

# Sustainable Alternative to Riprap

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**Permit SADF-23-01-000-MOD**

## Hurricane Ian September 2023

- No Plans to Replace the Wall
- Section Breached by a Boat
- Protection of Property



# Why We Are Here

- EPD recommended denial of our request to remove the requirement to place riprap as "the placement of riprap would not harm existing vegetation or cause a navigational hazard"
- Requesting a modification to remove the requirement of riprap based on decreased wave reverberation with just undulated vinyl sheets and plantings, that have a lower coefficient of reflection than standard materials used in 2008.
- Or allow the usage of coir logs instead of riprap along with plantings which absorb wave energy, are more environmentally friendly and more cost effective.

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# Shoreline Alteration & Dredge and Fill Permit

## DESCRIPTION

A shoreline alteration permit may be required if you are installing a seawall or other structures to stabilize your shoreline. This type of permit is also needed for dredging, drag lining, filling, pumping of sand, or other alterations to the shoreline or lake bottom of our lakes or canals. All shoreline alteration projects require a public hearing and approval by the Orange County Board of County Commissioners.

Generally, stone rip-rap and native vegetation should be installed waterward of a seawall to offset the adverse effects on the environment, unless these measures will cause navigation impairment or greater environmental harm.  Properly installed rip-rap reduces wave action energy, helps prolong the functional lifespan of a seawall, protects shorelines on adjacent properties, and creates vital wildlife habitat necessary for many species to perform basic life-cycle functions such as resting, nesting and foraging.

# Background

- We recognizes and fully support the need to protect shorelines from erosion while preserving aquatic habitats, water quality, and property integrity. However, stabilization methods have **not been** evaluated based on their wave attenuation performance, ecological benefit, and site-specific conditions.
- In 2008, the BCC approved the installation of riprap and plantings waterward of vertical seawalls **to reduce wave reverberation (energy)** based on knowledge, tools available at the time and EPD's **observations**.
- Inconsistency in requirement of riprap on the same street.
- Since 2008, there are new materials, new scientific studies.

# What Is Wave Reverberation?

In shoreline contexts refers to **wave energy reflection**

- When wave energy interacts with an object it is either **dissipated** (friction), **reflected** and/or **absorbed** depending on the material's properties



Each material has therefore a different reflection coefficient

Goal is for wave energy to be **absorbed** and/or **dissipated** but not reflected

# Building Material Evolution

2008



2008



# Riprap Environmental Drawbacks



- **Increases water temperature** (friction, turbulence and heat island effect)
- **Disrupts aquatic habitat** and fish spawning grounds
- Blocks vegetation regrowth and soil respiration
- **Traps wildlife**
- Introduces foreign organisms
- Safety hazard during installation, maintenance and repair
- Where accessible, requires heavy machinery, causing site disturbance
- Hardened shoreline, unnatural, unappealing, reduces property appeal
- Not carbon neutral
- High Cost - \$300 to \$400 per linear feet; 2-15% yearly maintenance

# Shoreline Stabilization Policy Comparison

Policy Area	Maine EPD	Orange County FL EPD
<b>Riprap Use</b>	Discouraged for inland lakes	Generally recommended near vertical seawalls since the early 2000
<b>Permit Standards</b>	Chapter 305 NRPA: Riprap only allowed on slopes >3:1 or stormwater outfalls	No slope-based criteria; riprap often required regardless of shoreline energy
<b>Preferred Method</b>	Vegetation and nature-based solutions prioritized	Riprap + vegetation interpreted as default requirement
<b>Scientific Basis</b>	Based on ecological studies, thermal pollution, habitat loss, and erosion	Based on field observations; lacks peer-reviewed research
<b>Flexibility</b>	Site-specific; allows coir logs, soil lifts, live staking	Only riprap and vegetation if navigation is not impeded or harms the environment
<b>Contractor Support</b>	Encouraged to use nature-based BMPs; supported by NRCS and conservation districts	Contractors often avoid proposing alternatives due to permitting risk
<b>Public Funding</b>	319 Grants prohibit riprap installations	No known funding restrictions on riprap
<b>Environmental Rationale</b>	Riprap causes thermal pollution, habitat loss, and wave reflection	DEP guidance acknowledges wave reflection but still recommends riprap

