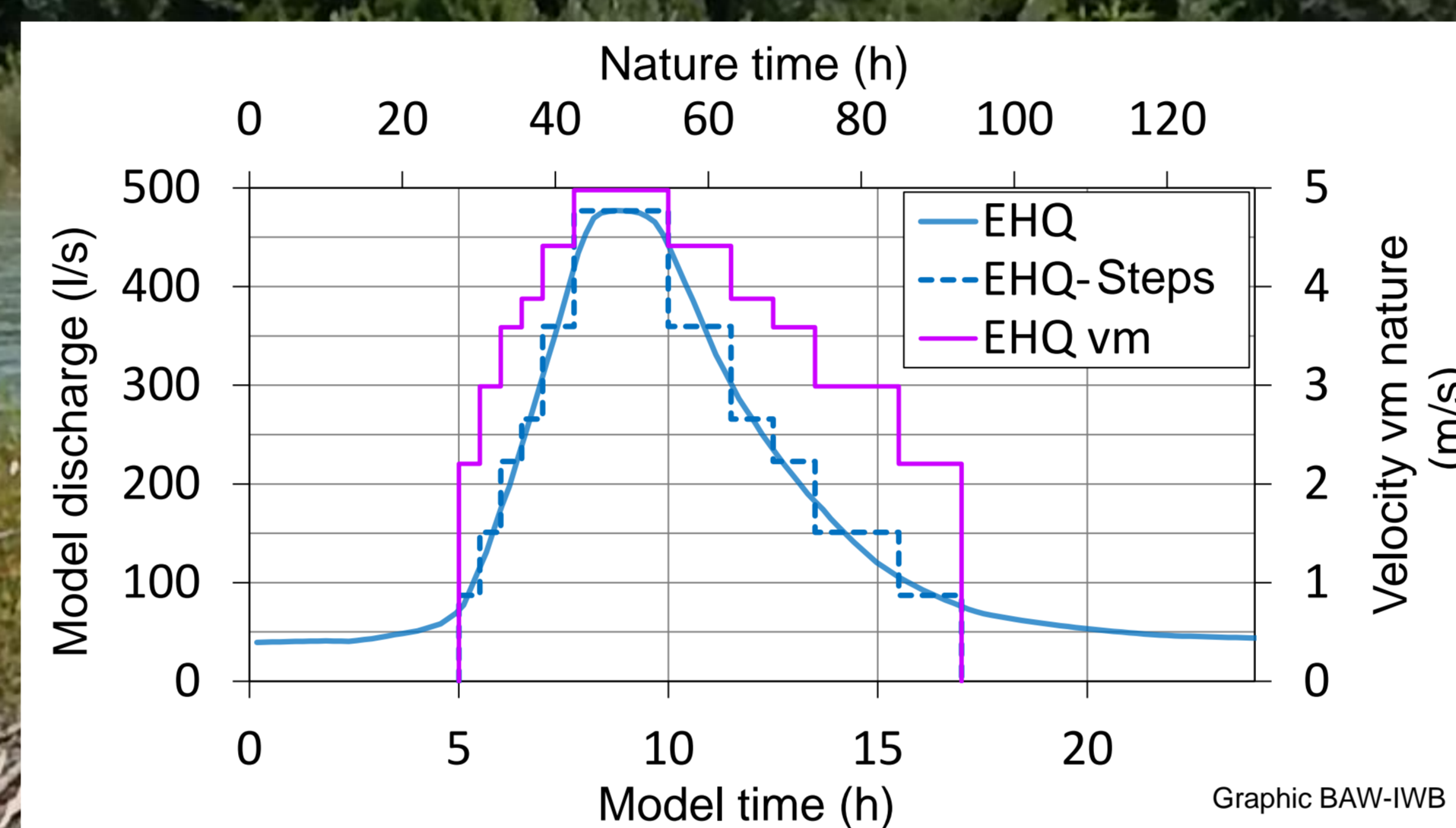
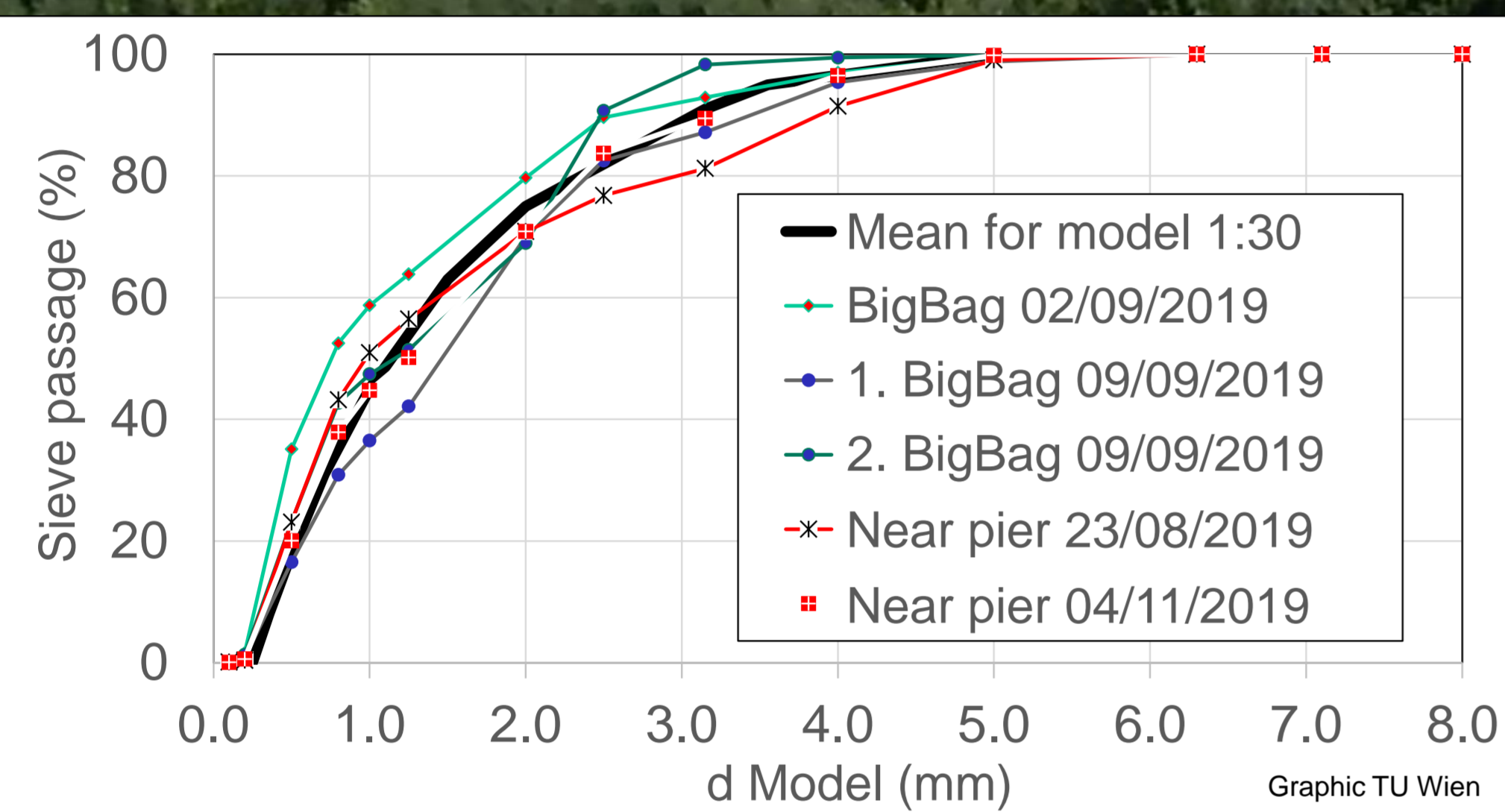
Question: What scour protection is required for the bridge piers of the river Rhine?

