Success Story
Sewer System

Simulation of complex multiphase systems

DIVE SOLUTIONS

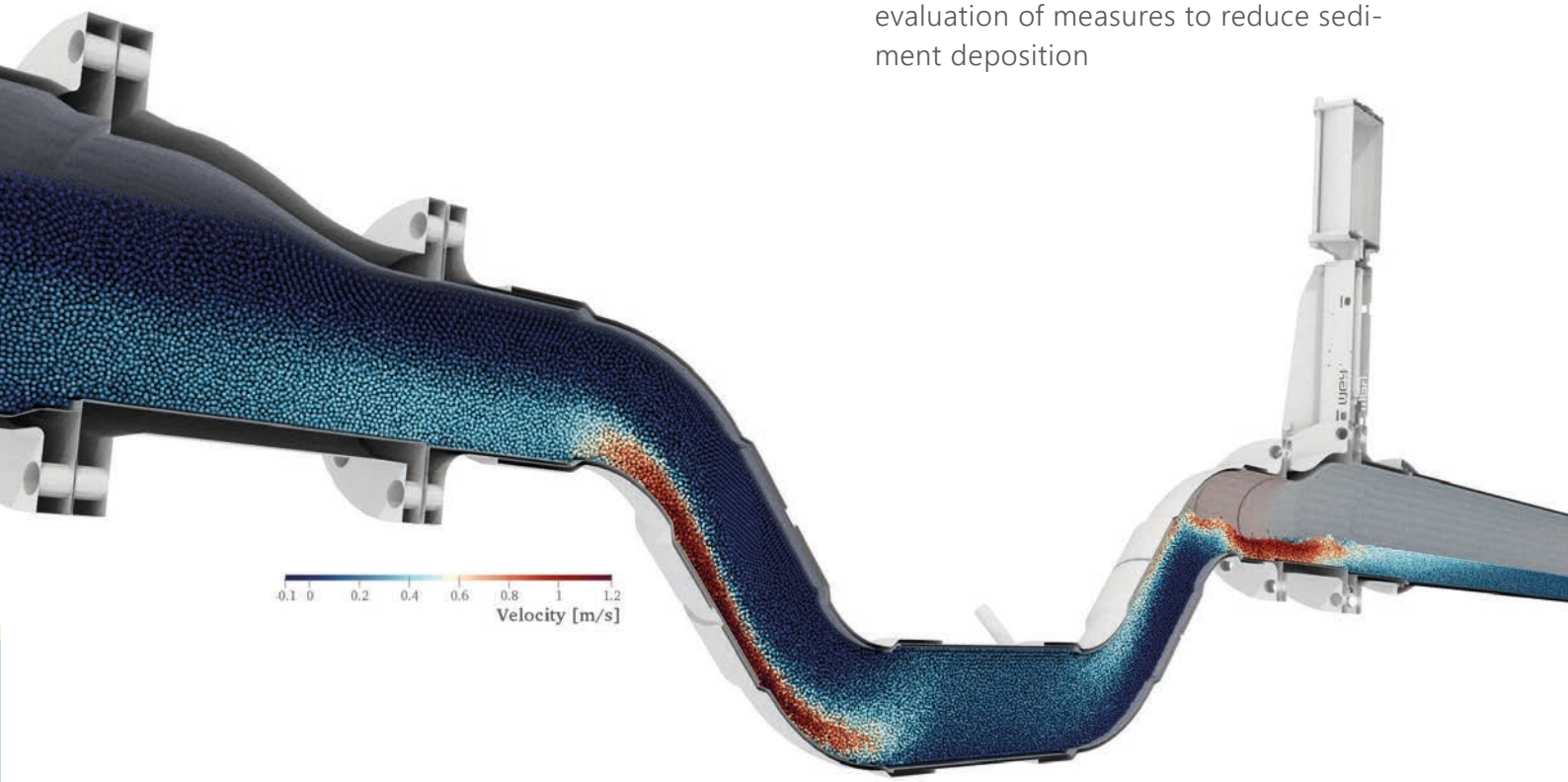
BASELINE

Berlin's municipal water supplier Berliner Wasserbetriebe is facing the challenge of adapting their sewage network to present conditions: Declining water consumption and more frequent drought periods lead to underload of the sewer. Increased deposit of sediment and rising costs of maintenance are the result. The duct component culvert is particularly susceptible to this (see illustration).
Berliner Wasserbetriebe and dive solutions decided to get to the bottom of the phenomenon in a cooperative simulation project on a sewer system test facility.

Test facility of "Berliner Wasserbetriebe" (unique in Germany)

GOALS

- Method development for the simulation of the facility (including sediment transport)
- Increase of process understanding and evaluation of measures to reduce sediment deposition



