Evaluating the Efficacy of Island Restoration and Enhancement for Coastal Protection: Swan Island

Project Summary

In October 2018, the Baltimore District of the U.S. Army Corps of Engineers (USACE) will dredge the navigation channel that runs between Swan and Smith Islands near the Maryland-Virginia border and beneficially use 78,000 cubic yards of dredged sediments to restore the footprint of Swan Island (Figure 1). The restoration plan includes creation of dunes and high and low intertidal marsh (Figure 2). Planting is scheduled for spring 2019. The creation/expansion of these habitats is expected to have significant benefits in terms of ecosystem service provision, increased resilience of Swan Island to future sea level rise, and abatement of erosive losses for the town of Ewell on adjacent Smith Island. However, there is currently no mechanism in place to evaluate whether these predicted outcomes are achieved.

Figure 1. Google Earth image showing location of Swan Island in relation to the Town of Ewell, Maryland and the beneficial use placement area scheduled for October 2018 (image from: Environmental Assessment Twitch Cove and Thorofare Federal Navigation Channel Project, Dec 2015).

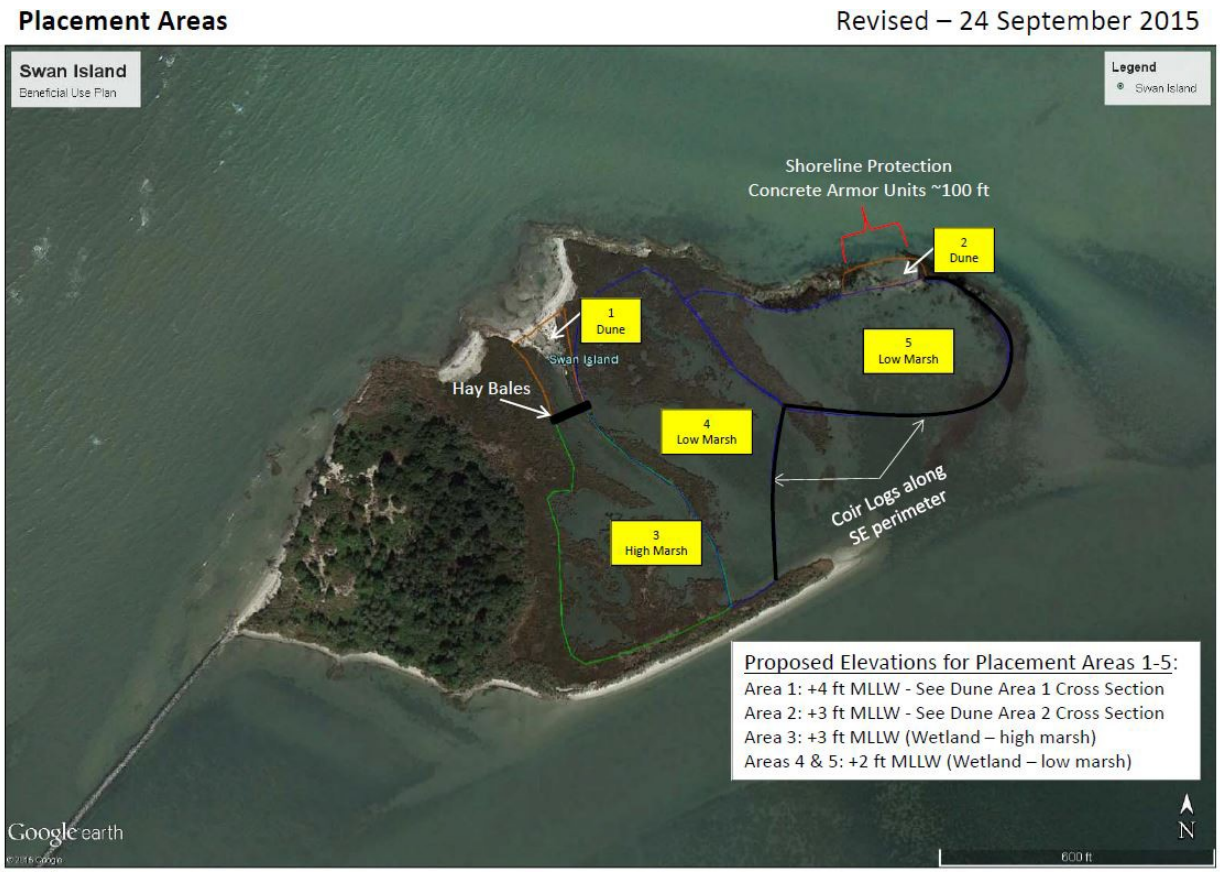

Figure 2. Google Earth image of Swan Island, with the beneficial use plan overlaid. Natural and nature- based features to be restored include low marsh, high marsh, dunes and strategic use of concrete armor units (image from: Environmental Assessment Twitch Cove

This project will capitalize on the imminent restoration of Swan Island, to address research gaps specific to our understanding of island system function, area of influence and ecological/engineering benefits, by gathering and evaluating the ecological and physical data necessary to evaluate the Swan Island restoration/placement. NCCOS scientists from Beaufort conducted pre-placement sampling (intertidal and subtidal vegetation, sediments and porewater and elevation profiles) of the island and MDDNR staff conducted annual SAV surveys in August 2018 to establish baseline conditions (Figure 3).

