OFFICE OF LONG ISLAND SOUND PROGRAMS

TIDAL WETLANDS BUFFERS GUIDANCE DOCUMENT

INTRODUCTION

This document was developed to provide local land use agencies with background information regarding the value of vegetated buffers as a tool in protecting tidal wetlands from adverse impacts associated with adjacent upland development. It presents a brief overview of tidal wetlands followed by a discussion of what vegetated buffers are, how they function, what characteristics make the ideal buffer and how buffers can be used to protect tidal wetlands. Key concepts in the development of buffer regulations are presented and model regulation language is provided.

This document concentrates on the value and establishment of buffers to protect tidal wetlands. However, it should be noted that buffers can be an effective tool in protecting other sensitive resource areas.

TIDAL WETLANDS

WHAT ARE TIDAL WETLANDS?

Tidal wetlands are:

> those areas which border on or lie beneath tidal waters, such as, but not limited to banks, bogs, salt marshes, swamps, meadows, flats, or other low lands subject to tidal action, including those areas now or formerly connected to tidal waters, and whose surface is at or below an elevation of one foot above local extreme high water; and upon which may grow or be capable of growing some, but not necessarily all, of [a list of specific plant species - see Connecticut General Statutes (CGS) section 22a-29(2) for complete list of species]" [CGS section 22a-29].

In general, tidal wetlands form in “low energy” environments protected from direct wave action. They are usually flooded by tidal waters twice a day and support a diverse ecosystem of vegetation and wildlife.

WHY ARE THEY VALUABLE?

Tidal wetlands are areas of high nutrient and biological productivity that provide detrital products forming the base of the food web in Long Island Sound. Next to tropical rainforests, tidal wetlands are the most biologically productive resource in the world. Tidal wetlands provide habitat, nesting, feeding, and refuge areas for shorebirds; serve as a nursery ground for larval and juvenile forms of many of the organisms of Long Island Sound and of many estuarine-dependent oceanic species; and provide significant habitat for shellfish. Most of the commercial fisheries stock that we eat start their lives in tidal wetlands. These resource areas also improve water quality by trapping sediments, reducing turbidity, restricting the passage of toxics and heavy metals, decreasing biological oxygen demand (BOD), trapping nutrients, and buffering storm and wave energy. Tidal wetland vegetation stabilizes shorelines and buffers erosion. Tidal wetlands provide recreational opportunities for fishing, wildlife observation and hunting; are important to commercial and recreational shell- and finfisheries; and are areas of scientific and educational value. Tidal wetlands are a major source of coastal open space and offer exceptional scenic views.

WHY DO TIDAL WETLANDS NEED PROTECTION?

Due in part to their transitional location between upland areas and coastal waters, tidal wetlands are very specialized habitats that are sensitive to disturbance. Human actions, both direct and indirect, can adversely impact tidal wetlands and their functions. Direct actions include activities such as filling, dredging and trampling; indirect actions include upland uses that result in sedimentation, increased stormwater discharge, proximate septic system failures or the installation of culverts in a manner that decreases salt water flushing. In these cases, the delicate balance between soil surface, water level, water quality and/or salinity is disturbed. This results in a stressed habitat which is usually less productive than a healthy marsh and frequently supports undesirable species, most typically Common Reed (*Phragmites australis*). Historically, many of these activities have occurred in Connecticut resulting in the loss or degradation of the majority of tidal wetlands. As a result it is even more important to protect the wetlands that remain.

WHAT ARE MUNICIPAL RESPONSIBILITIES TOWARD TIDAL WETLANDS?

Although activities within tidal wetlands are regulated by the DEP, municipalities are responsible for ensuring that adjacent upland development does not harm these resource areas. The Connecticut Coastal Management Act contains policies and standards regarding tidal wetlands that must be applied during municipal coastal site plan review process. Generally speaking, land use boards and commissions in coastal municipalities must ensure that development will not result in degradation of tidal wetlands, and that tidal wetlands are preserved, protected and, to the extent practicable, restored.

VEGETATED BUFFERS

WHAT IS A VEGETATED BUFFER?

A vegetated buffer is an undisturbed area or strip of land covered with permanent stable vegetation adjacent to a resource area. They can be either in a natural state or artificially planted. If artificially planted, low-maintenance, preferably native, non-invasive vegetation should be used. Vegetated buffers are frequently used to protect inland wetlands and watercourses. Depending upon their purpose and site-specific conditions, effective vegetated buffers can range in width from a few yards to several hundred feet.

