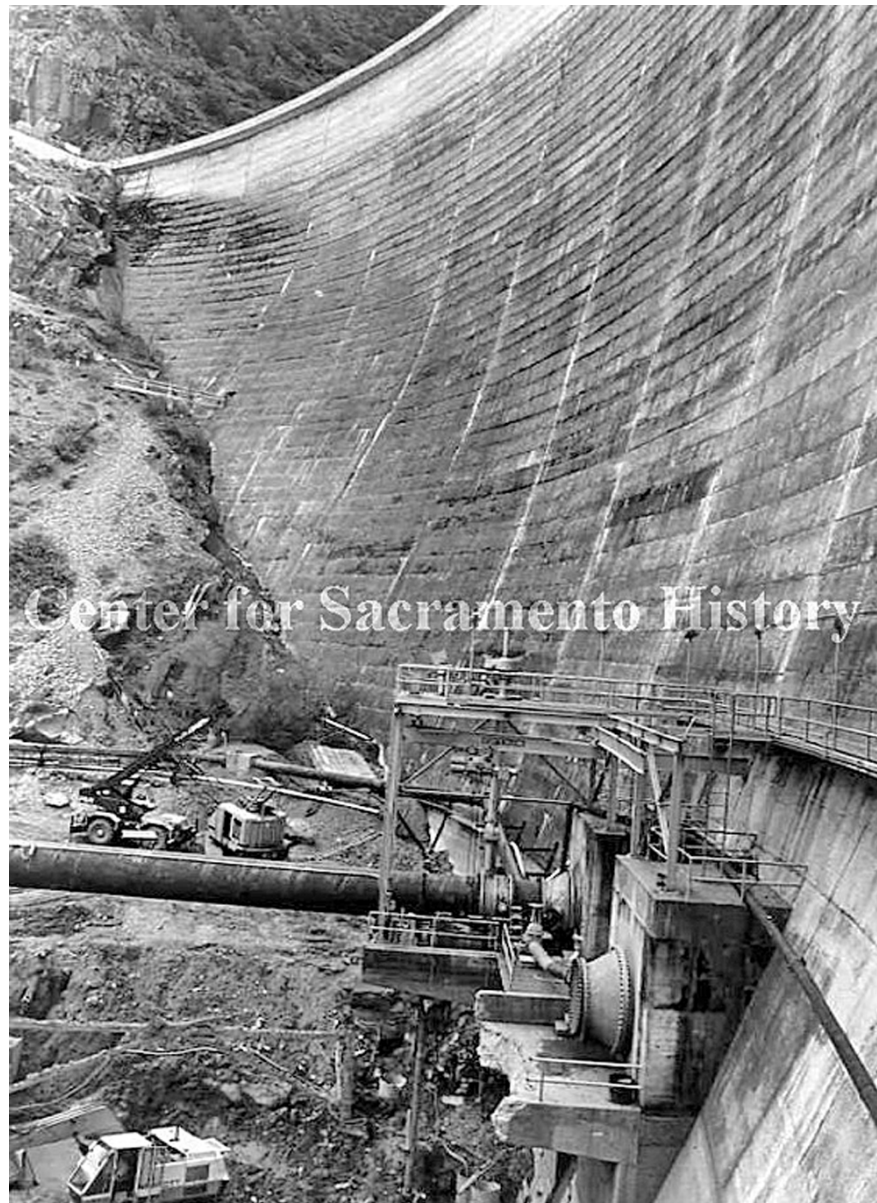


Power Generation at Monticello Dam

The Monticello Dam Powerplant was completed in 1983 and has three generators, totaling a capacity of 11.5 megawatts (MW). The Powerhouse at the base of Monticello Dam is owned, operated, and maintained by the Solano Irrigation District (SID). The electrical power is sent mostly to the North Bay area of San Francisco.

Monticello Dam, which began construction in 1953 and commenced operations in 1957, is also a backbone for local energy. Due to a 50-year contract that started in the 1980s, SID sells wholesale power to Pacific Gas and Electric, which they then place into their grid. Primarily, the power is transferred to PG&E's Santa Rosa substation, but the power is capable of being sent elsewhere. During the heavy rain conditions and rapid lake level rise, the generator produces 11.5 megawatts, which is peak production. Along with its contract with PG&E, SID also works with several other organizations, one of which is the Bureau of Reclamation.

When Monticello Dam was constructed in the 1950's, installation of a hydroelectric plant was not considered economically feasible. However, penstocks were included to enable turbines and generators to be added sometime in the future.



In 1979 the Federal Energy Regulatory Commission issued a preliminary permit to the Solano Irrigation District. The Department of Interior instructed the Bureau of Reclamation to negotiate a contract to buy power from SID. More than 85 percent of the voters in the District approved a \$17 million bond issue to build the plant.

Napa County Supervisors announced their intent to intervene and filed a competing application to build the powerplant. In the meantime, the City of Santa Clara had signed an agreement to become a partner in Napa's application to build the generating facility. More than a year of litigation ensued, which also included a dispute over the boundary between Napa and Solano counties where Monticello Dam is situated.

Napa County said it would settle for \$120,000 a year for 50 years from the power profits as compensation for having Lake Berryessa and Monticello Dam within its borders. S.I.D. retaliated for the Napa attack by having the Solano supervisors cut off Napa's temporary contracts for Solano Project water. Documents revealed later indicated that Napa County wasn't really serious about building the hydroelectric facility. The litigation was intended to force S.I.D to share the water or the revenue derived from the power sales. In January of 1981 the Federal Energy Regulatory Commission turned down Napa's application and issued S.I.D. a final license for the project.

