

# RIPARIAN BUFFERS IN THE MURDERKILL WATERSHED

## DEFINITION

Riparian buffers can be defined as protected land that borders a body of water, whether marine or fresh, perennial or intermittent, lake based (lacustrine) or moving water based (palustrine). It is a transitional territory between terrestrial and aquatic ecosystems. This land performs many functions that aid natural processes including the filtration of chemicals and nutrients, absorption of floodwaters, and the preservation of biodiversity by protecting habitat for a variety of aquatic and terrestrial species<sup>1</sup>.

Although wetlands can be located in riparian buffers, they are not the same. A wetland is a naturally defined area which conforms to certain hydrologic and biotic standards. A riparian buffer is an area designated by political or scientific boundaries to be preserved for the benefit of the ecosystem and can be modified for the specific needs of the waterway.

## WATER QUALITY FUNCTIONS

Buffer areas allow for interactions between uplands and water bodies on both surface and subsurface hydrology levels. The land serves as a “sink” for the adjacent waterway, filtering the runoff from the surrounding areas and assimilating nutrients and chemicals back into the ecosystem. Sediments from runoff are also deposited in these areas. If the sediments were allowed to enter into the waterway, it would change the flow by being deposited in the stream channel and impede sunlight from entering the water. In times of flood, riparian buffers act as an extended portion of the waterbody, allowing water to infiltrate the soil and return to the normal levels without human interference. Groundwater recharge usually provides a primary source of water for streams, establishing the “base flow”. It enters through the bank and bed sediments or through the neighboring soils of the riparian buffer.

## BIODIVERSITY PRESERVATION

Riparian buffers act as an interchange for habitats of land and water species. These areas serve a multitude of functions for many species including plants, animals and aquatic life. Many species of plants have specially adapted lifecycles to coincide with the seasonal cycles of water bodies. The plants depend on the body of water for nutrients and water supply. The water is filtered and cleaned by the plants, in turn creating a better habitat. Shrubs, grasses and trees all live in riparian areas.

Animals have also adapted for riparian living. Many bird species use riparian areas for rest points during their migration, or for nesting habitats during their reproductive cycle. The diversity of food sources from plants and insects is a major factor of their dependence. Amphibians and reptiles also depend on riparian buffers for survival; in fact, most species of reptiles and amphibians can live only in close proximity to water. The plentiful resources of the riparian buffers attract even mammals that are not specifically modified for living in wetlands. Riparian areas are even used as greenways, which aid the natural migration of animals through natural areas instead of changing the dangerous route through suburbanized areas.

## MANAGEMENT

Although there are many benefits associated with the use of buffers, the Murderkill Tributaries need to be primarily concerned with Nitrogen and Phosphorus reduction. In the published report, Technical Analysis for the Murderkill River TMDLs, it was found that the two largest concerns for the Murderkill watershed were extremely low amounts of Dissolved Oxygen (DO), which is important for fish survival, and exceedingly high amounts of nutrients, specifically nitrogen and phosphorus. Both of these concerns are a result of runoff from localities that over-fertilize their land, including both residential and agricultural areas<sup>2</sup>. So now that the problem is identified, what can be done?

There are four general approaches to the protection of riparian buffers by governments and interested parties:

- **Creating special management areas on public lands**, like state park initiatives and programs which educate visitors on the advantages
- **Establishing private land development/use regulation**, state and local stream buffer requirements may force residents to shield the stream that runs through their land
- **Promoting financial incentives, technical assistance and education**, USDA requirements, for instance, make stream protection mandatory in order to qualify for subsidies and federal grants
- **Assisting the public/non-profit purchase of private riparian lands from land owners**, as done by groups such as The Nature Conservancy in order to preserve habitat or create a Greenway through developed lands for wildlife

<sup>1</sup> *Riparian Areas; Functions and Strategies for Management* Water Science and Technology Board, 2001.

<sup>2</sup> *Technical Analysis for the Murderkill River TMDL*, DNREC Watershed Assessment Section, 2001.

There are still unanswered questions: How wide will the buffers be? How much will they impact the water quality? What results will we be able to see in the future?

