New York State Department of Environmental Conservation
Division of Fish, Wildlife and Marine Resources
Bureau of Habitat
AHP-01

Interpretive Guidance to Staff

Program: Aquatic Habitat Protection

Title: Shoreline Protection

Summary:

Increased development of shorelines is having a cumulative adverse impact on the State's freshwater environments. According to the available scientific literature, the protection of the shoreline and riparian zones of a water body is important for several physical and biological reasons. The DEC also conducted a search of the resource protection efforts for shorelines by neighboring states and provinces. Based upon these findings, this document provides a conceptual framework for evaluating options for projects proposed to stabilize eroding shoreline and riparian zones.

Factual Background:

The shoreline and riparian zones of a lake, stream or river are the critical interfaces between the upland zone and the water body's littoral zone. This strip of land between the edge of a water body and the adjacent upland zone provides many environmental services, such as retaining and conveying flood waters; stabilizing the shore against erosion; filtering nutrients, contaminants and sediments from water flowing from upland zones; and providing critical habitat and movement corridors for a wide variety of plants and animals. It is also the aesthetic focal point for those enjoying the State's waterways for recreation and other purposes. If left intact, both the shoreline and riparian zones are relatively stable and resilient to natural disturbances such as floods and storm events. However, human activities have often removed the native vegetation, altered the gradient, and/or installed a variety of structures, such as residences, lawns, roads, breakwalls, docks and railroad right-of-ways, within these zones. When this occurs, the shoreline and riparian zones can become destabilized and more subject to erosion.

Legal Background:

- ECL §15-0501 and 6NYCRR Part 608.2 require a permit for changing, modifying or disturbing the course, channel or bed of any protected stream or for the removal of sand, gravel or other materials from its bed or banks. A protected stream is any stream or portion of a stream for which there has been adopted by the department or any of its predecessors any of the following classifications or standards: AA, AA(t), A, A(t), B, B(t), C(t) or C(ts). Regulatory jurisdiction on protected streams extends landward to the top of the bank, which is considered to be that land area immediately adjacent to, and which slopes toward the bed of a watercourse. For purposes of this Part, the bed means that land area covered by water at mean high water elevation and the bank will not be considered to extend more than 50 feet horizontally from the mean high water elevation, with the following exception: where a generally uniform slope of 45 degrees (100 percent) or greater adjoins the bed, the bank is extended to the crest of the slope or the

first definable break in slope, either natural or constructed (i.e. road or railroad grade) feature, lying generally parallel to the water course.

- ECL §15-0505 and Part 608.5 require a permit for the excavation from or the placement of fill, directly or indirectly, in any of the navigable waters of the state or in the marshes, estuaries, tidal marshes, and wetlands that are adjacent to and contiguous at any point to any navigable waters of the state and that are inundated at mean high water level or tide. Navigable waters of the state include all lakes, rivers, streams, and other bodies of water in the state that are navigable in fact or upon which vessels with a capacity of one or more persons can be operated not withstanding interruptions to navigation by artificial structures, shallows, rapids or other obstructions, or by seasonal variations in capacity to support navigation (but do not include waters that are surrounded by land held in single private ownership at every point in their total area). Regulatory jurisdiction for navigable waters extends landward to the mean high water line or to the area of a contiguous wetland (or marsh), inundated at mean high water (whether or not that wetland is also protected by ECL Article 24).

- ECL Article 15, Title 27 and 6NYCRR Part 666.13(K)(5) require a permit for the disturbances of the bed and banks of scenic or recreational river segments including fill, excavation or permanent structures; 6NYCRR Part 666.13(I)(3)(a) require a permit for the harvesting, cutting, culling, removal, thinning, or other disturbance of vegetation, not associated with development, located less than 100 feet from the bank of scenic or recreational river segments; and 6NYCRR Part 666.13(I)(4)(a) require notification to DEC prior to commencement of any vegetative clearing or removal activities within 100 feet or less of the bank of scenic or recreational river segments.

- ECL Article 24 and 6NYCRR Part 663 require a permit for activities undertaken in a state wetland, including (a) filling, including filling for agricultural purposes; (b) clear-cutting timber; (c) clear-cutting vegetation other than trees, except as part of an agricultural activity; (d) constructing groins, bulkheads and other shoreline stabilization structures; and (e) reconstruction, restoration, expansion, or modification of existing functional structures. A permit *is* required (i) for cutting but not the elimination or destruction of vegetation, such that the functions and benefits of the wetland are not significantly adversely affected; and (ii) for the in-kind and in-place replacement of existing functional bulkheads and similar structures.

