WHY RIPARIAN SETBACKS?

Riparian areas are naturally vegetated lands along rivers and streams. When appropriately sized, these areas can limit streambank erosion, reduce flood size flows, filter and settle out pollutants, and protect aquatic and terrestrial habitat. This portfolio of riparian services flows directly from maintaining the dynamic connection between rivers and their riparian corridors. **Riparian setbacks are a tool local governments can use to maintain riparian area functions**. The relationship between riparian areas and riparian setbacks is summarized as follows:

- Setbacks are a zoning tool for local governments.
- Setbacks limit development and encroachment in riparian areas.
- By limiting disturbance, setbacks maintain riparian area functions that influence flooding, channel erosion, and water quality.
- These functions directly affect public health and safety, establishing the legal linkage for local governments to exercise their zoning authority.
- Setbacks preserve riparian area flood control, erosion control, and water quality protection functions at no direct cost.
- The loss of riparian area functions often requires significant investment in engineered structures to partially replace the lost riparian services.

To assist communities in establishing riparian setbacks, CRWP has developed a model regulation. **This model recommends that riparian setbacks:**

- Range from **25 feet** to **300 feet** depending on watercourse drainage area.
- Are **minimum distances** and apply to **both sides** of designated watercourses.
- **Conform to community** development patterns and natural resource management goals.
- Include provisions to **examine the combined impact of all setbacks** - side yard, rear yard, riparian, etc. - on a subdivision or a parcel and **make reasonable adjustments** to ensure existing **lots remain buildable** and **to maintain lot yields** from new subdivisions to the extent possible.

This handout summarizes research on riparian area functions and relates these to each purpose in CRWP's model riparian setback regulation.

Riparian Areas Limit Streambank Erosion

WHEREAS, streambank erosion is a significant threat to property and public health and safety, and vegetated riparian areas stabilize streambanks and provide resistance to erosive forces both within streams and on adjacent lands; and,

- The root systems of riparian vegetation, particularly trees, hold streambank soils in place against the erosive force of high velocity waters [1].

- Vegetated streambanks are up to 20,000 times more resistant to erosion than bare streambanks [2].

- In addition to altering channel hydraulics and dissipating erosive shear stresses, riparian vegetation increases the strength of streambanks through both mechanical effects of roots [3, 4], and hydrologic effects on the pore water pressure in the soil matrix [5].

- On the Cann River in Victoria, Australia, estimated rates of lateral channel migration have increased 150 fold with an 860 fold increase in annual sediment yield since European settlement. Most of these dramatic channel adjustments are estimated to have occurred in the last 40 years in response to the removal of riparian vegetation and removal of wood in the stream channel [6].

Riparian Areas Reduce Flood Size Flows

Whereas, flooding is a significant threat to property and public health and safety, and vegetated riparian areas lessen the damage from flooding by slowing the water velocity, enabling water to soak into the ground, and by providing temporary storage of overbank flood flow; and,

- During high flows, streams spread out across the floodplain, dissipating much of the energy of flood flows [1].

- Adjacent forest vegetation and litter lowered stream flood elevations from 32 feet to 17 feet for a 100-year flood [7].

- The combined effect of vegetated floodplains is to reduce flow velocity, increase the storage of water, and minimize downstream flood impacts [8].

- A riparian protection program that prohibits development in both the floodway and the flood fringe preserves the natural storage and dissipation of flood flows, and protects structures from flood damage [9].

- Protecting 8,500 acres of floodplain wetland on the Charles River in Massachusetts prevented an estimated $27 million in annual flood damages downstream, while avoiding the $100 million costs of levees and flood control reservoirs [10].

Riparian Areas Filter and Settle Out Pollutants

Whereas, vegetated riparian areas filter and trap sediments, chemicals, salts, septic discharge, and other pollutants from runoff and floodwaters, thus protecting surface and ground water quality; and,

WHEREAS, sedimentation of eroded soil adversely affects aquatic communities and incurs *removal costs to downstream communities; and,*

- Computer modeling of riparian systems shows that a 150 foot riparian setback on a 3% slope reduced sediment transport by 90% [11].

