Tips for Building a Nonexclusionary Culvert Protection Structure

by Chuck Caldwell, of the Beaver Patrol in Juneau, Alaska
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Purpose

Keystone style beaver exclusion structures protect culverts by keeping beavers far away from the sound and feel of moving water. However, this may restrict the in-stream movement of larger fish, turtles, and other animals.

The Beaver Patrol (in Juneau, Alaska) developed an alternative which allows those creatures to easily swim through a structure, while preventing beavers from placing larger wood into culverts. We noticed that large wood inside a culvert served as the primary structure to anchor rocks, small wood and other vegetation, and cause a total blockage.

By blocking the larger wood, other material is much more likely to wash through the culvert without a blockage forming.

Two nonexclusionary structures were installed at culverts on Dredge Creek in August 2019. Since then, not a single piece of wood has had to be removed from either structure.

Material Summary

T-posts – Optimal height varies by depth, bottom firmness, and current of water. For our two sites we mostly used 5 ½ foot posts. Where the bottom was either soft, or the strength of the current strong during high water times we instead used 7 foot posts driven deeply into the bottom.

Generally, we placed the t-posts roughly three feet apart. There is considerable latitude in this distance. We placed them closer when the bottom was soft or the current stronger.

Wire Mesh - Specifically we use vinyl coated 16 gauge mesh with ½ inch holes and 2 foot width. Most mesh with ½ inch holes is designed to contain chickens. For use in water with beavers the strength and durability of coated 16 gauge mesh is critical.

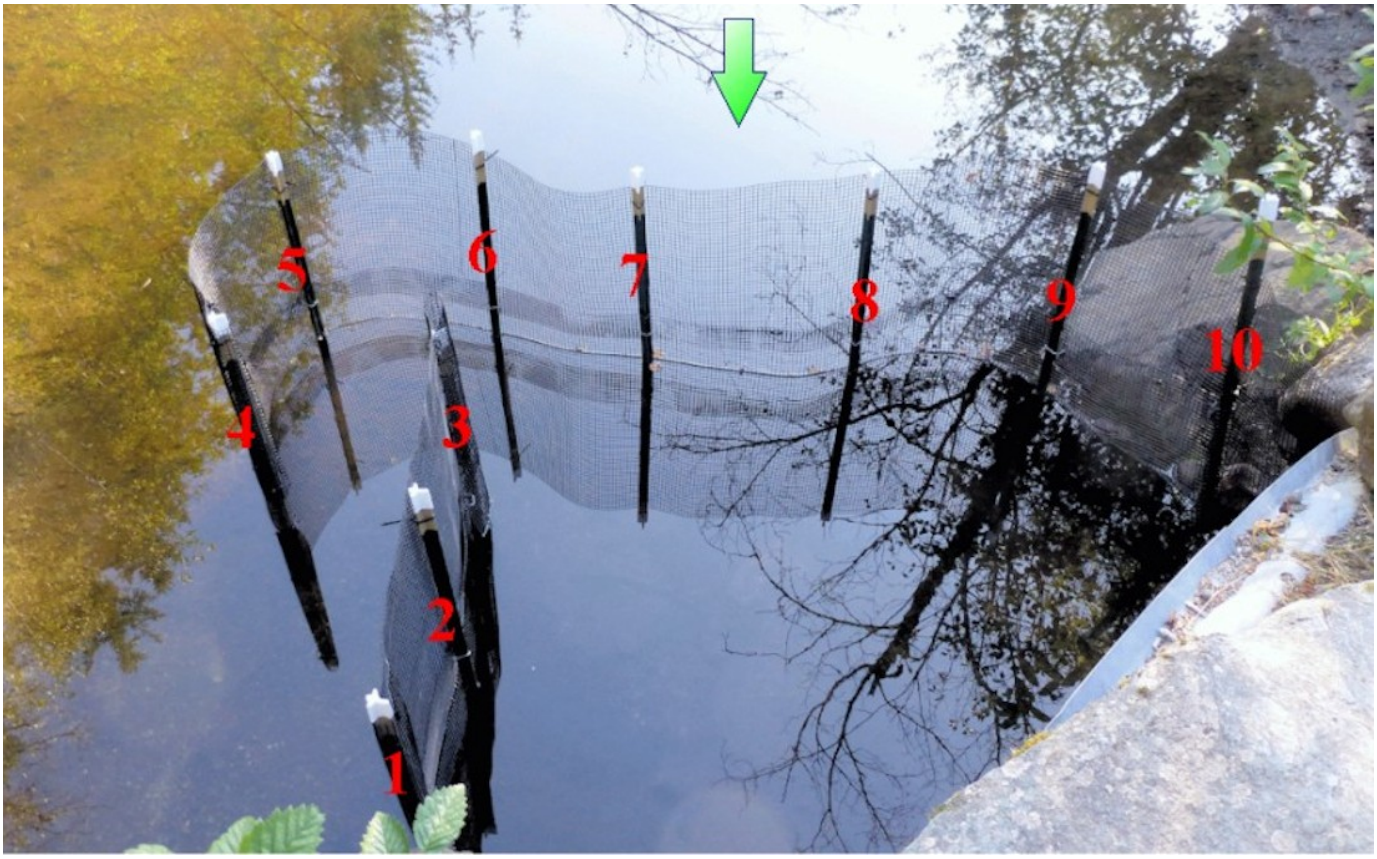
The two sites we constructed in 2019 had mesh heights averaging about 3 ½ feet. The height at any spot varied by several inches depending upon the shape of the stream bottom. Coated 16 gauge mesh with ½ inch holes is also available in 4 foot widths. However it is much less work to overlap 2 foot widths rather than cutting 4 foot widths. If water had been deeper we could have added a third row of 2 foot mesh.

