Clinch Drain-Down and Travel Times

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You may have wondered how long it takes the water to get to specific points on the Clinch tailwater when the turbines are turned on; and how long it takes flows to reach minimum when the generators are turned off. If you fish the river a lot, you probably have a pretty fair idea of how long it takes the water to rise and fall at different locations; but if you are a newcomer or otherwise have not had time to become familiar with the Clinch, you probably do not have a very good feel for river flow dynamics.

Several weeks ago, I met with Bill Proctor, a civil engineer at the TVA Engineering Lab. I asked Bill if he had a model that we could use to get a better handle on drain-down time (how long it takes to achieve minimum flow after the turbines are turned off) and travel time (how long it takes for the water to reach a specific spot after the turbines are turned on). Bill used a mathematical computer simulation model to generate a set of line graphs. Buzz Buffington and I converted the line graphs into the following tables. Buzz and I made a few minor adjustments based on our "ground (or water) truth" experience.

We used five locations: approximate river miles 77 (Miller Island), 73 (Peach Orchard), 70 (Cold Water Farm), 68 (Riverbend), and 67 (61 Bridge). These are all fairly well known, popular fishing spots up and down the river. Keep in mind that the times are approximate. We used 1,000 cubic feet per second (cfs) as a target flow because the river starts to become somewhat difficult to fish at this level.

Minimum flow (when the turbines are off and the only flow is that which enters from tributaries and leakage from the dam) in the Clinch is about 200 - 300 cfs. When turbines are turned on and the flow reaches 700 - 800 cfs, most wade fishermen start heading for shore. By the time the flow reaches 3,000 cfs (one turbine), it is too difficult to wade the river except in a few isolated spots. As a safety precaution, wade fishermen should be out of the river or in a position to quickly get out by the time the flows reach 1,000 cfs. The water comes up rapidly, and it is easy to get caught on the wrong side of the river if you do not move quickly once it starts to rise.

The two tables show the following:

Table 1 - How long it takes for the water to rise to 1,000 cfs at these five locations under one and two-unit flow conditions.

Table 2 - How long it takes for the water to fall to 1,000 cfs at the five locations under one and two-unit flows.

Note: Travel times are calculated based on the following assumptions:

1. There were several hours (~11) of no generation from the dam so the starting point at all locations is minimum flow. Fewer hours between generation periods can result in less time between the beginning of turbine operation and water travel time downstream. (This would mean that the water would get there quicker.)

2. Flows were based on best generation efficiency flows of approximately 3,600 and 7,200 cfs (one and two unit flows, respectively). Significantly higher flow rates could shorten the time it takes the water to rise after onset of generation by approximately 15 minutes or so.

When one unit is turned on (Table 1) with the river at minimum flow (200 cfs), it takes about 1.0 hour for the flow to reach 1,000 cfs at Miller Island and about 4.5 hours to reach 1,000 at Riverbend. If two units are turned on, it takes the flow about 1/2 hour to reach 1,000 cfs at Miller Island and 4.0 hours to reach 1,000 at the 61 Bridge. A two-unit flow will reach downstream locations about an hour sooner than a one-unit flow.

When one-unit is turned off (Table 2), it takes about 4.0 hours to reach 1,000 cfs at Peach Orchard and about 7.5 hours to reach 1,000 at Riverbend. When a two-unit flow is turned off, it takes about 2.0 hours to reach 1,000 cfs at Miller Island and about 8.0 hours to reach 1,000 cfs at Riverbend. It appears that the difference in the number of units affects drain-down times by about an hour.

When one unit is operated for the first hour followed by two units (a fairly common scenario), the water rise will only be delayed by about 30 minutes at Miller Island. No significant difference between starting the first hour with one-unit as compared to starting the first hour with two-units operating would be seen at other locations further downstream.

You probably noticed that it takes the water longer to drain-down than to rise. This is because of the wave effect that results when water is turned on. This causes the water to travel at a higher speed. It is similar to a wave coming onto a beach and then after crashing into the sand slowly flowing back out into the ocean.

I hope this information is of use to you as you fish the Clinch.

Table 1 - Approximate Travel Time (hours to reach 1,000 cfs from the time the generator(s) are turned on)

Location	**1 Unit**	**2 Units**
Miller Island	1.0	0.5
Peach Orchard	2.75	1.75
Cold Water	4.0	2.75
Riverbend	4.5	3.5
61 Bridge	5.5	4.0

Table 2 - Approximate Drain-down Time (hours to reach 1,000 cfs from the time the generator(s) are turned off)

Location	**1 Unit**	**2 Units**
Miller Island	1.5	2.0
Peach Orchard	4.0	5.0
Cold Water	6.0	7.0
Riverbend	7.5	8.5
61 Bridge	8.5	9.5