**EM-6 Shoreline Stabilization, Induced Sediment Deposition, and Living Shorelines**

1. **OBJECTIVES**
2. To facilitate the maintenance and restoration of existing marshes and swamps by reducing shoreline erosion along bays, lakes, canals and bayous.
3. To trap or induce the deposition of sediments in order to maintain and restore existing marshes and swamps, as well as build new marshes.
4. To construct and maintain living shorelines for shore erosion control wherever possible and feasible in order to create and enhance growth and sustainability of habitat that is naturally resistant to erosion.
5. **DESCRIPTION**

Shoreline stabilization refers to measures that reduce or halt shoreline erosion and is recommended wherever shoreline erosion is a problem. Preferred technologies and building materials for shoreline stabilization projects will vary by site due to location-specific conditions (e.g., elevations, soil strength, and exposure to wind and waves). The distance and orientation of structures relative to the shoreline can also influence their success. Sediment inducers and sediment trappers refer to stabilization measures that also aim to build land through the deposition of suspended sediment from the water column. Living shorelines stabilize shorelines (and perhaps also act as sediment inducers or trappers) using structures made from natural and man-made materials (e.g., wetland plants, submerged aquatic vegetation, oyster reefs, sand, and stone) that are designed to reduce erosion while retaining or enhancing ecological processes.

Table EM6-1 – Shoreline stabilization technologies. A plus sign indicates that structures can act as sediment inducers as well as shoreline stabilizers, and an asterisk indicates that the technology could represent or include a living shoreline depending on the methods and materials used.

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| **Technology** | **Description and Comments**  |
| Bulkheads | Hard structures built at the shoreline, designed to protect land behind from erosion or to stabilize a vertical earthen embankment; may be constructed from timber, steel, plastic, or concrete sheet pile; or cast in place concrete.  |
| Seawalls | Hard structures built at or behind the shoreline, usually designed to protect the land behind from erosion due to wave attack; may be constructed from timber, steel, plastic or concrete sheetpiles, stones, or cast in place concrete. |
| Breakwaters+ | Barriers (typically made of stone) constructed parallel to and off a shoreline; designed to lower wave energy that reaches the shore and slow sediment movement |
| Segmented Rock Breakwaters+ | Rectangular rock structures placed parallel to a shoreline at varying intervals in open water to diffract incoming waves causing them to lose energy and deposit sediment leeward of the structure; can potentially be used in sediment starved systems.  |
| Groins+ | Barriers constructed perpendicular to the beach to trap sediment in the littoral drift on the upstream side or to prevent longshore erosion of the downstream side; not recommended due to the potential for downdrift sediment starvation. |
| **Technology** | **Description and Comments**  |
| Timber Pylons+ | Treated timber pilings driven deep into soft sediments with cross members attached such that the structure appears as a wide “V” shaped fence pointing away from land; designed to baffle wave energy and promote suspended sediment deposition on the landward side. |
| Revetments+ | Hardened coverings constructed on the slopes of shore faces to protect from erosion due to wave attack and current movement; usually constructed of stone, precast concrete armor units, or cast in place concrete; usually have a filter system so material is not washed from behind by water. |
| Geotextile Tubes\*+ | Consist of a fine mesh pillow-shaped fabric tube that can be placed then filled with dredged material; function much like rock gabions in that they are self-contained and effective in soft sediments; easily positioned in a variety of arrangements depending upon wave climate and desired results.  |
| Foreshore Dikes\*+ | Low rock dikes placed adjacent to a channel bank to promote sediment deposition when waves break over them; useful along the banks of major navigation channels such as the HNC and the GIWW. |
| Foreshore Reefs\*+ | Conditions favorable to oyster reef establishment and growth of biological organisms such as oysters; reefs reduce wave energy and promote deposition of suspended sediment. |
| Rock Gabions\*+ | Diffract and baffle wave energy to protect the shoreline and promote deposition of suspended sediment; effective in soft unconsolidated sediments.  |
| Brush Fencing\*+ | Consist of treated timber cribbing (e.g., Christmas trees) filled with discarded brush material (usually old Christmas tree); useful in low energy environments with adequate suspended sediment to slow current velocities and promote suspended sediment deposition. |
| Terracing\*+ | Sediment piled to an elevation at which marsh vegetation can colonize using a small dredge or plow; generally built in linear or grid patterns surrounding shallow open water in order to baffle wave energy, create conditions favorable for establishment of submerged aquatic vegetation and marsh expansion, and protect adjacent marsh from wind driven erosion. |
| Vegetative Planting\*+ | Usually established from sprigs or seeds; vegetation stabilizes sediments and accumulates imported sediments |
| Material Replacement\*+ | Filling an eroded shoreline, usually with dredged material, to a historical or other desired configuration.  |

1. **BACKGROUND**

Shoreline erosion occurs wherever land meets water, and people have been trying to combat it since ancient times. This action supports the overall alliance objective of maintaining and restoring existing marshes and swamps by protecting the slightly elevated shoreline rim and therefore protecting marshes behind the shore from wave attack and salt water. Sediment trapping and inducing structures are most effective to improve deposition and prevent re-suspension in lower wave energy environments where they baffle small wind-generated waves and where suspended sediment concentration is high. They are less useful in areas of high wave activity, such as along canal banks, navigation channels (e.g., the Gulf Intracoastal Waterway), or the Gulf of Mexico shoreline where there is greater likelihood of adverse impacts such as undermining by storm wave action. While traditional structures provide hard substrates that may become colonized by reef building organisms and enhance fishing habitat, living shoreline technologies are specifically designed to promote sustainable habitat that naturally resists erosion and undermining.

