

Naturally Beneficial

Protecting Water Quality and Saving Money
with Riparian Buffer Ordinances





About PennFuture

Citizens for Pennsylvania's Future ("PennFuture") is a member-supported, statewide environmental advocacy nonprofit and watchdog fighting against potential threats to Pennsylvania's clean air, pure water, and healthy climate. Since 1998, PennFuture has combined legislative advocacy, educational outreach, civic engagement, and legal action at the local, state, and federal levels for just and equitable environmental outcomes that improve the quality of life for all Pennsylvanians.

PennFuture has stood at the forefront of major environmental milestones in Pennsylvania as a bold and vigilant defender of communities against pollution and environmentally harmful policies.

We have offices across Pennsylvania, including Harrisburg, Pittsburgh, Erie, and the Poconos.

Acknowledgements

PennFuture would like to thank the Kentfields Foundation for making this publication possible. *The opinions expressed in this report are those of PennFuture and do not necessarily reflect the views of the Kentfields Foundation.*

A special thank you to Brigitte Meyer, Staff Attorney at PennFuture, for her research and drafting of this guidebook. PennFuture would also like to thank the Brandywine Conservancy for providing their time and expertise in reviewing information, answering questions, and providing valuable comments and insights on the matters covered herein.

TABLE OF CONTENTS

INTRODUCTION	3
HOW LAND DISTURBANCE AND DEVELOPMENT AFFECT WATER RESOURCES	5
THE BENEFITS OF RIPARIAN BUFFERS	6
Riparian Buffers Control Flooding	6
Riparian Buffers Control Erosion and Sedimentation	8
Riparian Buffers Remove Nutrients and Other Water Pollutants	9
Riparian Buffers Moderate Water Temperatures	11
Riparian Buffers Provide Food and Shelter for Fish and Other Aquatic Species	12
Riparian Buffers Provide Habitat for Terrestrial Wildlife	13
Riparian Buffers Provide Opportunities for Recreation	14
Riparian Buffers Provide Economic Benefits	15
NATURAL FORESTED RIPARIAN BUFFERS ARE SUPERIOR TO GRASS BUFFERS	16
THE IMPORTANCE OF WETLAND BUFFERS	17
What is a Wetland?	17
History of Wetland Destruction	17
The Benefits Of Wetlands	17
Why Protecting Wetland Buffer Areas Is Essential	19
THE IMPORTANCE OF RIPARIAN BUFFERS IN HEADWATER AREAS	20
Why Headwater Streams and Wetlands Matter	20
How Riparian Buffers Benefit Headwater Streams	21
BUFFER RECOMMENDATIONS	22
Scientific Studies on Buffer Widths	22
PADEP and Environmental Law Institute Recommendations	23
Composition, Location and Use of Buffers	24
PRACTICAL CONSIDERATIONS	25
PENNFUTURE'S MODEL RIPARIAN BUFFER ORDINANCES	26
Explanation of Storm Water Management Ordinance (SWMO) Provisions	26
Explanation of Zoning Ordinance Provisions	29
Existing Uses And Structures	29
Why the SWMO and Zoning Ordinance? Why Not SALDO?	29
WHAT ABOUT STATE REGULATIONS?	31
APPENDIX A	33



INTRODUCTION



Riparian

Riparian means “along a stream or other watercourse.” It is often also used more generally to mean “along any body of water.”

A riparian buffer is an area of land along a body of water that is left undisturbed to allow for the natural growth of native plant life.¹ Riparian buffers, particularly those that are made up mostly of native trees and shrubs, are vital elements of every watershed because they protect surface and ground water from impacts related to human land use and provide many benefits to people and wildlife.² A very large portion of Pennsylvania’s riparian forests have already been destroyed, and development pressure continues to threaten what remains.³

We must protect what is left of the Commonwealth’s riparian buffer areas to reap the numerous benefits that these buffers provide. These include:

- flood control;
- erosion control;
- removal of sediment and other harmful pollutants from surface waters;
- regulating water temperatures;
- providing habitat for aquatic and terrestrial plants and animals;
- providing aesthetic and recreational opportunities;
- improving property values; and
- reducing the cost of municipal services like stormwater control and water treatment

Watershed

A body of water’s **watershed** is the area of land that drains to that body of water.

¹ Pa. Dep’t of Env’t Prot., Bureau of Watershed Mgmt., RIPARIAN FOREST BUFFER GUIDANCE, Doc. No. 394-5600-001 at 1 (2010).

² Ellen Hawes & Markelle Smith, Yale School of Forestry and Environmental Studies, RIPARIAN BUFFER ZONES: FUNCTIONS AND RECOMMENDED WIDTHS 3 (2005).

³ See ECONorthwest, The Economic Value of Riparian Buffers in the Delaware River Basin, 7 (2018).

Although human-built structures and technologies may be substituted to perform one or more of these functions, none deliver the full range of ecosystem services that a natural buffer can provide at little to no cost.⁴ In order to fully benefit from all that natural riparian buffers provide, adequate buffer widths should be established around all surface waters, especially headwater streams and wetlands.

Municipalities play an extremely important role in making this happen. While statewide regulations provide protection for some waters and even require riparian buffers in some circumstances, gaps and loopholes in state law mean that much of this work has to be done by local governments.



Native species

Native species are plants, animals, or other organisms that have been present in an area since before European colonization. Every place has its own unique collection of native species. Because native species have existed together for many thousands of years, they form a delicately balanced ecosystem that is suited to the land, the climate, and each other. Non-native species can disrupt this balance.

⁴ *Id.* at 24.

HOW LAND DISTURBANCE AND DEVELOPMENT AFFECT WATER RESOURCES



Impervious surface

Impervious surface refers to surfaces like buildings and pavement that water cannot penetrate.

To understand the benefits of riparian buffers, we must first understand why water resources must be buffered from certain activities in the first place. Impervious coverage is widely recognized as the largest factor contributing to loss of water quality in most watersheds.⁵ Impervious surfaces reduce the infiltration of water into the ground and can contribute to more storm water runoff, greater sediment yields, and increased pollutant loads, all of which can degrade water quality.⁶ Increased impervious surface also increases the volume, rate and velocity of stormwater runoff, which leads to more frequent and more severe flooding. In fact, “every acre of land that is covered with an impervious surface generates 27,000 gallons of surface runoff instead of groundwater recharge during a one-inch rainstorm.”⁷ Significant research shows that water quality in a watershed degrades when impervious cover exceeds 10 percent of the total watershed area, and degrades severely when impervious cover exceeds 25 percent.⁸ Sensitive streams such as cold-water fisheries can be impacted by as little as 5 to 10 percent impervious surface area within their watershed areas.⁹ If the impacts of converting natural ground cover to impervious surface are not managed, it can result in threats to human safety, property damage, erosion and widening of stream channels, loss of stream habitat, and decline in water quality.¹⁰

Even when no permanent structures or impervious surfaces are constructed, activities that disturb the surface of the earth, like tree clearing, grading, and earth moving, can affect water resources. These activities remove the vegetation that holds soil in place, allowing soil particles—and whatever pollutants may be attached to them—to be washed into streams, rivers, lakes and wetlands when it rains. This process is called sedimentation and is the leading cause of water pollution in Pennsylvania.

⁵ N.J. Highlands Water Protection and Planning Council, POLICY STANDARDS FOR WAREHOUSING IN THE NEW JERSEY HIGHLANDS REGION 12 (2023).

⁶ *Id.*

⁷ Pa. Dep’t of Transp., PENNDOT.GOV, *Pervious Pavement*, <https://www.penndot.pa.gov/about-us/StateTransportationInnovationCouncil/Innovations/Pages/Pervious-Pavement.aspx> (last viewed Mar. 31, 2023).

⁸ N.J. Highlands, *supra* note 5, at 12.

⁹ National Oceanic and Atmospheric Administration, HOW TO USE LAND COVER DATA AS AN INDICATOR OF WATER QUALITY: DESCRIPTION OF DATA AND DERIVATIVES USED 3; N.J. Highlands, *supra* note 5, at 12.

¹⁰ U.S. Dep’t of the Int., U.S. Geological Surv., STRATEGIES FOR MANAGING THE EFFECTS OF URBAN DEVELOPMENT ON STREAMS 14 (2012).

THE BENEFITS OF RIPARIAN BUFFERS

The benefits riparian buffers provide for humans and the environment are unmatched. This single practice helps control flooding, the costliest, deadliest, and most common weather hazard in Pennsylvania, and erosion and sedimentation, the single largest source of pollution in Pennsylvania's surface waters. Buffers keep excess nutrients that cause harmful algae blooms out of our lakes, streams, and rivers and moderate water temperature, ensuring that aquatic wildlife like trout can continue to thrive in our waters. They provide food and shelter for dozens of plant, insect, fish, bird, and mammal species that live in and around surface waters. They create opportunities for recreation, improve property values, and save municipalities money in stormwater management and wastewater treatment costs.

Not only do riparian buffers deliver these many benefits, but they do so with minimal design, engineering, construction, or cost. In most cases, all that is needed is simply to leave nature alone to do what it does. It is difficult to think of any other stormwater management practice that does so much while costing so little.

To learn more about exactly how riparian buffers deliver these benefits, read on!

Riparian Buffers Control Flooding

Why It Matters

Flood events are the costliest and deadliest weather hazards in Pennsylvania.¹¹ According to a 2021 study, flooding in Pennsylvania caused \$3.2 billion in property damage and 89 deaths between 1996 and 2018.¹² Flash flooding, which is a type of flooding caused by excessive rainfall in a short period of time, is particularly devastating and accounts for nearly two-thirds of these impacts.¹³ Flooding destroys homes, businesses, and infrastructure and can spread contaminants from industrial and brownfields sites and agricultural lands.¹⁴ It can also harm wildlife by scouring streambeds and killing fish and amphibians.¹⁵

Between 2010 and 2022, Pennsylvania recorded 663 unique flood and flash flood events, and the magnitude, frequency and intensity of flooding is only expected to increase in coming years with the effects of climate change.¹⁶ Pennsylvanians will need new strategies to address this new reality.



¹¹ Pa. Dep't of Env't Prot., Pennsylvania Climate Impacts Assessment 2024, Doc. No. 7200-RE-DEP6046 at 103 (2025); ICF Incorporated, Pennsylvania Climate Impacts Assessment 2021 at 48 (2021).

¹² Pa. Dep't of Env't Prot., *supra* note 11, at 103; ICF Incorporated, *supra* note 11, at 48.

¹³ Pa. Dep't of Env't Prot., *supra* note 11, at 103; ICF Incorporated, *supra* note 11, at 48.

¹⁴ ICF Incorporated, *supra* note 11, at 54.

¹⁵ Pa. Dep't of Env't Prot., Bureau of Watershed Mgmt., *supra* note 1, at 16.

¹⁶ Pa. Dep't of Env't Prot., *supra* note 11, at 27, 53.

How Riparian Buffers Control Flooding

Riparian buffers help control flooding by creating a rough surface that slows the flow of stormwater runoff and increases the amount of time that water is in contact with the absorbent ground surface.¹⁷ In addition, the root structures of the plants in the buffer help create small holes in the soil, helping water to seep into the ground.¹⁸ All of this allows water to absorb into the ground to be used by plants or to enter groundwater supplies instead of rushing immediately into streams or other surface waters.¹⁹ When water enters the groundwater system before flowing into surface waters, the water level in the surface water changes more gradually after rainfall, which helps minimize downstream flooding.²⁰

When streams and wetlands do not have buffers, these benefits are lost, and water flows rapidly into surface waters at great volumes during storm events instead of being absorbed into the ground. The onrush of water may be more than the stream or wetland can hold, causing it to overflow and flood downstream lands. What's more, these effects can snowball. As stream channels become carved out and enlarged from repeated flooding, they send water downstream even faster, resulting in even more flooding.²¹

Stormwater runoff

Stormwater runoff is the rain and melting snow that flows over the ground during and shortly after rainfall or snowfall.



Surface waters

Surface waters are bodies of water on the surface of the land, like rivers, streams, lakes, ponds, and wetlands. **Groundwater** is water that is below the surface of the ground, filling the spaces between soil particles, rocks, and other materials. Surface water and groundwater may seem separate, but they are constantly interacting with each other. Water flows from the surface into the ground, and vice versa, creating a vast interconnected water system where the health of one part impacts the health of the entire system.

¹⁷ Pa. Dep't of Env'tl. Prot., Bureau of Watershed Mgmt., *supra* note 1, at 15; Hawes & Smith, *supra* note 2, at 3.

¹⁸ Vicki Chase, Laura Deming & Francesca Latawiec, Audubon Society of New Hampshire, *BUFFERS FOR WETLANDS AND SURFACE WATERS: A GUIDEBOOK FOR NEW HAMPSHIRE MUNICIPALITIES* 2.5.1(a) (1997).

¹⁹ Hawes & Smith, *supra* note 2, at 3.

²⁰ Chase, Deming & Latawiec, *supra* note 18, at 2.1.

²¹ Judy L. Meyer, et al., *Where Rivers are Born: The Scientific Imperative for Defending Small Streams and Wetlands* 10 (2007).

Riparian Buffers Control Erosion and Sedimentation

Why It Matters

Erosion happens when water running over soil washes that soil away. It is a natural process, but when human activity, weather extremes, and land use changes speed up the natural pace of erosion, it becomes a problem.²² Erosion along streams and rivers destabilizes their banks, which can pose a risk to nearby structures such as homes, roads, bridges, trails, and utilities.²³ It also increases the amount of sediment in waterways.

Sediment—very small soil particles that wash into a body of water as the result of erosion—is the single largest pollution source in Pennsylvania’s surface waters, leading to the impairment of almost 10,000 miles of streams in the Commonwealth.²⁴ Sedimentation increases the turbidity (cloudiness) of the water, blocks sunlight, and limits the ability of aquatic plants to make energy from that sunlight.²⁵ It also increases water temperature and reduces the amount of oxygen that is available in the water for aquatic species to use.²⁶ Too much sediment in a body of water can prevent young fish from hatching, make it difficult for fish to absorb oxygen from the water, and lessen the ability of visual predators such as brook trout and largemouth bass to find prey.²⁷ Larger sediment particles can fill in cavities used by small fish, young salamanders, and other small prey species, reducing food sources for larger species and increasing losses to predation.²⁸

Sediment in surface waters can also serve as a vehicle for other pollutants. Nitrogen, phosphorus, and other pollutants from pesticides and herbicides often attach to soil particles and are carried into waterbodies along with them.²⁹ This deposition of nutrient-loaded sediment into waterbodies is the primary cause of accelerated eutrophication, which can result in harmful algal blooms (see page 9).³⁰ Sediment also carries other pollutants such as heavy metals, organic chemicals, bacteria and other pathogens.³¹ Trapping sediment is the most effective way to reduce this type of pollution.³²

How Riparian Buffers Help Control Erosion and Sedimentation

Riparian buffers help prevent erosion and sedimentation by holding soil in place and keeping it from washing into surface waters. Plant roots along a streambank, particularly the roots of trees and other woody plants, strengthen the bank by going through the topsoil into more stable layers below.³³ This holds the soil in place and prevents the streambank from eroding into the stream.³⁴ Plants farther from the water’s edge do the same. Leaf litter and vegetation slow surface runoff as it passes through the buffer, trapping sediment at the surface and allowing clean water to percolate downwards.³⁵ Depending on the width of the buffer and the type of plants in it, it may collect or absorb 50 to 100% of sediments, as well as the nutrients and pollutants attached to them.³⁶

Aquatic Terrestrial Semiaquatic

Aquatic species are plants and animals that live in water.

Terrestrial species live on land.

Semiaquatic species, like turtles and frogs, live both on land and in water.



²² Jeff Walters & Nichol Church, *Understanding Streambank Erosion*, <https://www.snyder-associates.com/real-world-solution-in-action-stream-bank-erosion-explained/>.

²³ *Id.*

²⁴ 2026 Pennsylvania Integrated Water Quality Report, <https://storymaps.arcgis.com/stories/c54540d19c2d4aeba8259291f8808bb9>.

²⁵ Hawes & Smith, *supra* note 2, at 3; Danielle Rhea, What is Sediment and Why Is It a Stormwater Pollutant?, Penn State Extension, <https://extension.psu.edu/what-is-sediment-and-why-is-it-a-stormwater-pollutant>.

²⁶ Hawes & Smith, *supra* note 2, at 4; Rhea, *supra* note 25.

²⁷ Chase, Deming & Latawiec, *supra* note 18, at 2.3.1(b); Rhea, *supra* note 25.

²⁸ *Id.*

²⁹ Hawes & Smith, *supra* note 2, at 3.

³⁰ *Id.*; Meyer, et al., *supra* note 21, at 14.

³¹ Rhea, *supra* note 25.

³² Pa. Land Trust Ass’n, *The Science Behind the Need for Riparian Buffer Protection 2* (2014).

³³ *Id.*

³⁴ *Id.*

³⁵ Chase, Deming & Latawiec, *supra* note 18, at 2.5.1(a).

