Rush Lake Erosion Research

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For decades lakeshore owners and boaters on Rush Lake (part of the Whitefish Chain north of Brainerd) have viewed the steep, sandy, eroding banks of County and DNR Islands. Past efforts to stabilize these banks have been partially successful, but the erosion continued.

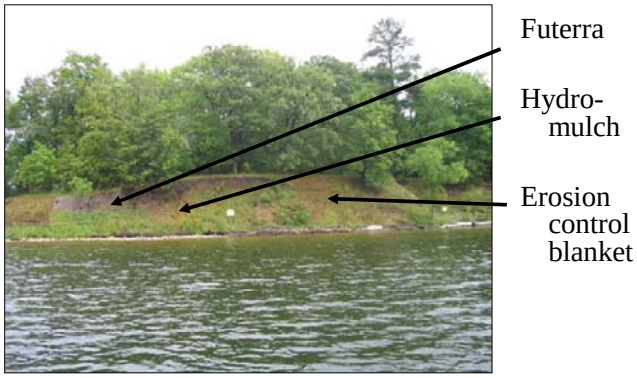
In the summer of 2004 people on Rush Lake were greeted with a curious sight resembling a patchwork quilt of colors on the steep slopes and a log jam along the bases of these two islands - these islands had become research sites, testing the effectiveness of several erosion control methods! Combining the successes of past erosion control efforts with new technology and techniques, several state and local agencies, organizations, and businesses coordinated and established this research project*.

This article will describe the methods used to stabilize the upland slopes on these islands. In the next issue learn about the methods used to control erosion at the water's edge.

Slope stabilization

The goal for stabilizing the upland slope area is to establish deep-rooted, drought tolerant, native plants. In order to facilitate installation (every footstep generates a small landslide of sand) and create a favorable growing environment for the plants, bio-terraces were installed by anchoring several brush bundles along the slope. Native grass seed, flower seedlings, and bare root shrub and tree seedlings were planted. In addition, four types of protective layers were applied to the soil surface to minimize slope erosion and to hold moisture for the plants during establishment: one layer of coconut fiber blanket, two layers of coconut fiber blanket, Futera - a blanket of wood fiber material, and hydro-mulch – a fiber slurry mixed with the native seed and sprayed on the slope.

Several bank treatments



The table below summarizes the cost and first-year plant establishment success for each of the four trials of protective layers.

Trial (each 600 sq ft)	Blanket & Bioterrace	Native Grass Seed (1#)	Native Flower Seedlings (45)	Percent Cover	Flower Survival
1 coco blanket	$174	$14	$158	33%	90%
2 coco blankets	$399	$14	$158	13%	64%
Futera blanket	$96	$14	$158	45%	57%
Hydro-mulch	$425	$14	$158	38%	64%

During the initial year, Rush Lake Association members watered the site during periods of drought, aiding establishment of the plants. Sixty percent of the bare-root seedlings established well. While the success of the native flower planting was evident, it is too early to comment on the success of the native grass seeding as very little growth is visible above ground the first year. Much of the plant cover on each plot at the end of this season consisted of annual weeds, native perennials that were not planted, and a few survivors of past planting efforts.

Along undisturbed shorelines native plants and/or natural rock guard against the erosive forces produced by waves and ice. The research sites on Rush Lake research are eroding primarily due to historic change in water level following which the native shoreland vegetation has never reestablished, as well as increased size and frequency of boat wakes. Multiple goals were considered when designing this portion of the Rush Lake project: provide long-term, no-maintenance stabilization of the slope toe; discourage boater foot traffic on the highly erodible slopes above; and create fish and wildlife habitat.

Toe Stabilization – where land meets water
Six toe protection methods were tested on Rush Lake: *live fascine* – 1-foot diameter bundle of willow and red-osier dogwood branches backed with geotextile and held in place with wooden stakes pounded through the bundles, *cocoa log* – 1-foot diameter compressed cocoa fibers in a woven jute sock held in place with nylon rope attached to wood stakes or cable attached to duckbill anchors, *rock gabion tubes* – 1.25 diameter tube of 4-8" diameter rock surrounded by chain link fencing (secured with tiger ties) and backed with geotextile, *anchored log rafts* – bundles of 3 to 5 logs anchored along the shore with cable attached to duckbill anchors, *stump revetment* – large stumps placed so that they overlap with roots facing the lake, and *rock rip rap* – a layer of 8-12 inch diameter rock placed over geotextile.

In addition, pre-vegetated aquatic plant mats were staked in and around the various toe treatments. Temporary wave breaks of brush bundles were installed offshore to minimize wave action until the plants firmly rooted into the lake bottom. Willow and red-osier dogwood bare root plants and live stakes, grass plugs and flower plugs were also planted upslope of the toe treatments. The following table summarizes the cost, installation time, maintenance time and effectiveness of each treatment after one year.

Toe Treatment (20 linear ft)	Cost	Installation time	Maintenance time	Effectiveness
Live fascine	$9	1.5 hrs	0 hrs	No erosion, fascines rooting and sprouting
Cocoa log (wood stake) (duckbill anchor)	 $157 $267	 0.5 hr 1 hr	 1.5 hrs	No erosion, cabled log replaced with live fascine
Rock gabion tube	$97	2.5 hrs	0 hrs	No erosion
Anchored log rafts	$206	5 hrs	3 hrs	Minor erosion in gaps between rafts
Stump revetment	$136	0 hrs	0 hrs	Moderate erosion between stumps
Rock rip rap	$1,800	0 hrs	0 hrs	No erosion
Live stake shrubs (10)	$0	0.5 hr	0 hrs	83% survival
Bare root shrubs (10)	$10			82% survival
Aquatic plant mats (7)	$112	0.5 hr	0.25 hr	Only mats between logs rooted
Plant plugs (20)	$20	0.5 hr	0.25 hr	only plugs behind log rooted

During this initial year, all toe treatments except for the anchored log rafts and the stump revetments were effective at stopping erosion. The anchored log rafts were problematic in that several duckbill anchors did not hold, allowing logs to work loose from the rafts and pose a hazard to boaters. This was corrected by replacing the duckbill anchors with earth anchors, as well as loosely fastening the cables to the logs with fencing staples. Continued erosion in the behind the stump revetment was due to waves washing between the widely spaced stumps. A tighter stump placement may diminish this erosion. In addition, wave action working on the cabled cocoa log cut the log in several pieces and was replaced with a live fascine.

Both bare root and live stake shrubs had a high survival rate this first year. However, the brush bundle wave breaks could not withstand the extreme wave action at these sites and only those mats and plugs protected by the toe treatment survived until autumn. Our Minnesota winter will test toe treatments and plants over the next few months.

* major contributors include: Rush Lake Association, Whitefish Area Property Owners Association, Crow Wing Soil and Water Conservation District, and University of Minnesota Extension Service, with significant financial support and contributions from the MN DNR Shoreland Habitat Program, Pequot Sand and Gravel, Professional Lake Management, and Lakeside Lawn and Landscape Company