Pennsylvania Fish and Boat Commission
Timothy D. Schaeffer, Executive Director

House Majority Policy Committee Hearing
Cleaning Streams to Prevent Flooding
Wellsboro, Pennsylvania
December 6, 2021

Good Morning Chairman Causer, Representative Owlett, and members of the House Majority Policy Committee. Thank you for the invitation to speak to you today on the topic of maintaining our creeks and streams to prevent flooding.

My name is Tim Schaeffer and I am the Executive Director of the Pennsylvania Fish and Boat Commission (Commission), the state agency dedicated to "protecting, conserving, and enhancing the Commonwealth's aquatic resources and providing fishing and boating opportunities for all."

Today's testimony comprises three main parts. It provides a brief overview of the causes of flooding, including both natural and anthropogenic factors that influence the frequency and severity of flooding events. It explains more on the Commission's mission, specifically relating to our state's rivers and streams. Finally, it describes how our agency's goals intersect with the topic of reducing flooding in our rivers and streams. I will also be outlining some of the strategic goals that guide our stream restoration efforts and providing several specific examples of on-the-ground projects that benefit aquatic resources as well as reduce the hazards posed by flooding.

Part I: Benefits and Consequences of Flooding

First, it should be acknowledged that flooding is a natural phenomenon and that periodic flooding has benefits to fish, wildlife, and aquatic ecosystems.[1] In the absence of human development, flooding events inundate the low-lying area adjacent to rivers and streams, called

[1] Benefits of Natural Floodplains. 2020. https://www.fema.gov/floodplain-management/wildlife-conservation/benefits-natural

the floodplain. This inundation provides many benefits, which include the formation and maintenance of wetlands; decreased flooding in downstream reaches, owing to the capture of excess water in the floodplain; the production of fertile agricultural lands; and the creation of habitats that support recreational activities like fishing.[2]

These benefits, however, do not discount the considerable damage caused by flooding to our infrastructure, livelihoods, and human safety. According to the National Climate Assessment[3], precipitation in the Northeast United States has increased by upwards of 10% in recent decades. This trend of increased precipitation, especially high-magnitude rain events, is expected to continue in Pennsylvania, as is the frequency and severity of flooding.[4]

In addition to these natural and anthropogenic factors that influence the frequency and severity of flooding in Pennsylvania, human encroachment on creeks and streams can exacerbate the prevalence and severity of flooding in a specific location. For example, where connectivity with a natural floodplain has been cut off, excess water can no longer be deposited in the floodplain which can increase the volume of water moving downstream.[5] Similarly, the lack of riparian buffers, which are strips of vegetation that line the banks of rivers and streams, can contribute to stream channelization which can also increase the possibility of flooding.[6] Both disconnected floodplains and the lack of riparian buffers help to create conditions where water can only go downstream, compared to being captured within a floodplain and eventually becoming groundwater.

Manmade infrastructure, including certain dams and culverts, can interfere with natural stream processes and also contribute to local flooding events. For example, although some dams are constructed to act as flood control structures, many others were originally created for different purposes such as local water supply, milling activities, or recreation. In Pennsylvania, the dams created for purposes other than flood control often become obsolete and may contribute to local flooding rather than prevent it. Culverts can exacerbate flooding when they are undersized and cannot accommodate heavy flow events. If a culvert is too small to pass water

---

[2] Why We Need to Restore Floodplains. 2021. https://www.americanrivers.org/threats-solutions/restoring-damaged-rivers/benefits-of-restoring-floodplains/; Benefits of Natural Floodplains. 2020. https://www.fema.gov/floodplain-management/wildlife-conservation/benefits-natural

[3] USGCRP, 2018: Impacts, Risks, and Adaptation in the United States: Fourth National Climate Assessment, Volume II [Reidmiller, D.R., C.W. Avery, D.R. Easterling, K.E. Kunkel, K.L.M. Lewis, T.K. Maycock, and B.C. Stewart (eds.)]. U.S. Global Change Research Program, Washington, DC, USA, 1515 pp. doi: 10.7930/NCA4.2018.

