The glory hole spillway at Hungry Horse Dam is the highest in the world. Water cascades over the rim and drops 490 feet.

PRODUCED IN PARTNERSHIP BY:

Montana Fish, Wildlife & Parks

Northwest Power and Conservation Council

Horse and Libby dams. VarQ was made permanent at Libby and Hungry Horse dams by 2009, after an extensive Environmental Impact Statement process. These studies concluded that VarQ provided ecosystem benefits while maintaining the same FRM benefits as under standard FRM.

How Does VarQ Impact Canada?

Above Libby Dam, both U.S. and Canadian residents share improved reservoir conditions provided by VarQ. Approximately half of the 90-mile Koocanusa Reservoir is in Canada. British Columbia and Montana residents using Koocanusa share the desire for higher reservoir levels during peak recreation periods in the summer, and VarQ better ensures higher reservoir levels in the summer, enhancing recreation and healthier fish populations on both sides of the border.

Below Libby Dam, both U.S. and Canadian fish populations benefit from river flows that more closely mimic the natural river flow. VarQ's design is to release more water during reservoir refill, thereby more closely mimicking the natural river flow than under standard FRM. This benefits all fish populations, and assists both nations in their effort to improve conditions for the Kootenai River white sturgeon, a species listed under the ESA.

The U.S. study of VarQ concludes that it maintains the same level of flood benefits as standard FRM. During high water years, when flooding is an increased concern at Bonners Ferry (Idaho), in Canada, and in the Portland/Vancouver Harbor areas, FRM at Libby Dam converts to the standard FRM procedure.

During the spring of 2011 and 2012, downstream flooding was a major issue because of historically high rain in the Kootenai Basin. High flows were further compounded by U.S. required experimental "spill tests" from Libby Dam during the spring of those years (in

excess of power house capacity) to potentially aid spawning sturgeon. Those test spills failed to achieve their intended purpose, were unrelated to VarQ, and have been discontinued.

Canada has raised issues regarding potential impacts to flood risk management at Kootenay Lake and power production in Canada downstream of Kootenay Lake resulting from implementation of VarQ. Canada and the United States continue to work together to address those concerns.

Montana has proposed improvements to the VarQ methodology that would further increase the probability of Koocanusa refilling, address flood concerns downstream, and improve hydropower efficiency.

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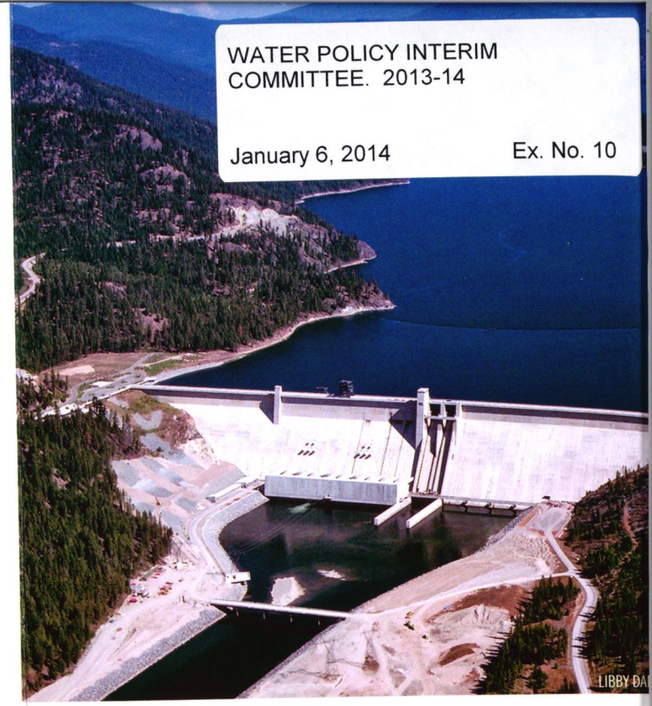


VarQ FLOOD RISK MANAGEMENT

What is VarQ?