³⁶ Hawes & Smith, *supra* note 2, at 3.

Riparian buffers also help control sedimentation within streams by contributing debris to the stream itself. Tree roots and fallen trees within streams slow the flow of water in the stream, forming a physical barrier that allows sediment and pollutants to settle out and be trapped.³⁷

Riparian Buffers Remove Nutrients and Other Water Pollutants

Why It Matters

Nutrients are important to healthy growth of plants and animals, but at high concentrations, they can harm humans, animals, and overall ecosystem health.³⁸ When excessive amounts of nutrients, mainly nitrogen and phosphorus, enter surface waters, they act like fertilizer and contribute to the runaway growth of algae and algae-like bacteria called cyanobacteria.³⁹ This causes harmful algal blooms (HABs) that can pose serious health problems for humans and animals. HABs produce toxins that can cause rashes, blisters, hives, and eye and nose irritation in humans or pets that touch them. Humans and animals, particularly dogs, that ingest these toxins can also experience diarrhea, vomiting, dizziness, headaches, weakness and even death. Even inhaling cyanobacteria can be harmful. The excess algae in the water also blocks out sunlight and decreases the amount of oxygen available in the water for other organisms.⁴⁰ If this process, called **eutrophication**, continues unchecked, it can create a dead zone in which there is not enough oxygen in the water to sustain life.⁴¹

Nutrient pollution can also create major economic issues.⁴³ HABs can negatively impact tourism and fishing, increase water treatment costs, and decrease property values.⁴⁴ They can also impact aquaculture and fish farms.⁴⁵

Eutrophication

Eutrophication is a process that happens when nutrients like nitrogen and phosphorus enter a body of water and cause runaway growth of algae and plants. The algae feed on the nutrients, growing, spreading, turning the water green, and sometimes releasing toxins that harm humans and animals. When the algae die, bacteria eat them. This process consumes oxygen in the water, depriving fish and other aquatic life of the oxygen they need to live. If enough oxygen is removed, there is no longer enough left in the water to sustain life, and the water becomes a “dead zone.”⁴²



³⁷ Pa. Land Trust Ass'n, *supra* note 32, at 2.

³⁸ U.S. Geological Surv., *Nutrients in the Water*, <https://water.usgs.gov/vizlab/water-availability/o5-nutrients>.

³⁹ U.S. Env't Prot. Agency, *Basic Information on Nutrient Pollution*, <https://www.epa.gov/nutrientpollution/basic-information-nutrient-pollution>.

⁴⁰ Bryn Wambaugh, *What is Nutrient Pollution and What Are Its Impacts?*, PennState Outreach, <https://www.shaverscreek.org/2021/06/08/what-is-nutrient-pollution-and-what-are-its-impacts/>

⁴¹ *Id.*

⁴² U.S. Geological Surv., *Nutrients and Eutrophication*, <https://www.usgs.gov/mission-areas/water-resources/science/nutrients-and-eutrophication>.

⁴³ Wambaugh, *supra* note 40.

⁴⁴ *Id.*

⁴⁵ *Id.*

How Riparian Buffers Control Water Pollution

Besides capturing sediment, there are two main processes that happen in riparian buffers that remove excess nutrients from surface waters: denitrification and plant uptake.⁴⁶ Denitrification is when bacteria in the soil take nitrogen from water within the soil and use it as an energy source, eventually converting it to gas.⁴⁷ Plant uptake is when plant roots absorb the nitrogen in groundwater and use it for plant growth.⁴⁸ Both processes remove nutrients from stormwater runoff before that water flows into surface waters. Studies of buffers in Maryland and Georgia found that each acre of buffer studied retained 23 to 65 pounds of nitrogen and 1.1 to 2.6 pounds of phosphorus per year.⁴⁹

Riparian buffers consisting mostly of trees and shrubs also control pollutants in another way: Leaves and other debris that fall on the land and in the water form an ecosystem that supports macroinvertebrates. These tiny creatures process sediments, nutrients, and toxins, removing them from the water.⁵⁰

While they are one of the most effective and cost-efficient water quality protection measures, riparian buffers cannot remove all water pollutants. Salt and heavy metals such as cobalt, lead, or mercury are not removed by natural buffer processes.⁵¹ This is why, depending on the adjacent land use, buffers should be accompanied by additional measures to ensure that these pollutants do not enter surface waters.

Macroinvertebrates

Macroinvertebrates (sometimes called **macros** for short) are animals that do not have a backbone and can be seen without a microscope. They may live on land or in water and include many different species of insects, worms, snails, crayfish, and mussels. **Aquatic** or **benthic macroinvertebrates** are macroinvertebrates that live in water. They are extremely important

in freshwater environments because they are an important link in the food chain. They eat plants, bacteria, and algae and then become food for larger animals such as fish, amphibians, and birds. Macroinvertebrates are also very good indicators of stream health. Because certain macroinvertebrates require exceptionally clean water while others are more tolerant of less-than-ideal conditions, the makeup of the macroinvertebrate community in a given body is a good indicator of how clean the water is.



⁴⁶ Bernard W. Sweeney & J. Denis Newbold, *Streamside Forest Buffer Width Needed to Protect Stream Water Quality, Habitat, and Organisms: A Literature Review*, 50 J. of Am. Water Res. Ass'n 560, 562 (2014).

⁴⁷ Pa. Land Trust Ass'n, *supra* note 32, at 2.

⁴⁸ *Id.*

⁴⁹ ECONorthwest, *supra* note 3, at 28.

⁵⁰ Pa. Dep't of Env't Prot., Bureau of Watershed Mgmt., *supra* note 1, at 15.

⁵¹ Chase, Deming & Latawiec, *supra* note 18, at 2.5.1(e).

Riparian Buffers Moderate Water Temperatures

Why It Matters

When rain falls on buildings, roads, parking lots, and other impervious surfaces, the resulting runoff is much warmer than water that falls on natural surfaces. If that runoff is allowed to flow unchecked into surface waters, it raises the temperature of the entire water body, creating problems for the aquatic creatures that live there and for humans as well.

Did you know?

Did you know that heat is considered a water pollutant, just like trash, sewage, chemical waste, and radioactive materials? That's right: the federal Clean Water Act and the Pennsylvania Clean Streams Law include heat or a change in water temperature among the list of pollutants that these laws are designed to control.⁵²

For species that live in water, water temperature is about more than comfort. Temperature affects the physiological, biochemical, metabolic, hormonal, and immunological systems of many aquatic species and significantly alters their ability to grow, develop, reproduce, and fend off disease. This is because many aquatic organisms are ectothermic (cold-blooded), meaning their body temperature depends on the water around them. When these organisms' body temperature rises, it forces their respiration (breathing) and metabolism into high gear, causing them to expend more energy doing everyday things like moving, digesting food, and reproducing. Warmer water also holds less oxygen, making it more difficult for the organisms struggling to survive in these warmer waters to get the increased amount of oxygen that their body demands. Faster respiration and metabolism can also cause organisms to take in harmful chemical contaminants from the water at a faster rate, increasing their overall toxicity.⁵³

Humans also suffer negative impacts when surface waters warm too much. Warmer water temperature increases the toxicity of many chemicals like ammonia that can be found in water. This means warmer water is less safe to drink and more expensive to treat.⁵⁴ Warmer water also holds less dissolved oxygen, which decreases a waterbody's capacity to process and remove organic wastes like those from wastewater treatment plants.⁵⁵ This means wastewater treatment costs are higher when they discharge to warmer waters.⁵⁶

How Riparian Buffers Control Water Temperature

Riparian buffers, especially forested buffers, cool surface waters by allowing warm stormwater runoff from buildings, roads, and parking lots to infiltrate into the ground and cool down before it reaches surface waters. Buffers also cool water by shading waterbodies and the adjacent land. In addition to cooling waters in the warmer months, forested buffers also help moderate harsh winter temperatures by trapping heat caused by the sun's warming of the earth.⁵⁷ In these ways, forested buffers limit both the maximum stream temperatures reached in the summer and the daily fluctuations in stream temperature year-round.⁵⁸

Temperature and Trout

Among the species that are sensitive to water temperature are the brook, brown, and rainbow trout prized by Pennsylvania anglers. The optimum water temperature for these species is between 50 and 60 degrees, and most cannot live in water above 70 degrees. The brook trout, Pennsylvania's only native trout species, is particularly sensitive to water temperature, and cannot tolerate temperatures above 65 degrees.

⁵² 33 U.S.C. § 1362; 35 P.S. § 691.1.

⁵³ Syed Shabi Ul Hassan Kazmi, et al., *Temperature Effects in Single or Combined with Chemicals to the Aquatic Organisms*, 143 ECOLOGICAL INDICATORS 109354 at 6 (2022).

⁵⁴ Pa. Land Trust Ass'n, *supra* note 32, at 3.

⁵⁵ Pa. Dep't of Env't Prot., Bureau of Watershed Mgmt., *supra* note 1, at 19.

⁵⁶ *Id.*

⁵⁷ *Id.*

⁵⁸ Pa. Land Trust Ass'n, *supra* note 32, at 3.

Riparian Buffers Provide Food and Shelter for Fish and Other Aquatic Species

Why It Matters

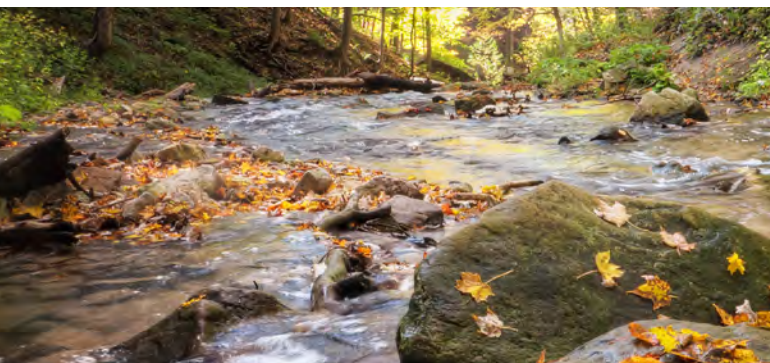
Leaves, twigs, and other small debris from plants are a “tree’s gift to a stream.”⁵⁹ When this debris falls into the water, it becomes food for things like microorganisms, fungus, and macroinvertebrates, which then become food for organisms higher up the food chain like fish, frogs, and birds.⁶⁰ This small-scale organic matter also provides habitat and cover for many aquatic species.⁶¹

Large woody debris like fallen trees and branches are also very important to the ecosystem within and around surface waters. Exposed logs and branches serve as basking sites for reptiles and perching sites for birds, and underwater logs and branches create cover and hiding places for fish and other aquatic organisms.⁶² Water flowing around the debris creates pools and undercuts that provide additional shelter for fish, and leaves caught in the branches of the debris form “leaf packs” that become hot spots for microbe and macroinvertebrate activity.⁶³ Large woody debris also helps feed the aquatic food chain from the bottom up. Algae growing on submerged debris feeds macroinvertebrates, which then serve as food sources for larger organisms like fish.⁶⁴ Large woody debris in streams and rivers also slows the water in a stream channel, which decreases downstream flooding and erosion.⁶⁵

How Riparian Buffers Provide Food and Shelter for Aquatic Species

For organic matter like leaves, twigs, branches, and logs to find its way into waterbodies, trees and other plants have to be located nearby.⁶⁶ As one author put it:

A good trout stream first needs to be a good insect stream. Insects, the favorite food of trout, are abundant in waters kept cool by streamside forests. Streams flowing through older, more complex forests receive the biggest buffet. Leaves, twigs, and other organic matter from streamside vegetation are both lunch and breeding ground for instream invertebrates which then in turn feed many others in the food chain. This means that a brook trout is as dependent upon trees as a squirrel.⁶⁷



Removing buffer vegetation deprives aquatic species of food and shelter. For some species, even a slight change in habitat structure or water quality may make an aquatic environment completely unsuitable for breeding, or even for individual survival.⁶⁸ For example, in a study of 12 southern Appalachia streams, clearing a 1–3 km stretch of forested buffer was found to have substantial impacts on fish populations, even when the rest of the watershed remained heavily forested.⁶⁹

⁵⁹ Rebecca Lauer, *How Fallen Leaves are a Tree's Gift to a Stream*, Stroud Water Research Center, <https://stroudcenter.org/news/how-fallen-leaves-are-a-trees-gift-to-a-stream/>.

⁶⁰ *Id.*

⁶¹ Hawes & Smith, *supra* note 2, at 4.

⁶² Danielle Rhea, *Benefits of Large Woody Debris in Streams*, Penn State Extension, <https://extension.psu.edu/benefits-of-large-woody-debris-in-streams>.

⁶³ Lauer, *supra* note 59.

⁶⁴ Rhea, *supra* note 62.

⁶⁵ *Id.*

⁶⁶ Chase, Deming & Latawiec, *supra* note 18, at 2.3.1(d).

⁶⁷ Connecticut River Joint Comm'n, *BUFFERS FOR HABITAT 2* (2000).

⁶⁸ Chase, Deming & Latawiec, *supra* note 18, at 2.3.1.

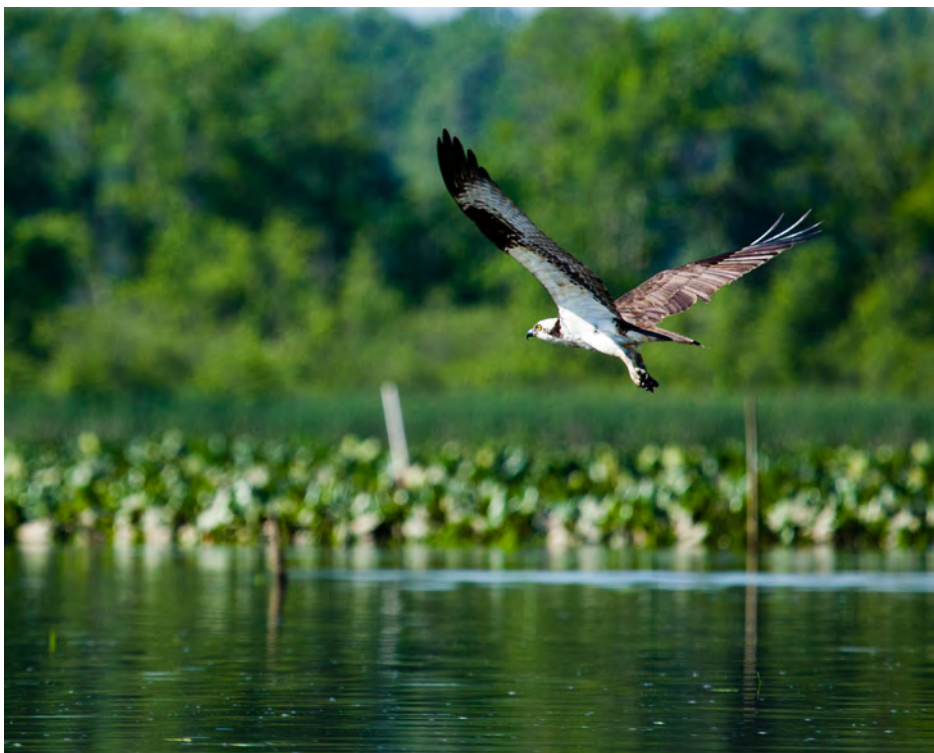
⁶⁹ Pa. Land Trust Ass'n, *supra* note 32, at 4.

Riparian Buffers Provide Habitat for Terrestrial Wildlife

Why it Matters

Many species that do not live in water still need habitat that includes surface waters.⁷⁰ In Pennsylvania, this includes species like salamanders, frogs, turtles, ducks, great blue herons, ospreys, eagles, minks, beavers, and otters.⁷¹ These species depend on streams and wetlands, but also require uplands (non-stream or wetland areas) for food, cover, habitat for reproduction and raising young, and protection from human disturbance.⁷² For example, wood ducks feed on aquatic insects and plants but nest in large cavity trees up to several hundred yards away from water.⁷³ Cavity trees, which are more abundant in wetlands and floodplain forest areas, are also essential for other species such as mergansers, owls, woodpeckers, squirrels, raccoons, fishers, bats, porcupines, foxes and black bears.⁷⁴

Riparian areas also serve as travel corridors for species such as deer and black bears that need to move safely among habitats without being disturbed by people or domestic animals.⁷⁵ Connected habitats created by these riparian corridors are better than isolated habitats because they allow species to move between different areas and to recolonize and remain in areas that they may not have been able to live in before.⁷⁶ This free movement of species across the landscape increases the likelihood of survival of individuals, and maintains genetic integrity of populations.⁷⁷ Black bears and deer also benefit from riparian habitat in another way—bears emerging from hibernation and deer seeking food after a long winter of eating browse benefit from the early spring greenery that emerges first in wetlands and riparian areas.⁷⁸



All of these factors make riparian areas regional hot spots that support a disproportionately high number of terrestrial wildlife species.⁷⁹ For example, many studies have shown that bird species richness and density is higher in riparian forests than in adjacent upland forests with similar types of trees.⁸⁰

How Riparian Buffers Benefit Terrestrial Wildlife

Riparian buffers preserve the unique habitat that is found only where land and water meet. When these areas are converted into pavement, buildings, lawns, or farm fields, the benefits of the riparian habitat are lost.

