Oroville Dam – A local perspective

A failure in spillway of the Oroville Dam in California triggered the evacuation of over 200,000 people over concerns about the structural integrity of the dam.

California Reservoirs have recently “refilled” after years of drought conditions that lead to major drawdowns. During the drought the PRIMARY SPILLWAY was dry for years. When the Reservoir has reached capacity the primary spillway is the first place the water goes.

At Oroville the primary spillway could not handle the reservoir overflow, failed, and the water began flowing over the emergency spillway in volumes that could not be managed. Major erosion downstream of the emergency spillway removed thousands of tons of rock and soils.
Water overflowing Oroville Primary Spillway

Image of Erosion from overflow of Oroville’s emergency spillway.
Eastsound Water’s Purdue Lake Dam

There are 3 dams on Purdue Lake, and the lake holds 36.5 million gallons of water. The Primary Dam is approximately 40’ tall. (the Oroville dam is 770’ tall, the highest earthen dam in the US)

Since its development in the late 1970’s Purdue Lake has filled to capacity each year, and additional run off flows through the primary spillway. At Purdue the primary spillway is a 60” diameter steel pipe, encased in concrete that drains through Dam #2. (photo to right)

Purdue also has an emergency spillway similar to the Oroville facility. (photo on next page.)
This 50’ long level concrete wall is designed to control and disperse any flow that exceeds the capacity of the primary spillway. Eastsound Water has mapped the flow of water leaving Purdue through developed stream courses till it reaches East Sound. There is very little development “downstream” of Purdue Lake. (map to right) Water has never gone over the emergency spillway since Purdue’s construction in the last 1970’s.
The Oroville event stimulated some questions at Eastsound Water. What type of storm event would it take to overwhelm Purdue Lake’s dams?

Purdue collects rainwater from a 385 acre basin that is heavily forested. For each 1” of rain, there is 9.5 million gallons of water that falls on the Purdue basin. That is a lot of water. However forested terrain has the capacity to absorb most of that water. Studies suggest that for each 1” of rain, 40,000 gal/minute is at the high end of a peak potential run-off rate. EWUA’s monitoring data suggest that 3,000 gal/minute is the highest run off rate recorded over a 24 hr. period.

The 60” overflow culvert can handle 367,000 gal/minute. This is the equivalent of at least 9” of rain. Examination of over 100 years of Orcas rainfall data finds that there are few months over the last century that Orcas experiences 9” of rain.

EWUA has collected overflow data from Purdue Leak. The largest overflow flow event at Purdue was recorded as 4.2 million gallons per day or just less than 3,000 gal/minute. The primary overflow of Purdue can handle 367,000 gal/minute and the largest overflow has been less than 1% of that rate.

This seems like a reasonable safety factor, especially considering that the emergency spillway can handle another +200,000 gal/minute of capacity if needed.

Purdue Lake dams are inspected by the Washington State Dam Safety Department every 5 years. These inspections include checking the condition of the overflow culvert, and the emergency spillway, and taking detailed survey measurements of the dam faces to insure they have not moved or settles. EWUA dams have been determined safe in these reports.

The Oroville dam at maximum overflow was releasing 12,600 cubic feet per second, or 5.6 million gallons per second. Purdue lake holds only 36.5 million gallons. Oroville’s dam was overflow the all the water in Purdue lake every 6 seconds! That’s a lot of water.

The engineering behind Purdue Lake dam seems to have included significant safety margins to accommodate even the extreme weather events that might occur on Orcas Island.

Just in case you were wondering.