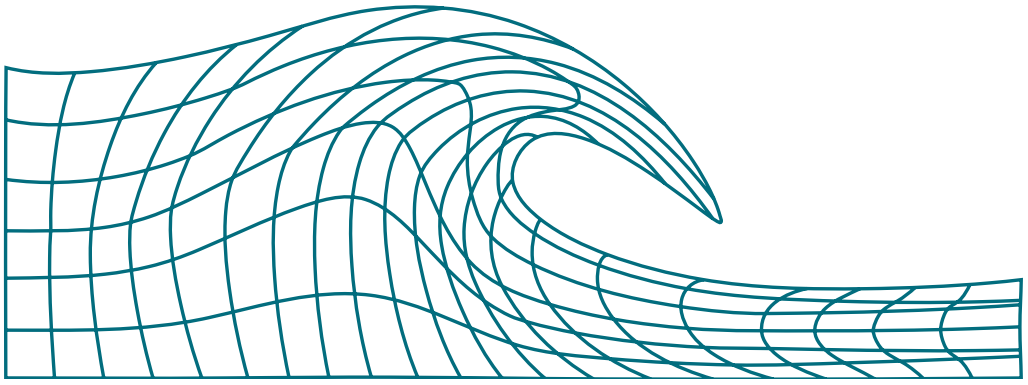
PROCEDURE

CHALLENGE

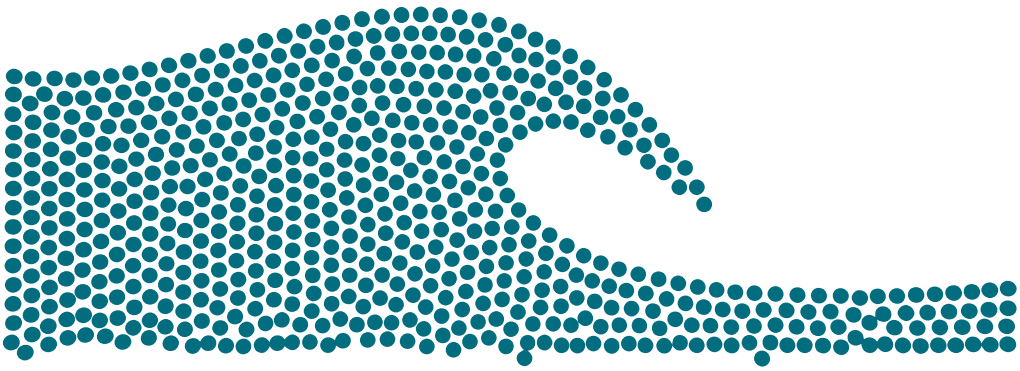
The simulation of the experimental sewer system comprises highly complex flow phenomena:

- Non-Newtonian fluids and sediment transport
- Sediment-fluid interaction (two-way coupling)
- Complex free surfaces and phase interfaces

Conventional, mesh-based CFD methods quickly reach their limits at this point.
The mathematical foundation used by dive solutions is based on the „Smoothed Particle Hydrodynamics" method. SPH models interacting continua as a conglomerate of freely moving particles. Thus, precise results in complex multi-phase cases can be achieved with little preparation effort.



Traditional mesh-based fluid model (FVM)



New particle-based fluid model (SPH)

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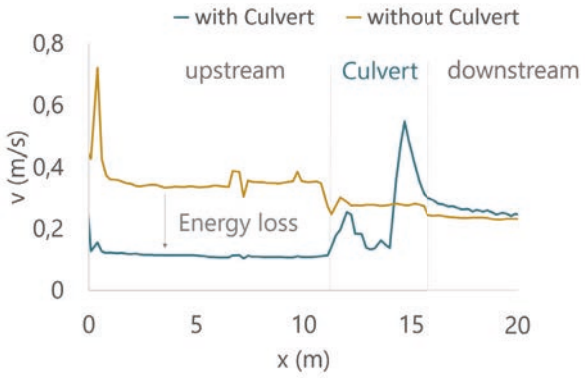
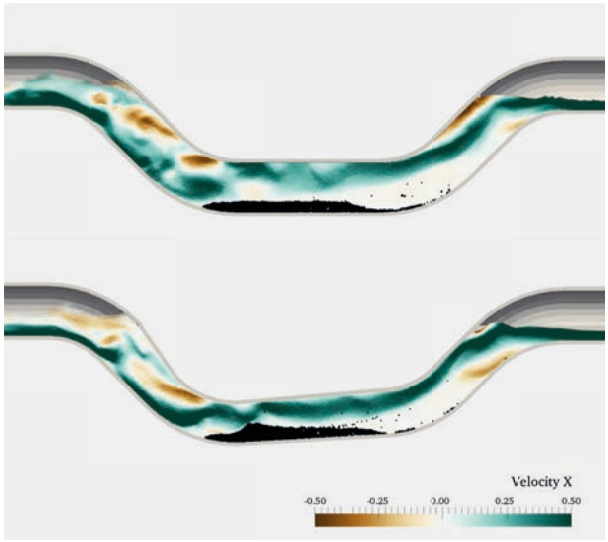
SINGLEPHASE SIMULATION OF THE SEWER NETWORK

- Detailed insights into the flow behaviour in the system
- Determination of the influence of the culvert on the entire system:
  - Deceleration of the flow
  - Enforcement of sediment deposits



Comparison of flow velocities with and without culvert



MULTIPHASE SIMULATION WITH SEDIMENT TRANSPORT

- Development of a valid sediment model
- Implementation in the in-house SPH software
- Simulation of sediment transport in the culvert
- Testing of various measures for fluidic optimization and reduction of deposition

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With dive solutions innovative SPH approach, complex multiphase processes could be simulated for the first time and with high efficiency.
Next step in the cooperation: extending the methodology to other applications in the channel system.

Development of a method for the simulation of solid transport

Gaining thorough understanding of flow phenomena in poorly accessible infrastructure

Examination and evaluation of optimization measures

In Kooperation mit:

Berliner Wasserbetriebe

A² Accelerator

Are you interested to find out more about this use case or our technology? Please contact us.
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