⁷⁰ Hawes & Smith, *supra* note 2, at 4.

⁷¹ Chase, Deming & Latawiec, *supra* note 18, at 2.3.2(b); Pa. Land Trust Ass'n, *supra* note 32, at 4.

⁷² Chase, Deming & Latawiec, *supra* note 18, at 2.3.2.

⁷³ *Id.* at 2.3.2(b).

⁷⁴ *Id.*

⁷⁵ *Id.* at 2.3.2.

⁷⁶ Env't Law Inst., Conservation Thresholds for Land Use Planners 10 (2003).

⁷⁷ Chase, Deming & Latawiec, *supra* note 18, at 2.3.2(c).

⁷⁸ *Id.* at 2.3.2(a).

⁷⁹ Env't Law Inst., *supra* note 76, at 19.

⁸⁰ Chase, Deming & Latawiec, *supra* note 18, at 2.3.2(a).

Riparian Buffers Provide Opportunities for Recreation

Why it Matters

Pennsylvanians love outdoor recreation. A 2024 Penn State survey found that more than 9 out of 10 Commonwealth residents participated in outdoor recreation at least once over the course of the past year.⁸¹ More than 30% did so two or more times per week, a 10% increase from just five years ago.⁸² In a survey of 12,000 Americans, seven out of ten children said that they would rather explore woods than play on grass.⁸³ When people look for recreational opportunities, most want something close to home. More than half of Commonwealth residents surveyed said they most often recreated locally.⁸⁴ In fact, 2% of respondents said they even relocated to be closer to outdoor recreation opportunities. Walking,

running, hiking, and backpacking were the top activities, with approximately 70% of people participating in one or more of these activities.⁸⁵ When asked what the single most important thing that outdoor recreation providers could do to help participation in outdoor recreation, outdoor enthusiasts overwhelmingly responded, “trails.”⁸⁶

Outdoor recreation is not just fun; numerous reports show that access to outdoor recreation is beneficial for physical and mental health. Eighty-two percent of Pennsylvanians reported that outdoor recreation is an essential part of their mental health, and 67% agree that parks, trails, and open space are an essential part of the health-care system.⁸⁷ Outdoor recreation also provides economic benefits. It contributes \$19 billion to Pennsylvania’s economy every year and employs over 168,000 people.⁸⁸ Over half of Pennsylvanians spent money at a local establishment during a recreational activity.⁸⁹

How Riparian Buffers Enhance Opportunities for Recreation

Riparian buffers increase the total area of land available for outdoor recreational activities and increase the enjoyment of those activities by preserving the visual appeal of waterside recreation areas.⁹⁰ Vegetation also provides screen for people using the streams, wetlands or other bodies of waters for recreation.⁹¹ In addition, buffers improve the quality of hunting, fishing, wildlife viewing, nature photography, and other wildlife dependent activities by providing habitat and supporting wildlife populations.⁹² Recreational activities are thereby enhanced by maintenance of the buffers and the ecological integrity that they provide.⁹³

⁸¹ Pa. Dep’t of Conservation and Nat. Res., Outdoor Places, SHARED SPACES: PENNSYLVANIA’S 2025-2029 STATEWIDE COMPREHENSIVE OUTDOOR RECREATION PLAN 31 (2025).

⁸² *Id.*

⁸³ ECONorthwest, *supra* note 3, at 46.

⁸⁴ Pa. Dep’t of Conservation and Nat. Res., *supra* note 81, at 35.

⁸⁵ *Id.* at 31.

⁸⁶ *Id.* at 37.

⁸⁷ *Id.*

⁸⁸ Bureau of Econ. Analysis, OUTDOOR RECREATION SATELLITE ACCOUNT (ORSA): 2023–PENNSYLVANIA 1 (2023).

⁸⁹ Pa. Dep’t of Conservation and Nat. Res., *supra* note 81, at 35.

⁹⁰ ECONorthwest, *supra* note 3, at 46.

⁹¹ Chase, Deming & Latawiec, *supra* note 18, at 2.2.

⁹² ECONorthwest, *supra* note 3, at 46.

⁹³ Chase, Deming & Latawiec, *supra* note 18, at 2.2.



Riparian Buffers Provide Economic Benefits

Why it Matters

Few people need to be convinced that saving money is a positive thing. Many municipalities struggle to meet their revenue needs,⁹⁴ and many are saddled with state or federal requirements that cost money but do not provide a commensurate source of funding. This includes requirements surrounding the provision of municipal separate storm sewer systems (MS4s), locally-owned systems of pipes, culverts, and other stormwater management facilities that collect water from developed area and discharge it to streams and rivers.

How Riparian Buffers Provide Economic Benefits

Riparian buffers provide ecosystem services that have real monetary value. A study performed on behalf of Our Pocono Waters in 2021 concluded that the total ecosystem service values for natural buffers in Monroe County was over \$330 million.⁹⁵ In a separate study, Delaware Riverkeeper Network found that buffers provide over \$13,300 per acre per year in monetized benefits (amount adjusted for inflation), far less than the cost to establish or enhance these buffers.⁹⁶

One of the main monetary benefits of buffer protection is reduced costs of water treatment.⁹⁷ The Trust for Public Land concluded in 2004 that “for every 10 percent increase in forest cover in the source area, treatment and chemical costs decreased by approximately 20 percent, up to 60 percent forest cover.”⁹⁸

New York City benefits from buffers.

The nation’s largest city has spent about \$1.5 billion dollars on watershed protection for its drinking water reservoirs in the Catskill Mountains of upstate New York.⁹⁹ By doing so, the city has avoided spending at least \$6 to \$8 billion in capital costs for the construction of a water filtration plant, and \$300 million in annual operating costs.¹⁰⁰

Riparian buffers do more than reduce water treatment costs. They reduce damage from flooding and erosion, reduce runoff pollution, and decrease stress on infrastructure, all of which saves communities real money.¹⁰¹ They also increase residential property values, with home prices generally increasing with proximity to a stream or buffer zone.¹⁰¹ One study found that residential properties that included or were adjacent to riparian buffer areas were up to 26% more valuable than similar properties lacking protected streams nearby.¹⁰³

Buffers also provide monetary recreational benefits. A study of the Conservation Reserve Program in Pennsylvania found that each acre of conserved riparian buffer provides approximately \$100 in annual recreational benefits.¹⁰⁴ Another economic impact analysis concluded that protection of pristine waterways in the Poconos could result in \$245 to \$982 million in regional sales output, with 1,845 to 7,380 additional jobs.¹⁰⁵

Ecosystem services

Ecosystem services are benefits that ecosystems provide to humans. Some examples are filtering and purifying air and water, controlling flooding, providing habitat for insects that pollinate crops, and increasing opportunities for recreation.

⁹⁴ Pa. Mun. League, *Municipal Finance*, <https://www.pml.org/advocacy/municipal-finance/>.

⁹⁵ Anna Perry, et al., *Economic Effects of Special Protection Stream Designations in the Pocono Mountains Region 11* (2022).

⁹⁶ ECONorthwest, *supra* note 3, at 7 (2018). Amount adjusted for inflation.

⁹⁷ Perry, et al., *supra* note 96, at 5.

⁹⁸ Pa. Land Trust Ass’n & Brandywine Conservancy, *A Scientific Foundation for Shaping Riparian Buffer Protection Regulations 4* (2014).

⁹⁹ ECONorthwest, *supra* note 3, at 36.

¹⁰⁰ *Id.*

¹⁰¹ Perry, et al., *supra* note 95, at 5.

¹⁰² ECONorthwest, *supra* note 3, at 41.

¹⁰³ Perry, et al., *supra* note 95, at 7.

¹⁰⁴ *Id.* at 6.

¹⁰⁵ *Id.* at 26.

NATURAL FORESTED RIPARIAN BUFFERS ARE SUPERIOR TO GRASS BUFFERS

Some of the benefits described above can be achieved with any kind of vegetated buffer, even turf grass.¹⁰⁶ However, the most effective riparian buffers are forested buffers that include a mix of native trees, shrubs, grasses and other non-woody plants.¹⁰⁷ This is because the ecological processes in Pennsylvania's streams, lakes, and wetlands evolved over time to relate to the specific mix of riparian vegetation that is naturally present in the state, and that's forest. In other words, "Pennsylvania streams need Pennsylvania trees!"¹⁰⁸

The unique benefits provided by a forested buffer include shading and cooling the water surface, providing leaves and branches that are a critical source of energy for aquatic food chains, allowing for bank undercuts that provide habitat for aquatic creatures, and preventing stream channel narrowing as often occurs when grass is planted up to a streambank.¹⁰⁹ They also provide the large woody debris that plays an important role in the aquatic environment. Trees and shrubs also provide fruits, nuts, seeds, and berries for a diverse population of native wildlife.¹¹⁰ The trees in mature riparian forest buffers also protect the ground below in storm events by shielding the ground from rainfall and collecting water.¹¹¹ In fact, forests can provide as much as 40 times more water storage than crop fields and 15 times more water storage than turf grass.¹¹²

This doesn't mean that the ideal buffer has only trees. Different types of plants are better at providing different benefits. For example, trees are very effective at shading waters, stabilizing stream banks, providing habitat for both terrestrial and aquatic species, and controlling flooding, but they are less effective at filtering sediment and the pollutants that attach to sediment. Grasses filter sediment better than trees do, but they do not provide much bank stabilization, flood control, or wildlife habitat, or any shade. Shrubs can provide a moderate amount of shading, sediment filtration, habitat, and flood protection. Only when all of these plant types are combined does a riparian forest buffer provide maximum benefit.¹¹³



Turf grass buffers do not provide bank stabilization.



¹⁰⁶ Pa. Land Trust Ass'n & Brandywine Conservancy, *supra* note 98, at 2.

¹⁰⁷ Hawes & Smith, *supra* note 2, at 7.

¹⁰⁸ Pa. Land Trust Ass'n & Brandywine Conservancy, *supra* note 98, at 4.

¹⁰⁹ Pa. Dep't of Env't Prot., Bureau of Watershed Mgmt., *supra* note 1, at 16.

¹¹⁰ *Id.* at 17.

¹¹¹ *Id.* at 15.

¹¹² *Id.* at 38.

¹¹³ Pa. Dep't of Env't Prot., Bureau of Clean Water, *Riparian Forest Buffer Guidance*, No. 386-5600-001, at 1 (2010).

THE IMPORTANCE OF WETLAND BUFFERS

What is a Wetland?

Wetlands are areas of land that are covered by shallow water or where the soil is saturated with water often enough to support plants that are specially adapted for life in wet soil conditions.¹¹⁴ They include areas that are commonly referred to as swamps, marshes, and bogs. There are roughly 404,000 acres of wetlands in Pennsylvania, concentrated mainly in the northeastern and northwestern corners of the state where glaciers once covered the land.¹¹⁵

Delineating Wetlands

To determine whether an area meets the definition of a wetland, experts perform what is known as a wetland delineation. This involves studying the area to see if it has the three main characteristics of a wetland: it is dominated by vegetation that has the ability to grow and thrive in wet soils (called hydrophytic vegetation), it has soil that is saturated often enough to develop anerobic (low oxygen) conditions, and it is in fact covered or saturated with water for at least 5% of the growing season in most years.

Once the expert determines where the wetland is, they will mark the boundary between the wetland and the adjacent upland (non-wetland) area and transfer that information to a map or plan so that others know where the wetland is located.

History of Wetland Destruction

Before Europeans came to Pennsylvania, there were an estimated 1.1 million acres of wetlands in the state.¹¹⁶ Early European settlers did not see these lands as valuable resources, but as noxious, disease-breeding swamps that had to be drained, filled or manipulated so that the land could be put to “productive” uses such as agriculture.¹¹⁷ This mindset continued for hundreds of years, and as a result, Pennsylvania suffered continuous wetland loss from the 1800s into the late 20th century.¹¹⁸ Since the 1970s, increasing awareness of the value of wetlands and changes to government policy have slowed wetlands loss,¹¹⁹ but the damage has already been done. More than 65% of the wetlands that existed in Pennsylvania in 1780 are now gone.¹²⁰

The Benefits of Wetlands

Wetlands’ contributions to the ecosystem are far out of proportion to the area they cover.¹²¹ Wetlands support an immense variety of microbes, plants, insects, amphibians, reptiles, birds, fish, and mammals, and they are among the most productive ecosystems in the world, comparable to rain forests

¹¹⁴ 25 Pa. Code §§ 78a.1, 92a.2, 93.1, 105.1.

¹¹⁵ Pa. Dep’t of Env’t Prot., *Net Gain Strategy*, <https://www.pa.gov/agencies/dep/programs-and-services/water/bureau-of-waterways-engineering-and-wetlands/stream-and-wetland-regulatory-program/regulations-and-laws/net-gain-strategy>; Schmid & Co., Inc., THE EFFECTS OF CONVERTING FOREST OR SCRUB WETLANDS TO HERBACEOUS WETLANDS IN PENNSYLVANIA 2 (2014).

¹¹⁶ Thomas E. Dahl, U.S. Dep’t of Interior U.S. Fish and Wildlife Serv., REPORT TO CONGRESS: WETLANDS LOSSES IN THE UNITED STATES 1780’S TO 1980’S at 6 (1990).

¹¹⁷ *Id.* at 2; Thomas E. Dahl & Gregory J. Allord, *History of Wetlands in the Coterminous United States* in NATIONAL WATER SUMMARY ON WETLAND RESOURCES 19, 19 (Judy D. Fretwell, John S. Williams, and Phillip J. Redman, compilers, 1996).

¹¹⁸ Dahl & Allord, *supra* note 117, at 24.

¹¹⁹ *Id.*

¹²⁰ Dahl, *supra* note 116, at 6. (with updated current wetland acreage from <https://www.pa.gov/agencies/dep/programs-and-services/water/bureau-of-waterways-engineering-and-wetlands/stream-and-wetland-regulatory-program/regulations-and-laws/net-gain-strategy>).

¹²¹ Schmid & Co., Inc., *supra* note 115, at 2.

and coral reefs.¹²² More than half of the United States' threatened and endangered species use wetlands at some point in their life cycle, and one-third live only in wetlands.¹²³ In Pennsylvania, even though wetlands account for only 1.5% of the land surface, thirty-two of our 41 native amphibian species (78%) and eleven of our 38 reptile species (29%) spend the majority of their lives in wetlands.¹²⁴ More than 120 species of birds in Pennsylvania spend at least part of their life cycle in wetlands, including 10 of the 17 state endangered or threatened species.¹²⁵ Mammals like beaver, otter, and muskrat also make wetlands their home.

In addition to providing habitat for wildlife, wetlands provide extensive benefits for humans. In times of high rainfall, wetlands slow and stop stormwater runoff, which reduces harmful downstream flooding and erosion and allows water to percolate through the soil to recharge the ground and surface waters that provide our drinking water.¹²⁶ What's more, wetlands also improve water quality. Often referred to as the kidneys of the earth, wetlands act as a giant filtering system that traps pollutants and purifies water, reducing the amount it costs to treat water to make it safe for drinking.¹²⁷ Wetlands also provide areas for humans to recreate in the outdoors and support many of the fish and game species prized by Pennsylvania hunters and anglers.¹²⁸

Even when wetlands seem like they are too small or isolated to have much of an effect on the larger water system, research shows that even "isolated" wetlands are not isolated at all, but are linked to regional water systems through groundwater.¹²⁹ Wetlands are often involved in the underground exchange



¹²² U.S. Env't Prot. Agency, *Why are Wetlands Important?*, <https://www.epa.gov/wetlands/why-are-wetlands-important>.

¹²³ *Id.*

¹²⁴ Pa. Dep't of Env't Prot., Fact Sheet: Wetlands: Functions at the Junctions (2003); see Pa. Fish and Boat Comm'n, Pennsylvania Native Reptile and Amphibian Species, <https://www.pa.gov/agencies/fishandboat/conservation/species-management/reptiles-and-amphibians/pa-native-species> (updated species counts).

¹²⁵ Pa. Dep't of Env't Prot., *supra* note 124.

¹²⁶ Meyer, et al., *supra* note 21, at 11.

¹²⁷ Michaela Galeski, *What's in a Wetland?*, Fontenelle Forest, <https://fontenelleforest.org/whats-in-a-wetland/>.

¹²⁸ 25 Pa. Code. 105.1(d)(3).