USACE will be installing up to three small platforms (Figure 4) for the attachment of an Acoustic Doppler Velocimeter (ADV) that will collect continuous wave, current and turbidity data (Figure 5). In addition, USACE proposes to conduct additional LIDAR surveys and nearshore boat surveys to provide information on dredged sediment spreading outside the construction prism. Additional surveys are proposed at 3, 6, and 9 months post construction to evaluate evolution of the island platform.

Figure 3. Satellite image of Swan Island indicating the location of the temporary benchmark and the marsh and seagrass transects surveyed in August 2018, prior to restoration of the islands natural features with the placement of dredged sediments.

Figure 4. Image of the ADV platform type to be installed by USACE staff.

Figure 5. Site locations proposed for ADV instrumentation to be installed by USACE staff.

In summary, sampling will include environmental and hydrodynamic parameters to quantify island performance (e.g. how they change over time, longevity), benefits (ecological and storm risk reduction) and the island's area of influence on surrounding features (Table 1). These data are also critical to the development/validation of sediment transport models, habitat models, guidance/tools and best practices that can be applicable beyond the Chesapeake to other regions with a similar tidal range (e.g. Gulf Coast, southeast, mid-Atlantic etc.), making island features common practice in the future.

We propose three years of post-restoration monitoring to occur annually (or more depending on the parameter) and before and after storm events for the next three years.

Table 1. Parameters to be collected during monitoring efforts.

Parameter Category	Parameter Type	Metric-Collection method	Purpose	Agency collecting the data
Ecological Parameters	terrestrial vegetation	Quadrats, percent cover, density, species along a transect	Habitat modeling	NCCOS
	terrestrial elevations	RTK GPS points along transects	Habitat modeling	NCCOS
	Sediment characteristics	Sediment cores on a transect	Habitat modeling	NCCOS

Parameter Category	Parameter Type	Metric-Collection method	Purpose	Agency collecting the data
	porewater	Porewater cores	Habitat modeling	NCCOS
	underwater vegetation/benthic environment	Quadrats, percent cover, density, species at random locations	Habitat modeling	MDDNR/NCCOS
Topography/bathymetry	Submerged bathymetry	LIDAR and/or boat surveys	Habitat & hydrodynamic modeling	Existing data?
	island bathymetry	LIDAR (existing or otherwise)	Habitat & hydrodynamic modeling	Existing data?
Hydrodynamic parameters	Currents	ADVs deployed on three platforms	Hydrodynamic modeling	USACE-ERDC
	Turbidity	ADVs deployed on three platforms	Hydrodynamic modeling	USACE-ERDC
	Waves	ADVs deployed on three platforms	Hydrodynamic modeling	USACE-ERDC
Water Quality	salinity	TBD	Habitat modeling	
	oxygen	TBD	Habitat modeling	
	pH	TBD	Habitat modeling	
	temperature	TBD	Habitat modeling	
	chlorophyll	TBD	Habitat modeling	

ANTICIPATED PROJECT OUTCOMES:

There are several advantages to developing a comprehensive understanding of the system where island projects occur and the benefits they provide. Research outcomes may include, but are not limited to:

1. **OUTCOME -** Quantification of island performance metrics and benefits (e.g. protection of adjacent land from erosion, breaking of offshore/storm waves, attenuation of wave energy, etc) over time will demonstrate how restoring these islands, by combining natural and engineered processes, can achieve ecological, economic and social benefits making these projects common practice in the future.

2. **OUTCOME -** Monitoring of the island ecological benefits over time, using vegetation as a proxy, (e.g. T&E species, migratory birds, etc), including documenting changes to the shallow water habitats around and in the 'lee' of the island footprint. Documenting the latter may address the "habitat switching' debate long considered a barrier to permitting and implementation of these kinds of projects. As follow-up, we will document island ecology and develop best-practices guidance for other sites based on data from this study.

3. **OUTCOME -** Data from this project will support new and existing hydrodynamic and ecological habitat models that will be used to evaluate island benefits and the island's influence on adjacent sites.

4. **OUTCOME -** Guidance will be developed for applying models that are refined or developed as part of Outcome 3. Guidance documents will aide practitioners in applying models for use in determining the utility and performance of future-proposed islands. In addition, guidance will include information specific to model benefits, limitations, applications, data needs, etc.

5. **OUTCOME -** Monitoring this island will produce data that informs future island construction projects around the nation. For example, the performance data will be integrated with other applicable data sets, and other tools and models that support future construction of island-based, natural and nature-based features (NNBF) for the purpose of storm risk reduction.

PROJECT TEAM (TO-DATE):

USACE
Baltimore District - Danielle Szimanski - Project Manager
ERDC - Joe Gailani - Sediment Transport Processes and Modeling
ERDC - Jeff King - Research Civil Engineer, EWN assistant lead
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NOAA
Paula Whitfield - Research Ecologist/Environmental Compliance,
Jenny Davis - Research Ecologist/Coastal Restoration Specialist,
Don Field - Research Biologist/Ecologist and Remote Sensing Expert
Carolyn Currin – Research Ecologist/Microbiologist
Jason Spires – Marine Biologist
JD Dubick - Biologist

USFWS – Matt Whitbeck - Blackwater Refuge Manager
MDDNR - Brooke Landry - Natural Resource Biologist; Chair, CBP SAV Workgroup
MDDNR - Becky Golden - Program Manager; Vice-chair, CBP SAV Workgroup