WHY ARE VEGETATED BUFFERS VALUABLE FOR TIDAL WETLANDS PROTECTION?

Properly designed buffers protect resource areas from direct and indirect adverse impacts associated with adjacent upland development. They protect tidal wetlands from adverse changes to water quality and temperature; control erosion and trap sediment; protect and provide wildlife habitat; reduce the effects of flooding on adjacent upland property; reduce the potential for direct human and/or pet disturbance of sensitive wetland areas; maintain aesthetic diversity and enhance recreational value of coastal areas. An effective and established buffer provides a mosaic of inter-dependent functions.

Establishing a vegetated buffer area can decrease lawn maintenance requirements and associated costs and impacts by reducing the area of manicured landscape. This results in lowered costs for lawn care, including mowing and fertilizer and pesticide application, while improving tidal wetland protection.

HOW DO WE KNOW THAT VEGETATED BUFFERS ARE EFFECTIVE?

There have been numerous research projects to assess the value of buffers as wetland protection measures. The scientific literature to date has examined several different types of buffers (e.g., forested, grassy, shrubby) of varying widths and evaluated their effectiveness at protecting water quality in adjacent wetlands and watercourses from specific impacts associates with identified upland uses. As with most scientific research, each study has generally had a narrow focus and has examined specialized functions such as the retention of nitrogen, phosphorous, sediment or pesticides and herbicides. The majority of this research has been done with respect to freshwater wetlands and watercourses with little research specific to tidal wetlands. Despite the research done to date, there are still too many unknowns to determine the optimum buffer width for every instance.

HOW DO VEGETATED BUFFERS WORK?

In general, retaining an undisturbed buffer area adjacent to a tidal wetland will promote stormwater infiltration, pollutant retention, and habitat protection. It will also discourage direct human disturbance and increase visual diversity. Buffers provide these benefits in very specific ways, depending upon the intent of the buffer.

HOW DO VEGETATED BUFFERS PROTECT WATER QUALITY?

When used for water quality protection, the primary role of a vegetated buffer is as a stormwater management measure. Since the land within a buffer area is not developed or significantly disturbed, it typically does not generate pollution. Such an undisturbed area acts as a filter to intercept and absorb nutrients, sediment and other pollutants carried in stormwater runoff that flows across or through the buffer. A vegetated buffer also slows the flow of runoff which both reduces erosion of the buffer area and allows silt and other suspended solids to settle out within the buffer before reaching adjacent wetlands. Additionally, any contaminants attached to the trapped sediment are retained in the buffer area and do not reach the wetland. Slowing the speed of runoff also allows the water to infiltrate the soil and ultimately discharge to the wetland as groundwater rather than as overland flow thereby reducing the volume of surface runoff. This is especially significant as freshwater, even if of drinkable quality, when introduced into a saline habitat, such as most tidal wetlands in Connecticut, can have significant adverse impacts by diluting the natural salt content of the receiving area. Discharge as groundwater reduces potential adverse impacts as it is usually below the root zone of the wetland area and, thus, has less effect on the resource. Buffer areas also trap bacteria, pathogens and pesticides which then decompose or break down in place, aiding in the preservation of water quality.

HOW DO VEGETATED BUFFERS PROTECT AND PROVIDE WILDLIFE HABITAT?

Vegetated buffers provide wildlife with needed areas for feeding, resting, nesting and raising young, as well as corridors through which wildlife can safely transverse otherwise developed areas. Vegetated buffers not only provide wildlife habitat directly within the buffer area but also protect adjacent wildlife habitat in the abutting resource area. Some wildlife species use the buffer area itself, while others use the tidal wetlands protected by vegetated buffers and some species will use both areas.

HOW DO VEGETATED BUFFERS PROVIDE FLOOD CONTROL?

Naturally vegetated buffer areas adjacent to tidal wetlands serve a number of functions for flood control. On level areas abutting tidal wetlands, vegetated buffers can serve as areas where flood waters can spread out. Root systems of shrubby and forested vegetation within the buffer areas generate pores in the soil, allowing flood waters to infiltrate the soil within the buffer. Significantly more water can infiltrate soil that supports shrubby and forested vegetation than land used for lawn, buildings, patios and terraces, driveways or other less permeable surfaces. Buffers also provide flood control by moving development back from the naturally flood-prone resource area.