- Recognizing that a one-size-fits-all approach is unlikely to be optimal in any particular situation, the National Academy of Sciences described 100 foot setbacks as the default standard for watershed protection in the United States [12].

- The effectiveness of riparian setbacks at removing sediments is directly related to their width. Most degradation of the aquatic benthic community from sediment deposition is prevented by riparian setbacks 98 feet wide or greater [13].

- Forested riparian areas prevent nonpoint source pollutants from entering small streams. They also enhance the in-stream processing of pollutants, reducing their impact on downstream rivers and estuaries [14].

- Significant increases in infiltration rates are consistently observed in vegetated riparian areas [15] contributing to sediment removal, and carrying dissolved constituents into shallow groundwater where they may be further immobilized and metabolized by geochemical and microbial processes [16, 17].

- Connected riparian corridors function as living filters that protect adjoining streams and downstream receiving waters [18].

- Preserving riparian corridor functions is unequivocally recognized as one of the most effective means to manage excess nutrient losses from intensively used watersheds [19].

- A 150 foot riparian setback is necessary to protect water quality from sedimentation and pollutants. In developing this number, 34 pollutant specific studies were reviewed. These studies showed an 82 foot setback necessary to remove 80% of sediments; a 197 foot setback necessary to remove 80% of suspended solids and nitrogen; and a 279 foot setback necessary to remove 80% of phosphorus [9].

Riparian Areas Protect Habitat

Whereas, vegetated riparian areas can provide a dense tree canopy that helps to maintain and improve the stability of watercourse temperatures, thus protecting aquatic ecosystems, and helps to reduce the presence of aquatic nuisance species; and,

Whereas, the protection of riparian areas can result in a diverse and interconnected riparian corridor that provides habitat to a wide array of wildlife;

- A 100 foot forested riparian setback from both sides of a perennial stream minimized the increase and fluctuation in river temperature following timber harvesting [20].

- Biological monitoring of Ohio's urban and suburban streams found the few sites where biological integrity was maintained occurred in streams where the floodplain and riparian area were relatively undeveloped [21].

- Considering all life history stages, minimum core habitat for amphibians and reptiles extends between 466 and 948 feet from the edge of riparian systems [22].

- During Spring and Fall, migratory birds are 10 to 14 times more abundant in riparian habitat than in surrounding upland habitat [2].

- More than 50% of the breeding bird species in Ohio use riparian wooded areas to nest [2]. During Spring and Fall, migratory birds are 10 to 14 times more abundant in riparian habitat than in surrounding upland habitat [2].

- In Bear Brook, New Hampshire more than 98% of the organic matter was supplied by the riparian forest [23].

References

1. Gregory, S.V., et al., *An Ecosystem Perspective of Riparian Zones.* Bioscience, 1991. **41**(8): p. 540-551.
2. OEPA, *The Benefits of Stream and Riparian Habitat Protection in Ohio. Appendix to Volume I in Ohio Water Resources Inventory, OEPA, Division of Surface Water, Columbus, Ohio.* 1994.
3. Easson, G. and L.D. Yarbrough, *The effects of riparian vegetation on bank stability.* Environmental & Engineering Geoscience, 2002. **8**(4): p. 247-260.
4. Pollen, N. and A. Simon, *Estimating the mechanical effects of riparian vegetation on stream bank stability using a fiber bundle model.* Water Resources Research, 2005. **41**(7).
5. Simon, A. and A.J.C. Collison, *Quantifying the mechanical and hydrologic effects of riparian vegetation on streambank stability.* Earth Surface Processes and Landforms, 2002. **27**(5): p. 527-546.
6. Brooks, A.P., G.J. Brierley, and R.G. Millar, *The long-term control of vegetation and woody debris on channel and flood-plain evolution: insights from a paired catchment study in southeastern Australia.* Geomorphology, 2003. **51**(1-3): p. 7-29.
7. Castelle, A.J., A.W. Johnson, and C. Conolly, *Wetland and Stream Buffer Size Requirements - a Review.* Journal of Environmental Quality, 1994. **23**(5): p. 878-882.
8. Smardon, R. and J. Felleman, *Protecting Floodplain Resources: A Guidebook for Communities. The Federal Interagency Floodplain Management Task Force.* 1996.
9. Desbonnet, A., et al., *Vegetated Setbacks in the Coastal Zone. ISBN 0-938 412-37-x. Coastal Resource Center, Rhode Island Coastal Sea Grant, University of Rhode Island. Providence, Rhode Island.* 1994.
10. EDV&CBN, *The Economic Benefits of Parks and Open Spaces.* Environmental Damage

