
A stone toe is installed along the Lake Iroquois shoreline in Williston, VT to stabilize the banks. Erosion control blankets were installed after the slope was regraded and native vegetation will be installed.

# 5.7 Stone Toe

## Definition

A technique that includes a band of hardened armoring at the water's edge combined with bioengineering techniques including fiber coir rolls, slope regrading, and vegetated buffers.

## Purpose

Rock can be layered at the toe of the shoreline as an armoring technique to provide additional strength to banks. Rock lining the shoreline toe is more effective at protecting the bank when combined with bioengineering practices such as live staking, plantings, and seeding. This combination is how natural lakeshores avoid bank instability and erosion problems.

## Conditions Where Practice Applies

Stone toes are well suited for moderate to high energy sites where hardened armoring is required to resist wave action and ice push. Stone toes provide a solid foundation for other bioengineering techniques, including encapsulated soil lifts and live crib walls.

## Tips and Considerations

Stone toes can be constructed utilizing natural stone located along the shoreline. For lower energy sites, smaller stone can be used in conjunction with fiber coir rolls to form the stone toe. For higher energy sites, a larger footer stone supported with gravel foundation is most appropriate. Excavation below the mean water level will require permitting.

## Plans and Specifications

A base foundation consisting of either gravel cushion or geotextile fabric should be excavated. For higher energy sites, a rock toe is installed with larger base stone to provide a sloped foundation to resist higher velocities. For lower energy sites, alternative methods could be utilized (see fiber coir roll detail). Slopes should be prepared by following guidance from the slope regrading and vegetated buffer practices.

## Maintenance Considerations

Inspect for undermining and scour under and around stone toe, most importantly during the first three seasons following construction and after ice out.