¹²⁹ Meyer, et al., *supra* note 21, at 9.

of water by storing and releasing water into groundwater, where it later resurfaces as springs that feed streams.¹³⁰ If these connections are broken or disrupted, streams, rivers, and wells can run dry.¹³¹ “Isolated” wetlands are also an important link in the larger system of wildlife habitat; many animals, from aquatic insects to raccoons, routinely move between land-locked wetlands, streamside wetlands, and stream channels.¹³² The loss of these wetlands not only decreases habitat availability for this wildlife, but increases travel distances among remaining wetlands, thus making it more difficult for wildlife to migrate and spread out and to increase the genetic variation between individuals in the breeding population.¹³³

Why Protecting Wetland Buffer Areas Is Essential

Protecting the riparian area around wetlands is just as important as protecting wetlands themselves. The functions that any given wetland is capable of performing depend on both the characteristics of the wetland itself and of the surrounding area.¹³⁴ Wetlands are a balanced ecosystem that depends on the presence of some, but not too much, water. Disturbances to the land outside a wetland can have major impact on how water moves in and out of the wetland, profoundly altering its ecosystem by draining or flooding it.¹³⁵ In addition, altering light and wind by removing the surrounding forest can cause a major change in the plants and animals that can survive in a wetland.¹³⁶ Intact buffers are also important to the wildlife species that depend on both wetlands and the surrounding uplands throughout their life cycle.¹³⁷ For example, certain aquatic insects, frogs, salamanders, and beavers spend time in wetlands, but also range into the adjoining uplands for distances of many hundreds of feet over the course of a day or of their lives.¹³⁸ Some animals use different parts of the aquatic environment at different points in their life cycle and need overland connections between wetlands and larger waterways.¹³⁹ If the adjacent lands are stripped of trees, paved, or cut off from the wetland by a road or fence, the wetland habitat can become useless to such creatures.¹⁴⁰

For all these reasons, maintaining the many functions that wetlands serve depends on both a healthy riparian buffer on the border of the wetland and on corridors that connect geographically isolated wetlands.¹⁴¹ States like New York and New Jersey have long considered the preservation of buffer areas adjacent to wetlands to be an essential part of protecting wetlands’ functions and values. The absence of statewide wetland buffers regulations in Pennsylvania leaves our wetlands at risk of unavoidable degradation unless municipalities step in to protect these resources.¹⁴²

¹³⁰ *Id.* at 11.

¹³¹ *Id.*

¹³² *Id.* at 9.

¹³³ Env’t Law Inst., *supra* note 76, at 10; Chase, Deming & Latawiec, *supra* note 18, at 2.4.1.

¹³⁴ Schmid & Co., Inc., *supra* note 115, at 8.

¹³⁵ *Id.* at 10.

¹³⁶ *Id.*

¹³⁷ Chase, Deming & Latawiec, *supra* note 18, at 2.3.2.

¹³⁸ Schmid & Co., Inc., *supra* note 115, at 10.

¹³⁹ Meyer, et al., *supra* note 21, at 9.

¹⁴⁰ Schmid & Co., Inc., *supra* note 115, at 10.

¹⁴¹ Meyer, et al., *supra* note 21, at 9.

¹⁴² Schmid & Co., Inc., *supra* note 115, at 10.

THE IMPORTANCE OF RIPARIAN BUFFERS IN HEADWATER AREAS

Why Headwater Streams and Wetlands Matter

Headwaters are small streams that carry water from the upper reaches of a watershed to the main channel of a stream or river. These waters are rarely named and are often so small that a child can step across them with ease.¹⁴³ Some may even be intermittent streams that flow during wet seasons but shrink or disappear in dry times.¹⁴⁴ Small as these streams may be, when they are impacted, effects are felt throughout the stream network.¹⁴⁵

Headwaters serve many important functions. Water flows more slowly in these small, narrow streams, and this slower moving water is more likely to seep into the stream's bed and banks and to re-



charge groundwater instead of rushing downstream.¹⁴⁶ This maintains stream flow during dry seasons and reduces the intensity and frequency of floods in times of high water.¹⁴⁷ In their natural state, small streams are good at this job and can absorb significant amounts of rainwater and runoff.¹⁴⁸ However, when the natural landscape is altered, runoff can exceed the stream's capacity and lead to downstream flooding.¹⁴⁹

Headwaters also perform a disproportionate amount of nutrient removal. In headwater streams, more water is in direct contact with the ground surface, where most nutrient processing takes place. Bacteria, fungi, and other microorganisms living on the bottom of a stream consume nitrogen and phosphorus and convert them into less harmful, more biologically beneficial compounds.¹⁵⁰

This is true for wetlands as well. One study found that wetlands associated with headwater streams were responsible for 90 percent of wetland phosphorus removal in eight northeastern watersheds.¹⁵¹ If these nutrients are instead allowed to travel downstream to larger streams in large quantities, those streams cannot remove them as efficiently, which can lead to harmful algal blooms (see page 9).¹⁵²

Like other nutrients, carbon is an element that is essential to life but can be harmful to freshwater ecosystems if there is too much of it or it is in the wrong chemical form.¹⁵³ If all the organic material that entered headwater streams, such as leaves, branches, and the bodies of dead animals, went directly downstream, the overabundance of decomposing material could deplete oxygen in downstream rivers, damaging and even killing fish and other aquatic life.¹⁵⁴ Small streams and wetlands are very efficient at breaking down these organic carbon compounds and converting them to useable nutrients, more so than larger streams.¹⁵⁵ The nutrients created by this process are then taken up by the aquatic insects,

¹⁴³ Pa. Land Trust Ass'n, *supra* note 32, at 5.

¹⁴⁴ Meyer, et al., *supra* note 21, at 6–7.

¹⁴⁵ *Id.* at 10.

¹⁴⁶ *Id.*

¹⁴⁷ *Id.* at 6.

¹⁴⁸ *Id.* at 10.

¹⁴⁹ *Id.*

¹⁵⁰ *Id.* at 14.

¹⁵¹ *Id.* at 15.

¹⁵² *Id.* at 14.

¹⁵³ *Id.* at 15.

¹⁵⁴ *Id.*

¹⁵⁵ Pa. Land Trust Ass'n, *supra* note 32, at 5; Pa. Land Trust Ass'n & Brandywine Conservancy, *supra* note 98, at 5; Meyer, et al., *supra* note 21, at 16.

which are remarkably abundant in these headwater zones.¹⁵⁶ These insects become food for larger animals like fish and birds.¹⁵⁷ In this way, headwater streams and wetlands both store and process organic matter in ways that control the release of carbon to downstream lakes and rivers and provide food and fuel for downstream species and ecosystem processes.¹⁵⁸

Headwater streams also offer an enormous array of habitats for plants, animals, and microbial life. These small freshwater systems provide shelter, food, protection from predators, spawning sites, nursery areas, and travel corridors through the landscape.¹⁵⁹ They also provide habitat for distinct plant and animal communities due to their cool microclimate and are primary production areas for food and fuel that are essential to the health of the entire aquatic system.¹⁶⁰ In particular, the aquatic insect community is “remarkably abundant” in headwater zones, which plays a vital role in downstream ecosystems.¹⁶¹ Headwater streams also act as a temporary refuge for species that live in rivers during most of their lives but need smaller streams during specific life-history stages and critical periods of the year, such as warm summer months.¹⁶²

How Riparian Buffers Benefit Headwater Streams

Headwater streams cannot fully function and provide all these benefits without a forested riparian buffer along their banks. Wildlife in headwater areas is usually adapted to cold water and, therefore, relies on the cooling effects of riparian trees.¹⁶³ Because the streams are small, riparian trees have relatively greater impact by providing better shade and temperature control, more stable and diverse habitat, and greater diversity and abundance of food.¹⁶⁴ Removing a forested buffer from the banks of these small, heavily shaded streams and wetlands will have a much greater impact on water temperature and aquatic habitat throughout the watershed than removing vegetation from larger rivers, where only a fraction of the water is shaded.¹⁶⁵ Studies in Pennsylvania have shown that when the forest surrounding headwaters is replaced by meadows or lawns, increased sunlight promotes grass growth along stream banks. The grasses trap sediments and narrow the stream channel to one-third of the original width, which reduces the amount of streambed available for nutrient processing. As a result, nitrogen and phosphorus travel downstream five to ten times farther, increasing risks of downstream eutrophication.¹⁶⁶

All of this means that, if land uses change near headwater streams and riparian buffers are not maintained, effects are multiplied throughout the stream network.¹⁶⁷ Rivers and lakes downstream from degraded headwater streams and wetlands may have less consistent flow, more algal growth, more frequent and/or higher floods, poorer water quality, and less diverse flora and fauna.¹⁶⁸ Even the best buffers along these larger rivers and streams cannot significantly improve water that has already been degraded.¹⁶⁹ In conclusion, maintaining and protecting forested riparian buffers, though important throughout a watershed system, is most critical at the very “top” of the watershed system along the smallest headwater streams.¹⁷⁰

¹⁵⁶ Pa. Land Trust Ass’n, *supra* note 32, at 5; Pa. Land Trust Ass’n & Brandywine Conservancy, *supra* note 98, at 5.

¹⁵⁷ Pa. Land Trust Ass’n, *supra* note 32, at 5.

¹⁵⁸ Pa. Land Trust Ass’n & Brandywine Conservancy, *supra* note 98, at 1; Meyer, et al., *supra* note 21, at 15.

¹⁵⁹ Meyer, et al., *supra* note 21, at 4.

¹⁶⁰ Pa. Land Trust Ass’n, *supra* note 32, at 6; Pa. Land Trust Ass’n & Brandywine Conservancy, *supra* note 98, at 1.

¹⁶¹ Pa. Land Trust Ass’n & Brandywine Conservancy, *supra* note 98, at 5.

¹⁶² Pa. Land Trust Ass’n, *supra* note 32, at 5.

¹⁶³ *Id.*

¹⁶⁴ Pa. Land Trust Ass’n & Brandywine Conservancy, *supra* note 98, at 4–5.

¹⁶⁵ Hawes & Smith, *supra* note 2, at 11.

¹⁶⁶ Meyer, et al., *supra* note 21, at 14.

¹⁶⁷ *Id.* at 10.

¹⁶⁸ *Id.* at 5.

¹⁶⁹ Pa. Land Trust Ass’n, *supra* note 32, at 5; Hawes & Smith, *supra* note 2, at 11.

¹⁷⁰ Pa. Land Trust Ass’n & Brandywine Conservancy, *supra* note 99, at 2.

BUFFER RECOMMENDATIONS

Scientific Studies on Buffer Widths

The width needed for a riparian buffer to be effective depends on the functions, or eco-services, it is meant to deliver as well as other factors such as soil composition and ground slope.¹⁷¹ Because every location is different, and there are many factors at play, it is difficult for scientists to make generalized statements about how wide a riparian buffer should be. However, there are a number of studies that have explored the relationship between buffer widths and composition and certain specific benefits. These studies provide a strong basis for concluding that, in general, the wider and more varied the plant life in a buffer, the more beneficial it will be. Below is a short summary of these studies, organized by the buffer benefit studied.

Flood Control

If buffers are to provide adequate flood control, they must be at least 65 feet and up to 500 feet.¹⁷²

Sedimentation Control

When it comes to removing sediment and the pollutants attached to sediment particles, one study showed that buffers 10 m (33 ft) wide can trap about 65% of the sediment carried by stormwater runoff, while buffers 30 m (108 ft) wide trap about 85%.¹⁷³ A separate study showed that a 50 m (164 ft) wide buffer removed 94% of sediment from runoff.¹⁷⁴ Buffers on the upper end of this range are also especially effective at capturing finer silts and clays (the smallest sediment particles), which narrow buffers can release in concentrations high enough to impair water quality.¹⁷⁵

Removal of Nutrients and Other Pollutants

A buffer's ability to remove dissolved nitrogen, which does not attach to sediment particles, depends on several factors, including topography, soil depth and texture, and the rate of subsurface water entering the buffer (flux).¹⁷⁶ One study concluded that, for a site with average water flux, a 30 m (108 ft) buffer removed only 48% of dissolved nitrogen entering the buffer while a 100 m (330 ft) buffer removed 90%.¹⁷⁷ Buffer widths needed to filter pesticides out of the water range from 49 feet to 328 feet.¹⁷⁸



¹⁷¹ Pa. Land Trust Ass'n, *supra* note 32, at 1.

¹⁷² Hawes & Smith, *supra* note 2, at 5, Appx. 2.

¹⁷³ Sweeney & Newbold, *supra* note 46, at 569.

¹⁷⁴ Hawes & Smith, *supra* note 2, at 8.

¹⁷⁵ Sweeney & Newbold, *supra* note 46, at 569.

¹⁷⁶ Pa. Land Trust Ass'n & Brandywine Conservancy, *supra* note 98, at 2.

¹⁷⁷ Sweeney & Newbold, *supra* note 46, at 566.

¹⁷⁸ Hawes & Smith, *supra* note 2, at 5.

Water Temperature

Buffers of at least 100 feet are generally needed to control water temperature. Only at this width are waterways fully protected from measurable temperature increases, allowing macroinvertebrate and fish communities to thrive.¹⁷⁹ In fact, buffers may need to be up to 230 feet to completely control stream temperature, depending on the size of the channel and the type of vegetation in the buffer.¹⁸⁰

Habitat Protection

If a buffer is meant to protect all ecological functions, such as providing terrestrial wildlife habitat and supporting species diversity, it must be wider than a buffer intended only to provide water quality services.¹⁸¹ A generally accepted minimum width to provide adequate protection for semi-aquatic and terrestrial wildlife is 300 feet, but certain species such as bald eagles, herons, and cavity nesting ducks may require up to 600 feet.¹⁸² Forest dependent songbirds also need wide buffers. Several studies have shown that the species richness of these birds increases in buffers that are at least 100 meters (330 feet) wide and that the presence of forest dependent songbirds decreases dramatically when buffers are less than 50 meters (164 ft).¹⁸³

Preservation of Buffers Over Time

A buffer's ability to perform its functions may diminish over time due to saturation with sediment and nutrients.¹⁸⁴ This is a bigger problem with smaller buffers than with wider ones.¹⁸⁵ One study of 21 established buffers in Washington State found that 76% of them were negatively altered over time, with smaller buffers suffering the most.¹⁸⁶ Nearly all buffers of less than 50 feet showed a significant decrease in effective size within a few years, and in some cases, degradation was so great that the buffer's benefits were effectively eliminated.¹⁸⁷ By contrast, fewer than half of the buffers that were originally 50 feet wide or more were noticeably degraded.¹⁸⁸

PADEP and Environmental Law Institute Recommendations

PADEP

The **Pennsylvania Department of Environmental Protection (PADEP)** is the state agency responsible for protecting Pennsylvania's air, land, and water through enforcement of the state's environmental laws. PADEP's Bureau of Clean Water protects and preserves our over 86,000 miles of streams and lakes by establishing water quality standards, performing water quality monitoring and assessment, permitting and inspecting facilities and activities that affect water quality, and enforcing water quality regulations.¹⁸⁹ PADEP also publishes guidance documents to help people understand and meet the requirements of environmental laws, including those related to riparian buffers.

¹⁷⁹ Sweeney & Newbold, *supra* note 46, at 572.

¹⁸⁰ Hawes & Smith, *supra* note 2, at 5.

¹⁸¹ Env't Law Inst., *supra* note 76, at 20.

¹⁸² Connecticut River Joint Comm'n *supra* note 67, at 4.

¹⁸³ Pa. Land Trust Ass'n, *supra* note 32, at 4.

¹⁸⁴ James M. McElfish, Jr., Rebecca L. Kihlslinger & Sandra Nichols, *Setting Buffer Sizes for Wetlands*, 30 NAT'L WETLANDS NEWSLETTER 6, 7 (2008).

¹⁸⁵ *Id.*

¹⁸⁶ *Id.*

¹⁸⁷ Andrew J. Castelle, et al., Washington State Dep't of Ecology, WETLAND BUFFERS: USE AND EFFECTIVENESS 11 (1992).

¹⁸⁸ *Id.*

¹⁸⁹ Pa. Dep't of Env't Prot., Bureau of Clean Water, <https://www.pa.gov/agencies/dep/programs-and-services/water/clean-water>.

The Pennsylvania Department of Environmental Protection advises that a minimum buffer width of 150 feet is needed for waters designated as Exceptional Value or High Quality, and that other waters need a minimum 100-foot buffer.¹⁹⁰ It further advises that this width should be extended:

- In areas known to be sources of sediment;
- In areas of known high nutrient content or where fertilizer, manure, or animal waste or sludge application occurs;
- Where there are steep slopes or soils of very low permeability or high erosion potential;
- Where the specific goals, conditions, and evidence indicate that additional width is necessary to achieve desired environmental functions and benefits.¹⁹¹

Based on the majority of scientific findings, the Environmental Law Institute recommends riparian buffers of at least of 25 meters (82 feet) to provide nutrient and pollutant removal; a minimum of approximately 30 meters (98 feet) to provide temperature and microclimate regulation and sediment removal; a minimum of 50 meters (164 feet) to provide leaf litter for stream habitat and bank stabilization; and over 100 meters (330 feet) to provide for wildlife habitat functions.¹⁹²

The Environmental Law Institute

The Environmental Law Institute is a nonprofit organization based in Washington D.C. that conducts research, develops policy, and educates the public about law, policy and critical environmental issues of the day.

