

# Bioengineering Case Studies

*Natural Shoreland Erosion Control Certification - 2025*

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**WINDENWATER<sub>LLC</sub>**

# SOIL LIFTS





82F 28.50 inHg

VB02

08/28/2023 08:27:32AM

















**BIOENGINEERED DRIFTWOOD LOGS  
BANK STABILIZATION**

*Natural lakeshores have plenty of woody materials on the shoreland.  
Driftwood, deadwood, downed wood, overhanging wood, etc.*

*We have removed much of this material (a.k.a. “habitat” & “erosion control”) for aesthetics,  
recreation, & other reasons.*



*Lake Michigan, MI*



*Gray Wolf Lake, MT*



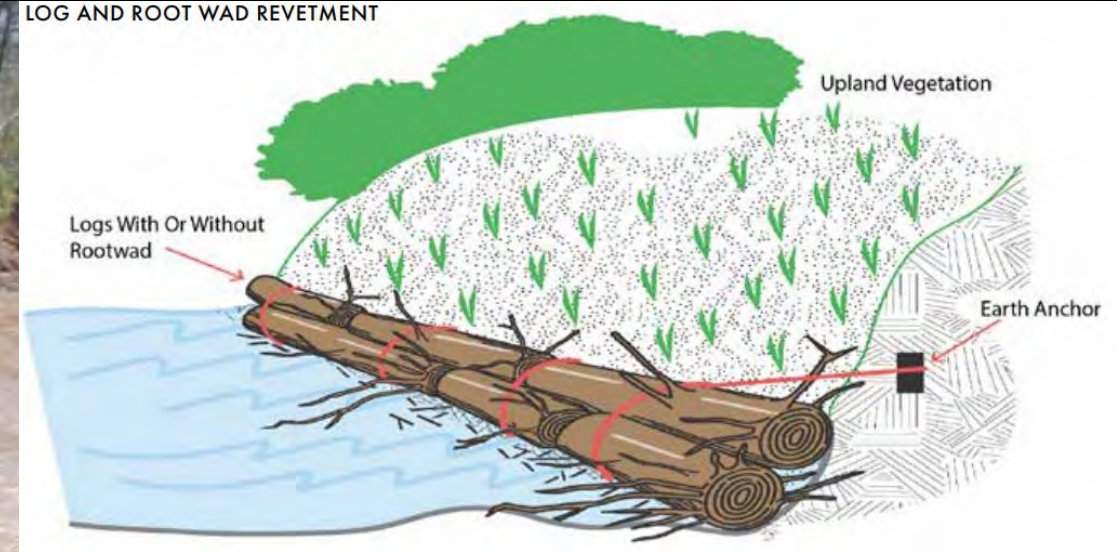
# OVERVIEW MAP

ALEXANDER PROPERTY - SHADOW LAKE SHORELAND RESTORATION PROJECT  
 JUNE 29, 2023

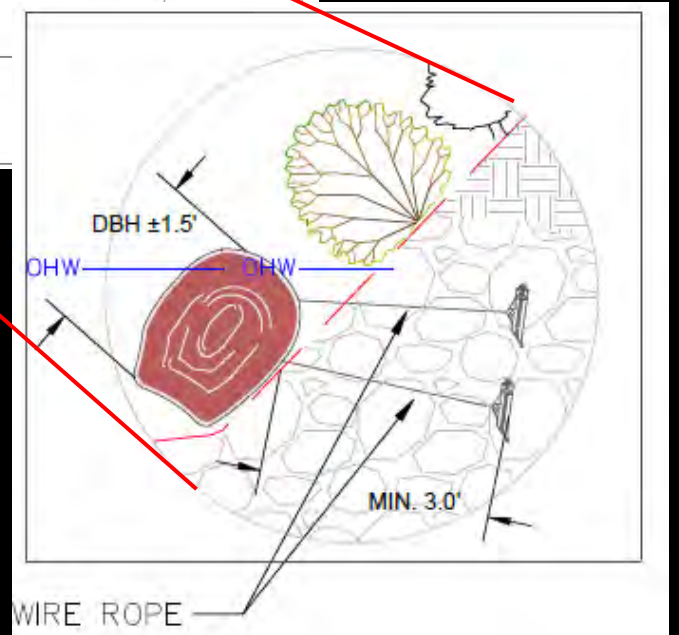
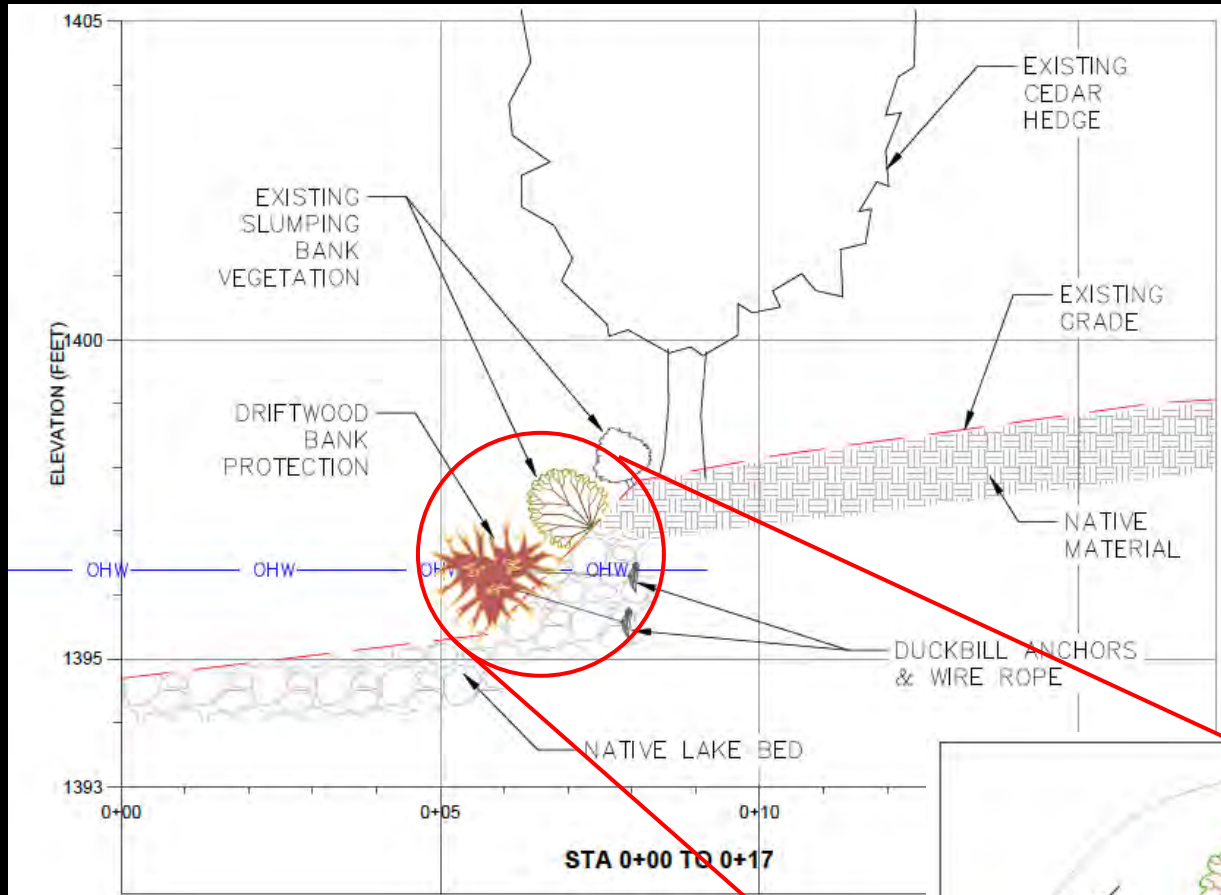




*Wood is being used in restoration projects to replenish what has been lost in both riverine & lacustrine settings...*







