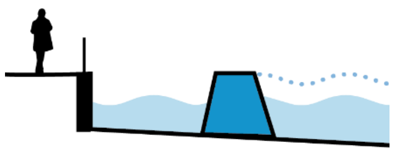
Measure Profile

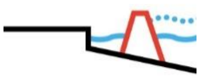
Floating Wave Attenuator

Flood Adaptation Measure

PHYSICAL INFRASTRUCTURE



SHORELINE LOCATION:



In Water

West Harbor Breakwater, San Francisco, CA ©Marinetek

DESIGN LIFE	ADAPTABILITY	IMPACT ON THE WATERFRONT	CONSTRUCTION COST
25 years	Varies	Living with Water	TBD

COASTAL FLOOD HAZARDS MITIGATED:

Sea Level Rise | Storm Surge | Groundwater | **Waves** | **Erosion**

MEASURES COMPATIBILITY:

Flood	Seismic
All	All

ECOSYSTEM SERVICES: Measure may affect these shoreline values

Aquatic Habitat	Terrestrial Habitat	Water Quality	Carbon Storage
↑	—	—	—

DESCRIPTION:

Floating wave attenuators reduce wave energy on the shore side of the structure through a combination of reflection of incoming waves off the side of the structure or dissipation as the wave passes over and under the structure. Floating wave attenuators have traditionally been used to reduce wave energy inside of harbors. However can be used to reduce waves at the shoreline and, therefore, reduce wave runup and overtopping and erosion during a storm event.

CONSIDERATIONS:

- Placement and function is dependent on the location and aspect to wave action.

ADVANTAGES:

- Retain their functionality at varying water levels.
- Cost effective for areas with deep water or poor foundation material.
- Minimal impact to water circulation and fish migration.

DISADVANTAGES:

- Limited wave attenuation compared with fixed, bottom-supported structures.
- Not suitable for areas with moderate to long period waves.
- Fatigue can lead to failure of system components.

Floating Wave Attenuator

Flood Adaptation Measure

	• Low visual impact. Low profile, regardless of tide elevation. • Potential for multiple uses such as walkways and docks. • Can be moved or relocated relatively easily.	• Likely to be attractive to seals and sea lions for habitat.
CONSTRUCTION IMPACTS TO THE PUBLIC:	**SEA LEVEL RISE ADAPTATION OPPORTUNITIES:**	**CASE STUDIES:**
• Minimal as construction is in the water and parts are mostly modules that are built off site and transported in.	• Wave attenuators float so can be adjusted to changing water levels over time, however since these measures do not influence tidal water levels sea level rise could still be an issue.	• Small Boat Marina, Gibraltar • Taqah Fishing Marina, Taqah, Oman • West Harbor Breakwater, San Francisco, CA

DESIGN OPPORTUNITIES:

Ecological Enhancements	Urban Design	Form
• Can be designed to incorporate habitat for nesting shore birds.	• Can be designed to incorporate public uses such as walkways and docks.	• TBD

DESIGN CONSIDERATIONS:

- Floating wave attenuators must be designed for the local wave conditions.
- Floating wave attenuators and their moorings must be designed for extreme wave loads.
- Because they move with the waves, fatigue can also be an issue, particularly at connections between units and with mooring components.

SITE-SPECIFIC CONSIDERATIONS:

- Design for local wave conditions and depth.
- Sites exposed to ocean swell on the northern reach of the waterfront should be considered poor candidates for floating wave attenuators due to longer wavelengths of incident waves.
- Sites along the eastern/southern shoreline with extreme wave periods on the order of 5 seconds or lower should be considered as candidate sites for floating wave attenuators.
- Sufficient water depth should be available to prevent the attenuators from bottoming out during low tides.

INSTALLATION AND CONSTRUCTABILITY CONSIDERATIONS:

- Wave attenuators are typically constructed offsite in modules and these transported to the site by road and/or water. Modules are towed into place and connected to each other and to the mooring system. Offshore construction to be performed from a barge by a competent marine contractor.

HISTORICAL RESOURCE CONSIDERATIONS:

- In-Bay construction would need to consider potential buried archeological resources.

OPERATION AND MAINTENANCE CONSIDERATIONS:

- Periodic inspection and maintenance as required, particularly connections and moorings.