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Managing Water in the West
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Managing Reservoir Sediment

Computer model predicts reservoir and downstream sediment impacts for effective sediment-management planning

What Is The Problem?

As dams and reservoirs age, it becomes necessary to manage the sediment that accumulates in the reservoirs. Rainfall runoff, snowmelt, and river channel erosion produce a continuous supply of sediment that accumulates in reservoirs. The accumulation of sediment reduces reservoir storage capacity and may affect other reservoir uses such as recreation and fish and wildlife habitat.

Managing sediment in reservoirs can be complex and costly. Management options include sluicing sediment through a dam, mechanical sediment removal, and in some cases, dam removal. Sluicing and releasing sediment downstream is achieved by lowering the reservoir water surface to expose the sediments and the incoming stream flow carries the sediments through openings in the dam. Removing reservoir sediment using mechanical methods (dredging or excavation) can be very costly. In removing a dam, potential sediment impacts (erosion, transport, and deposition) could occur in the reservoir and in the river channel. The water discharged from a reservoir typically has a reduced sediment load and this affects channel and habitat conditions downstream of a dam. There are benefits to restoring the sediment supply to the downstream channel but potential negative impacts, such as increased flooding potential and temporary destruction of habitat could occur. However, these potential sediment impacts can be reduced or avoided with an effective sediment-management plan.

For water managers to make effective sediment management decisions, they need to predict potential river channel and in-reservoir impacts. Because of the potential negative impacts, managers tend to avoid using management options such as sluicing and dam removal to minimize potential liability risks. Instead, they use mechanical removal methods including dredging or excavation which can be very costly.

What Is The Solution?

Reclamation has developed a computer model to reduce the uncertainty associated with predicting the river channel and in-reservoir effects of large sediment releases. This model predicts the efficiency of reservoir sluicing operations, the amount of sediment eroded after dam removal; and it simulates the resulting river channel and in-reservoir impacts such as deposition and changes in geometry, and more. It is available in one and two dimensional versions (SRH-1D and SRH-2D). The latter version provides more precise results but requires much more input data. Input data consists of sediment composition, flow rates in and out of the reservoir and river channel geometry.

The ability to predict the effects of sediment sluicing and dam removal reduces planning risks and allows the use of lower cost alternatives for sediment management. In some cases the cost savings can be millions of dollars. In addition to cost savings, the benefits of improved sediment management include increased reservoir storage capacity, improved recreational and habitat conditions and improved river channel conditions.

Who Can Benefit?

SRH-1D and SRH-2D can be applied to both sediment sluicing and dam removal scenarios and other river management applications. Water managers, planners, and engineers considering sediment management options can benefit. The model can be customized as needed for specific applications.

Matilija Dam and Reservoir with extensive sediment deposition in the foreground and the dam in the far upper left corner

Where Have We Applied This Solution?

The accuracy of SRH-1D for modeling sediment sluicing from a reservoir was validated by reproducing results of a sluicing experiment performed at Black Canyon Dam on the Payette River in the 1980s. Proposed sluicing plans for the PaloVerde Diversion Dam on the Colorado River were recently evaluated using SRH-2D. For dam removal, SRH-1D was applied to Matilija Dam in Ventura County, CA where modeling results were crucial to choosing an alternative that would require less stabilization of sediment and reduce project costs by about $9M.

More Information

The SRH-1D/2D software and user's manual can be obtained from http://www.usbr.gov/pmts/sediment/model.

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Collaborators

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