[4] Pennsylvania Climate Impacts Assessment 2021. http://www.depgreenport.state.pa.us/elibrary/GetDocument?docId=3667348&DocName=PENNSYLVANIA%20CLIMATE%20IMPACTS%20ASSESSMENT%202021.PDF%20%20%3cspan%20style%3D%22color:green%3b%22%3e%3c/span%3e%20%3cspan%20style%3D%22color:blue%3b%22%3e%28NEW%29%3c/span%3e%204/30/2023

[5] The Science Behind the Need for Riparian Buffer Protection. https://conservationtools.org/guides/131-the-science-behind-the-need-for-riparian-buffer-protection

[6] Zaimes et al. 2004. Stream Bank Erosion Adjacent to Riparian Buffers, Row-Crop Fields, and Continuously-Grazed Pastures along Bear Creek in central Iowa. Journal of Soil and Water Conservation: 59, 1.

and debris under a road during high flow events, that excess water is likely to overtop the streambank and cause flooding and even damage to the road and crossing itself.[7] Collectively, the benefits and consequences of flooding as well as the projected increase in the frequency and severity of flooding in the future necessitates that local and state governments evaluate the current and future impacts of flooding on society and the environment.

Part II: Mission and Goals Relating to Rivers and Streams

"Stream cleaning" is the term often used to describe the use of heavy equipment to straighten or deepen a waterway, and it is often proposed as a solution to mitigate the impacts of flooding. However, in certain instances this practice can potentially have adverse effects on stream ecosystems and the populations that they support. As mentioned earlier, the mission of the Pennsylvania Fish and Boat Commission is "to protect, conserve, and enhance the Commonwealth's aquatic resources and provide fishing and boating opportunities." This mission encompasses a diverse set of activities, ranging from habitat restoration to pollution enforcement, and everything in between. By highlighting some of our Commission's specific goals that relate to stream and creek ecosystems, it demonstrates that there are alternative approaches to increasing flood resiliency that also benefit our aquatic resources.

As an agency, the Commission is guided by a strategic plan which provides a detailed blueprint of how to achieve the mission. Two of our most relevant strategic goals to this hearing's topic are "…to expand the stream habitat program to perform stream corridor Best Management Practices (BMPs) to improve local water quality and fish habitat…" and additionally to "continue to work with partner organizations to coordinate and implement connectivity plans that improve fish passage."[8] Included in the goal of increasing aquatic connectivity are both the removal of small dams and the identification and prioritization of culvert replacement opportunities that increase Aquatic Organism Passage (AOP). Currently, the Commission's Division of Habitat Management is involved with stream restoration and fish passage projects throughout the Commonwealth. These projects include the installation of instream habitat structures, riparian buffer plantings, streambank grading and stabilization, small dam removals, and culvert replacements.

Part III: How the Commission's Strategic Goals Intersect with Preventing Flooding in Creeks and Streams

To expand on the intersection of our mission and goals and the desire to reduce flooding along streams and creeks, there are three examples to discuss: streambank and floodplain

[7] Gillespie et al. 2014. Flood Effects on Road-Stream Crossing Infrastructure: Economic and Ecological Benefits of Stream Simulation Designs. Fisheries: 39:2

[8] Pennsylvania Fish and Boat Commission Strategic Plan 2020-2023. https://www.fishandboat.com/AboutUs/AnnualReports/Documents/strategicPlans/StrategicPlan2020-2023.pdf

restoration, small dam removals, and replacement of road-stream crossings to promote aquatic organism passage.

Streambank and floodplain restoration

A fully functioning aquatic ecosystem includes stable streambanks, a connected floodplain, and a vegetated riparian zone directly adjacent to the stream or creek. Our Stream Habitat Section, housed in the Division of Habitat Management, facilitates streambank and floodplain restoration efforts across the state. Specifically, we provide technical guidance and construction oversight in collaboration with our many project partners. These partners include federal agencies, such as the U.S. Fish and Wildlife Service; other state agencies, such as Pennsylvania Department of Conservation and Natural Resources; county conservation districts; private landowners; and non-governmental organizations (NGOs), including the Western Pennsylvania Conservancy and the Northcentral Pennsylvania Conservancy. With the help of these and other partners, our agency completed 33 streambank and floodplain restoration projects that improved over five miles of streambank during 2021 alone.