HOW DO VEGETATED BUFFERS PROTECT WETLANDS FROM HUMAN DISTURBANCE?

When used to protect tidal wetlands from disturbance by humans and their pets, a vegetated buffer primarily provides a physical barrier between areas of human occupation and tidal wetlands. Human disturbance often takes the form of trampling, disposal of grass clippings and other lawn waste, intermittent filling, and other improper disposal actions. Pets can interrupt the life routines of wildlife of the wetlands and buffer area by both predation and general disturbance. The denser the vegetation in the buffer area, the less it is apt to be penetrated by humans and their pets.

HOW DO VEGETATED BUFFERS MAINTAIN AESTHETIC DIVERSITY AND RECREATIONAL VALUE OF COASTAL AREAS?

A healthy tidal wetland is usually fairly flat and the most obvious vegetation is comprised of grasses. Abutting vegetated buffers can offer a visually interesting contrast in terms of vegetation type and texture. This contrast increases aesthetic diversity of the coastal area and, because they are both interesting to look at and provide habitat for birds and other wildlife, they increase the recreational value of the coastal area by providing improved opportunities for birding, painting/drawing, and other passive recreational pastimes.

WHAT DETERMINES THE OVERALL EFFECTIVENESS OF A VEGETATED BUFFER AREA FOR PROTECTING TIDAL WETLANDS?

- The general topography of the buffer area. Flat or gently sloping buffers are more effective because they are more successful at slowing the rate at which stormwater flows across them. A slower flow rate enhances the infiltration and filtering capability of the buffer. The ability to provide flat or gently sloping buffers is clearly related to individual site characteristics.

- The type of stormwater flow. Sheet flow (slow unrestricted flow across the ground) along the length of the buffer allows the buffer area to more effectively trap sediments, attenuate pathogens and pollutants, and encourage infiltration. Concentrated flow (e.g., flows directed through swales, pipes or other conveyances or flows that are strong enough to create gullies or other eroded channels) reduce or essentially eliminate the effectiveness of a buffer for stormwater management.

- The permeability of the soils and the depth to the water table. Generally, higher soil permeability (the rate that water can flow through soils) and greater depth to the water table will increase the rate of infiltration and attenuation within the buffer area. It should be recognized that, except for areas where the land slopes sharply up from the wetland boundary, generally the depth to groundwater adjacent to tidal wetlands is quite shallow.

- Whether the current vegetation is native or non-native, its density and its character (e.g., forested, shrubby, grassland, etc.). Dense, minimally groomed, native vegetation is inherently suited to the local climate and generally provides an effective buffer that requires less maintenance than non-native or heavily groomed vegetation.

- Whether the land use above the buffer poses a high, medium or low risk for pollution or other disturbance. The higher the risk posed by the upland use, the greater the need for an effective buffer. Increasing the width of a required buffer and/or increasing the density of native plantings can aid in offsetting the potential impacts from a high-risk upland use.

- What types of activities are permitted within the buffer. The fewer activities allowed, the more valuable a vegetated buffer will be. Land clearing, grading or other disturbances and establishing or maintaining impervious surfaces with vegetated buffer diminish their overall effectiveness for a variety of purposes. However, in some instances, minimal access to the tidal wetlands edge might be appropriate as a reasonable exercise of riparian or littoral rights in order to obtain access to a dock or boating facility. For large projects, passive recreation amenities, such as hiking trails, benches and/or picnic tables may be appropriate to provide a necessary water-dependent use provided they are properly designed to minimize disruption of the buffer as a resource protection measure.

HOW WIDE IS WIDE ENOUGH?

The scientific literature to date has examined several different types of buffers (e.g., forested, grassy, shrubby) and evaluated their effectiveness at protecting water quality in adjacent wetlands and watercourses. As is typical with research projects, most projects have been narrowly focused and generally each study has examined isolated impacts or values associated with specific upland uses. For example, a single research paper might examine the effectiveness of a 60 meter (197 foot) wide buffer in removing total suspended sediments (TSS) in stormwater runoff. Or a study might investigate the use of a 30 meter wide buffer by avian species for general habitat.