Boundary conditions:

- Higher design flow (up to 5800 m³/s compared to 3100 m³/s previously),
- Implementation as economically as possible

Model test: cutaway model scale 1:30

- Width of the channel 2.5 m, corresponds to a width of 75 m in nature
- Total length of channel 30 m, riverbed gradient 1.0 ‰
- Approx. 40 t of model sand installed



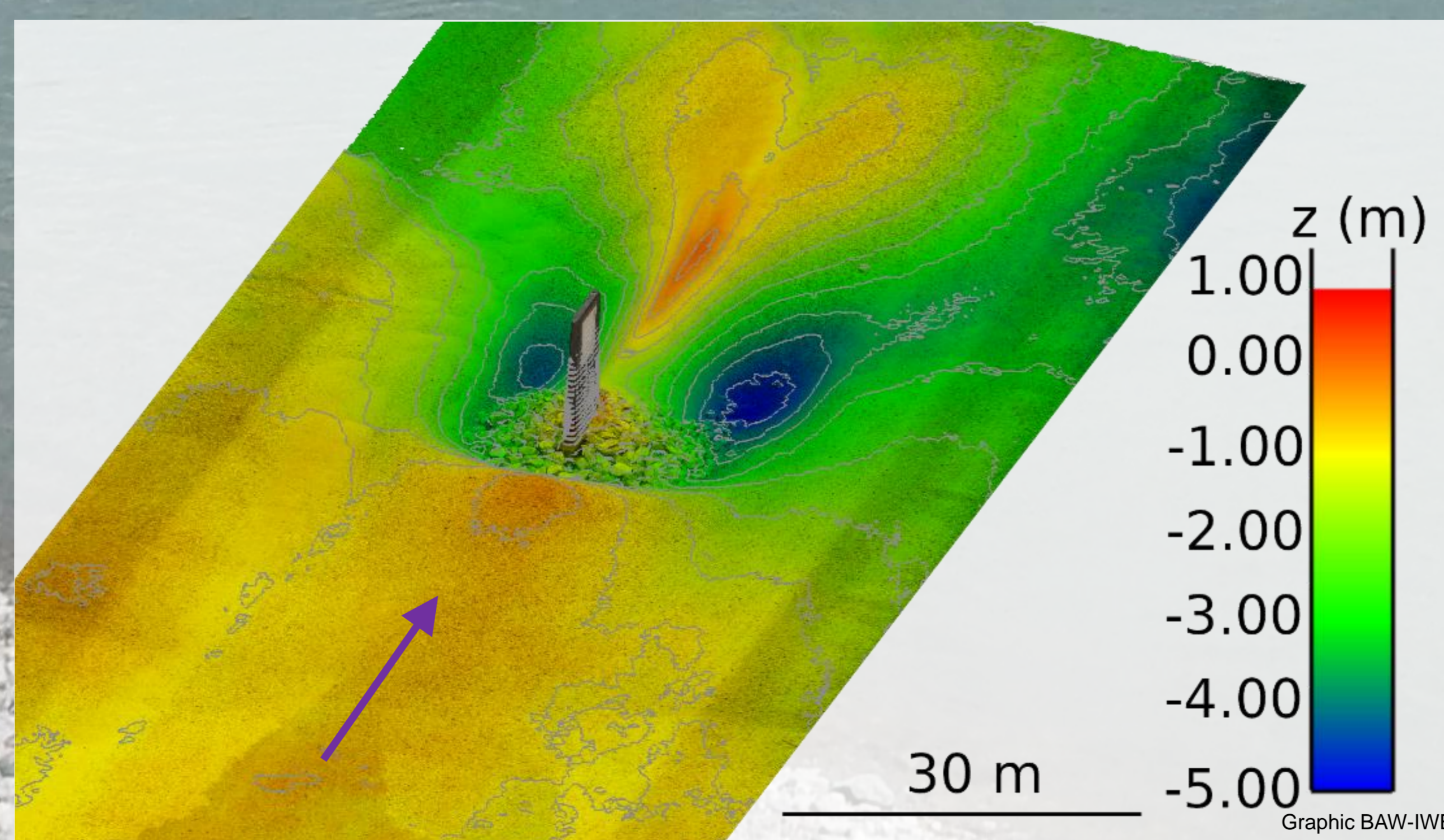
Experiments: Direct and oblique flows around piers, pre-formed scour channels as well as log jams on the pier were investigated.

Intermediate result: For the dimensioning of scour protection around a bridge pier in the Rhine, the governing scenario is always the one involving a debris accumulation made of driftwood.

