1 May 2022

To Marisa Egbert, Carl Ege, Chris Penne, Nathan Daugs, and David Rosenberg:

I attach the pertinent part of my mapping of the Temple Fork quadrangle, which the Utah Geological Survey has. It has not yet been published. Similar, but perhaps not quite as detailed, is Plate 4 in Oaks and Runnels (1992). My map shows the area of the proposed dam near the mouth of Temple Fork. The blue color [mainly Qms landslides] shows several areas of active landslides in the poorly consolidated, red-colored Wasatch Formation [Tw] and two bedrock slides along the steep face of the Temple Peak fault zone to the east. The lower parts of several of the landslides in Tw will be inundated by water behind the proposed dam. The high-water position is shown on the UDWR map ~30 feet below the 6200' contour (which is shown darkened on my attached map). If the dam is built and one or more of those newly saturated landslides fails suddenly and cascades into the reservoir, the surge wave created could overtop a concrete dam and additionally take out an earthfill dam.

A rapid rockfall and landslide in 1963 caused a surge wave that overtopped the concrete Vaiont dam in northern Italy, with large loss of life both upstream and downstream. The main engineer who earlier proclaimed the Vaiont dam safe despite warnings from locals took his life rather than attend the board of inquiry (*fide* an Introductory Geology text that I used in my classes three decades ago). The steep bedrock slides in my map area could fail during a major earthquake and reach the reservoir. The 1959 Hebgen earthquake near West Yellowstone in 1959 caused oscillating seiche waves in Hebgen Lake that overtopped the north margin of the dam at least 3 times about ten minutes apart (Stermitz, 1962, p.144-145).

A number of years ago I persuaded the late Chip Sibbernsen of the U.S. Forest Service to re-route the road along Temple Fork up onto the ridge to the west, around the heads of these landslides, rather than have to continue to bulldoze the landslide toes each year to maintain the former road along the stream, and contemplate the hazard of a failure completely blocking the road and perhaps causing loss of life in case of a rapid failure.

In addition, there are several faults near the mouth of Temple Fork that could be re-activated by additional weight from the dam and the reservoir behind. At least two faults underlie the landslides. Differential subsidence of the Earth when reservoirs are filled is a well-documented phenomenon. A earth-fill dam in Waco, Texas, built across a fault thought to be inactive, began to tilt and subside slightly on one side of the fault, so the reservoir was never more than partially filled (Dr. Frank Smith, Baylor University, oral communication at the site, 1965).

I am concerned that the potential for sudden landslide failures into the reservoir will make construction of a dam at the mouth of Temple Fork a hazardous and therefore unwarranted venture.

Dr. Bethany Neilson of the Utah State University Water Lab has evaluated the seasonal flow toward the dam site (oral communication, 2 May 2022) and found it inadequate to supply the amount of water needed to make this proposed dam viable. She also raised the possibility that much of the impounded water could leak into underlying bedrock and drain away. This happened at the first Rose Ranch dam in Curlew Valley where leakage made the dam ineffective and caused it to be abandoned (Oaks, 2004).

As drawn, the N-S-trending, S-plunging fold axis of the broad Red Banks anticline crest is shown near the widest part of the proposed reservoir. This axis is poorly constrained, and may lie closer to the proposed dam site, but not farther east where it is constrained by SE dips of the bedrock. The cover of poorly consolidated Wasatch Formation is thin across this area, and the underlying Ordovician Garden

City Limestone is exposed along Temple Fork in both the upstream part of the proposed reservoir and the downstream area near the dam where water would be deepest. One characteristic of brittle rocks like limestone is that they commonly are very highly fractured near fold axes, both parallel and perpendicular to the fold axes. Victor Church (1956) mapped Logan Cave in the Garden City Limestone in the Temple Peak quadrangle 2.4 miles SW of the proposed dam. He found that the long passages run NNE, parallel to the Logan Peak syncline farther west, and the short passages are perpendicular. Ricks Spring, also in the Garden City Formation, is 0.45 mile north of the proposed dam. Dr. J.Stewart Williams, head of the Geology Department and Dean of the College of Science when I join the Utah State University faculty in 1966 took me on a field trip up Logan Canyon, and at that site told me that fluorescein dye had been put into the Logan River around the bend upstream, and it came out in Ricks Spring before it made it around the bend of the Logan River to a point across the road from that spring. I have seen a video of scuba divers in a submerged cavern that lies between Ricks Spring and where the dye was put in.

Larry Spangler (2001; Table 1) of the U.S. Geological Survey placed fluorescein dye into different formations at strategic places along streams in the Bear River Range. He found that dye placed into the Garden City Formation at Blind Hollow reached Logan Cave at a minimum velocity of 528 ft per day. Dye placed into Bear Hollow reached Ricks Spring at a minimum velocity of 256 ft/day. The potential for major loss by leakage from the reservoir impounded by the proposed Temple Fork dam is very high.

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