Valuation and Cost Benefit News, 2000. **VII**(3): p. 4-7 http://www.costbenefitanalysis.org/newsletters/nws00mar.pdf accessed 10 September 2005.
11. Wong, S.L. and R.H. McCuen, *The design of vegetative buffer strips for run-off and sediment control.*, in *Technical Paper, funded by the Maryland Coastal Zone Management Program, University of Maryland. College Park, MD.* 1982.
12. NRC, *Watershed Management for Potable Water Supply: Assessing the New York City Strategy*. National Research Council Committee to Review the New York City Watershed management Strategy. 2000: National Academy Press. Washington, DC.
13. Divelbiss, C.F., *A Review of Selected Functions of riparian Buffer Zones and Widths Associated With Them. Presented at the Rivers Without Boundaries Convergence, American Rivers Management Society. Grand Junction, CO. April 21, 1994. Ohio DNR, Division of Natural Areas and Preserves, Columbus, OH.* 1994.
14. Sweeney, B.W., et al., *Riparian deforestation, stream narrowing, and loss of stream ecosystem services.* Proceedings of the National Academy of Sciences of the United States of America, 2004. **101**(39): p. 14132-14137.
15. Schultz, R.C., et al., *Design and Placement of a Multispecies Riparian Buffer Strip System.* Agroforestry Systems, 1995. **29**(3): p. 201-226.
16. Abu-Zreig, M., et al., *Experimental investigation of runoff reduction and sediment removal by vegetated filter strips.* Hydrological Processes, 2004. **18**(11): p. 2029-2037.
17. Abu-Zreig, M., et al., *Phosphorus removal in vegetated filter strips.* Journal of Environmental Quality, 2003. **32**(2): p. 613-619.
18. Martin, T.L., et al., *Review: Denitrification in temperate climate riparian zones.* Water Air and Soil Pollution, 1999. **111**(1-4): p. 171-186.
19. Kuusemets, V. and U. Mander, *Ecotechnological measures to control nutrient losses from catchments.* Water Science and Technology, 1999. **40**(10): p. 195-202.
20. Lynch, J.A. and E.S. Corbett, *Evaluation of Best Management-Practices for Controlling Nonpoint Pollution from Silvicultural Operations.* Water Resources Bulletin, 1990. **26**(1): p. 41-52.
21. Miltner, R.J., D. White, and C. Yoder, *The biotic integrity of streams in urban and suburbanizing landscapes.* Landscape and Urban Planning, 2004. **69**(1): p. 87-100.
22. Semlitsch, R.D. and J.R. Bodie, *Biological criteria for buffer zones around wetlands and riparian habitats for amphibians and reptiles.* Conservation Biology, 2003. **17**(5): p. 1219-1228.
23. Fisher, S.G. and G.E. Likens, *Energy Flow in Bear Brook, New Hampshire: An Investigative Approach to Stream Ecosystem Metabolism.* Ecological Monographs, 1973. **43**: p. 421-439.

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