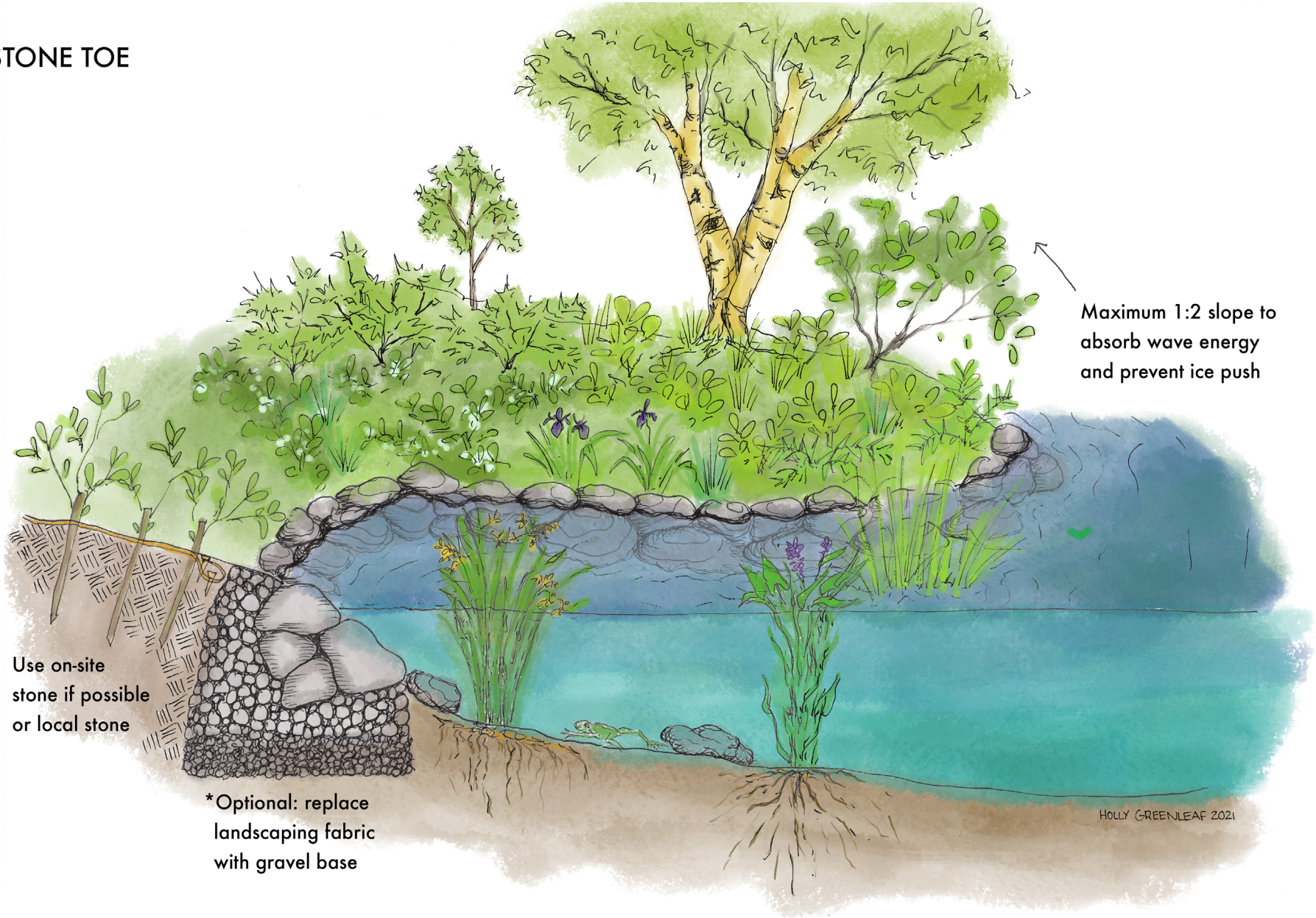


Before (left) and after (right) regrading and installation of a stone toe to protect this bank.

## Design Criteria

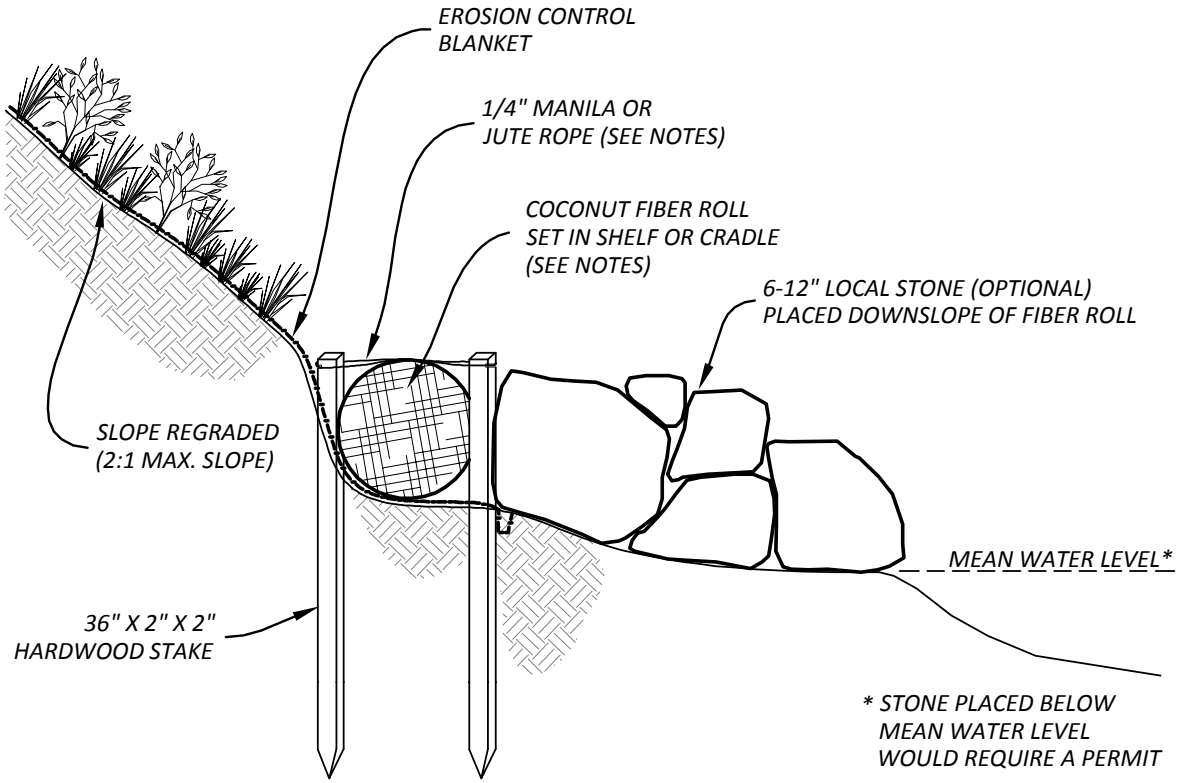
| Dimension | Name | Typical Unit | Guidelines | Description |
|---|---|---|---|---|
| **A** | Stone Toe Diameter | Inch | 6 inches to 12 inches for lower energy sites, 12 inches to 18 inches for higher energy sites. | Average diameter of stone toe fill. Larger diameter in excess of 18 inches may be utilized for higher energy sites if available. |
| **B** | Regraded Slope Pitch | Foot:Foot, Percent (%) | >3:1 (33%) slopes can be utilized at lower slope. Maximum slope of 2:1 (50%). | Ratio of horizontal run to elevation rise of buffer as measured from the top of bank adjacent to the lakeshore to developed lands (managed turf or impervious area). |