The majority of this research has been done with respect to freshwater wetlands and watercourses. However, in the absence of tidal wetland specific investigations, it may be reasonable to assume that the data on freshwater systems is transferable to tidal wetlands.

The data available does not clearly indicate an optimum minimum buffer width for multi-purpose buffers. However, The Scientific Basis for Protecting Riparian & Wetland Buffer Zones (REMA Ecological Services) indicates the following removal rates can generally be provided by a 100 foot buffer:

81 percent of total suspended solids
89 percent of sediment
89.5 percent of nitrogen
82 percent of phosphorous

Of these potential water quality contaminants, TSS is only one for which a removal standard has been set. The US Environmental Protection Agency has set a TSS removal goal of 80 percent.

It should be noted that there is a strong indication in the literature that the effectiveness of buffers is not a linear function. In other words, one cannot take the data listed above and assume that if a 100 foot buffer removes 82 percent of phosphorous, for example, each foot of buffer will remove 0.82 percent of phosphorous or that a 122 foot buffer will remove 100 percent of phosphorous. However, this data does suggest that a 100 foot vegetated buffer has a significant effect in removing the listed substances.

In contrast, the data related to the provision of buffers for wildlife functions, including feeding, nesting, resting and movement corridors vary considerably. The following list of effective buffer widths for wildlife functions is taken from How Ecology Regulates Wetlands (Washington State Department of Ecology).

15-23 m (49-75 feet) of riparian wooded area can provide general avian habitat
15-30 m (49-98 feet) of densely growing mixed vegetation can protect wetlands habitat from low-intensity disturbance
30 m (98 feet) of unspecified area can provide a wildlife travel corridor
30-45 m (98-148 feet) of densely growing mixed vegetation can protect wetlands habitat from high-intensity disturbancest
60 m (197 feet) of unspecified area can provide breeding sites for fragment-sensitive bird species
60-100 m (107-328 feet) of unspecified area can provide general wildlife habitat
67 m (220 feet) of wooded riparian area can provide small mammal habitat
91.5 m (300 feet) of natural vegetation a can provide protect significant wildlife habitat
178 m (584 feet) of unspecified area can provide general wetland habitat protection
200 m (656 feet) of unspecified area can provide diverse songbird habitat
<200 m (656 feet) of riparian forest can provide reasonable habitat for all except the largest mammals

As is apparent from these limited data examples, there is no single universal width that can provide all the desired benefits of a buffer. It can be stated, however, that the effectiveness of a buffer increases with its size. Wide buffers (e.g., 100 feet or greater in width) provide the best protection for water quality by moderating temperature changes and improving control of erosion, sediment and pollution and provide the widest range of wildlife values. It can be concluded that wider buffers also provide more overall benefits such as reducing human disturbance, maintaining wildlife habitat and providing improved flood protection. However, even a narrow buffer (25 to 50 feet in width) can be effective for specific purposes in certain limited situations. For example, a 50-foot buffer supporting dense native vegetation might provide substantial aesthetic benefits and general avian habitat; however, it would not provide adequate entrapment of total suspended solids to meet the EPA goal of 80 percent unless combined with the implementation of other best management practices.

Thus, it should be apparent that the optimum width of a tidal wetlands buffer depends upon a combination of on-site and adjacent conditions (topography, soils, upland use, etc.) and desired function of the buffer (water quality protection, wildlife habitat provision, physical barrier to human intrusion, etc.).

IN GENERAL TERMS, WHAT DOES THE ULTIMATE TIDAL WETLANDS BUFFER LOOK LIKE?

The answer will depend on what you want the buffer to do. Realistically, given Connecticut's historic patterns of development and irregular topography, it often will be difficult to provide a vegetated tidal wetlands buffer that can do it all. However, in general terms, the ultimate tidal wetlands buffer is relatively flat with only a very gentle slope, with undisturbed, moderately permeable soils and dense native vegetation with a heavy layer of leaf litter and is as wide as possible given the lot size, site conditions and proposed upland use(s).

CREATING VEGETATED TIDAL WETLANDS BUFFERS:

WHERE SHOULD WE USE VEGETATED TIDAL WETLANDS BUFFERS?