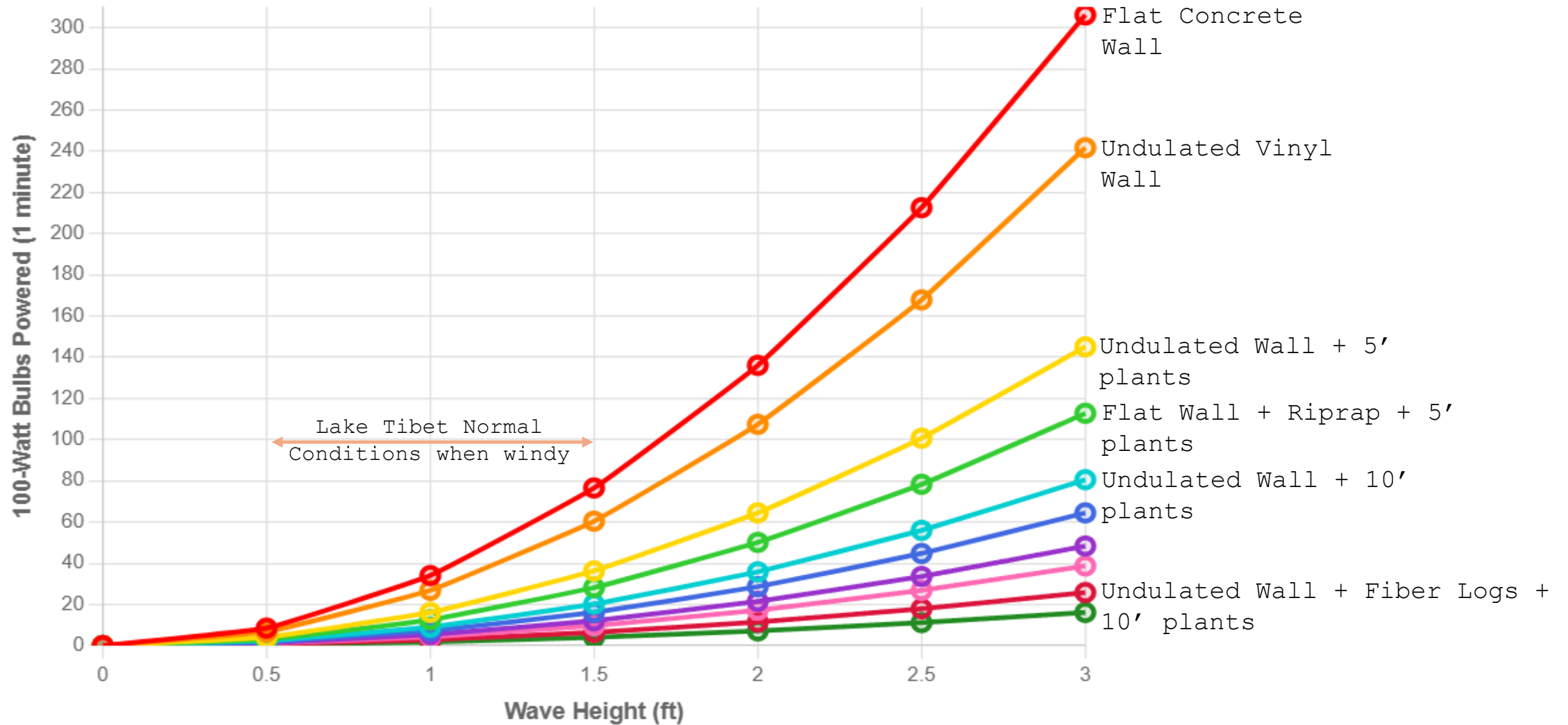
# Wave Energy Reflection Coefficient

Scenario	Scenario Description	ChatGPT						Average	
		Pro	CoPilot	Meta AI	GeminiPro	Claude	DeepSeek		Perplexity
1	Concrete Seawall (smooth, impermeable)	0.95	0.90	0.90	0.95	0.88	0.85	0.90	0.90
2	Undulated Vinyl Seawall ESP 4.1	0.80	0.70	0.85	0.90	0.73	0.70	0.75	0.78
3	ESP 4.1 + mature vegetation (5ft deep)	0.60	0.55	0.60	0.50	0.50	0.55	0.30	0.51
4	Concete Seawall + riprap (2:1 slope) + mature vegetation (5 ft deep)	0.42	0.50	0.40	0.42	0.38	0.50	0.45	0.44
5	ESP 4.1 + mature vegetation (10ft deep)	0.50	0.45	0.55	0.30	0.40	0.45	0.25	0.41
6	ESP 4.1 + riprap (2:1 slope) + mature vegetation (5 ft deep)	0.45	0.50	0.35	0.25	0.25	0.40	0.28	0.35
7	ESP 4.1 + Flexamart foam (5 ft deep) + mature vegetation (5 ft deep)	0.50	0.50	0.32	0.35	0.30	0.35	0.28	0.37
8	ESP 4.1 + coir logs (4 ft) + mature vegetation (7 ft)	0.40	0.45	0.30	0.20	0.18	0.30	0.22	0.29
9	ESP 4.1 + coir logs (4 ft) + mature vegetation (10 ft)	0.35	0.40	0.28	0.15	0.15	0.25	0.20	0.25
10	Natural Sand Shoreline (gentle natural slope)	0.15	0.25	0.10	0.20	0.08	0.15	0.15	0.15



- Water surface elevation = 98.52'
- Elevation seawall toe = 97.1'
- NHWL= 98.52'
- Lake slope = 6.5 degrees
- Wave height = 1.5'
- Wave frequency = 2 seconds

# Wave Power Generation by Seawall Type



- Flat Concrete Wall
 ○ Undulated Vinyl (ESP 4.1)
 ○ Undulated + 5ft Plants
- Concrete + Riprap + 5ft Plants
 ○ Undulated + 10ft Plants
 ○ ESP 4.1 + Riprap + 5ft Plants
- Undulated + Flexamart + Plants
 ○ Undulated + Fiber Logs + 7ft Plants
- Undulated + Fiber Logs + 10ft Plants
 ○ Natural Sand Shoreline

# An Alternative: Coir Logs + Native Plants

- Coir logs are **biodegradable coconut fiber rolls** that stabilize shorelines while allowing vegetation to root through.