Although the Commission is primarily interested in the enhancement and restoration of these key features because of the benefits they provide to our aquatic resources, there are additional benefits to performing stream corridor Best Management Practices, including the mitigation of flood impacts and the reduction of downstream sediment and nutrient loading. For instance, recently the Commission planted approximately 1,500 trees to create 7.5 acres of riparian buffer on three of our boat launch properties in Juniata County. Riparian buffers, especially ones that are vegetated with trees, absorb more rainwater which reduces the amount of water entering a stream or creek immediately after a rain event. This slower release of water can reduce both the frequency and severity of flooding as well as recharge groundwater supplies.[9] Research supports this notion, as streams with more intact riparian buffers generally exhibit greater flood resiliency compared to those with little or no riparian buffer.[10] Furthermore, projects like the ones completed on our properties can reduce nutrient and sediment loads and improve water quality in our local watersheds, as well as larger ones such as the Chesapeake Bay watershed.

Small dam removal

Dams can impede the movement of fish and other aquatic organisms, reduce water quality, and alter ecosystem processes such as sediment and nutrient transport. The Commission helps to facilitate the removal of obsolete dams across the Commonwealth to achieve fish passage, restore free-flowing rivers, and promote aquatic connectivity. In fact, Pennsylvania is

[9] The Science Behind the Need for Riparian Buffer Protection. https://conservationtools.org/guides/131-the-science-behind-the-need-for-riparian-buffer-protection

[10] Keeton, et al. 2017. Riparian Forest Structure and Stream Geomorphic Condition: Implications for Flood Resilience. *Canadian Journal of Forest Research, 47*(4), 476-487.

the national leader in dam removals with over 340 dams removed through 2020.[11] In addition to the benefits of small dam removal to our aquatic resources, removing obsolete dams may also reduce flooding through several primary mechanisms.

Although uncommon, antiquated and obsolete dams can experience catastrophic failure during storm events which causes widespread flooding and damage downstream. Dams often also raise the water level in the impounded section of a stream or river, and this may make low-lying areas surrounding the impoundment more prone to flooding. Therefore, the removal of dams that no longer serve their intended purpose can benefit aquatic resources and promote flood resiliency. Two recent projects in Pennsylvania that achieved both fish passage and reduced local flooding were the removals of the Harmony Junction Dam on the Connoquenessing Creek, Butler County, in 2009 and the Patton Dam on Chest Creek, Cambria County, in 2019.[12]

Aquatic Organism Passage (AOP) at road-stream crossings

Pennsylvania is home to more than 86,000 miles of streams and over 120,000 nonfederal public roads.[13] As a result, there are tens of thousands of road-stream crossings throughout the state. Unfortunately, many road-stream crossings, especially culverts, prohibit the movement of fish and other aquatic organisms up or downstream. There are many causes for this restricted movement, including vertical drops at the inlet and outlet of a crossing, too much or too little water passing through a culvert, a lack of continuity in stream bed material through the entire structure, and debris clogging of the structure itself.[14] These factors, alone or in combination, can restrict or even prohibit AOP, which can have detrimental impacts on aquatic ecosystems and the fish populations that they support. As such, the Commission is focused and committed to improving AOP at road-stream crossings by replacing structures that prohibit AOP with ones that promote it.

Although the primary motivation for the Commission to facilitate the replacement of road-stream crossings (culverts) is to promote aquatic organism passage, these projects are often win-win scenarios for increasing resilience to flooding.[15] The reason for this overlap is that in most cases, a primary cause of a lack of AOP is an undersized structure.[16] A culvert that is not the same width (or larger) as the stream channel acts as a pinch point, backing water up behind

[11] American Rivers Dam Removal Database. 2020. https://www.americanrivers.org/2021/02/69-dams-removed-in-2020/

[12] Personal communication, Lisa Hollingsworth-Segedy – American Rivers

[13] Bloser, S. 2019. Improving Road Stream Crossings for Storm Resiliency and Aquatic Organism Passage: Pennsylvania Case Study. https://onlinepubs.trb.org/onlinepubs/circulars/ec248.pdf#page=344