A possible issue at stake with induced sedimentation is the ownership of created land when projects are constructed using federal or state funds. According to the state Attorney General’s opinion (92-472), new land resulting from restoration projects belongs to the adjacent landowner when formed along a river or stream and to the public when formed in open water (lakes, bays, etc.).

1. **LOCATION**

This plan supports limited construction of projects of local concern that are favored by local government and landowners although they might not affect large areas of the basin. This action is recommended especially in areas where there are blowouts – where erosion has occurred to the point where marshes abut canals and other water bodies as well as in areas where extensive marsh erosion may occur. Sediment inducing and trapping techniques are encouraged whenever practical based on the project locality, cost, and availability of suspended sediment. Wherever feasible, living shorelines are also recommended as they act to promote establishment and growth of habitat and organisms important to the coastal ecosystem and should also resist erosion naturally and sustainably.

1. **LEAD AGENCY RESPONSIBLE FOR IMPLEMENTATION**

**CWPPRA**

The Coastal Wetlands Planning, Protection and Restoration Act, (CWPPRA), is federal legislation designed to identify, prepare, and fund construction of coastal wetlands restoration projects. The CWPPRA task force consists of representatives from five federal agencies - Army Corps of Engineers, Environmental Protection Agency, Fish and Wildlife Service, Natural Resource Conservation Service, and National Marine Fisheries Service - and the local cost share sponsor, the state of Louisiana.

**Other likely implementers**

Louisiana Coastal Protection and Restoration Authority; Louisiana Department of Natural Resources; Louisiana Department of Environmental Quality; Louisiana Department of Wildlife and Fisheries; Louisiana Department of Agriculture; Louisiana Department of Culture, Recreation, and Tourism; Lafourche Fresh Water District; Bayou, Soil and Water Conservation Districts; and other quasi state agencies, citizen action groups, parish governments, and landowners

1. **TIMELINES AND/OR MILESTONES**

It is difficult to lay out a conceptual timeline for the implementation of this action plan. Locations where shoreline erosion is a problem have been well identified in the BTES, but other critical areas may arise, for example if threatening a pipeline or other structure. The lack of a reliable source of funding and the general high cost of shore protection precludes setting up a time line for implementation.

1. **POSSIBLE RANGE OF COSTS AND SOURCES OF FUNDING**

It is also difficult to determine costs for the implementation of projects in this action plan. Shoreline stabilization projects can vary greatly in their scope and are often included as components of larger projects in combination with other types of ecological restoration such as marsh creation using dredged material, hydrologic restoration, or barrier island restoration (considered separately). A possible range of costs for individual projects is suggested from examples of completed projects below.

**Terrebonne Bay Shore Protection Demonstration** (CWPPRA, TE-45), Cost: $2.74 M

Purpose: demonstration of the cost and effectiveness of three shoreline protection methods (gabion mats, concrete onshore armor units, and foreshore triangular units) for their ability to abate erosion and develop and sustain oyster reef:

**Lake Salvador Shore Protection Demonstration** (CWPPRA, BA-15), $2.8 M

Purpose: test four shoreline protection methods for effectiveness in reducing erosion and construct 9,000 ft of rock shoreline stabilization to protect the shoreline and adjacent marsh from wave-induced erosion.

**GIWW Bank Restoration of Critical Areas in Terrebonne** (CWPPRA, TE-43), $13M

Purpose: restore and armor critical lengths of deteriorated channel banks along the GIWW with construction of over 40,000 linear ft of foreshore rock dike protection.

**West Lake Boudreaux Shoreline Protection and Marsh Creation** (CWPPRA, TE-46), $17.9 M

Purpose: reduce erosion of the west Lake Boudreaux shoreline and protect emergent marsh with over 10,000 linear feet of rock dike; note the cost also includes a significant marsh creation component.

**Little Lake Shoreline Protection/Dedicated Dredging Near Round Lake** (CWPPRA BA-37), $29.4M

Purpose: prevent erosion along Little Lake shoreline with construction of over 25,000 feet of foreshore rock dike protection; note the project also includes a significant marsh creation component.

Estimated costs for shoreline protection in Louisiana’s 2012 Coastal Master Plan are even higher. For example, $184.5 M is estimated for 140,000 ft of rock breakwaters along the GIWW from Bayou LaFourche to Bayou Perot, and $563.2 M is estimated for 426,000 ft from Bourg to Amelia.

1. **PERFORMANCE MEASURES**
	1. **Possible Data Gathered:**

Implementing organizations should maintain design plans with project areas and expected benefits, results of geotechnical analyses, and construction documents with as built elevations and volumes of material. Monitoring and Maintenance reports should also contain data on the project effects.

* 1. **Monitoring:**

Implementing organizations should conduct inspections to monitor the project and its effects. For example, CWPPRA projects are typically monitored for 5 years. Relevant parameters to be monitored may include: elevation, shoreline change, hydrology, oysters.

* + 1. **Parties Responsible**: implementing agency (CWPPRA, CPRA, etc.)
		2. **Timetable for Gathering Data:** Annual Reports
		3. **How Data is Shared:** Via Agency Websites
		4. **Possible Data Gaps:** None Identified
		5. **If Additional Funding is Needed:** Yes, as available