## CASE STUDIES

There have been numerous studies on the impacts of buffer strips on overenrichment. One such study was done by the Delaware Department of Natural Resources and Environmental Control (DNREC) in an area of the Inland Bays Watershed to mimic the effects of a large-scale buffer installation on natural waterways. A buffer strip length of 100-feet was decided upon because there is more data available on this distance. The pilot reduction calculations used nutrient loading rates and buffer effectiveness rates from a Maryland Lower Eastern Shore agricultural study. The results found that with these calculated nutrient loading rates and the 100 foot buffer effectiveness rates, significant reductions in nutrient loading could occur<sup>3</sup>:

- ❖ 275 lbs/day of groundwater nitrogen to 94 lbs/day
  - **65% reduction of nitrogen**
- ❖ 200 lbs/day of surface water nitrogen to 80 lbs/day
  - **60% reduction of nitrogen**
- ❖ 3.27 lbs/day surface water phosphorus to 0.98 lbs/day
  - **70% reduction in phosphorus**

A study in North Carolina's Coastal Plains region confirmed the effectiveness of riparian buffers while concentrating on Dissolved Phosphorus (DP) in surface water and groundwater. In this study, a field of Coastal Bermuda Grass was sprayed with hog manure for ten years. The adjacent black water stream was buffered with a grass strip area flanking the field, and then a riparian area with trees and shrubs. The grass strip was approximately 16-32 feet wide, whereas the riparian area varied in width from 39-67 feet. There were six wells located in the spray field, 7 in the grass strips at varying distances from the field and 4 at the stream edge. There were also 4 control wells located in the field on the opposite side of the stream, which has never been sprayed, in the grass strip and at the stream edge. The results are summarized as follows:

- ❖ The **grass strip** wells had the **highest DP** concentration of all the wells
- ❖ The **stream edge** wells did not yield DP enriched groundwater
  - **Grass strip DID absorb excess Phosphorus**
- ❖ The difference between the average **grass strip** and **stream edge** Phosphorus concentrations was **87%**
  - **Grass strip buffers CAN reduce the amount of Phosphorus in ground water by 87%**

These case studies varied in the type of buffer; the first concentrated on forested buffers and the second's results came from grassed buffers. A study done in Connecticut

re-enforces the idea of forested buffers. After measuring nitrate runoff in buffered areas and non-buffered areas, **Nitrate** was found to be **95%** lower in buffered areas<sup>4</sup>. In another study in Connecticut, the restoration of a grassed buffer between a corn field and stream reduced **nitrogen** by **83%** and **phosphorus** by **73%**<sup>5</sup>. The difference in nutrient reduction seems to be in favor of forested buffers, but the varying land uses and land owners could account for that difference. Most studies have concerned themselves with forested buffers as well.

## IMPLEMENTATION ISSUES

There are scientific and political issues to resolve before riparian buffer may be implemented. Scientific issues center around the exact purposes and goal of buffers, with questions such as:

- What wildlife inhabits this area?
- What nutrients are problems and what are the specific plants that will reduce them?
- What soil types occur and how will that effect loading rates?

The political issues are focused on the execution of the scientific concerns. Numerous questions must be answered, for instance:

- Who will enforce mandatory buffers?
- Will economic benefit be given for land that will no longer be farmed or developed?
- Who is responsible for the scientific research?
- If buffers are required for new development, what about existing developments?
- The NM Law says no one can require buffers on Agricultural lands; is this efficient and what can be done?

### MURDERKILL WATERSHED

*This fact sheet was prepared by the Delaware Department of Natural Resources and Environmental Control's Whole Basin Team for citizens and stakeholders interested in one of Delaware's most environmentally and economically attractive areas—the Murderkill River and its surrounding lands, surface and ground waters.*

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*Delaware's good nature depends on you!*

<sup>3</sup> *Urban Riparian Buffers Inland Bays Tributary Team, 2001*

<sup>4</sup> *Statistical Evaluation of Effects of Riparian Buffers on Nitrate and Ground Water Quality, Spruill, 2000.*

<sup>5</sup> *Water Quality Changes from Riparian Buffer Restoration in Connecticut Clausen, et al, 2000.*