An advantage of using mesh with only ½ inch holes is that beavers cannot jam wood into the holes to add to the structure. This substantially reduces the time required to maintain the structure in areas with high beaver activity. Modest moss and leaf build up does not adversely impact the effectiveness of the structures. A little buildup just increases the water flow through the exit of the structures.

Attachment of Mesh to T-posts - Initially we bought some clips designed to hold mesh to t-posts. Turns out that they did not work well with ½ inch mesh. What did work was heavy duty 7.9 inch zip ties rated to 120 lb. tensile strength.

Safety Caps – In the past, volunteers tossing sticks often snagged their arms on the top of uncapped t-posts. Adding vinyl safety caps to the tops of all t-posts has eliminated this problem.

Example of a Structure
This photo was taken a couple weeks after construction, and shortly after the end of a long drought. The green arrow at the top of the photo shows the direction of the current. The culvert being protected is at the lower right.



- Note that the distance between posts 6 & 7 is much less than between 7 & 8. That was done to avoid a rock on the bottom. This design can be scaled to fit the terrain and culvert size of other sites.

- Distances between posts 3 & 4 as well as between 3 & 6 were large enough for:
  - Even our largest volunteer to walk through to facilitate any needed maintenance
  - Migration of salmon and swimming animals to exit
  - Stream flow capacity, in case vegetation buildup substantially reduces water flow through the mesh

We seldom clean minor vegetation buildup from the mesh as more water flowing through the opening could be useful for salmon migration.

After the photo was taken a beaver tried to put a log of about 4 feet into the structure. It never made it to the culvert, but did get hung up between posts 4 & 7. So we made the following adjustments:

- Posts 6 was moved a couple inches closer to post 3.

- Posts 4 & 5 were moved downstream a few inches.

Beavers use stream current to assist in forcing wood into unprotected culverts. To push wood into a nonexclusionary structure, with post 4 downstream of post 3, beavers have to work against the current. This increases the effectiveness of the nonexclusionary design.

After those minor changes, no more wood made it into the structure during the remainder of the year.