Composition, Location and Use of Buffers

A buffer's effectiveness depends on its location on the landscape as well as its width.¹⁹³ As discussed above, buffers are particularly important around headwater streams and wetlands. In addition, buffers are most effective when they are connected together and provide travel corridors for wildlife to move through the landscape. To serve as safe travel corridors, buffers should be connected to other protected areas and valuable wildlife habitats.¹⁹⁴ Therefore, it is more beneficial to create continuous, connected buffers throughout a waterbody or system, even if they are relatively narrow, than it is to create wider but disjointed buffers.¹⁹⁵

Achieving maximum benefits from riparian buffers also depends on excluding major sources of disturbance and contamination from the buffer zone. This includes things like heavy construction/earth disturbance, impervious surfaces, logging roads, forest clear cutting, mining, septic tank drain fields, agriculture and livestock, waste disposal sites, and application of pesticides and fertilizers.¹⁹⁶

¹⁹⁰ Pa. Dep't of Env't Prot., Bureau of Watershed Mgmt., *supra* note 1, at 10.

¹⁹¹ *Id.*

¹⁹² Env't Law Inst., *supra* note 76, at 20.

¹⁹³ Chase, Deming & Latawiec, *supra* note 18, at 2.4.1.

¹⁹⁴ *Id.*

¹⁹⁵ Hawes & Smith, *supra* note 2, at 11; Env't Law Inst., *supra* note 76, at 20.

¹⁹⁶ Env't Law Inst., *supra* note 76, at 21.

PRACTICAL CONSIDERATIONS

Local buffer regulations should be science-based, but they also must be capable of administration by local officials. Municipalities may take one of two approaches: variable-width or fixed-width buffers. Variable width models take into account multiple factors such as slope, erodibility, and infiltration rates and apply different buffer width requirements in different situations.¹⁹⁷ This approach closely tracks what science tells us about buffers—that the width needed depends on many factors—but it is difficult to implement because it requires municipalities and landowners, who are often laypeople, to have or obtain technical expertise in mapping soils, determining slopes, etc. The logistics, legal implications, and enforcement difficulties of different buffer widths throughout a municipality further complicates such an approach.¹⁹⁸

Uniform-width buffers are the preferred choice of most state and local governments because they are easier to enforce; require less specialized knowledge, time, and resources to administer; and allow for greater regulatory predictability.¹⁹⁹ However, if a uniform buffer width is to be applied across a municipality, care must be taken to select the appropriate width for the resources being targeted and the local landscape.²⁰⁰ Municipalities should consider factors such as the existing quality of waterbodies, the rarity or uniqueness of the municipality's surface water features and ecosystem, and the extent of existing and likely development in an area. If a fixed buffer width is chosen, it should be on the conservative side to provide leeway for variations in slope and soil type across the municipality.²⁰¹ Allowing for variances or waivers from the generally-applicable width is a way to ensure that it can be adjusted when circumstances warrant.



¹⁹⁷ Hawes & Smith, *supra* note 2, at 8.

¹⁹⁸ Chase, Deming & Latawiec, *supra* note 18, at 4.1.

¹⁹⁹ Env't Law Inst., *supra* note 76, at 20.

²⁰⁰ Hawes & Smith, *supra* note 2, at 8.

²⁰¹ *Id.*

PENNFUTURE'S MODEL RIPARIAN BUFFER ORDINANCES

PennFuture suggests a multi-pronged approach to riparian buffer protection that incorporates storm water management ordinance (SWMO) provisions and zoning ordinance provisions. The model ordinance language can be found in Appendix A.

Our approach is explained in more detail below.

Explanation of Storm Water Management Ordinance (SWMO) Provisions.

Storm Water Management Ordinances

The Storm Water Management Act is a state law in Pennsylvania that encourages coordinated planning and management of stormwater runoff in each watershed. This law requires counties to create plans for controlling and managing stormwater runoff and requires municipalities to adopt ordinances that are consistent with those plans. In most municipalities, this ordinance is called a storm water management ordinance or SWMO. These ordinances typically address things like the process for getting a permit for storm water discharge, what information has to be submitted to get a permit, the design requirements for stormwater management facilities, and who is responsible for maintaining those facilities. Many SWMOs include riparian buffer requirements as part of the overall scheme to manage storm water runoff in the municipality.

Applicability

In general, the proposed SWMO would apply whenever a person builds a structure such as a building, driveway, or parking lot or does any activity that disturbs the surface of the earth. This is because all such activities have the potential to cause harmful impacts to water resources. However, certain activities are completely exempted from the SWMO because they are so thoroughly regulated at the state level that municipalities are prohibited from creating their own requirements on top of what the state requires. These include mining, oil and gas operations, storage and handling of animal manure, and public utilities. For these activities, state law will dictate if and how large of a buffer may be required. The SWMO also does not apply to low-impact activities that must occur near water like docks and boat launches and stream restoration projects.

Recommended Buffer Widths

PennFuture's model SWMO contains three different buffer width requirements. The first applies to large projects that will have a significant impact on water resources. This includes any project that will result in 50,000 square feet or more of new impervious surface. For these activities, a 150-foot buffer must be provided around all streams, rivers, lakes, and ponds, and around wetlands and vernal pools larger than 5,000 square feet. The suggested buffer width for these activities is 150 feet because science supports this as the width at which maximum stormwater management and water quality benefits are achieved. Very small wetlands and vernal pools are exempted from this requirement to avoid imposing restrictions that may be out of proportion to the benefits provided by these resources.

The second requirement applies to medium-sized projects: Those that will result in 20,000 square feet or more of impervious surface (except for residential construction that meets certain requirements) and any other activity that will disturb 1 acre or more of land, regardless of whether any structures are

built. For these activities, a 100-foot buffer must be provided around all streams, rivers, lakes, and ponds, and around wetlands and vernal pools larger than 5,000 square feet. The suggested buffer width for these activities is 100 feet because this width appropriately balances water quality benefits and the burden on property owners for projects of this size.

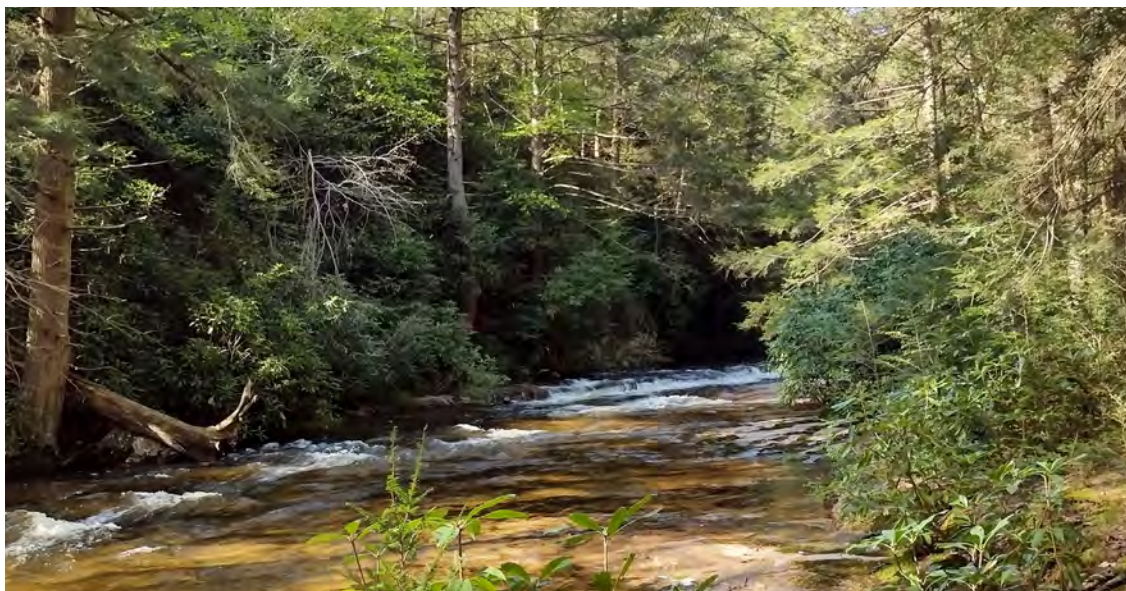
For all activities that do not meet the threshold for a 150-foot or a 100-foot buffer, the proposed SWMO requires a 50 foot buffer. This provision is intended to serve as a backstop to protect surface waters from harmful impacts even when a larger buffer may not be warranted. The required buffer width is smaller, but it applies to nearly all surface waters and all land uses and activities. This ensures at least minimally-adequate buffer protection even where a larger buffer is not necessary. The 50-foot width was chosen based on scientific research showing that 50 feet is the minimum width necessary to prevent degradation of surface waters and provide any meaningful benefit.

Because buffers are less effective in areas of steep slope, the ordinance also requires that the required buffer width be increased where the slope of the riparian area exceeds 10%. The amount of additional buffer width required increases as the steepness of the slope increases.

Requirement to Establish Riparian Forest Buffer

For most activities covered by the SWMO, the person conducting the activity needs only to maintain the required riparian buffer area in the existing condition, whatever that may be; they do not have to change or improve the vegetation already present. However, very large projects—those resulting in 100,000 square feet or more of impervious surface—are required to maintain or establish a riparian forest buffer. This enhanced requirement is to ensure that projects with the greatest potential to disrupt the natural hydrological scheme provide a greater level of protection against those impacts.

For purposes of the ordinance, a riparian forest buffer is defined as a riparian buffer that consists mainly of native trees and shrubs and provides a minimum of 60% canopy cover. Persons constructing projects that meet the 100,000 square foot threshold are required to establish a 150-foot riparian forest buffer by either supplementing the vegetation in an existing vegetated buffer or by planting new vegetation that satisfies the 60% canopy cover requirement. The person also must submit a riparian buffer management plan prepared by a professional that includes the planting plan for converting or establishing the riparian forest buffer, a maintenance schedule, an inspection schedule, and measures to ensure long term functioning of the riparian forest buffer.



Uses Permitted In Riparian Buffer

The proposed SWMO divides all required buffers, whether comprised of existing vegetation or a newly-established riparian forest, into an inner and an outer buffer. The purpose of dividing the buffer in this way is to provide maximum protection for the critical buffer area closest to the water while allowing reasonable flexibility to conduct certain low-impact activities in areas farther from the water. The activities permitted in the inner buffer are very limited, but the activities permitted in the outer buffer are less so.

Where a 100-foot or 150-foot buffer is required, the inner buffer is defined as the fifty (50) feet closest to the water's edge. Where only a 50-foot buffer is required, the entire buffer is treated as an "inner" buffer. To ensure that this critical area adjacent to the water stays intact and is able to provide maximum stormwater management benefits, activities permitted in the inner buffer are very limited. They include maintenance and restoration activities; correction of hazardous conditions; passive uses such as trails,

wildlife sanctuaries, and nature preserves; areas for scientific study; and water obstructions and encroachments permitted by DEP. No other activities are allowed in the inner buffer, and any disturbance to the inner buffer created by the permitted activities must be minimized to the greatest extent possible.

Where a 100-foot or 150-foot buffer is required, the outer buffer consists of the remaining 50 or 100 feet. To preserve the integrity of the buffer and ensure it is able to deliver stormwater management benefits, activities permitted in this area are still limited. However, in order to appropriately balance the benefits of the outer buffer area against the limitations on the use of private property, the activities permitted in the outer buffer are somewhat broader than those permitted in the inner buffer. These activities include plant nurseries and orchards, accessory uses for residential purposes, stormwater facilities covered by a valid permit, trails, and sustainable forestry. Up to 20% of the outer buffer may be disturbed for these uses or activities.



Maintenance

In order to ensure that the stormwater management benefits provided by the riparian buffer are not lost over time, the SWMO requires certain maintenance activities. These include protecting existing native vegetation, removing invasive vegetation whenever practicable, preventing the development of concentrated stormwater flow pathways in and immediately adjacent to the buffer, and excluding live-stock from the buffer area.

Waivers

The SWMO sets forth circumstances where a municipality may waive its requirements. These are limited to situations where a waiver is required to enable the reasonable use of the property, where the proposed activity is reasonably necessary to serve a public need and no feasible alternative is available, and where the proposed activity consists of repair or maintenance of public improvements. The waiver provisions are designed as a "safety valve" to prevent the SWMO's requirements from being unfairly imposed when they would amount to an unlawful taking of private property, or where the benefits provided by the riparian buffer are outweighed by a more important public concern.

Explanation of Zoning Ordinance Provisions

Riparian Buffer Overlay District

This optional section is designed to provide maximum protection for certain, targeted riparian buffer areas that a municipality identifies as having exceptional ecological value. A municipality choosing to create such an overlay district would identify a limited number of stream corridors, wetlands, or other surface water resources that warrant this level of protection and craft an overlay district that covers these areas only. Because the benefits of riparian buffer widths in excess of 150 feet are related to wildlife habitat for semi-aquatic and terrestrial wildlife, the overlay should target areas that serve as important habitat or travel corridors for these species.

The suggested overlay district requires a 300-foot buffer around the selected surface waters, comprised of an inner and an outer buffer, similar to those required by the SWMO. The total buffer width of 300 feet was chosen because most wildlife habitat benefits can be achieved at this width, and the additional benefits of a width beyond this likely do not outweigh the burden to landowners. However, in some circumstances a wider buffer may be warranted. The width of the inner buffer is kept at 50 feet to provide consistency between the overlay and the SWMO ordinances and to avoid confusion or ambiguity where an activity is subject to multiple sets of requirements. The remaining 250 feet are designated as outer buffer. Limited disturbance of this area is permitted for a limited number of uses/activities, consistent with the requirements for an outer buffer in the SWMO.

Existing Uses and Structures

When a landowner is using their land for a lawful purpose and a new ordinance comes along that would restrict that use or make it unlawful, the landowner has a vested, constitutional right to continue the existing use and to expand it within reasonable bounds, notwithstanding the new ordinance.²⁰² When this is the case, the only way a municipality can force a landowner to give up the use is if the use is a nuisance, the owner abandons it, or the government takes the property by eminent domain.²⁰³ Because the constitution requires it, PennFuture's proposed SWMO ordinance exempts any activity or structure lawfully existing on the date the ordinance is adopted. These uses would only become subject to the SWMO if the owner abandons them for a year or more or expands them beyond a reasonable amount (defined by the ordinance as 20% of the existing land coverage). Existing uses affected by the riparian buffer overlay district would be protected by the municipality's existing zoning ordinance provisions for nonconforming uses.

Why the SWMO and Zoning Ordinance? Why Not SALDO?

PennFuture chose to place the "core" buffer protections within the SWMO for several reasons. First, the benefits provided by buffers of up to 150 feet in width are primarily (though not exclusively) related to water quality and the mitigation of harmful impacts related to uncontrolled stormwater runoff. This makes the SWMO the logical home for these provisions. In addition, a SWMO may regulate activities that cause earth disturbance and, consequently, harmful stormwater impacts, but that may not fall within the purview of a zoning ordinance. These include activities such as grading, excavation, or moving soil or rock. Placing the buffer provisions within the SWMO allows the municipality to apply them to

²⁰² *Silver v. Zoning Bd. of Adjustment*, 255 A.2d 506, 508 (Pa. 1969); *Eitnier v. Kreitz Corp.*, 172 A.2d 320, 323 (Pa. 1961); *Dunbar v. Zoning Hearing Bd.*, 144 A.3d 219, 225 (Pa. Cmwlth. 2016); *Hunterstown Ruritan Club v. Straban Twp. Zoning Hearing Bd.*, 143 A.3d 538, 545 (Pa. Cmwlth. 2016); *Foreman v. Union Twp. Zoning Hearing Bd.*, 787 A.2d 1099, 1103 (Pa. Cmwlth. 2001).

²⁰³ *Dunbar*, 144 A.3d at 225.



these activities. Finally, placing these provisions in a SWMO, not a zoning ordinance, enables a municipality to use a waiver standard that differs from the standard for granting a variance, which is the only permissible standard for “waiving” the provisions of a zoning ordinance. This allows for a standard more closely tailored to this type of regulation.

The suggested zoning ordinance provisions also include a Riparian Buffer Overlay District to be incorporated into a municipality’s zoning ordinance. The zoning overlay concept was used here because it allows for restrictions to be applied in a specific geographical location in a way that is more difficult to accomplish in a SWMO. In addition, the 300-foot buffer protection afforded by the overlay is aimed at wildlife habitat preservation more than stormwater management. An ordinance with this purpose is more properly contained within a municipality’s zoning ordinance, not the SWMO.