# STONE TOE


Maximum 1:2 slope to absorb wave energy and prevent ice push
Use on-site stone if possible or local stone
*Optional: replace landscaping fabric with gravel base
HOLLY GREENLEAF 2021

**STONE TOE PROTECTION WITH COCONUT FIBER ROLL**

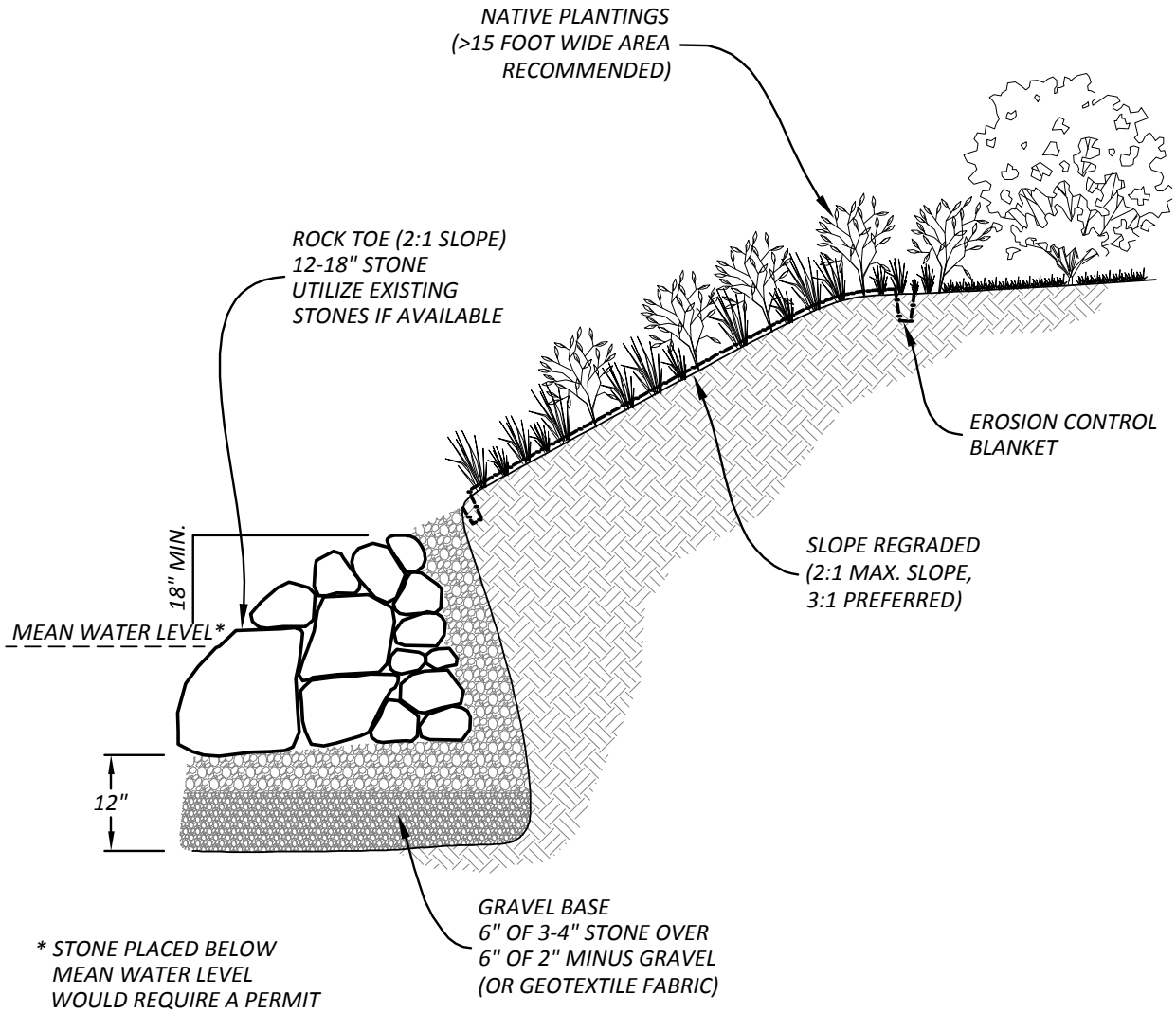
**LAKEWISE BIOENGINEERING CONSTRUCTION DETAILS**