[14] Recommendations for Aquatic Organism Passage at Maryland Road-Stream Crossings. 2021. https://www.chesapeakebay.net/channel_files/43044/recommendations_for_aquatic_organism_passage_at_maryland_road-stream_crossings_draft_05262021.pdf

[15] Gillespie et al. 2014. Flood Effects on Road-Stream Crossing Infrastructure: Economic and Ecological Benefits of Stream Simulation Designs. Fisheries: 39:2

[16] Bloser, S. 2019. Improving Road Stream Crossings for Storm Resiliency and Aquatic Organism Passage: Pennsylvania Case Study. https://onlinepubs.trb.org/onlinepubs/circulars/ec248.pdf#page=344

the crossing and increasing the velocity of the water that does pass through the structure.[17] In high flow events, this constriction can have devasting effects on roadways and the surrounding area, in addition to prohibiting AOP. For example, an undersized road-stream crossing can lead to a stream overtopping the roadway, causing a public safety threat and potentially costly damage to infrastructure.[18]

Fortunately, the types of road-stream crossings that promote AOP also increase flood resilience by eliminating many of the causes of reduced AOP *and* increased flooding. For example, a primary means of achieving AOP is to simulate stream-like conditions all the way through a road-stream crossing.[19] A key factor to achieving this is to make sure the crossing spans the entire width of the natural stream channel. In addition to improving AOP, wider structures increase the hydraulic capacity of the crossing. Subsequently, the crossing no longer acts as a pinch point for the stream, meaning that there is not water backed up behind the crossing, reducing the risk of flooding and the risk that the stream overtops the road. These larger structures can also reduce debris clogging on the upstream side of culverts, further reducing the risk of flooding.

Recently, the Commission has helped to identify, prioritize, and in some cases, fund culvert replacement projects across the state. In 2015, funding was provided for a culvert replacement on Little Lyman Run in Potter County. Prior to replacement, an old and undersized culvert was not only a barrier to Brook Trout passage on this Class A stream, it also required a substantial amount of maintenance by the local township, with gravel needing to be removed from the inlet of the culvert after almost every rain event. With the help of the Commission, the undersized culvert was removed and replaced with a structure spanning the entire bank-full width restoring fish passage and alleviating township maintenance.

Summary

The Pennsylvania Fish and Boat Commission engages in activities that protect, conserve, and enhance our state's aquatic resources. In many cases, these efforts can also increase resiliency to flooding. In this testimony, examples of how the conservation efforts being undertaken were highlighted as means of mitigating the risks associated with flooding. First, the creation of natural floodplains and riparian buffers increases water-holding capacity and decreases the amount of water that immediately enters a stream or creek during a high-magnitude precipitation event. Second, the removal of obsolete dams to restore fish passage can also reduce

[17] Vermont Stream Crossing Handbook. 2016. https://vtfishandwildlife.com/sites/fishandwildlife/files/documents/Learn%20More/Library/REPORTS%20AND%20DOCUMENTS/AOP/AOP%20HANDBOOK.pdf

[18] Gillespie et al. 2015. "Session B1: Lessons Learned from Tropical Storm Irene 2.0: How Flood Resiliency Benefits of Stream Simulation Designs Are Changing Policy within the U.S.". International Conference on Engineering and Ecohydrology for Fish Passage. 22. https://scholarworks.umass.edu/fishpassage_conference/2015/June22/2

[19] Stream Simulation: An Ecological Approach to Providing Passage for Aquatic Organisms at Road-Stream Crossings. 2008. https://www.fs.fed.us/eng/pubs/pdf/StreamSimulation/hi_res/%20FullDoc.pdf

the impacts of flooding by eliminating the risk of catastrophic dam failure or reducing localized flooding in formerly impounded locations. Finally, the replacement of culverts that restrict aquatic organism passage with structures that span the entire stream channel may mitigate flooding by expanding the hydraulic capacity of road-stream crossings. The Commission will continue to engage in these activities to the benefit of aquatic ecosystems and the populations that they support.

Thank you for the opportunity to testify today, and I welcome any questions.