Tidal wetlands buffers should be located between tidal wetlands and adjacent upland development. Some water-dependent uses or water-dependent components of projects will likely require development within a buffer area, but water-dependent uses and tidal wetlands buffers are not necessarily mutually exclusive. Structures which provide private water access such as appropriately designed walkways or docks may also need to be sited within a buffer area; however, such access should be carefully designed and implemented to minimize potential adverse impacts to the abutting tidal wetlands.

HOW BIG IS BIG ENOUGH?

As indicated above, the size of an effective buffer is dependent on many factors and can be anywhere from a relatively narrow unmown area of a lot to a wide forested strip. The ideal buffer width will depend on the desired emphasis (water quality, wildlife habitat, temperature moderation, erosion control, etc.), the amount of available land, and the current or proposed use of the property. In general, a 100-foot wide vegetated area will provide many of the desired buffer benefits.

HOW CAN A MUNICIPALITY IMPLEMENT TIDAL WETLANDS BUFFERS?

- Update zoning regulations to better protect sensitive tidal wetlands by establishing or increasing protective buffers between development and all tidal wetlands1. These buffers should be required landward of the upland limit of tidal wetlands. In those cases where steep slopes (25 percent or more) abut tidal wetlands, the buffer width should be measured in from the top of the slope. The most effective buffers support dense growth of shrubs and trees. (see below for model regulation language).

- Most uses should be prohibited in vegetated buffers. A reasonable exception might be to allow limited access to and, in the case of general public access, along the tidal wetland border.

- Once buffers are established by regulation, they should be strictly honored. Variances of the minimum buffer width should only be allowed in those extremely limited cases where there is a strict statutory hardship as defined in the Connecticut General Statutes section 8-6(3) and where compliance with the buffer requirement would render an otherwise buildable lot unusable.

- Revise subdivision regulations to require 100-foot wide vegetated buffers abutting all tidal wetlands in new subdivisions.

- Revise zoning and subdivision regulations to limit clearing of vegetation adjacent to tidal wetlands and within buffer areas. Establish specific standards for the removal of invasive species and perhaps allow minimal clearing to enhance views and provide access where necessary while maintaining the effectiveness of the buffer.

- Revise zoning and subdivision regulations to require larger minimum lot sizes in areas containing or abutting tidal wetlands.

- You may want to consider adopting buffers to address other resource protection needs.

Different approaches to creating vegetated buffers

There are many different ways to structure a requirement for vegetated buffers. The most simple approach is to specify a fixed minimum width. While this is simple to administer, it may not be effective enough unless the minimum width is quite wide (100' or more). A wide fixed buffer may be hard to implement in Connecticut given our established development patterns that frequently resulted in housing and other development clustered along the edges of tidal wetlands. Nevertheless, this approach is attractive due to its simplicity.

A second approach is to require that a minimum percentage of lot depth be established as a vegetated buffer. This provides some flexibility to respond to the constraints posed

1 For technical legal reasons, a municipality cannot establish a tidal wetlands buffer under its inland wetlands authority, however, this is not a problem because municipal planning and zoning authority is amply sufficient.

by existing development. However, the common perception may be that owners of deeper (perhaps more valuable lots) are being penalized by being required to provide more buffer in overall width than owners of smaller, less deep lots.

A third approach is the use of an equation that factors in specific site conditions such as slope, existing vegetation type (e.g., grassy, shrubby, forested), soil permeability and upland use(s). Often these equations can be quite complicated, municipal staff would require specialized training to enable them to determine the minimum buffer width on a case by case basis. Implementation and enforcement can be labor intensive and time consuming.

A fourth technique utilized by some states is to grade wetlands into categories based on their existing value and functions and establish minimum buffer widths that vary based on the category of abutting wetlands. This is not a practical approach to establishing tidal wetlands buffers in Connecticut as our general statutes do not differentiate between varying qualities or values of tidal wetlands. If a wetland area meets the definition of tidal wetlands its specific condition (e.g., pristine or degraded) is not relevant to the statutory responsibility to protected the resource.

There are other approaches to establishing a tidal wetlands buffer that do not prohibit development within the buffer area, but include incentives for locating new impervious surfaces outside of the buffer. Usually these incorporate the creation of compensation areas based on the area of new impervious surface proposed within the minimum buffer area. This type of approach is attractive as it provides more flexibility than the other approaches noted above. However, establishing appropriate regulation language is a difficult task that requires careful and deliberate consideration.

