Culvert Restoration to Improve Fish Passage in the Town of Salisbury

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ABSTRACT

The common expression "out of sight, out of mind" alludes to a sense of security that all is well. However, all too often, this phrase can be used to describe culverts hidden beneath our roadways. Improper sizing and installation of culverts occurs during construction due to lack of funding or knowledge of sustainable culvert design that ensures aquatic organism passage. After their construction, these structures are often forgotten and neglected leading to problems such as the build up of debris and the deterioration of culvert pipes.

Issues such as these have a devastating impact on the aquatic ecosystem. Organisms that depend on mobility in stream habitats are suppressed by fragmented habitats. Our goal in this project was to survey existing culverts in Salisbury, Connecticut to understand which crossings are a potential barrier to fish passage. The replacement of problem barriers will improve the overall health of the aquatic systems in Northwestern Connecticut.

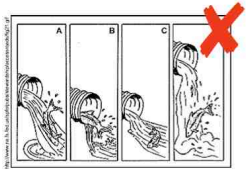
INTRODUCTION

Culverts are structures installed on road stream crossings that allow the flow of water to continue uninterrupted. In efforts to save time and money, however, many culverts have been installed without the consideration of the natural ecosystem that is affected. Culverts that are too high, steep, or long can act as a barrier to aquatic life, obstructing mobility. As a result, habitat fragmentation has become a growing concern for organizations like Trout Unlimited whose mission is to conserve, protect, and restore cold-water fisheries and their watersheds. Trout Unlimited is only one of the many organizations that is working with local municipalities around the country to identify and correct problem culverts. Trout Unlimited is working hand-in-hand with the Housatonic Valley Association to complete a formal survey of culverts in Salisbury.

Located in rural Northwest Connecticut, Salisbury is a small town surrounded by healthy natural ecosystems that support a wide variety of organisms. Protected forests provide for nearly pristine low order streams, creating quality habitat for Connecticut's aquatic organisms including native trout species. Pettee Brook and Burton Brook, two cold water streams that feed into the Housatonic River, contain problematic culverts that highlight the issues facing aquatic populations. The importance of the habitats in these streams are unmatched as they are necessary in providing adequate conditions for fish spawning. The mobility of the aquatic organism present in these waterbodies, however, is obstructed by poorly designed culverts that block fish passage.

Access to these smaller tributary habitats is vital to aquatic organisms. By redesigning and modifying problematic culverts present in the town of Salisbury, the fragmentation of the aquatic ecosystem will be drastically reduced, allowing fish and other organisms to access these habitats. Doing so will allow these organisms to thrive and promote healthy populations of native fish, including Brook Trout.

CULVERT PASSAGE BARRIERS

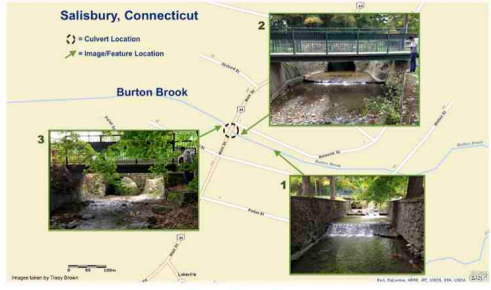


When culverts are blocked by debris, increase turbulence, are too high, shallow, or empty into shallow pools, access to upstream waterways is lost, resulting in habitat fragmentation.

RECOMMENDATIONS

Burton Brook Culvert

The culvert located at the intersection of Burton Brook and Main Street is a high concern culvert that must be restored. The first obstruction to fish passage occurs downstream in the form of a man made elevated platform that is two feet in height. This barrier, as seen in image 1, results in shallow water and obstructs fish passage. The same type of concrete platform is located upstream directly in front of the culvert (image 2), creating a slightly perched outlet and shallow water levels. The culvert itself is narrower than the stream and the cement bottom does not simulate the natural stream bottom.The culvert should be redesigned to be wider to reduce flow constriction and an open bottom structure should be designed to simulate the natural stream bottom. The obstruction downstream shown in image 1 should be modified to reduce its affect on fish mobility. The two sidewalk bridges located on either side of the road do not restrict flow and will not be modified.



Pettee Brook Culverts

Culvert [Y] located at the Pettee Brook and Main Street crossing is one of high concern. As seen in image 1, the entrances of the dual metal culverts are blocked by debris. The debris creates a barrier that obstructs fish passage and heavily affects the velocity and turbulence of water. The culverts also appear to be worn out and in poor condition. For a temporary solution it is recommended that all debris present is cleared from the culvert inlet. The culvert should be replaced by an wide open bottom arch culvert so that the natural stream bottom can be recreated and prevent alterations in flow. This will not only prevent debris build up but will also allow fish to access habitats upstream.