*NOTES:*

1. *GRADE SLOPES AS INDICATED BY PLAN.*
2. *CREATE 6" DEPRESSION AT TOE OF STABILIZED/REGRADED SLOPE WITH SHOVEL FOR SETTING COIR LOG.*
3. *PLACE & STAKE EROSION CONTROL BLANKET IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS WITH BOTTOM EDGE BURIED IN SHALLOW TRENCH AND TOP EDGE EXTENDED INTO 5" DEPRESSION.*
4. *PLACE COIR LOG ON TOP OF TOE EDGE OF EROSION CONTROL BLANKET IN DEPRESSION.*
5. *DRIVE HARDWOOD STAKES ON FRONT & BACK SIDES OF COIR LOG 12" FROM EACH END, BOTH ENDS, THEN STAGGERED 12" ON-CENTER FRONT TO BACK FULL LENGTH OF LOG TO A DEPTH WHERE TOP OF STAKE IS SLIGHTLY ABOVE TOP EDGE OF COIR LOG.*
6. *NOTCH STAKES ON OUTSIDE EDGE AND SECURE MANILA OR JUTE ROPE TIGHTLY IN S-PATTERN.*
7. *SECURE ENDS OF LOGS TO ADJACENT LOG WITH ADDITIONAL MANILA OR JUTE ROPE.*
8. *DRIVE STAKES ADDITIONALLY TO CINCH DOWN ROPE SECURELY TO LOG. CUT OFF EXCESS STAKE HEIGHT SO TOP OF STAKE IS FLUSH WITH TOP OF COIR LOG.*
9. *PLACE 6-12" LOCAL ROUNDED STONE ON LAKEWARD EDGE OF COIR LOG IF INDICATED, SLOPED DOWN FROM TOP OF LOG TO EXISTING GRADE.*

Plan design: Watershed Consulting Associates, LLC.




**STONE TOE PROTECTION WITH NATIVE PLANTINGS**

*LAKEWISE BIOENGINEERING CONSTRUCTION DETAILS*

Plan design: Watershed Consulting Associates, LLC.