

**Tieton Diversion Dam
Proposed Modification for Boater Safety**

by Clifford A. Pugh

Judging from the original construction drawings, the site visit, and pictures of the dam during operation at various flows, it appears that the timber cribbing originally placed in the stilling area has been removed creating a 6-to 7-foot-deep hole immediately downstream of the crest (see figure 1). The overall drop from the top of the railroad tie bolted to the dam crest to the apron downstream of the stilling area is 4.74 feet. The hole downstream of the dam appears to be partially filled with rock near the left side of the structure, accounting for the difference in head drop from the right side to the left side of the structure. The bend in the river upstream from the structure also concentrates flow on the right side.

The flow at the diversion dam was simulated in our hydraulic laboratory, using a 3-foot-wide sectional model of the site (at a model scale of 1 to 12). The enclosed reproductions of videotape still frames show the model in operation (figs. 3 and 4). The existing situation was simulated first to verify the model. When rafts passed over the dam they were trapped in the same manner as observed at the structure. The videotape demonstrates how the rafts and kayaks are trapped.

Figure 1 is a section through the present dam showing flow profiles at 1,140 and 2,700 ft³/s. The first modification tried was to place 2-foot riprap in the hole downstream of the crest. This approach was intended to reduce the head in steps, thus creating an undular jump and eliminating the roller which traps boaters. The drop from the top of the railroad tie to the top of the riprap was 2 feet. The riprap continued horizontally for about 10 feet downstream then dropped off at a 3 to 1 slope to the downstream apron elevation.

When this configuration was tested in the model, the riprap eroded and a deep hole formed about 2 feet downstream of the crest. A hydraulic jump resulted which was similar to the original problem. The riprap size was then increased until it was stable. Local velocities up to 18 ft/s (prototype) were measured at the top of the riprap in the model at a simulated flow of 2,700 ft³/s. The required maximum stone size indicated by the model to prevent movement was 4 feet. This large stone size caused additional problems since fins formed in the gaps between the stones. These gaps and flow concentrations could be hazardous to boaters.

The next solution tried was to use 2-foot riprap and grout between the rocks to hold them in place. This solution solved two problems. The riprap was stabilized and the gaps between the rocks were eliminated, thus smoothing the flow. According to our experience with modifications to structures for boating safety on the South Platte River in Denver, the grouted 2-foot riprap should be more economical than 4-foot riprap. Figure 2 shows the recommended solution using grouted riprap. Flow over the modified structure is also shown in the video tape.

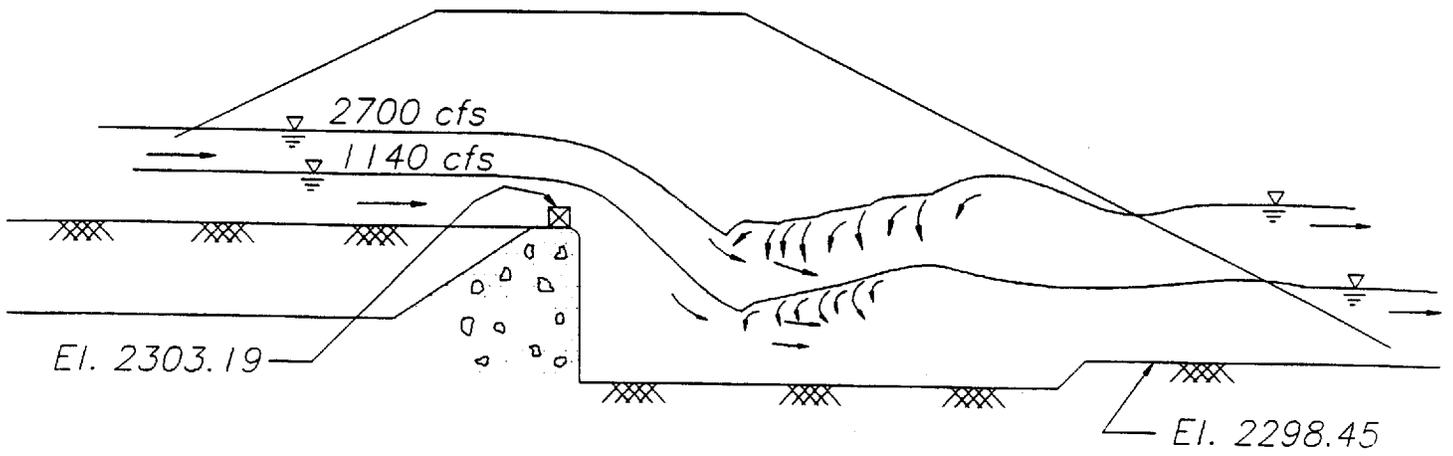


Figure 1 - Tieton Diversion Dam, existing condition

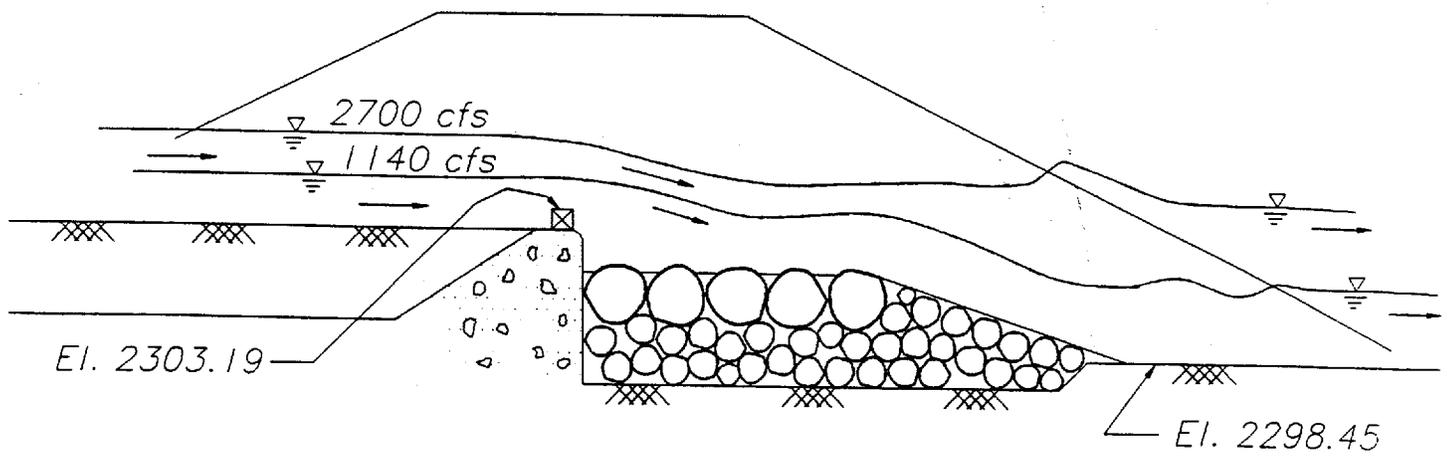


Figure 2 - Tieton Diversion Dam, recommended modification



Figure 3. - Tieton Diversion Dam sectional model - existing condition.



Figure 4. - Tieton Diversion Dam sectional model - recommended modification.