VarQ is a flood risk management (FRM) methodology developed in the late 1990's and implemented in the early 2000's for Libby and Hungry Horse dams in Montana. VarQ stands for variable discharge. It adjusts the wintertime drawdown in proportion to the forecasted inflow and then continuously regulates outflows in response to the observed inflows. VarQ allows dam operators to more reliably supply spring and summer flows for fish while simultaneously better ensuring higher reservoir elevations in the summer. It maintains the level of local and mainstem flood protection in the Columbia River as would occur under the previous procedure (standard FRM). In years when the seasonal water supply volume forecast is in the mid-range (between 80% and 125% of average runoff), VarQ allows more water to remain in the reservoir by the end of winter for multiple uses in the spring, summer and early fall.

HUNGRY HORSE DAM

Why is VarQ important?

VarQ allows the Kootenai and Flathead rivers downstream of the dams to more closely mimic the natural annual stream flow pattern, which is better for fish and wildlife habitat.

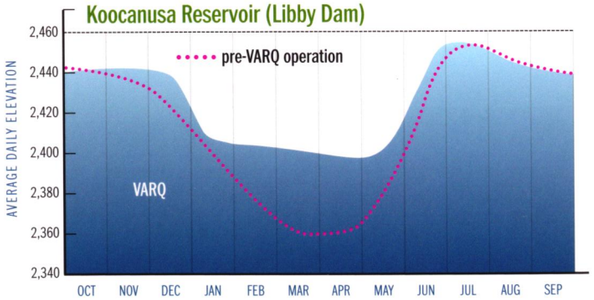
It allows more water to remain in Koocanusa and Hungry Horse reservoirs prior to the spring than would occur without VarQ (under standard FRM procedures)—reducing the likelihood of deep reservoir drawdowns and improving the likelihood of reservoir refill in summer. VarQ supports Montana's upstream needs while supporting downstream efforts to recover species of salmon and steelhead listed as endangered under the U.S. Endangered Species Act (ESA). This benefits both upstream and downstream ecosystems. VarQ does not compromise the flood risk management requirements locally or for the Columbia system.

White sturgeon

In the Kootenai, this helps with ESA-listed species such as the Kootenai River white sturgeon that are found between Kootenai Falls and Kootenay Lake in British Columbia and whose survival is a priority for both countries. It also benefits fish populations in general.

In the Flathead, this helps stabilize Flathead Lake elevations in dry years and helps with ESA-listed fish like bull trout, and also with native westslope cutthroat trout, Montana's state fish. The watershed upstream of Hungry Horse Dam contains about 50 percent of the remaining habitat for westslope cutthroat trout populations left in Montana.

Bull trout



The pink dotted line represents the average daily elevations of Koocanusa reservoir prior to VARQ (1995-2002), compared to levels since VARQ was implemented in 2003. VARQ ends when the reservoir approaches refill (full pool elevation is 2459). Other operational requirements for other purposes such as fisheries, power, etc., also influence Koocanusa elevations.

How does VarQ work?

VarQ is a FRM procedure that applies in all but the wettest and driest years. In those years, the FRM procedure converts to the "standard FRM" procedure.

In the mid-range water volume years, the standard FRM procedure resulted in lower reservoir levels at Koocanusa and Hungry Horse during the summer and fall—negatively impacting fisheries and recreation.

VarQ and standard FRM both use the seasonal water runoff forecast to determine the amount of space in the reservoir needed for flood storage. In years when VarQ is applicable, less water needs to be evacuated for flood storage than needed under standard FRM. To account for the reduced amount of storage that is evacuated under VarQ, higher minimum flows are required during the reservoir refill season.

LIBBY DAM

Reservoir refill probability is improved in certain water supply years, because less water is evacuated from the reservoirs for FRM.

By increasing the probability of reservoir refill, more water is available for multiple uses during the summer and fall—a time of maximum reservoir recreation use and a critical period for fish growth.

The U.S. Army Corps of Engineers created VarQ in the late 1990's with direct involvement by the State of Montana, the Confederated Salish and Kootenai Tribes, the State of Idaho, the Kootenai Tribe of Idaho, and others.

In 2000, implementation of VarQ was included in "biological opinions" issued by NOAA Fisheries and the U.S. Fish and Wildlife Service to aid ESA-listed resident fish affected by the operation of Libby and Hungry Horse dams, and ESA-listed salmon and steelhead in the Columbia River.

In 2003, the Northwest Power and Conservation Council's Mainstem Amendments to the Columbia River Basin Fish and Wildlife Plan adopted VarQ for Libby and Hungry Horse dams.

By 2003, VarQ was implemented on an interim basis at Hungry