A long-range reservoir operating plan study.

Mississippi River Headwaters
Reservoir Operating Plan Evaluation (ROPE)

Minnesota

Overview:
The purpose of the ROPE study is to work with the public and other government agencies to create a basin wide operating plan that manages the Mississippi Headwaters in a way that benefits the natural, economic and cultural resources of the region. One of the many aims of this study is to inform the public to the possible merits of environmental stewardship and returning all or portions of the system to more natural operations.

The U.S. Army Corps of Engineers and the U.S. Forest Service are jointly sponsoring the ROPE study. Its purpose is to focus on the current and future needs of the Headwaters in the areas of tribal trust resources; flood damage reduction; fish and wildlife habitat enhancement, restoration, and preservation; recreation and tourism; water quality and water supply; erosion and sedimentation; hydropower; and navigation on the lakes and rivers.

Possible outcomes from the study could include lake level changes, winter drawdown changes, restoration of some sections of river ecosystems, a more natural flow release for downstream river reaches and, in some lake areas, changes in flood control operations for differing sections of the total system and possibly even the purchase of some land for maximizing efficient operation.

The Headwaters reservoirs consist of six primary reservoirs located in central northern Minnesota: Winnibigoshish, Pokegama, Leech, Cross, Sandy and Gull. In addition to these, other lakes contribute to the system, including: Lake Bemidji, Andrusia, Big, Big Wolf, Cass, Sucker, Ball Club, Little Winni, Mud, Goose, White Oak and others. The Minnesota Department of Natural Resources, Ottertail Power and Minnesota Power are collaborating Headwaters dam operators included in this planning effort.

Computer Models:
PRM (Prescriptive Reservoir Model) is a reservoir-system modeling tool that uses optimization to determine operations that maximize the stated goals of the system. The goals are defined by numerous objectives of the water system (recreation, erosion, flood control, wild rice). The model distributes water (or operates the reservoirs) by minimizing negative consequences set by the system goals and objectives. Optimization provides the ability to evaluate and quantify trade-offs between conflicting system objectives (flood control and natural conditions) and suggests new operating schemes for the reservoir system.

A period-of-record analysis with PRM produces a series of optimal reservoir releases and storage levels over a historical period, from which efficient operating rules can be inferred. The "answer" provided by optimization is a time series of reservoir levels and releases. This is valuable information, but it is the "answer" only for the historic inflow that produces similar levels and flows for the historic inflow data. This can also be applied in practical circumstances with new inflows. The STELLA situation model will be used to demonstrate and refine those operating rules.

STELLA (Structural Thinking Experimental Learning Laboratory with Animation) is a flexible and powerful systems analysis tool that can be configured to represent diverse systems ranging from river basins to high-speed data networks. Because STELLA is not specifically designed for river basin planning, the user is responsible for inputting elements of the river system such as reservoirs, inflows, outflows and flood control operation. STELLA is customized for the river system under study. STELLA has been successfully used to model river systems and to build a common vision across multiple groups about how the reservoir/river system operates, it's limits and the possibilities of the system.

For More Information

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