
SUSTAINABLE SEDIMENT MANAGEMENT

Shaping our world



Sediments can make or break a Project

Numerous examples of dams and reservoirs can be found throughout the world whose live storage was filled with sediments after only a few years of operation. Once the storage has filled up with sediments, only very few options remain to meet the original requirements such as power generation, water supply, flood control, navigation and environmental benefits.

Sediment problems, however, are not limited to reservoirs and dams. Plenty of irrigation schemes around the world suffer from a massive lack of water, owed to heavy sedimentation in the water distribution network.

The reasons for many sediment problems are obvious: sediments had been neglected in the planning or the overwhelming quantities encountered during the operation were underestimated. As a consequence owners and operators face increased running costs for sediment removal, along with power production losses or poor harvests.

Sediment engineering and management, beyond any doubt, is crucial for a project to become successful. No matter whether you are considering the implementation of a new project, or you are facing an accumulation of sediments in an existing scheme – Lahmeyer International offers a comprehensive range of services for sustainable sediment engineering and management. We have the capability, expertise, resources, and long-standing experience to meet the challenges of your project successfully.

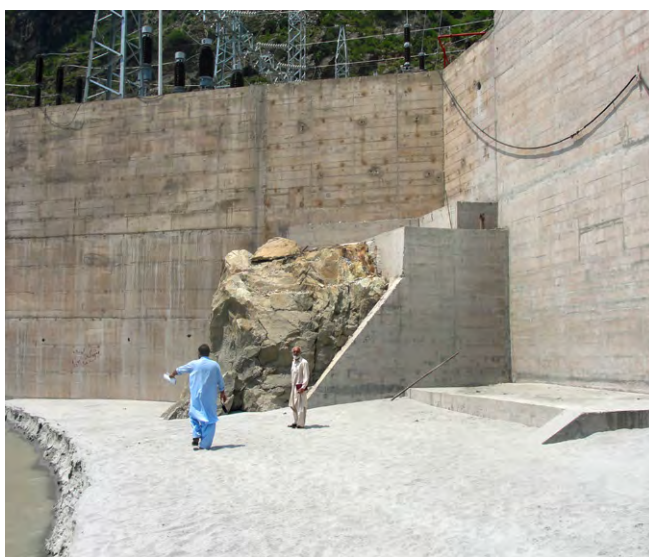
Our sediment related services include:

- Reservoir sedimentation studies
- Sedimentation studies for irrigation canals
- River degradation studies
- Design of sediment exclusion works (desanders, desilters, etc.)
- Design of flushing and sluicing
- Dredging studies
- Studies on the disposal of removed sediments by dredging
- Excavation dredging and river deepening studies
- Erosion Control



Sediment sluices under a power intake after a successful test (before and after flushing operation – 1:35 scale model).

Cover: *Sediment delta at Phewa Tal Reservoir, Pokhara, Nepal. Impounded in the late sixties, the foreset has progressed to the main body of the reservoir.*



Khan Kwar HPP, Indus River, Shangla District, Pakistan: turbine outfall after the flood



Overwhelming depositions of fine sediments after only one flood season

Sediment Data Acquisition

A comprehensive sediment study is always based on sound field data. Lahmeyer International offers services for the planning of sediment sampling studies as well as the implementation of river-wide or even river-basin-wide sediment sampling programs to international standards: this includes the identification of suited sampling locations and the determination of an appropriate but economic sampling frequency. Pragmatic concepts have been developed for isolated locations such as deserts as well as remote mountain valleys.

After samples have been taken, analyses of the grain size distribution and the sediment concentrations have to be conducted and the results need to be checked, assessed and recorded. Lahmeyer has the capacity and the knowledge to plan the establishment of sediment laboratories, staff trainings on field work, as well as on the work to be done in sediment laboratories.

Reservoir Sedimentation and Downstream River Degradation

On account of a drop of the flow velocity, sediments moving with flowing water can settle at the head or in the body of a reservoir. This leads to a depletion of the available storage capacity and imposes a major restriction on the economic operation. Due to the lack of sediments downstream of the dam, the river bed may degrade and the water levels may drop. This, in turn, can have major implications on the turbine operation, on pumps and other water abstraction facilities downstream and other features on the river.