All the water released from the dam or through the powerhouse is being used for agriculture and maintaining minimum flows in Putah Creek. The only other time water is released is when the lake is above 438 feet to generate power instead of letting it flow through the Glory Hole. When the powerhouse is operating all the flow is diverted through the turbines and is output below the concrete pad which is below the water surface. There is no indication it is running unless you look very closely and notice the turbulence from under the pad.

The water flows out of the dam and into the powerhouse through a massive pipe, with a giant manifold directing the flow to each of the three units. The water flows down through a 60-inch turbine shut-off valve. For each unit, the water enters the turbine, spins the "runner" and exits through a giant pipe. The water flow is controlled with "wicket gates" inside the turbine. They are what SID use to fine tune the amount of water that goes through. There are 20 gates.

On the two larger generators, the runner is about 30 inches in diameter. It spins a 13,000-pound flywheel connected by a shaft, which extends into a big gray box that houses the actual generator. Electricity flows from there through conduit to a transformer on top of the powerhouse. Electricity is transmitted at 115,000 volts from the powerhouse to the PG&E grid.

Normally the only time the bypass valves are operating is when they are doing maintenance on the powerhouse and need it shut down but still need to deliver the water required for the Putah South Canal and Putah Creek downstream of the Diversion Dam. When work on the three generators in the powerhouse is needed, the water flows through a big tube called a hollow jet that bypasses the generators.

The smaller of the two visible jet valves is used when the required flow is at the lower levels which is between 45-90 cubic feet per second (CFS). When the required flow is above this, they will switch to the big jet valve. When the powerhouse is running at full capacity it is only using around 900 CFS. The reason for this is that the maximum summer flows required by contract is around 900 CFS. It only runs when there are water demands downstream.

To ensure flow in the inter-dam reach, 45 cubic feet per second (CFS) is the minimum flow that always needs to be released from the dam. Starting at a lake level of 438 feet, the powerhouse can operate at the maximum output which is 700-750 CFS as long as this is never larger than the input to the lake. As inflow drops below this level the powerhouse will also decrease the flow rate so that the lake either maintains its level or is slowly increasing. When the powerhouse is operating all the flow is diverted through the turbines and is output underneath the concrete pad and, unless you are looking very closely, it will not be noticed. The other valves that are occasionally used are for diverting flow around the powerhouse during maintenance, or to increase the water being released above what can be diverted through the powerhouse.

They are always releasing a minimum of 45 CFS even when the powerhouse is shut down completely to insure a minimum flow in the inter-dam reach. There is also never a time that the minimum flow required for the Putah South Canal and Putah Creek goes below this value, so it is always being used and is never wasted. The other goal of the 45 CFS is to minimize fish stranding in the Interdam Reach. While SCWA does not have a legal mandate for the 45 CFS, they are also trying to be a good steward above and beyond the Putah Creek Accord requirements.

Water is never released above what is being used downstream so there is no reason to have the ability to go above this value. During heavy rain conditions like 2017 everything runs wide open to assist the Glory Hole in controlling the lake level. If the Glory Hole releases so much water that the jet valves become submerged, they need to be shut down, and at those flows they aren't really doing much compared to the Glory Hole anyway



The production of electricity by the three generators in the 11.5-megawatt hydroelectric plant is not the main focus of the powerhouse, however. It's a byproduct. The electrical output is not what's driving the generators. The water orders drive the plant. Water orders come from Solano Irrigation District customers along the 33.3-mile long Putah South Canal that winds its way to the Green Valley area, as well as orders from the water treatment plants in Vacaville, Fairfield, Suisun City, Benicia and Vallejo. During the spring and summer water season, orders are gathered each day from 6 a.m. to 3 p.m. and submitted to the powerhouse. Changes are made in anticipation of what the next day's flow is going to be.

In the summertime, as the flows get higher there tend to be more changes required, sometimes more than three or four changes during the day. The Solano Irrigation District wants zero water loss. They don't want to spill and lose water anywhere. If a user below the dam cuts off water requirements, the dam decreases water output to compensate. Providing enough water to flow to customers without flowing too much requires the significant coordination of a team working together.

When work on the three generators in the powerhouse is needed, the water flows through a big tube called a hollow jet that bypasses the generators.

SID has to do a lot of close coordination with PG&E when it changes flow rates, because they have to know how much load is being generated. Water from the powerhouse flows 7 miles downstream to the diversion dam. From that location, some water continues down Putah Creek and some is directed to Putah South Canal.

SID diverts water as necessary for the required flow of the creek. Water for Solano Irrigation District customers, meanwhile, is diverted to the Putah South Canal. The flow of water from the Monticello Powerhouse is adjusted as needed to meet the required flow of the creek and to provide for the water orders from the canal.

The Putah South Canal, which is fed by gravity, winds its way through Vacaville, Fairfield and Suisun Valley as a concrete-lined canal – except for an underground segment called the Putah South Pipeline near the end of its route. In addition to providing irrigation water, the canal conveys municipal and industrial water for Vacaville, Fairfield, Suisun City and Vallejo. The canal ends at the Terminal Dam west of Green Valley.

SID owns and operates a water delivery system of about 370 miles of pipes, canals, and ditches. It delivers water to agricultural lands covering 65,000 acres in any one year (out of over 80,000 acres in the District). It also owns 32 wells, which supplement surface water deliveries.