The concrete culvert [X] located upstream directly under Route 44 is shallow and the lip of the culvert is perched half a foot above the outlet water level as seen in image 2. Although this height does not exceed fish jumping capabilities, the shallow water level in the culvert may make it difficult fish to travel through. A temporary solution to this issue is to construct hand made rock dams downstream of the outlet, to raise the tail water levels and reduce the height of the outfall seen in image 2. The entrance of the culvert is slightly blocked by debris (image 3) which should be removed promptly. This culvert will be monitored closely during the formal survey to determine if it is a high priority crossing replacement project.

BENEFICIAL IMPACTS

The recommended modifications to the Pettee and Burton Brook culverts will reduce the biological risk being posed on the aquatic ecosystem of the town of Salisbury. By eliminating the issues present on the existing culverts, aquatic organisms including the native Brook Trout will be able to access valuable spawning grounds upstream.

Restoring the current culverts will reduce the height of outfall drops that would otherwise pose a struggle to aquatic wildlife trying to move upstream. These organisms will be able to freely travel through the structure without stress or harm.

Installing open bottom arch culverts will resolve issues with low flow depth in the culverts, allowing for clear passage through the structures. This modification, along with the removal of debris, will prevent any alteration to the stream's flow (velocity and turbulence). The new culverts should be wider than the stream to prevent changes in flow caused by funneling water through a small structure. Steady stream flow will reduce the stress on aquatic organisms and the habitat.

The Pettee and Burton Brook culverts act as passage barriers for aquatic organism due to the improper installation and maintenance of the structures. With the implementation of these recommendations, a total of 9.1 miles of valuable cold-water stream habitat will be made accessible to organisms once blocked by problematic culverts.

The installation of an open bottom corrugated metal culvert.

Open bottom culverts reduce major alterations to the stream bed and simulate the stream's natural flow.

CONCLUSIONS

The protection of aquatic habitats is vital in maintaining a healthy ecosystem in all waterways. With low order streams playing such a vital role in the life cycle of many aquatic organisms, including fish spawning, it is necessary to make these areas accessible. Two significant passage barriers in Pettee and Burton Brook currently stand in the way of valuable habitats. It is crucial to eliminate these barriers by modifying and replacing the current culverts to allow unobstructed stream passage for aquatic wildlife. By putting the given recommendations in place, miles of stream habitat will be made accessible, improving the biological health of Connecticut's waterways.

In addition to restoring habitat, replacing culverts will also be beneficial in flood events. As climate change makes storm systems more powerful and less predictable, it becomes more important to size culverts correctly. Undersized culverts increase the risk of flooding which can jeopardize the surrounding area and cause erosion. Properly sized culverts will allow for efficient draining and reduce the possibility of flooding.

The replacement of these structures, especially the historic bridge on Burton Brook, is very complicated and potentially very costly. The Salisbury Highway District, Connecticut Department of Transportation, and Trout Unlimited should work together to prioritize and implement culvert replacement projects in Salisbury.

REFERENCES

Barnard, R. J., J. Johnson, P. Brooks, K. M. Bates, B. Heiner, J. P. Klavas, D.C. Ponder, P.D. Smith,and P. D. Powers.(2013). Water Crossings Design Guidelines, Washington Department of Fish and Wildlife, Olympia, Washington. http://wdfw.wa.gov/habitat/culverts.htm Dodds, Glen, and Carl Schwartz.

"Culvert Design for Fish Passage." U.S. Fish & Wildlife Service. N.p., n.d. Web. 30 Feb. 2014. <http://www.fws.gov/northeast/nyfo/hot/ref_culvert_design.pdf>.

"FishXing, Fish Passage through Culverts." Aquatic Organism Passage. US Forest Service, n.d. Web. 27 Feb. 2014. <http://stream.fs.fed.us/fishxing/index.html>.

"Housatonic Watershed Habitat Continuity in Northwest Connecticut." CT DEEP. Housatonic Valley Association, n.d. Web. 29 Feb. 2014. <http://www.ct.gov/deep/lib/deep/natural_resources/housatonichabitat_continuity_concept_proposal.pdf>.

West, Richard L. "A Landowner's Guide to Building Forest Access Roads." US Forest Service. N.p., n.d. Web. 27 Feb. 2014. <http://www.na.fs.fed.us/spfo/pubs/stewardship/accessroads/accessroads.htm>.

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