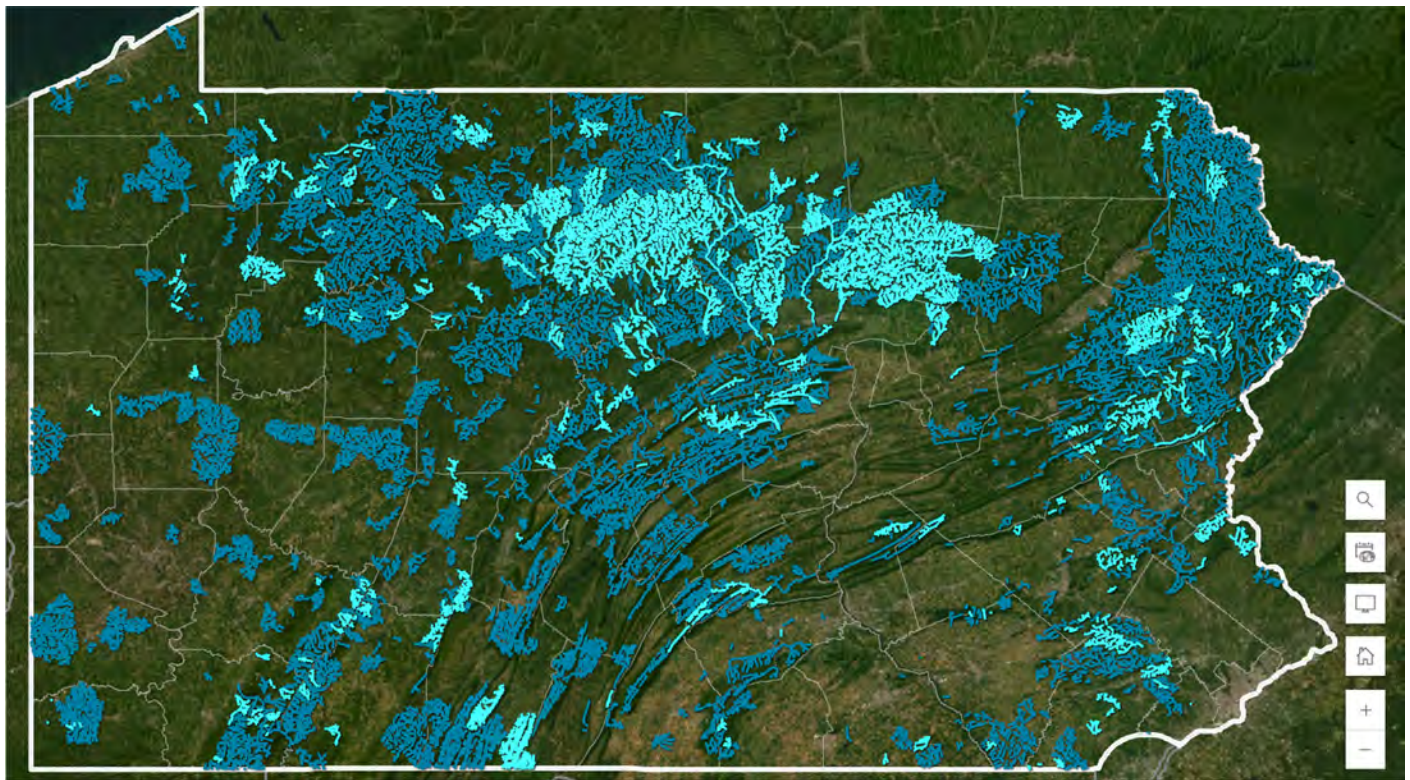
A municipality’s subdivision and land development ordinance (SALDO) is not the recommended home for these provisions. Municipalities only have the powers that are given to them by the state, and each type of ordinance has to be rooted in a specific authority that the state has spelled out in a statute. Article V of the MPC is the statute that authorizes and governs SALDOs, and it does not clearly give municipalities the authority to manage stormwater or protect environmental resources through that type of ordinance. The authority to do these things is more clearly given in the Storm Water Management Act, which authorizes SWMOs, and Article VI of the MPC, which authorizes and governs zoning ordinances.²⁰⁴

²⁰⁴ The Storm Water Management Act (as well as other statutes like the Second Class Township Code) authorizes municipalities to manage stormwater and control the harmful effects of uncontrolled runoff through SWMOs. Article VI of the MPC allows municipalities to use zoning ordinances to “promote, protect, and facilitate . . . the provision of a safe, reliable, and adequate water supply,” to “preserve the natural, scenic, and historic values of the environment,” and preserve forests, wetlands, aquifers, and floodplains.

WHAT ABOUT STATE REGULATIONS?

Municipal officials may believe that they do not have to worry about protecting riparian buffers because “DEP takes care of that.” It is true that state regulations in Pennsylvania require riparian buffers in some circumstances, but there are gaps in the statewide buffer protection scheme that municipalities must fill.

In general, state regulations require a 150-foot riparian buffer around certain waters whenever a person does construction or conducts some other type of activity that disturbs the land surface and requires a certain type of permit. However, this protection does not cover all situations. Most significantly, statewide regulations only require buffers around rivers, streams, lakes, ponds and reservoirs. They do **not** require buffers around wetlands. In addition, the statewide buffer protection applies only in what are known as Special Protection watersheds. These are the watersheds of streams and rivers that PADEP has designated as Exceptional Value (EV) or High Quality (HQ)—designations given to only the cleanest and most ecologically significant streams. As the below map of EV (light blue) and HQ (dark blue) streams shows, many watersheds are not included in this designation and thus are not protected under the state regulation.²⁰⁵



²⁰⁵ An interactive version of this map can be found at <https://dss.maps.arcgis.com/apps/mapviewer/index.html?webmap=875bff6572774bc894117c3117f39464>.

Finally, the statewide regulation does not apply to projects that do not require a permit under Chapter 102 of DEP's regulations. This means it does not apply to:

1. Construction activities involving less than one acre of earth disturbance;
2. Oil and gas activities involving less than 5 acres of earth disturbance;
3. Timber harvesting activities involving less than 25 acres of earth disturbance; and
4. Single family homes that are not part of a larger common plan of development where the parcel was acquired by the applicant prior to November 19, 2010.

Municipalities can enhance water protection by filling in some of the gaps in the state regulation. Most importantly, municipalities can provide buffer protections for wetlands and for streams other than Special Protection streams. In addition, municipalities may consider buffer widths of more than 150 feet where appropriate.

APPENDIX A

PennFuture’s Model Riparian Buffer Stormwater Management and Zoning Ordinances

[MUNICIPALITY]
[COUNTY NAME] COUNTY, PENNSYLVANIA
ORDINANCE NO. _____

**AN ORDINANCE OF THE [GOVERNING BODY] OF [MUNICIPALITY], PENNSYLVANIA,
TO AMEND THE [MUNICIPALITY] STORM WATER MANAGEMENT ORDINANCE¹ TO
PROVIDE REASONABLE CONTROLS GOVERNING THE CONSERVATION, MANAGEMENT,
DISTURBANCE, AND RESTORATION OF RIPARIAN BUFFERS.**

WHEREAS, The Storm Water Management Act, 32 P.S. § 680.1, et seq., and [Section 2704 of the Second Class Township Code]² authorize the [MUNICIPALITY] to enact storm water management ordinances to govern and regulate the planning, management, implementation, construction, and maintenance of storm water facilities;

WHEREAS, Article I, Section 27 of the Pennsylvania Constitution requires all municipalities to conserve and maintain Pennsylvania’s public natural resources, including pure water, for the benefit of all people, including generations yet to come;

WHEREAS, Riparian buffers adjacent to surface waters manage the effects of storm water runoff by controlling erosion and sedimentation, providing flood control, and removing pollutants.

NOW, THEREFORE, BE IT ORDAINED AND ENACTED, by the [GOVERNING BODY] of [MUNICIPALITY] as follows:

Section 1. Chapter XXX of the [MUNICIPALITY] Code of Ordinances, Storm Water Management³, is amended to add the following Article XXX, Riparian Buffers:

ARTICLE XXX – RIPARIAN BUFFERS⁴

§ XXX-XX – **Statement of Findings.** The [GOVERNING BODY] of [MUNICIPALITY] finds that:

- A. Inadequate management of accelerated stormwater runoff increases flood volumes and velocities, contributes to erosion and sedimentation, overtaxes the carrying capacity of streams and storm sewers, greatly increases the cost of stormwater management facilities, reduces groundwater recharge, threatens surface and ground water quality, and threatens public health and safety.
- B. The most cost-effective and environmentally advantageous way to manage stormwater runoff is through nonstructural project design, minimizing impervious surfaces, avoiding sensitive areas, and designing to topography and soils to maintain the natural hydrologic regime.
- C. Riparian buffers are a nonstructural means of managing storm water runoff that provide a myriad of benefits including stabilizing streambanks, shading surface waters, capturing and removing excess nutrients from runoff, serving as a barrier to prevent most pollutants from entering surface waters, and increasing the level of instream pollution processing.
- D. Riparian forest buffers are the only storm water management practice that can accomplish all of the following: capture and hold stormwater from the majority of Pennsylvania storms in a given year; infiltrate most of that water and/or transport it as shallow flow through soils where pollutant uptake and processing occurs; release excess storm flow evenly, further processing dissolved and particulate substances associated with it; sequester carbon at significant levels; improve the health of the surface water; and increase its capacity to process organic matter and nutrients.
- E. A minimum riparian buffer width of 50 feet is necessary to obtain meaningful stormwater management benefits.
- F. A riparian buffer width of width of 150 feet is necessary to obtain full stormwater management benefits.

¹ This is intended to be an amendment to the municipality’s existing storm water management ordinance (SMWO). The Storm Water Management Act requires municipalities to adopt a SWMO within six months after a county watershed storm water plan is adopted and approved by DEP.

² Omit if not a second class township.

³ Change this if this is not what the municipality calls the ordinance addressing storm water management.

⁴ Resources reviewed in preparation of this document include: DEP Document No. 394-5600-001, Riparian Forest Buffer Guidance (2010); Proposed Riparian Buffer Act, HB 1275 (2023 session); We Conserve PA model riparian buffer ordinance (2016); Monroe County Conservation District model stormwater management ordinance; Chester County model Act 167 Ordinance.

§ XXX-XX – **Definitions.** As used in this Article, the following terms shall have the meanings indicated below:⁵

Agricultural plowing or tilling: Earth disturbance activity involving the preparation and maintenance of soil for the production of agricultural crops. The term includes no-till cropping methods, the practice of planting crops with minimal mechanical tillage.⁶

Common plan of development: A plan for development in which is contemplated either:

- i. A single earth disturbance or construction activity; or
- ii. multiple separate and distinct earth disturbance and/or construction activities occurring as part of a coordinated project in a contiguous area under common ownership or control, whether at the same or different times.⁷

Canopy cover: the area of ground directly beneath the crowns of trees or woody vegetation as delineated by the vertical projection of crown perimeters, expressed as a percentage of total ground area.⁸

Earth disturbance activity: Any construction or other human activity which disturbs the surface of the land, including land clearing and grubbing, grading, excavations, embankments, land development, agricultural plowing or tilling, operation of animal heavy use areas, timber harvesting activities, road maintenance activities, oil and gas activities, well drilling, mineral extraction, and the moving, depositing, stockpiling, or storing of soil, rock or earth materials.⁹

Ephemeral stream: A stream or reach of stream that flows for less than one month per year in direct response to precipitation and which does not obtain flow from groundwater discharge. Commonly used names for ephemeral streams include stormwater channel, drain, swale, gully, hollow, saddle, and “dry streams.”

Floodplain: The lands adjoining a river or stream that have been or may be expected to be inundated by flood waters in a 100-year frequency flood.

High tunnel: A structure which meets the following:

- iii. Is used for the production, processing, keeping, storing, sale or shelter of an agricultural commodity as defined in Section 2 of the Act of December 19, 1974 (P.L. 973, No. 319), known as the “Pennsylvania Farmland and Forest Land Assessment Act of 1974” or for the storage of agricultural equipment and supplies; and
- iv. Is constructed consistent with all of the following:
 - a. Has a metal, wood or plastic frame;
 - b. When covered, has a plastic, woven textile, or other flexible covering; and
 - c. Has a floor made of soil, crushed stone, matting, pavers or a floating concrete slab.

Impervious surface: A surface that prevents or substantially bars the infiltration of water into the ground. Impervious surfaces include, but are not limited to, buildings, pavement, sidewalks, driveways, gravel drives, roads, parking lots, and compacted fill or earth.

Intermittent stream: A watercourse flowing in a channel or bed composed primarily of substrates associated with flowing water and which obtains its flow from both surface runoff and groundwater discharge but is below the local water table during periods of the year.¹⁰

Normal pool elevation:

- i. For water bodies which have no structural measures to regulate height of water, the height of water at ordinary stages of low water unaffected by drought.
- ii. For structurally regulated water bodies, the elevation of the spillway, outlet control or dam crest which maintains the body of water at a specified height.
- iii. This term does not apply to wetlands.

Noxious weed: A plant determined by Pennsylvania law to be injurious to public health, crops, livestock, agricultural land, or other property. Refer to 7 Pa. Code § 100.1 for a current list of noxious weeds.

⁵ Definitions taken from Chapter 102, Chapter 105, the proposed Riparian Buffer Protection Act (HB1275, 2023 Session), and the Municipalities Planning Code.

⁶ See 25 Pa. Code § 102.1.

⁷ See Pa. Dept. of Env't'l Prot., Common Plan of Development or Sale, National Pollutant Discharge Elimination System (NPDES) Permits for Stormwater Associated with Construction Activities, Frequently Asked Questions (FAQ) (Nov.14, 2025).

⁸ Pa. Dep. of Env't'l Prot., Bureau of Clean Water, *Riparian Forest Buffer Guidance*, No. 386-5600-001 at 2 (2010).

⁹ See 25 Pa. Code § 102.1.

¹⁰ Pa. Dep. of Env't'l Prot., Bureau of Clean Water, *Riparian Forest Buffer Guidance*, No. 386-5600-001 at 2 (2010).

National Pollutant Discharge Elimination System (NPDES): The system for the issuance of permits under section 402 of the Federal Clean Water Act, the Pennsylvania Clean Streams Law, and Chapters 92 and 102 of the Pennsylvania Code.

PADEP: The Pennsylvania Department of Environmental Protection

Perennial: a watercourse or water body that contains water year-round during a typical year.

Riparian buffer: A vegetated area of land immediately adjacent to any watercourse, water body, or wetland that is maintained in a natural state or sustainably managed.

Riparian forest buffer: A type of riparian buffer that consists predominantly of native trees and shrubs that provides at least 60% uniform canopy cover.

Semi-pervious surface: A surface such as stone, rock, lattice block or other material that permits some infiltration of water into the ground but at a rate below the rate of natural ground cover.

Surface waters: Watercourses, water bodies, and wetlands.

Structure: any man-made object having an ascertainable stationary location on or in land or water, whether or not affixed to the land. For purposes of this Article, the term shall include impervious and semi-pervious surfaces.

Vernal pool: Seasonal depressional wetlands that are covered by shallow water for variable periods from winter to spring, but may be completely dry for most of the summer and fall.

Water body: A natural or manmade lake, pond, vernal pool, reservoir, or impoundment. The term does not include a pond or facility designed and constructed solely to contain or convey storm water or any facility approved for wastewater treatment such as wastewater treatment impoundments, cooling water ponds, and constructed wetlands used as part of a wastewater treatment process.

Watercourse: A flowing surface water having a defined bed and banks, including a stream, river, brook or creek, whether natural or artificial, with perennial or intermittent flow. The term does not include ephemeral streams.

Wetland: An area that is inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support, and that under normal circumstances does support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Commonly used names for wetlands include swamps, marshes, and bogs. Wetlands shall be identified in accordance with the most current U.S. Army Corps of Engineers Manual for Identifying and Delineating Wetlands.

§ XXX-XX – Applicability and Exceptions¹¹

A. Applicability:

B. The following are subject to the provisions of this Article:

1. Earth disturbance activities.
2. Construction or placement upon the land of new structures or additions to existing structures.

C. Exemptions: The following land uses, structures, and activities shall be exempt from this Article XXX, provided that they comply with the requirements of 25 Pa. Code Ch. 102 (relating to erosion and sediment control) and applicable best management practices, do not diminish water quality, and are located as far as reasonably possible from any watercourse, water body, or wetland:

1. Agricultural production that is consistent with Federal and State law, the regulations promulgated by PADEP, and best management practices established by the State Conservation Commission and the Department of Agriculture.¹²
2. A high tunnel¹³ where the high tunnel or its flooring does not result in an impervious area exceeding 25% of all structures located on the owner's total contiguous land area and, in addition, meets at least one of the following:
 - a. The high tunnel is located at least 35 feet from any surface water and located on land with a slope not greater than 7%
 - b. The high tunnel is located at least 100 feet from any surface water and located on land with a slope greater than 7%

¹¹ This section can be omitted if the municipality already has a similar section addressing the applicability of the SWMO as a whole

¹² See proposed Riparian Buffer Act (HB 1275, Session of 2023).

¹³ The Storm Water Management Act requires this exemption.

