DHI SOLUTIONS

Reservoir sedimentation management

Cost-efficient and sustainable solutions for the dam industry

The annual cost caused by reservoir sedimentation is US$ 15 billion

Over the last century, a large number of big dams have been constructed worldwide. The combined storage in large dams today amounts to more than 6,000 km^3. Sedimentation causes significant losses to the storage volume each year, estimated at around 0.5% - 1.0% of the total combined storage. This results in replacement costs of the storage loss in an order of magnitude of US$ 10 billion.

Other cost-intensive factors related to sediment are damages to turbines, loss of hydropower production as well as downstream impacts, with combined costs of more than US$ 5 billion. Thus, the annual cost of reservoir sedimentation exceeds US$ 15 billion—a significant amount compared to the annual investment costs in hydropower. However, the annual spending on sedimentation mitigation is much lesser than the costs incurred by reservoir sedimentation.

Dam development is moving up the climate agenda

With climate change and the search for CO_2-neutral energy, hydropower and dam development has not only regained a central position in many national and international development strategies, but it has also gained importance with international donors.

Good sedimentation management is key to sustainable hydropower, as it ensures that storage is a renewable resource.

SUMMARY

Client

Dams/Hydropower designers and operators, international donors

Challenge

- Loss of storage
- Loss of hydropower revenue
- Damage to turbines and other hydro-mechanical parts
- Adverse environmental impacts

Solution

Proper sediment management through integrated solutions combining technical, environmental and economic parameters; State-of-the-art numerical modelling of reservoir sediment and hydrodynamics.

Value

- Sustainable sedimentation management from the planning to the operation stage
- Reduced repair and maintenance costs
- Increased revenue

Sustainable development is 'development that meets the needs of the present without compromising the ability of future generations to meet their own needs', as defined by the Brundtland Commission in 1987. This 'inter-generation equity principle' is particularly relevant to reservoir sedimentation, as storage is not a renewable resource without proper sedimentation management strategies in both design and operation of hydropower projects.

Model-based analyses of reservoir processes

Based on our expertise, our advanced numerical modelling solutions as well as decades of international experience, we can help you tackle the problems associated with sedimentation in all phases of project development and operation.

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To allow for economically efficient and sustainable sedimentation handling, you need to

- be able to predict reservoir sedimentation and
- test alternative sedimentation mitigation measures.

DHI has developed a suite of models for the simulation of reservoir processes that can improve the management of reservoir sedimentation. These models can represent reservoirs ranging from small pools at run-of-river (ROR) schemes to large storage reservoirs, with almost any configuration of gates, spillways and intakes. They allow to test alternative set ups and thereby contribute effectively to optimisation of both design and operations.

Reservoir simulation in all dimensions

DHI's model suite for reservoir simulation comprises

- MIKE 11 – a one-dimensional (1D) model for simulation of both fine suspended and coarser bed load transport in rivers and similar water bodies. It is applicable to long narrow reservoirs.
- MIKE 21 – a two-dimensional (2D; depth integrated) model for simulation of sediment and morphology in shallow water bodies. Primarily applicable in (shallow) ROR reservoirs. A curvilinear version is particularly useful for long-term simulations.
- MIKE 3 – a three-dimensional (3D) model for simulation of sediment transport in all types of water bodies including deep storage reservoirs.

	MIKE 11	MIKE 21	MIKE 3
Backwater sedimentation and flood risk	✓	✓	
Long term sedimentation	✓	✓	
Detailed sedimentation pattern		✓	✓
Deisng of flushing strategies	✓	✓	✓
Layout of intakes, gates and spillways		✓	✓
Estimation of sediment in intakes			✓
Downstream morphology impact	✓	✓	
Decommissioning of dams	✓	✓	

Characteristic application areas of DHI's modelling systems.

Specifically, DHI offers:

- Analyses of existing databases as well as design and execution of required field work
- Analyses of sediment load based on catchment modelling or data analyses
- Estimation of reservoir sedimentation patterns
- Reservoir flushing analyses – effectiveness and environmental impact
- Design of sedimentation mitigation measures in ROR and storage schemes
- Optimisation of sediment handling in ROR schemes
- Lifecycle management of sediment
- Downstream impact on morphology
- Impact of climate changes

Typical sedimentation pattern in a ROR scheme.

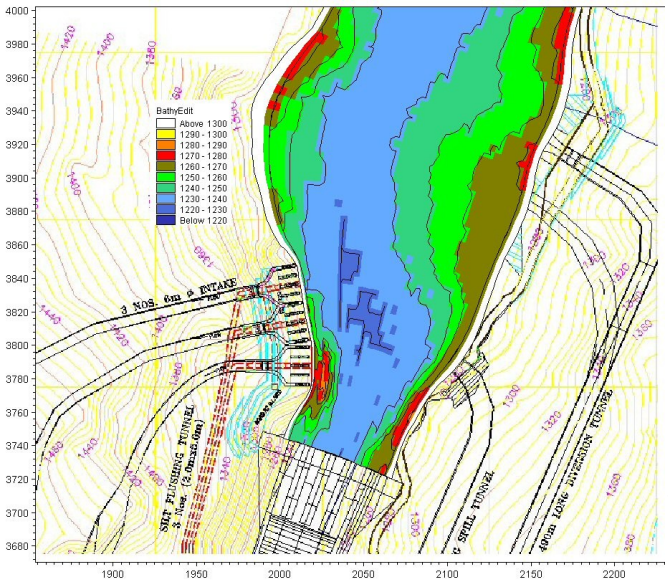
Solutions for all stages of your project

Right from the conception of the project, we supply you with a thorough evaluation of the existing database on hydrology and sediments and define the need for additional data.

To fill this need, our Survey & Monitoring Group will measure and assess hydrological parameters and sediment load in rivers utilising both modern and traditional equipment.

We can contribute to the design and execution of monitoring programs, including the training of field staff.

During the pre-feasibility and feasibility phase of your project, our vast experience within hydrology, catchment modelling, hydraulics, sediment transport, reservoir sedimentation analyses and Environmental Impact assessments (EIAs) will contribute to the high-quality and cost-efficient execution of the required studies. For planned and existing project, we can develop sedimentation-guided operation policies that will



Two-dimensional model of an ROR scheme. Detail of the model in the vicinity of the dam, power intake and sediment flushing tunnels.

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