Resource Issues of Concern:

For decades, shoreline erosion control measures have centered on “hard” construction approaches (e.g. vertical concrete, metal, or wooden break-walls; gabions; and rip-rap). Instead of absorbing the energy of wave and water action like vegetated sloping shorelines do, these hardened vertical or near vertical structures reflect wave energy, thereby worsening turbulence and increasing erosion of the littoral zone in front of and adjacent to the structure. All of these factors contribute to an adverse and detrimental impact on the chemical, biological, and physical condition of the water body. The increased turbulence and turbidity can adversely impact plant and animal species and their habitat by reducing water quality, altering the hydrology, and changing the structure of the substrate.

Vertical walls replace naturally sloping shoreline and eliminate gradual and diverse changes in

water depth near the shore, thereby reducing or eliminating valuable littoral, shoreline and riparian habitat as well as flood storage capacity. The vertical walls can also be a barrier both to habitat connectivity (by the limiting the movement of many aquatic and semi-aquatic animal species, particularly the smaller ones, that regularly move between the water body and the adjacent riparian or upland zones) and recreational opportunities (e.g. boating and fishing).

Vertical erosion-control structures are expensive to construct and require regular maintenance to repair damage from direct wave impact, undercutting by currents or waves, overtopping by waves and seepage from the riparian/upland zones. If not adequately maintained, they can fail due to inadequate toe protection, subsidence of backfill materials, buildup of hydraulic pressure associated with inadequate drainage, and direct wave impacts that exceed design specifications. When a structure fails, it can further increase erosion into the adjacent littoral zone. As part of repair activities, landowners often seek to replace the structure with a new one constructed further out into the water body and then backfilling behind the new wall. This results in a never-ending encroachment into waters of the state and important aquatic habitat in the littoral zone.

Rip-rap can reduce some of the impacts of vertical walls because it allows for the absorption of some of the energy from moving water. However, the size and placement of the large rocks can create a barrier to many smaller species of wildlife that cannot traverse the boulder field presented by the rip-rap. Because it is not vegetated, rip-rap does not provide the water quality benefits (e.g. filtration) that natural or restored shoreline and riparian zones can provide.

Overall, the impacts from vertical walls and rip-rap include:

- reduced or degraded habitat for spawning, nesting, breeding, nursery, feeding, thermo-regulating and loafing of aquatic invertebrate and vertebrate species, and impaired movement between aquatic habitat and adjacent uplands for a wide variety of invertebrates, fish, amphibians, reptiles, shorebirds, waterfowl, fur-bearers and other wildlife;

- altered physical structure of the water's edge, with its attendant impacts to hydrology;

- reduced recreational opportunities; and

- localized changes in water quality (including changes to the temperature regime) and increases in settleable solids, turbidity, nutrients and contaminants by the disruption of shoreline sediment transport processes.

Shoreline Erosion Options:
Currently, there are four basic approaches to addressing shoreline erosion problems (NRPC 2003) :

1. Non-structural: simplest, cheapest, and most effective where problems are minor and the land is least disturbed. It may include simply re-planting native vegetation within the eroded area or improving roadside drainage.

2. Bioengineering: uses vegetation, both through plantings and for structural purposes, to provide stability and resistance in light to moderate wave action. This includes using

live-staking, brush-matting, and "wattling" on slopes to create naturally vegetated conditions that can withstand prevailing wave energy.

3. Biotechnical: combines bioengineering approaches with some degree of structural design where higher wave energy exists and/or severe erosion has occurred. It may include erosion control matting or vegetated gabions or rip-rap.

4. Structural: although relatively effective at controlling erosion at their point of installation, these devices are expensive, require maintenance, and have the most severe environmental impacts. They may be required, however, under conditions of extreme wave energy or severe erosion. They include structures like bulkheads, revetments, concrete walls, and gabions.

Recommended Guidance:
In all situations where a new or replacement shoreline erosion project is being proposed, the project sponsor should be required to take the least structural or softest approach available to address the erosion problem at the site, as illustrated above from non-structural options (#1) through to fully engineered structures (#4). It is important to emphasize that hardened shorelines are only a temporary fix for an erosion problem usually caused by the removal of shoreline and riparian vegetation. Therefore, whenever possible, the character of the natural shoreline and riparian zones should be retained or restored.