- c. The high tunnel is supported with a buffer of diversion system that does not directly drain into a surface water and manages storm water runoff in a manner consistent with the requirements of this Article and the Act of April 18, 2018 P.L. 91, No. 15, and the Act of October 4, 1978 (P.L. 864, No 167).¹⁴
3. Surface mining as defined by the Surface Mining Conservation and Reclamation Act, 52 P.S. § 1396.3, or the Noncoal Surface Mining Conservation and Reclamation Act, 53 P.S. § 3303.¹⁵
4. Strip mining of anthracite as defined by the Anthracite Strip Mining and Conservation Act, 52 P.S. § 681.3.¹⁶
5. Oil and gas operations regulated under Chapter 32 of the Oil and Gas Act, 58 Pa. C.S. §§ 3201–3274.¹⁷
6. Practices related to the storage, handling or land application of animal manure or nutrients, the construction or operation of facilities used for storage of animal manure or nutrients, and practices otherwise regulated by the Nutrient Management Act, 3 Pa. C.S. §§ 501–522 and regulations promulgated thereunder.¹⁸
7. Public utilities as defined by the Public Utility Code, 66 Pa. C.S. § 102.¹⁹
8. A stream restoration project, stream bank restoration project, vegetation restoration project, or wildlife and fisheries management activity.
9. A structure, including a United States Geological Survey gauging station, public water supply intake structure or permitted discharge outfall that, by its nature, cannot be located anywhere except within the riparian buffer area. The structures shall provide for the minimum practicable disturbance of the riparian buffer area by minimizing size and location and by taking advantage of collocation, if possible. A storm water conveyance structure or outfall shall not be included under this paragraph and shall be located outside of the buffer area.
10. Low-impact facilities for outdoor recreation activities that are water-dependent, including docks or boat launches, that result in less than 500 square feet of buffer disturbance.
11. Interpretive and educational displays or overlooks, provided that they minimize buffer disturbance to the greatest degree possible, and individually and collectively, result in less than 500 square feet of buffer disturbance.
12. Activities and structures lawfully existing as of the effective date of this ordinance, provided that:
 - a. the activity or structure is not enlarged, extended, substituted, or structurally altered to exceed 20% of the existing land coverage as of the effective date of this ordinance; and
 - b. the activity or structure has not been abandoned for a year or more following the effective date of this ordinance.²⁰

D. Compliance With Other Ordinance Requirements

1. Approvals issued pursuant to this Article do not relieve the applicant of the responsibility to secure required permits or approvals for activities regulated by any other applicable federal, state, or local code, rule, act, or ordinance. If there is a conflict between the standards of this Section and any other standard of the [Municipality] Code, the more restrictive standard shall apply.
2. Persons proposing to use or develop land shall comply with all applicable provisions of the Zoning Ordinance concerning buffers, setbacks, agriculture, forestry, landscaping, steep slopes or karst hazard areas. If the event that the requirements of the Zoning Ordinance are inconsistent with the terms of this Article, the more stringent requirements shall apply.

¹⁴ This refers to the Storm Water Management Act and the 2018 amendments thereto that incorporated exclusions for high tunnels. Storm Water Management Ordinances must include this exemption.

¹⁵ The Surface Mining Conservation and Reclamation Act and the Noncoal Surface Mining Conservation and Reclamation Act expressly preempt local regulation of surface mining as defined by these Acts. 52 P.S. §§ 1396.17a, 3316. Our courts have held that this effectively preempts stormwater management ordinances as applied to surface mining and related activities. See *Hoffman Mining Co. v. Zoning Hearing Bd.*, 32 A.3d 587, 600 (Pa. 2011); *Gib. Rock, Inc. v. New Hanover Twp.*, 118 A.3d 461, 467 (Pa. Cmwlth. 2015); *Pa. Coal Co. v. Twp. of Conemaugh*, 612 A.2d 1090, 1093 (Pa. Cmwlth. 1992).

¹⁶ The General Assembly has preempted all local regulation of anthracite strip mining. *Harris-Walsh, Inc. v. Dickson City*, 216 A.2d 329, 336 (Pa. 1966).

¹⁷ The Oil and Gas act preempts all ordinances that purport to regulate oil and gas operations except zoning and floodplain ordinances that do not impose conditions, requirements, or limitations on the same features of oil and gas operations regulated by Chapter 32 of the Act. 58 Pa. C.S. § 3302.; *Robinson Twp. v. Commonwealth*, 147 A.3d 536, 566 (Pa. 2016). Setback distances from water bodies are among the features of oil and gas operations regulated by Chapter 32, meaning regulation of this nature is preempted whether found in a zoning ordinance or SWMO. See 58 Pa. C.S. § 3215.

¹⁸ The Nutrient Management Act and regulations promulgated under it preempt all “practices related to the storage, handling or land application of animal manure or nutrients or to the construction, location or operation of facilities used for storage of animal manure or nutrients or practices otherwise regulated by [the NMA]” if the municipal ordinance or regulation is in conflict with the NMA or the regulations. 3 Pa. C.S. § 519; 25 Pa. Code § 25 Pa. Code § 83.205. Conflict exists where local ordinances regulate the same matters as the NMA and regulations, which include stormwater runoff. See *Berner v. Montour Twp. Zoning Hearing Bd.*, 217 A.3d 238, 243 (Pa. 2019).

¹⁹ Matters pertaining to the location of utility facilities lie within the ambit of the Pennsylvania Utility Commission’s authority and local regulation of these matters is preempted. See *PPL Elec. Utils. Corp. v. City of Lancaster*, 214 A.3d 639, 656, 659 (Pa. 2019).

²⁰ See PennFuture’s guidebook, *Naturally Beneficial: Protecting Water Quality and Saving Money with Riparian Buffer Ordinances* for explanation of applicability to pre-existing lawful uses.

§ XXX-XX – **Minimum Required Buffer.** Any person conducting an earth disturbance activity, construction, or other activity regulated by this Article which is not exempted under Section [XXX-XX(C)] and which is not subject to the expanded buffer width requirement in Section [XXX-X] or the requirement in Section [XXX-XX] to maintain, convert, or establish a riparian forest buffer shall maintain a riparian buffer having an average width of 50 feet on both sides of all watercourses and surrounding all waterbodies and wetlands. Activities permitted in the buffer shall be limited to those permitted in an inner buffer as provided by Section [XXX-XX(A)]. The buffer shall be maintained in accordance with Section [XXX-XX], Maintenance of Buffers.

§ XXX-XX – **Expanded riparian buffer widths for certain activities.**

- A. An expanded riparian buffer shall be provided in accordance with this Section (A) for the following activities:
 1. Earth disturbance activities that will result in 1 acre or more of earth disturbance
 2. Construction, alteration, or expansion of structures that will result in the construction or addition of [20,000] square feet²¹ or more of impervious or semi-pervious surface within a common plan of development, except that construction of a single-family residence, duplex, or triplex and associated accessory structures shall not be subject to this Section if:
 - a. The residence is not part of a larger common plan of development or sale;
 - b. The land development conforms with all other zoning and land use regulations;
 - c. No portion of any structure is located in a 100-year floodplain;
 - d. No septic tank, septic drain field or other sewage management facility is located within the riparian buffer area; and
 - e. The structure(s) avoids disturbance of the riparian buffer area to the maximum extent possible.²²
 3. Where this section applies, the person conducting the regulated activity shall maintain a riparian buffer as follows:
 - a. **Watercourses and waterbodies.** A riparian buffer having an average width of 100 feet shall be maintained on both sides of all watercourses and around all waterbodies. The buffer shall consist of a 50-foot inner buffer and a 50-foot outer buffer.
 - b. **Wetlands.** A riparian buffer having an average width of 100 feet shall be maintained around all wetlands and vernal pools greater than 5,000 square feet in area.²³ The buffer shall consist of a 50-foot inner buffer and a 50-foot outer. The 50-foot buffer required by Section [XXX-XX] shall be maintained around all other wetlands.
 4. The activities permitted in the inner and outer buffer required by this Section shall be governed by Section [XXX-XX], Activities Permitted in Buffer
 5. A riparian buffer required by this section shall be maintained in accordance with Section [XXX-XX], Maintenance of Buffers.
- B. An expanded riparian buffer shall be provided in accordance with this Section (B) for the construction, alteration, or expansion of structures that will result in the construction or addition of [50,000] square feet²⁴ or more of impervious or semi-pervious surface within a common plan of development.
 1. Where this section applies, the person conducting the regulated activity shall maintain a riparian buffer as follows:
 - a. **Watercourses and waterbodies.** A riparian buffer having an average width of 150 feet shall be maintained on both sides of all watercourses and around all waterbodies. The buffer shall consist of a 50-foot inner buffer and a 100-foot outer buffer.
 - b. **Wetlands.** A riparian buffer having an average width of 150 feet shall be maintained around all wetlands and vernal pools greater than 5,000 square feet in area.²⁵ The buffer shall consist of a 50-foot inner buffer and a 100-foot outer. The 50-foot buffer required by Section [XXX-XX] shall be maintained around all other wetlands.
 2. The activities permitted in the inner and outer buffer required by this Section shall be governed by Section [XXX-XX], Activities Permitted in Buffer
 3. A riparian buffer required by this section shall be maintained in accordance with Section [XXX-XX], Maintenance of Buffers.

²¹ This threshold can be adjusted as the municipality sees fit. We have created a document showing developments of various sizes to help readers visualize the types of projects that would trigger the various thresholds: [Reference photos for buffer ordinance size thresholds.docx](#)

²² See Chester County Model Act 167 Ordinance.

²³ This size threshold is included to prevent overly-onerous buffers being applied to tiny, tiny wetlands and ponds. The 5,000 square foot threshold comes from We Conserve PA's/ Brandywine Conservancy's model ordinance, but I don't know what their rationale was.

²⁴ This threshold can be adjusted as the municipality sees fit. We have created a document showing developments of various sizes to help readers visualize the types of projects that would trigger the various thresholds: [Reference photos for buffer ordinance size thresholds.docx](#).

²⁵ This size threshold is included to prevent overly-onerous buffers being applied to tiny, tiny wetlands and ponds. The 5,000 square foot threshold comes from We Conserve PA's/ Brandywine Conservancy's model ordinance, but I don't know what their rationale was.

§ XXX-XX – Protecting, Converting, and Establishing Riparian Forest Buffers

- A. **Applicability.** This section shall apply to the construction, alteration, or expansion of structures that will result in the construction or addition of [100,000]²⁶ square feet or more of impervious or semi-pervious surfaces within a common plan of development.
- B. **Riparian forest buffer establishment.**²⁷ Where this section applies, a person conducting regulated activities shall protect, convert, or establish a riparian forest buffer as follows:
 1. **Protecting existing riparian forest buffer.** Where a riparian forest buffer having the total aggregate width required by Section [XXX-XX] exists, it shall be maintained. The composition of an existing riparian forest buffer need not be altered to establish separate inner and outer buffers.
 2. **Converting an existing riparian buffer to riparian forest buffer.** Where the existing buffer area does not satisfy the composition of a riparian forest buffer or the width requirements of Section [XXX-XX], it shall be established, enhanced or widened to create a riparian forest buffer in accordance with this paragraph.
 3. Where an existing riparian buffer is converted to a riparian forest buffer, or where a new riparian forest buffer is established, the buffer shall have an average width of 150 feet and be comprised of an inner buffer and an outer buffer as follows:
 - a. The inner buffer shall begin at the top of the streambank for a watercourse, the normal pool elevation of a water body, or the delineated edge of a wetland and shall occupy a 50-foot wide strip of land measured horizontally on a line perpendicular to that boundary. The inner buffer shall consist of a variety of native trees.
 - b. The outer buffer shall begin at the landward edge of the inner buffer and occupy an additional 100-foot wide strip of land measured horizontally on a line perpendicular to that boundary. The outer buffer shall consist of a variety of native trees and shrubs.
 - c. New plantings shall consist of a diverse native plant community appropriate to the geographic location, soil type, USDA hardiness zone, and ecological context of the site and shall be planted at a density to achieve 60% canopy cover within 10 years. At time of planting, trees shall be a minimum three-inch caliper and shrubs shall be a minimum of 24 inches in height.²⁸
 4. The activities permitted in the inner and outer buffer required by this Section shall be governed by Section [XXX-XX], Activities Permitted in Buffer.
- C. **Riparian Buffer Management Plan.**²⁹
 1. Where a newly converted or established riparian forest buffer is required by this section, a riparian buffer management plan shall be prepared by a registered landscape architect or similar professional and consist of the following at a minimum:
 - a. A map of the site including:
 - i. Delineation of watercourses, water bodies, and wetlands
 - ii. Delineation of the riparian forest buffer area, including the inner and outer buffers
 - iii. Marked planting zones.
 - iv. Existing structures in the riparian forest buffer area
 - b. A planting plan for converting or newly establishing the riparian forest buffer that identifies the number, density, and species of native trees and shrubs that will satisfy the requirements of this section.
 - c. A maintenance schedule and measures to ensure survival and growth of plantings and protection from competing plants and animals, including noxious weeds and invasive species, over a five (5) year establishment period. Protection measures may include tree guards, tree shelters, or fencing. Maintenance measures may include activities or practices such as disturbance of existing vegetation, tree removal, shrub removal, clearing, mowing, burning, or spraying in accordance with long term operation and maintenance.
 - d. An inspection schedule and measures to ensure long term maintenance and proper functioning of the riparian forest buffer, including measures to repair damage to the buffer and to replace dead plantings.³⁰

²⁶ This threshold can be adjusted as the municipality sees fit. We have created a document showing developments of various sizes to help readers visualize the types of projects that would trigger the various thresholds: [Reference photos for buffer ordinance size thresholds.docx](#).

²⁷ Pa. Dep. of Env't Prot., Bureau of Clean Water, *Riparian Forest Buffer Guidance*, No. 386-5600-001 at 12 (2010).

²⁸ Composition of plantings based on We Conserve PA model riparian buffer ordinance, p. 8. Minimum sizing standards based on Tobyhanna Township SALDO § 22-1101(2)(A).

²⁹ For additional information about establishing and managing riparian forest buffers, see DEP's Riparian Forest Buffer Management Plan Toolkit, found in Appendix C of the Department's *Riparian Forest Buffer Guidance*, Document No. 386-5600-001 (2010).

³⁰ Pa. Dep. of Env't Prot., Bureau of Clean Water, *Riparian Forest Buffer Guidance*, No. 386-5600-001 at 10–11 (2010).

2. The riparian forest management plan shall be submitted for the review and approval of the [governing body], which approval shall not be unreasonably withheld, prior to the conversion or establishment of the riparian forest buffer.
3. The buffer shall be maintained in accordance with the riparian forest management plan and Section [XXX-XX], Maintenance of Buffers.

§ XXX-XX – Measurement of buffers

- A. Riparian buffers shall be measured perpendicularly from the top of streambank for watercourses, from the top of normal pool elevation for waterbodies, and from the delineated edge of wetlands.
- B. Riparian buffers should be measured horizontally with no more than 10% variation below the minimum width.³¹
- C. The required buffer widths shall be increased as follows in areas of steep slopes:³²
 1. By 10 feet where the slope of the riparian buffer area is between 10% and 15%
 2. By 25 feet where the slope of the riparian buffer area is between 15% and 25%
 3. By 50 feet where the slope of the riparian buffer area exceeds 25%
- D. Where resource buffers overlap, the most restrictive requirements shall apply.

§ XXX-XX – Activities permitted in buffer

- A. **Inner buffer.** The purpose of the inner buffer is to stabilize streambanks and shorelines; create a stable ecosystem adjacent to the water's edge; provide a soil-water contact area to facilitate nutrient buffering processes; provide shade to moderate water temperature; and to contribute necessary detritus and large woody debris as food to the ecosystem. The following shall apply to the inner buffer:
 1. The following activities shall be permitted in the inner buffer. No other earth disturbance, grading, filling, buildings, structures, construction, or development shall be permitted:
 - a. Buffer maintenance and restoration activities, including streambank stabilization
 - b. Correction of hazardous conditions
 - c. Wildlife sanctuaries, nature preserves, forest preserves, fishing areas, passive areas of public and private parklands
 - d. Water obstructions and encroachments³³ covered by a valid permit issued by PADEP under 25 Pa. Code Ch. 105, Dam Safety and Waterway Management.
 - e. Scientific studies, including water quality monitoring, biological stream surveys, and stream gauging.³⁴
 2. The area of the inner buffer altered by the permitted activities shall be minimized to the greatest extent practicable.
- B. **Outer buffer.** The purpose of the outer buffer is to remove, transform, or store sediment, nutrients, and other pollutants, and provide long-term storage of nutrients in the biomass of trees, shrubs, and other vegetation.³⁵ The following shall apply to the outer buffer:
 1. The following activities shall be permitted in the outer buffer. No other earth disturbance, grading, filling, buildings, structures, construction or development shall be permitted in any portion of the outer buffer:
 - a. Activities permitted in the inner buffer
 - b. Plant nurseries and orchards
 - c. Temporary fairs and carnivals
 - d. Accessory uses for residential purposes
 - e. Private sportsmen's club activities that do not involve construction of permanent structures
 - f. Stormwater facilities covered by a valid NPDES permit or municipal stormwater permit
 - g. Sustainable forestry in accordance with a Forest Management Plan that maintains 60% uniform canopy cover.
 - h. Trails and multiuse paths, provided they are for non-motorized use only, are constructed using nonhazardous, pervious materials, and have a maximum width of four feet.
 2. No more than 20% of the cumulative outer buffer on a parcel shall be altered by the permitted activities.