- When paired with native flowering plants, they **absorb wave energy**, reduce erosion, and support wildlife



# Coir Logs Usage

## **Jurisdiction**

## **Agency / Program**

### **Michigan**

*Michigan Natural Shoreline Partnership* - promotes coir logs for inland lakes

### **Connecticut**

*CT Department of Energy & Environmental Protection (DEEP)* - includes coir logs in its Living Shorelines Techniques guidance for marsh edges and banks

### **Maryland**

*Maryland DNR & Chesapeake Bay Foundation* - uses coir logs in low-energy systems and living shoreline training

### **Vermont**

*Vermont DEC* - implemented coir log stabilization on lakes like Iroquois and Bomoseen

### **Texas (Austin)**

*City of Austin Watershed Protection Department* - tested coir logs on Lake Austin with measurable success

### **Virginia**

*Virginia Institute of Marine Science (VIMS)* - recommends coir fiber logs in Chesapeake Bay



**In  
Summary**

<b>Factor</b>	<b>Riprap</b>	<b>Coir Logs</b>
Energy Reflection	Good, reflects	Better, absorbs
Environmental Impact	High	None, biodegradable
Improves Water Quality	No	Yes
Cost (per ft)	\$300-\$400	\$30-\$60
Habitat Value	Poor	Excellent (pollinators, fish)
Maintenance	Frequent, Hazardous	Minimal (after establishment)
Risk	High	Low
Carbon Footprint	High	None
Compliance	Low	High
Aesthetic	Harsh	Natural

# How You Want our Future to Look?



# Call to Action

- **Modification of permit:**
  - **Remove the requirement of riprap** while keeping plantings to 10 ft.
  - Or, allow **usage of coir logs** and vegetation as an alternative for riprap and vegetation.
- **Support innovation** in shoreline protection

**Let's Build Better through Efficiency**

maximizing benefits while minimizing costs