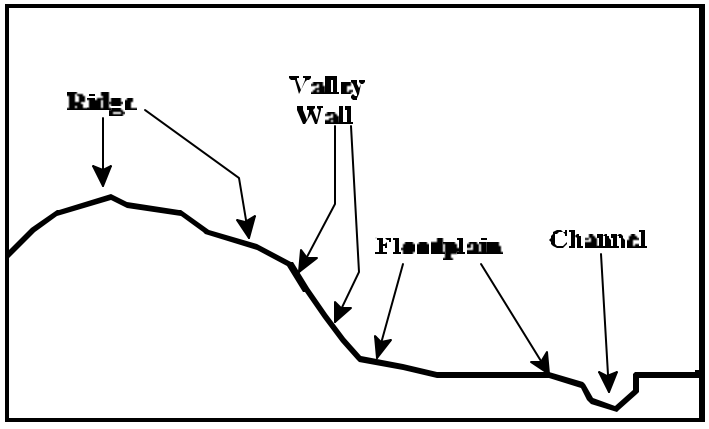
BUFFERS FOR STREAM, LAKE & WETLAND PROTECTION

BUFFER BENEFITS

A buffer, in the context of aquatic resource protection, is a strip of vegetation - preferably forest - running along the banks of a stream or river, the shoreline of a lake or tidal waters, or the outer perimeter of a wetland. Such a buffer provides many important benefits:

A. The presence of a buffer reduces the likelihood that bulldozers and other heavy equipment will accidently enter a stream or wetland;
B. Wooded buffers provide vital habitat for fish and other organisms when trunks and branches fall into the waterway or roots extend into the channel;
C. Leaves and twigs serve as an essential source of nutrition for aquatic organisms;
D. Wooded buffers shade trout streams and other temperature-sensitive waters from the heating effects of the sun;
E. The trunks of near-channel shrubs and trees retard flood waters reducing downstream flooding and channel erosion;
F. Some of the pollutants entrained in surface runoff from adjacent land uses may be removed as it flows through a buffer, however, buffers alone are rarely sufficient to control the pollution from cropfields, logging, construction and mining sites, or development;
G. Preserving near-stream steep slopes or highly erodible soils as wooded buffers can greatly reduce the amount of sediment delivered to an aquatic resources;
H. Wooded buffers provide essential habitat and migration corridors for birds, mammals, and others forms of wildlife; and
I. Wooded buffers enhance the aesthetic appeal of a waterway.



HOW MUCH BUFFER IS ENOUGH?

The amount and nature of a buffer depends upon the objective(s) one is seeking to achieve. Following is a brief review of how buffer needs may vary depending upon the purpose. The illustration on this page shows various features referenced below.

Accidental Entry

Allowing heavy equipment to enter a stream channel or wetland results in substantial damage and years may be required for full recovery. Because of this, a minimum buffer of 25- to 50-feet must be maintained between the area where the structure is being built and the aquatic resource. Prior to the start of construction - before any existing vegetation is disturbed - the buffer area should be clearly delineated with blaze orange plastic mesh fencing. If the sole purpose of the buffer is prevention of accidental entry, then it does not matter whether the buffer is vegetated with grass, shrubs or trees. But as you will see in the remainder of this fact sheet, there are many good reasons why a wooded buffer should be established.

Habitat & Food Inputs

Fish and other aquatic organisms use submerged logs, branches, and roots as a place to hide from predators. Also, bacteria, fungi, algae, and other organisms grow upon the surface of woody objects. These organisms serve as a food source for snails, aquatic insects and others. These organisms, in turn, serve as a food source for other creatures. Thus the abundance of sport fish in a waterway frequently is a direct reflection of the abundance of in-stream woody habitat. The leaves and twigs which fall or are blown into small, headwater streams also serve as a food source for aquatic organisms. From this brief description it is obvious that the buffer should be wooded (composed of trees and shrubs). Though there appears to be little scientific research on this point, a wooded buffer of at least 75- to 100-feet is probably required to maintain the entry of woody material into a stream, lake or wetland.