³¹ See Pa. Dep. of Env't'l Prot., Bureau of Clean Water, *Riparian Forest Buffer Guidance*, No. 386-5600-001 at 12 (2010).

³² The concept of increasing buffer widths in areas of steep slopes is taken from the proposed Riparian Buffer Act (HB 1275, Session of 2023). We have simplified and somewhat reduced the required increased widths for ease of administration, to align with the standard slope categories used in most ordinances (less than 15%, 15–25%, and over 35%)

³³ This category includes bridges, roads, culverts, utility crossings, and other structure located in, along or across any watercourse, water body, or wetland. See 25 Pa. Code. Ch. 105.

³⁴ Pa. Dep't of Env't'l Prot., Bureau of Watershed Management, *RIPARIAN FOREST BUFFER GUIDANCE*, Doc. No. 394-5600-001 at 11 (2010).

³⁵ Pa. Dep. of Env't'l Prot., Bureau of Clean Water, *Riparian Forest Buffer Guidance*, No. 386-5600-001 at 8 (2010).

§ XXX-XX – **Maintenance of Buffers.** Riparian buffers and riparian forest buffers required by this chapter shall be maintained in accordance with the following:³⁶

- A. Existing native vegetation shall be protected and maintained within the buffer area.
- B. Whenever practicable, the landowner shall actively remove invasive vegetation and noxious weeds. Selective herbicide application by a qualified professional is permitted to control noxious weeds and invasive species.
- C. Storm water runoff entering the inner buffer shall be limited to sheet flow or natural subsurface flow only.³⁷ Concentrated flow pathways and accelerated erosion and sedimentation shall be prevented in the riparian buffer or riparian forest buffer and the area upgrade and immediately adjacent to the buffer.
- D. Livestock shall be excluded from the buffer area except for designated stream crossings.³⁸

§ XXX-XX **Waivers.** The [governing body] may grant a waiver from the requirements of this Article if the applicant demonstrates any of the following:³⁹

- A. There are unique physical circumstances or conditions peculiar to the particular property, not created by the applicant, including irregularity, narrowness, or shallowness of lot size or shape, or exceptional topographic features, and that, because of such physical circumstances or conditions, a waiver is necessary to enable the reasonable use of the property. In such cases, the waiver, if authorized, shall be the minimum necessary to afford relief.⁴⁰
- B. Strict compliance would prevent all economic use of the property.
- C. The project is reasonably necessary to serve a public need and no feasible alternative is available.
- D. The project consists of the repair and maintenance of public improvements where avoidance and minimization of adverse impacts to the riparian buffer area have been addressed.

Section 4: Severability. If any sentence, clause, section, or part of this Ordinance is for any reason found to be unconstitutional, illegal or invalid, such unconstitutionality, illegality or invalidity shall not affect or impair any of the remaining provisions, sentences, clauses, sections, or parts hereof. It is hereby declared as the intent of the [governing body] that this Ordinance would have been adopted had such unconstitutional, illegal or invalid sentence, clause, section or part thereof not been included herein.

Section 5. Repealer. All Ordinances or parts of Ordinances conflicting with any provision of this Ordinance are hereby repealed insofar as the same affects this Ordinance.

Section 6. Effective Date. This Ordinance shall take effect five (5) days after its adoption.

A downloadable copy of PennFuture’s Model Riparian Buffer Storm Water Management Ordinance can be found at:



<https://bit.ly/PFRiparianBufferSWMO>

³⁶ From Chester County Model Act 167 ordinance.

³⁷ Pa. Dep. of Env't'l Prot., Bureau of Clean Water, *Riparian Forest Buffer Guidance*, No. 386-5600-001 at 7 (2010).

³⁸ Pa. Dep. of Env't'l Prot., Bureau of Clean Water, *Riparian Forest Buffer Guidance*, No. 386-5600-001 at 7 (2010).

³⁹ Unless otherwise cited, the provisions in this section are taken from HB1275. This section may be omitted if the municipality's existing SWMO contains suitable waiver provisions.

⁴⁰ From MPC § 910.2(a)(1).

[MUNICIPALITY]⁴¹
[MONROE] COUNTY, PENNSYLVANIA
ORDINANCE NO. _____

**AN ORDINANCE OF THE [GOVERNING BODY] OF [MUNICIPALITY], PENNSYLVANIA,
TO AMEND THE [MUNICIPALITY] CODE OF ORDINANCES TO ESTABLISH A RIPARIAN
BUFFER OVERLAY DISTRICT.**

WHEREAS, Article VI of the Pennsylvania Municipalities Planning Code, 53 P.S. § 10601, et seq., authorizes the [MUNICIPALITY] to enact, amend and repeal Zoning Ordinances within the [MUNICIPALITY];

WHEREAS, the Pennsylvania Municipalities Planning Code provides that zoning ordinances shall provide for protection of natural features and resources and shall be designed to promote, protect, and facilitate the provision of a safe, reliable, and adequate water supply and the preservation of forests, wetlands, aquifers, and floodplains;

WHEREAS, Article I, Section 27 of the Pennsylvania Constitution requires all municipalities to conserve and maintain Pennsylvania's public natural resources, including pure water, for the benefit of all people, including generations yet to come;

WHEREAS, riparian buffers adjacent to surface waters provide numerous benefits to humans, including, but not limited to: flood attenuation, erosion control, removal of pollutants from drinking water sources, increasing property values, and providing esthetic and recreational opportunities;

WHEREAS, riparian buffers also provide numerous environmental and resource management benefits, including, but not limited to: pollution control, water temperature regulation, and providing and enhancing habitat for aquatic and terrestrial wildlife;

NOW, THEREFORE, BE IT ORDAINED AND ENACTED, by the [GOVERNING BODY] of [MUNICIPALITY] as follows:

Section 1. Chapter XXX for the [MUNICIPALITY] Code of Ordinances, Zoning, is amended to add the following Section.

§ XXX-XX – Riparian Buffer Overlay District

A. **Purpose.** The purpose of this section is to:

1. Preserve and protect riparian areas of exceptional ecological importance by providing riparian habitat of sufficient width to support all life-stages of aquatic, semi-aquatic, and terrestrial wildlife.
2. Provide undisturbed and minimally-disturbed riparian corridors of sufficient width to allow free movement of species across the landscape.
3. Provide the full range of ecosystem benefits of a riparian buffer, including removal of nutrients, sediment, organic matter, pesticides, or other pollutants from stormwater runoff prior to entry into surface waters, moderation of water temperature in surface waters, attenuation of flood flow, and opportunities for passive recreation.⁴²

B. **Applicability.**

1. The requirements of this Section shall apply in addition to all other applicable standards of the Zoning Ordinance, the Storm Water Management Ordinance. If there is a conflict between the standards of this Section and any other standard of the [Municipality] Code, the more restrictive standard shall apply.

C. **Definitions.** As used in this Section, the following terms shall have the meanings indicated below:

Canopy cover: the area of ground directly beneath the crowns of trees or woody vegetation as delineated by the vertical projection of crown perimeters. Canopy cover is commonly expressed as a percentage of total ground area.⁴³

Earth disturbance activity: Any construction or other human activity which disturbs the surface of the land, including land clearing and grubbing, grading, excavations, embankments, land development, agricultural plowing or tilling, operation of animal heavy use areas, timber harvesting activities, road maintenance activities, oil and gas activities, well drilling, mineral extraction, and the moving, depositing, stockpiling, or storing of soil, rock or earth materials.

⁴¹ Nothing contained in this model ordinance is intended to be legal advice. The model should be adapted to reflect the specific facts and circumstances of the municipality under the guidance of legal counsel. The authors disclaim any attorney-client privilege with any person to whom this document is furnished.

⁴² Upper Salford Township Code of Ordinances § 1800

⁴³ Pa. Dep. of Env't'l Prot., Bureau of Clean Water, *Riparian Forest Buffer Guidance*, No. 386-5600-001 at 2 (2010).

Ephemeral stream: A stream or reach of stream that flows for less than one month per year in direct response to precipitation and which does not obtain flow from groundwater discharge. Commonly used names for ephemeral streams include stormwater channel, drain, swale, gully, hollow, saddle, and “dry streams.”

Floodplain: The lands adjoining a river or stream that have been or may be expected to be inundated by flood waters in a 100-year frequency flood.

Intermittent stream: A watercourse flowing in a channel or bed composed primarily of substrates associated with flowing water and which obtains its flow from both surface runoff and groundwater discharge but is below the local water table during periods of the year.⁴⁴

Normal pool elevation:

- a. For bodies of water which have no structural measures to regulate height of water, the height of water at ordinary stages of low water unaffected by drought.
- b. For structurally regulated bodies of water, the elevation of the spillway, outlet control or dam crest which maintains the body of water at a specified height.
- c. This term does not apply to wetlands.

Noxious weed: A plant determined by Pennsylvania law to be injurious to public health, crops, livestock, agricultural land, or other property. Refer to 7 Pa. Code § 100.1 for a current list of noxious weeds.

National Pollutant Discharge Elimination System (NPDES)– The system for the issuance of permits under section 402 of the Federal Clean Water Act, the Pennsylvania Clean Streams Law, and Pa. Code Chs. 92 and 102.

PADEP: The Pennsylvania Department of Environmental Protection

Perennial: a watercourse or water body that contains water year-round during a typical year.

Riparian buffer: The area of land immediately adjacent to any watercourse, water body, or wetland. The width of a riparian buffer is measured perpendicular to and horizontally from the top-of-bank on both sides of a watercourse, the normal pool elevation of a lake, pond, or reservoir, or the delineated edge of a wetland.

Riparian forest buffer: A type of riparian buffer that consists predominantly of native trees, shrubs and forbs that provides at least 60% uniform canopy cover and which is maintained in a natural state or sustainably managed.

Top of streambank: The first substantial break in slope between the edge of the bed of a watercourse and the surrounding terrain, lying generally parallel to the watercourse. The top of streambank can either be a natural or constructed feature.

Vernal pool: Seasonal depressional wetlands that are covered by shallow water for variable periods from winter to spring, but may be completely dry for most of the summer and fall.

Waterbody: A natural or manmade pond, lake, reservoir, or impoundment. The term does not include a pond or facility designed and constructed solely to contain or convey storm water or any facility approved for wastewater treatment such as wastewater treatment impoundments and cooling water ponds.

Watercourse: A flowing surface water having a defined bed and banks, including a stream, river, brook or creek, whether natural or artificial, with perennial or intermittent flow. The term does not include ephemeral streams or any facility designed and constructed solely to contain or convey storm water.

Wetland: An area that is inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support, and that under normal circumstances does support, a prevalence of vegetation typically adapted for life in saturated soil conditions, including swamps, marshes, bogs and similar areas. Wetlands shall be identified in accordance with the most current U.S. Army Corps of Engineers Manual for Identifying and Delineating Wetlands. The term does not include constructed wetlands used as part of a wastewater treatment process.

Wetland delineation: A delineation of the boundaries of a wetland performed by a qualified professional in accordance with the *1987 Army Corps of Engineers Wetland Delineation Manual (Technical Report Y-87-1)* along with the guidance provided by the United States Army Corps of Engineers, Major General Arthur E. Williams’ memorandum dated 6 March 1992, *Clarification and Interpretation of the 1987 Manual*.⁴⁵

⁴⁴ Pa. Dep. of Env’tl Prot., Bureau of Clean Water, *Riparian Forest Buffer Guidance*, No. 386-5600-001 at 2 (2010).

⁴⁵ See 25 Pa. Code § 105.451, which establishes this as the wetland delineation method used for purposes of DEP regulations.

D. Identification of District.

1. The Riparian Buffer Overlay District is hereby created to be defined as the area extending:
 - a. Three hundred (300) feet on both sides of [identify relevant watercourses or reaches⁴⁶ thereof], measured perpendicularly from the top of streambank;
 - b. Three hundred (300) feet around [identify relevant waterbodies], measured radially from the normal pool elevation; and
 - c. Three hundred (300) feet around [identify relevant wetlands], measured perpendicularly from the delineated edge of the wetland or vernal pool.
2. The Riparian Buffer Overlay District Map, dated [date], attached hereto and incorporated herein by reference, shall be used as a general guide for determining the boundaries of the District. However, where subdivision and/or land development approval, conditional use approval, a special exception, other zoning approval, or any permit is required by the [municipality], the applicant shall be responsible for identifying the location of the Riparian Buffer Overlay District, subject to the review of the [governing body]. The applicant shall use an actual field survey and/or wetland delineation (as appropriate) as the basis for determining District boundaries.

E. Activities Permitted in Buffer. The Riparian Buffer Overlay District shall consist of an inner buffer and an outer buffer

1. **Inner buffer.** The purpose of the inner buffer is to stabilize streambanks and shorelines; create a stable ecosystem adjacent to the water's edge; provide a soil-water contact area to facilitate nutrient buffering processes; provide shade to moderate water temperature; and to contribute necessary detritus and large woody debris as food to the ecosystem. The following shall apply to the inner buffer:
 - a. The inner buffer shall begin at the top of the streambank for a watercourse, the normal pool elevation of a water body, and the delineated edge of a wetland and shall occupy a strip of land 50 feet wide measured horizontally on a line perpendicular to that boundary.
 - b. The following activities shall be permitted in the inner buffer. No other earth disturbance, grading, filling, buildings, structures, construction, or development shall be permitted:
 - i. Buffer maintenance and restoration activities, including streambank stabilization
 - ii. Correction of hazardous conditions
 - iii. Wildlife sanctuaries, nature preserves, forest preserves, fishing areas, passive areas of public and private parklands
 - iv. Water obstructions and encroachments⁴⁷ covered by a valid permit issued by PADEP under 25 Pa. Code Ch. 105, Dam Safety and Waterway Management.
 - v. Scientific studies, including water quality monitoring, biological stream surveys, and stream gauging.⁴⁸
 - c. The area of the inner buffer altered by the permitted activities shall be minimized to the greatest extent possible.
2. **Outer buffer.** The purpose of the outer buffer is to remove, transform, or store sediment, nutrients, and other pollutants; provide long-term storage of nutrients in the biomass of trees, shrubs, and other vegetation; provide habitat for aquatic, semi-aquatic, and terrestrial wildlife; and provide undisturbed and minimally-disturbed riparian corridors of sufficient width to allow free movement of species across the landscape.⁴⁹ The following shall apply to the outer buffer:
 - a. The outer buffer shall begin at the landward edge of the inner buffer and occupy an additional strip of land 250 feet wide measured horizontally on a line perpendicular to that boundary.
 - b. The following activities shall be permitted in the outer buffer. No other earth disturbance, grading, filling, buildings, structures, construction or development shall be permitted in any portion of the outer buffer:
 - i. Activities permitted in the inner buffer
 - ii. Plant nurseries and orchards
 - iii. Temporary fairs and carnivals

⁴⁶ A reach is a section of a stream or river.

⁴⁷ This category includes bridges, roads, culverts, utility crossings, and other structure located in, along or across any watercourse, water body, or wetland. See 25 Pa. Code. Ch. 105.

⁴⁸ Pa. Dep't of Env'tl. Prot., Bureau of Watershed Management, RIPARIAN FOREST BUFFER GUIDANCE, Doc. No. 394-5600-001 at 11 (2010).

⁴⁹ Pa. Dep. of Env'tl Prot., Bureau of Clean Water, *Riparian Forest Buffer Guidance*, No. 386-5600-001 at 8 (2010).

- iv. Accessory uses for residential purposes.
- v. Private sportsmen's club activities that do not involve construction of permanent structures
- vi. Stormwater facilities covered by a valid NPDES permit or municipal stormwater permit
- vii. Sustainable forestry in accordance with a Forest Management Plan that maintains 60% uniform canopy cover.

c. No more than 20% of the cumulative outer buffer on a parcel shall be altered by the permitted activities.

F. **Nonconforming Structures and Uses.** Nonconforming structures and uses within the Riparian Buffer Overlay District shall be regulated under the provisions of [cite applicable ordinance provisions governing nonconforming uses].

Section 2: Severability. If any sentence, clause, section, or part of this Ordinance is for any reason found to be unconstitutional, illegal or invalid, such unconstitutionality, illegality or invalidity shall not affect or impair any of the remaining provisions, sentences, clauses, sections, or parts hereof. It is hereby declared as the intent of the [governing body] that this Ordinance would have been adopted had such unconstitutional, illegal or invalid sentence, clause, section or part thereof not been included herein.

Section 3. Repealer. All Ordinances or parts of Ordinances conflicting with any provision of this Ordinance are hereby repealed insofar as the same affects this Ordinance.

Section 4. Effective Date. This Ordinance shall take effect five (5) days after its adoption.

A downloadable copy of PennFuture's Model Riparian Buffer Zoning Overlay Ordinance can be found at:



<https://bit.ly/PFRiparianBufferZoningOrd>





www.pennfuture.org

Contact PennFuture:
info@pennfuture.org
800-321-7775
610 North Third Street
Harrisburg, PA 17101



This booklet is printed on 100% recycled paper.