Lahmeyer International has been involved in numerous reservoir sedimentation and river degradation studies for large dams around the world. Projects with grain sizes down to 0.1 mm have been studied.

Numerical modelling tools are available for the simulation of the location, thickness and the grain size distributions of the deposits in a

reservoir. 1D software has been successfully employed for the calculation of the sedimentation and the reservoir boundaries for projects as long as 220 km and over time periods of 100 years and more. 2D and 3D tools were frequently used to investigate sedimentation and degradation processes within the direct vicinity of the dam.

Flushing and sluicing help reduce or even avoid the settling of particles and can even remobilize settled sediments. Both commercial and in-house developed numerical tools also allow the quick and efficient testing of flushing and sluicing scenarios. Another subject of a reservoir sedimentation study can also be the development of operation rules comprising the most economic balance between maintaining power production as high as possible during the flood, and the sustainable minimization of the settling of sediments.



Flushing operation during flood season to prevent depositions in the reservoir



Desander with an integrated flushing device. Project: La Higuera HPP in the Chilean Andes.

Erosion Control

To maintain the stability of a structure, erosion has to be avoided or at least limited. In particular, the highly turbulent flow conditions behind stilling basins require special attention. Lahmeyer International has also various references for the successful design of bed protection measures. Various approaches (rip-rap, gabion mattresses, etc.) have been designed, tested by physical models and constructed.

Sediment Exclusion

Lahmeyer International has the specialised technical expertise to design structures which effectively facilitate flushing and sluicing by using a minimum amount of water. Flushing ducts were designed for a large number of projects. Physical models have been used to verify and confirm the functionality of the designs.

We also have experience in the design of settling basins for various grain sizes.

While large grains settle within a short distance, fine grains in the clay and silt size range require a significant effort for their exclusion. Lahmeyer International has references for the design of various types of settling basins.

Depending on the head available and on the sediment characteristics (grain size and cohesion, for example) a hopper-shaped settling basin has been proposed and designed. Common in high head hydropower schemes, this type enables emptying of the settled grains without interruption of power production or water supply.

Once the sediments have accumulated at the bottom of a water body such as a reservoir, settling basin or a river, a possible remedy can be dredging. We have developed dredging concepts for depths of up to 60 metres and several types of dredgers in lakes, reservoirs and irrigation canals.

The dredgers considered in studies carried out by Lahmeyer International include the following types:

- Suction dredgers (floating or amphibious, detachment of the consolidated sediments on the ground by cutter heads or high pressure water jet systems),
- Mechanical dredging by draglines,
- Clamshells or hydraulic long reach excavators.

Studies on the deposition of the dredged sediments were carried out. Subject of the studies was to investigate the possible treatment of the pumped sediment-water mixture, also referred to as slush, either onshore in the form of tailings, or returning it to a river under compliance with strict environmental legislation.



Physical model tests of scouring protection measures



Our Services



Sediment Data Acquisition

- Planning of sediment sampling campaigns, sampling stations, and sediment laboratories



Reservoir Sedimentation

- Reservoir sedimentation studies including the investigation of flushing and sluicing scenarios



Sediment Exclusion

- Design of sediment exclusion facilities, such as desanders and desilters – above and underground
- Verification of the design by physical model tests



Dredging and Disposal of Sediments

- Planning of dredging and maintenance activities for reservoirs, intakes, and irrigation schemes
- Planning of sediment disposal facilities



Erosion Control

- Design of river bed protection
- Verification of the design by physical model tests



Lahmeyer – A Company of Tractebel

At the helm of the Energy Transition, Tractebel provides a full range of engineering and consulting services throughout the life cycle of its clients' projects, including design and project management. As one of the world's largest engineering consultancy companies and with more than 150 years of experience, it's our mission to actively shape the world of tomorrow. With about 4,500 experts and offices in 33 countries, we are able to offer our customers multidisciplinary solutions in energy, water and infrastructure.

Since December 2014, Lahmeyer belongs to Tractebel and thus is part of the international ENGIE group headquartered in Paris. Tractebel, which is based in Brussels, and Lahmeyer, which is based in Bad Vilbel near Frankfurt, cooperate on numerous international projects and keep growing closer as one company.

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