If a site does require the use of more hardened control measures, such as rip-rap, revetments, or vertical breakwalls, the project sponsor should include steps to mitigate for potential adverse impacts by only installing such structures at or above the mean high water elevation; by limiting that aspect of the site design to the smallest possible footprint necessary; by armoring the toe/base area with rip-rap or stone with a 1:2 to 1:3 (vertical to horizontal) slope ratio; by wrapping the ends of the structure back into the shoreline and, if deemed appropriate, by incorporating passage areas/breaches or other measures to facilitate the movement of wildlife species of concern to and from the water and to accommodate flood waters. Due to their own inherent problems, the installation of jetties or groins should be dealt with as a separate action.

For sites with an existing vertical wall or similar hardened structure installed at or below the mean high water elevation, where a vertical hardened structure remains as the only feasible alternative, the replacement structure should ideally be installed, whenever possible, *behind* the existing one and not by encroaching an additional 18-24 inches into waters of the state. The existing structure and all fill in the intervening area should be removed and the exposed bed restored. Alternatively, the structure can be removed and replaced within the same footprint. In the event that site conditions cannot meet either requirement, then a permit should be issued which authorizes the additional encroachment into the water body on condition that the area behind the new structure should not be compromised in such a manner as to preclude future replacement behind the new structure. All replacements of an existing structure should also include the steps to mitigate for potential adverse impacts noted previously for new installations.

In those situations where an impassable vertical barrier must be established or retained, mitigative measures for natural resources should be prescribed for site-specific migratory concerns. Property owners/project sponsors and permit application reviewers should access the

master habitat data bank to obtain a list of species for which migratory concerns might be an issue for the property in question. If a migratory concern is identified, then the property owner/project sponsor should be prepared to work jointly with their engineering company and natural resource staff (state and federal) to mitigate these concerns. For example, a floating ramp being installed seasonally on the lakeward side of a vertical breakwall at a Lake Ontario marina to enable soft-shelled turtles to move to an upland nesting area. The placement of properly-sloped rip-rap in front of a wall and amphibian passageways (similar to those employed for roadways) are two other potential measures for mitigating vertical structure impacts.

It is imperative that any approved structures be properly designed and installed. Project sponsors must provide design specifications that demonstrate structural integrity and adequate consideration for erosion control. "Cocktail napkin" designs are unacceptable for a project with such potential for adverse environmental impacts.

References and Resources:

Publications:

The Northwest (Vermont) Regional Planning Commission. 2003. The Shoreline Stabilization Handbook for Lake Champlain and Other Inland Lakes. St. Albans, VT. 49 pages. *(Note: This guide explains the causes of erosion, how to plan an erosion control, compares options, and provides further references.)*

Land and Water - The Magazine of Natural Resources Management and Restoration . *(Note: Each edition provides a variety of techniques, case studies, and recommendations for erosion control*.)

Mitchell, J.C., A.R. Breisch, and K.A. Buhlmann. 2006. Habitat Management Guidelines for Amphibians and Reptiles of the Northeastern United States. Partners In Amphibian and Reptile Conservation Technical Publication HMG-3, Montgomery, AL. 108 pp.

Schneider, R. L. 1998. Streamside Protection - Why Bother? Cornell Cooperative Extension Stand By Your Stream Program. 2 p.

Schneider, R. L. 1998. Stream Management - Do's and Don'ts. Cornell Cooperative Extension Stand By Your Stream Program. 2 p.

Schneider, R. L. 1998. Streamside Restoration - A Team Effort. Cornell Cooperative Extension Stand By Your Stream Program. 2 p.

Websites:

www.anr.state.vt.us/dec/waterq/lakes/htm/lp_protection.htm

www.muskoka.on.ca/planningeconomic/plan_pub.htm

www.dfo-mpo.gc.ca/regions/central/pub/index_e.htm

www.reston.org/Nature/n_publications.html

www.landandwater.com

Agencies:
County Soil and Water Conservation Districts can often provide landowners with technical guidance on choosing and designing a project to address local erosion problems. They can be found under the "Local Government" section of the phone book.

Definitions:
For the purpose of this guidance only, the following definitions shall be employed:

Littoral Zone is that area which extends from the water's edge lakeward to approximately where sunlight no longer penetrates to the bottom.

Shoreline Zone is that area which extends from the water's edge landward to the top of the bed (as delimited by the Mean High Water Elevation).

Riparian Zone is that area which extends, at a minimum, from the top of the bed to the top of the bank.

Upland Zone is that area which extends landward from the riparian zone.