The suggested model regulation language offered below is fashioned after the most simple approach of designating a fixed, effective minimum width tidal wetlands buffers. Based on the data available, a minimum width of 100 feet is recommended for a fixed width vegetated buffer.

MODEL REGULATION LANGUAGE

Based on the above discussion regarding the value of tidal wetlands buffers and the types of approaches to requiring them, OLISP offers the following model regulation language that establishes a uniform 100-foot vegetated buffer adjacent to all tidal wetlands. Prior to adoption, this regulation may be tailored to the specific conditions and concerns in your municipality.

A resource protection buffer of 100 feet shall be established along the upland edge of any tidal wetland as defined by Connecticut General Statutes section 22a-29(2). The width of the buffer shall be measured inland from the upland edge of the tidal wetlands except in the case of wetlands bordered by slopes greater than 25% in which case the buffer shall be measured inland from the top of the slope.

The following uses and activities are prohibited within the buffer:

1. *new building construction that increases the building area or footprint including minor additions to existing buildings;*
2. *detached accessory buildings such as garages and sheds;*
3. *pools, tennis courts, patios, terraces;*
4. *driveways, parking areas;*
5. *other impervious surfaces;*
6. *seawalls, bulkheads, retaining walls, landscaping walls or similar structures;*
7. *grading, excavation or filling, including the construction of new septic systems;*
8. *land clearing, except for minor clearing to allow for appropriate landscaping or the provision of acceptable access as noted below;*
9. *dumping of lawn clippings and other wastes; and*
10. *the application of fertilizers and/or pesticides except when necessary to address a public health issue as determined by the local health official and/or the State Department of Health Services or to control an infestation of invasive vegetative species if authorized by the local conservation commission.*

The following uses and activities, although not expressly prohibited, are discouraged within the buffer area:

1. *the establishment of new lawn areas;*
2. *extensive clearing or pruning. Minimal clearing to provide views may be allowed; however, to maximize the effectiveness of the buffer, pruning should only be done to the extent necessary to clear a view lane and in a manner that maintains the understory and, if forested, the canopy of the buffer area, i.e., no pruning should be conducted within three feet of the ground to protect the understory and, if wooded, no pruning should occur above 9 feet above the ground to protect the canopy.*

The following uses and activities are permitted and/or encouraged within the buffer area:

1. *preservation of existing native vegetation, including shrubs and trees;*
2. *removal of invasive species and replacement with native species;*
3. *elimination and/or minimization of mowing to encourage a variety of native species including shrubs and trees;*
4. *planting of native vegetation; and.*
5. *provision of passive recreational opportunities, including the provision of public access where appropriate. However, such uses should be provided*

at an appropriate scale so as not to significantly diminish the performance of the buffer as a measure to protect tidal wetlands from disturbance and/or degradation. For larger projects, passive recreation components within a tidal wetlands buffer could include provision of walking trails, benches, small-scale picnic areas, and associated amenities.

This regulation does not prohibit the continued use, reconstruction or renovation of any septic disposal system, building, or other improvement in existence on the effective date of the regulation nor does it prohibit the construction of new improvements necessary for the function of water-dependent uses as defined by Connecticut General Statutes section 22a-93(16) except when those improvements can functionally be located outside of the buffer area.

Variance of this regulation is strongly discouraged. Exceptions may be made only in those instances where strict adherence would render a parcel unusable. In those cases, the minimum variance necessary to make the parcel usable should be the maximum variance considered.

PRIMARY REFERENCES

1. *"How Ecology Regulates Wetlands"* Washington State Department of Ecology, February 1992, Publication #97-112*"Vegetated Buffers in the Coastal Zone: A*

2. *"The Scientific Basis for Protecting Riparian and Wetland Buffer Zones: A Summary of the Literature"* REMA Ecological Services, LLC

3. *Summary Review and Bibliography* (Desbonnet et al. 1994) prepared by the Coastal Resources Center of the University of Rhode Island School of Oceanography

4. *"Vegetative Buffers along Coastal Waters: a Case Study of the Chesapeake Bay Critical Area Program"*, Jenny Lynn Plummer, May 1993

5. *"Wetland Buffers: Use and Effectiveness"* Washington State Department of Ecology, February 1992, Publication #92-10