Shade

Many small, heavily shaded headwater streams stay relatively cool or even cold throughout the summer. In fact trout and other coldwater organisms require a water temperature of 68°F or less and begin dying when a stream warms to 75°F. During the peak of summer a stream flowing from a densely wooded valley into an area of treeless grass can heat by 20°F within the first half-mile and may reach a water temperature

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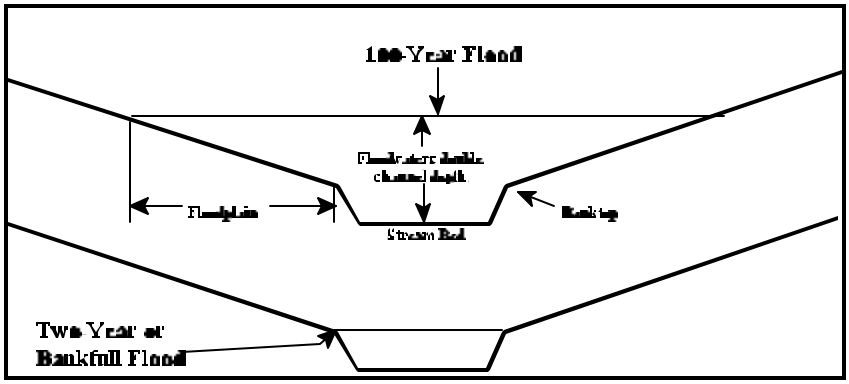
in the 85°F to 90°F range. In this temperature range many organisms other than trout begin experiencing stress. As water warms it holds less oxygen and the toxicity of various contaminants increases. Unfortunately, once a waterway becomes heated it is very difficult to cool it down. One study showed that a stream cooled by only 3°F after traveling a quarter-mile through a heavily wooded valley. The thermal benefits of shade are not restricted to headwater streams. Several studies have shown a decline in wetland ecosystems exposed to the full heating effects of the sun. To prevent excessive heating a wooded buffer should extend a minimum of 75- to 100-feet from stream banks and other aquatic resource perimeters.

Flooding & Erosion

As shown in the illustration below, about once every two years a storm will occur which releases sufficient rain to cause streams to fill with floodwaters from channel bed to bank top. This event is called a *bankfull* flood. About once every hundred years a storm will cause a flood which reaches a depth twice that of the channel. The resistance offered by in- and out-of-channel roots, trunks, logs and branches slows the velocity of floodwaters which reduces the potential for downstream flooding and erosion. Removing trees from the area inundated by the 100-year flood - the *floodplain* - and areas downstream may experience increased damage during future deluges. Ideally, the entire floodplain should be kept in woodland.



Pollutant Removal

While buffers provide many important benefits, pollutant removal is limited. There are two reasons why buffers are relatively ineffective for pollutant removal. First, to remove significant portions of the pollutant load, runoff must flow over the buffer (forest) flow in a very thin sheet. Unfortunately runoff tends to concentrate in channels which allow little opportunity for pollutants to settle from suspension. Efforts to prevent channel flow using measures such as *level spreaders* have proven difficult to construct and maintain. Second, stream channel meander across their floodplains over time. As the channel erodes from one valley wall to another, pollutants deposited in the past enter the channel with eroding bank soils. It is far more effective to locate pollutant removal measures - filters and ponds - outside the buffer area.

Steep Slopes & Highly Erodible Soils

Usually, the steepest slopes are found on the walls of a stream valley. Slope steepness is usually expressed as a percentage. A hillside that rises 10 feet vertically for every hundred feet of horizontal distance has a 10% slope. When slopes exceeding 15% are allowed to be disturbed, then soil erosion can be very high. If the slope is part of the valley wall, then the close proximity to a stream channel ensures that a large percentage of the eroded soil will enter the aquatic environment. The U.S. Natural Resources Conservation Service has assigned an erodibility factor to all soils. As the erodibility factor increases, so does the potential for soil erosion. When a steep slope (15% or greater) or highly erodible soils (0.35 or greater) are present in a stream valley, then the buffer should be expanded to encompass these erosion prone areas.

Migration Corridors & Habitat

Wooded stream valleys serve as a vital corridor for migrating birds, mammals and other wildlife. Wooded valleys also provide habitat for a number of temporary or permanent resident species. Depending upon the species, a wooded corridor 100- to 300-feet in width may be required.

Aesthetics

For those hiking a stream valley trail or plying lake or tidal waters, a wooded shoreline is far more pleasing than one dominated by houses or other forms of development. To preserve a sense of wilderness along a streamside trail, woodland should extend from both banks to the top of the valley wall.

Closing

In summary, a buffer provides many benefits. The optimum buffer extends at least 100 feet from a stream bank, a wetland perimeter, or a shoreline. The buffer should then be expanded to include adjoining slopes over 15% or slopes composed of highly-erodible soils. A further expansion may be needed if the buffer is also intended to reduce flooding, channel erosion, protect important wildlife species or to preserve visual amenities. For further information on buffers see Chapter 5, in *Site Planning for Urban Stream Protection*, which is available from the Center for Watershed Protection (http://www.cwp.org/). If you would like examples of laws establishing minimum buffer requirements or other assistance in establishing buffers, then contact us at 1-410-654-3021. Information on related topics can be found on the CEDS website: www.ceds.org.