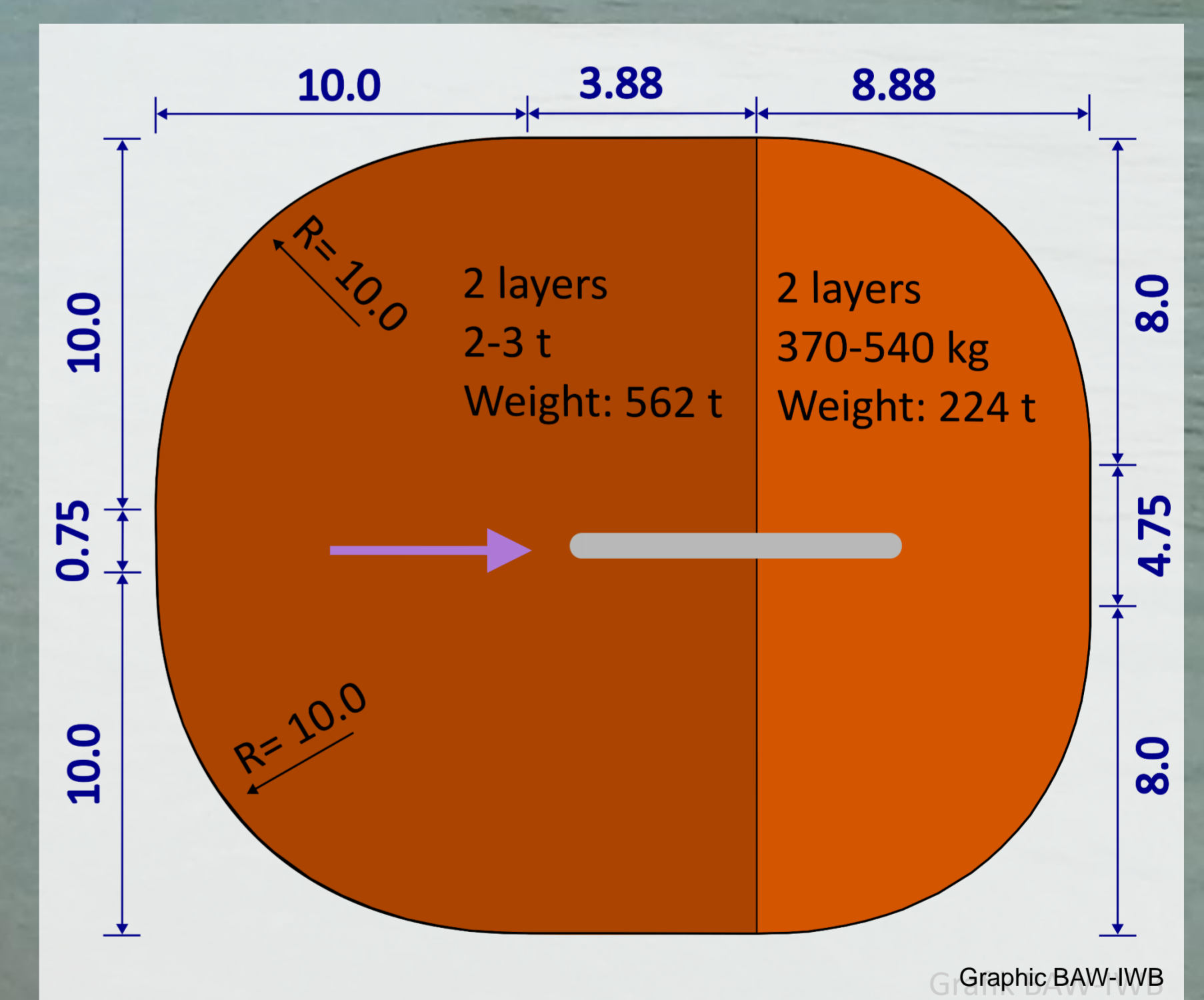
Log jam structure Bridge Höchst Lustenau



Scour after maximum flood load scenario with log jam structure (Bridge Oberriet-Meiningen)



Recommendation scour protection Bridge Oberriet-Meiningen



Results:

- Log jams at bridge piers result in significant scour depths and require substantial scour protection efforts, even for slender and hydrodynamically favourable piers.
- The number of stones must be sufficient to form a stable slope towards the scour.
- Only select stones that are large enough to prevent them from being carried away.
- The scour protection shifts the scour outwards towards the bank (effects on bank protections possible).

