Shoreline Restoration Monitoring and Assessment Framework for the York River, Piankatank River, and Mobjack Bay

The Shoreline Restoration Monitoring and Assessment Framework aims to provide recommendations for monitoring and assessment protocols for shoreline restoration projects in the York and Piankatank rivers and Mobjack Bay in Virginia. This framework is based on the monitoring protocols of three shoreline restoration project designs along the York River, which have similar restoration objectives: (1) shoreline protection and resiliency; and (2) habitat enhancement for key living resources. The framework can inform monitoring and assessment protocols for other future shoreline restoration projects in the region. By developing standard restoration monitoring guidance for all projects in the region, improvements in shoreline resiliency and habitat enhancement can be assessed and compared across projects, and used to determine the collective success of restoration efforts in the region. This framework was endorsed by the Habitat Restoration Steering Committee of the York River and Small Coastal Basin Roundtable on July 20, 2021.

The layout of this monitoring and assessment framework was inspired by similar frameworks from other shoreline restoration groups. There are two tiers of metrics: (1) core metrics, which measure shoreline resiliency (e.g. elevation); and (2) conditional metrics, which measure enhancement of habitat value (e.g. biodiversity). The core metrics are ones that are standard in all monitoring protocols across the nation as they are less costly and require less effort. Conditional metrics are more difficult to measure due to cost and effort limitations, and are therefore only implemented when sufficient resources are available. In addition to the metrics, potential methods and data collection considerations are presented. Note that the common methods listed in the framework are not exhaustive, and additional methods may be included as new technologies and approaches are developed. It is also recommended that photos and videos of the restoration site be captured throughout the course of the project in order to evaluate restoration success in the future with new technologies.

Ideally, all shoreline restoration projects would assess both improvements in shoreline resiliency and habitat enhancement, but this is often not possible due to resource limitations. It is therefore recommended that shoreline restoration projects focus primarily on core (resiliency) metrics, and include the conditional (habitat enhancement) metrics if able. To assess restoration success, project teams would ideally implement Before-After-Control-Impact (BACI) designs at both restoration and control sites. This would allow for comparisons between pre- and post-restoration shoreline and habitat characteristics, and would provide a better understanding of restoration impacts in terms of resiliency and habitat enhancement.

Shallow, nearshore habitats are often important foraging and nursery grounds for many fishes and invertebrates. In the Chesapeake Bay, these areas provide food and refuge for key commercial and recreational species such as blue crab, striped bass, black sea bass, summer flounder, and Atlantic croaker. These economically and ecologically valuable species are often negatively impacted by shoreline and nearshore habitat degradation and would therefore benefit from restoration and enhancement. Sustaining a healthy, diverse ecosystem also has societal benefits such as increased fishing opportunities, improved water quality, and increased resilience to erosion and coastal flooding, which can affect property value.

While shoreline resiliency and habitat enhancement are the primary focus of this monitoring framework, restoration practitioners may also be interested in monitoring practices that meet verification requirements for best management practice (BMP) credit under the Chesapeake Bay Total Maximum Daily Load (TMDL). For more information on BMP verification requirements, please see the Shoreline Management Practices Expert Panel Report and FAQ (U-14) at https://chesapeakestormwater.net/bmp-resources/shoreline-management. Additional information from the Shoreline Erosion Advisory Services (SEAS) of the Virginia Department of Conservation and Recreation can be found at https://www.dcr.virginia.gov/soil-and-water/seas.

Class	Ecosystem Service	Metric	Methods to Consider	Purpose	Current Projects
Core	Shoreline Stabilization	Elevation	RTK GPS, LiDAR, aerial imagery	Changes in elevation due to erosion and accretion can indicate shoreline stability in response to external forces.	NWSY, CAPS, Hog Island
		Shoreline position	RTK GPS, aerial imagery	Provides information about the impacts to the shoreline (i.e. wave energy, erosion, etc).	NWSY, CAPS, Hog Island
		*Oyster reef success (density, biomass, recruitment)	Quadrats	Document the success of the oyster reef as a stabilizing structure.	NWSY
	Habitat and Biodiversity	Vegetation cover and zonation (percent cover, area, diversity, shoot density, biomass)	Transects, aerial imagery (e.g. drones)	Increased vegetation can improve shoreline stability and resilience. Marsh vegetation zonation can indicate shoreline stability and marsh restoration success.	NWSY, CAPS, Hog Island
Conditional	Shoreline Stabilization	Sediment characteristics	ASTM field methods	Sediment composition can indicate shoreline stability and resilience. Soil organic matter can indicator carbon storage potential and sediment maturation.	NWSY, CAPS
	Flooding Mitigation	Tidal inundation (water level)	Data loggers, RTK GPS, forecasts (e.g. Tidewatch) based on hydrocyanic models (e.g. SCHISM)	Measures of tidal inundation provide valuable data on where the marsh sits within the tidal frame. Also determines the distribution of marsh plants.	NWSY, CAPS
	Habitat and Biodiversity	Nekton community (abundance, density, biomass, diversity)	Seines, trawls, scrapes, traps, pots, gill nets, fyke nets	Fundamental component of coastal biodiversity and can be used as indicator of biological community health.	NWSY, CAPS
		** Benthic community (diversity, abundance, density, biomass)	Suction sampling, sediment cores, quadrats, removal by scraping (epifauna)	Fundamental component of coastal biodiversity and plays important role in water quality and substrate stabilization, and can therefore be used as an indicator of biological community health.	NWSY, CAPS
		Invasive species (presence, percent cover, shoot density)	Observation, transects, aerial imagery (e.g. drones)	Can be used an indicator of biological community health and resilience.	NWSY, CAPS

* If oysters are being used as a restoration structure and are not just part of the benthic community, this should be considered a core metric.

** The benthic community is comprised of both infauna and epifauna, and the monitoring methods used are dependent on the taxa of interest.