## Duckbill Earth Anchors Holding Capacity

Duckbill Model	Ultimate Capacity	Normal Soil*	Normal Installation Depth
40	580 lbs (261 kg)	300 lbs (135 kg)	20 inches (.5m)
68	2,045 lbs (920 kg)	1,100 lbs (495 kg)	30 inches (.75m)
88	6,180 lbs (2,781 kg)	3,000 lbs (1,350 kg)	42 inches (1.05m)
138	10,670 lbs (4,802 kg)	5,000 lbs (2,250 kg)	60 inches (1.5 m)



*Driving duckbill anchors & cabling the rootwads & logs*



*Logs are also interlocked between rootwads & existing cedars*







**LAKESHORE RE-GRADING &  
BIOENGINEERING**









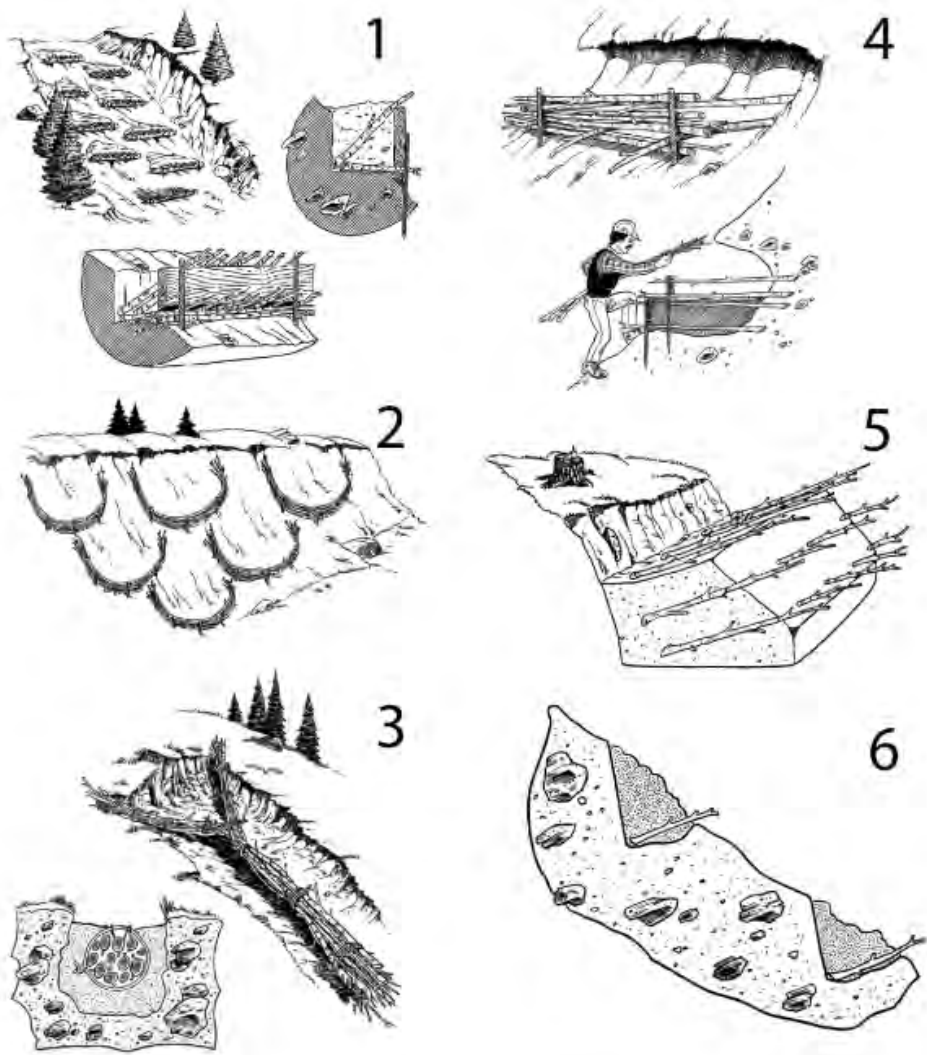


Figure 6. Modified brush layers (1), live smiles (2), live pole drains (3), live reinforced earth walls (4), brush layers in a fill (5) and brush layers in a cut (6) can be used to treat a variety of slope problems.

## Bioengineered bank stabilization using live staking, wattles, & vegetated brush banks

Courtesy of River Design Group & David Polster

