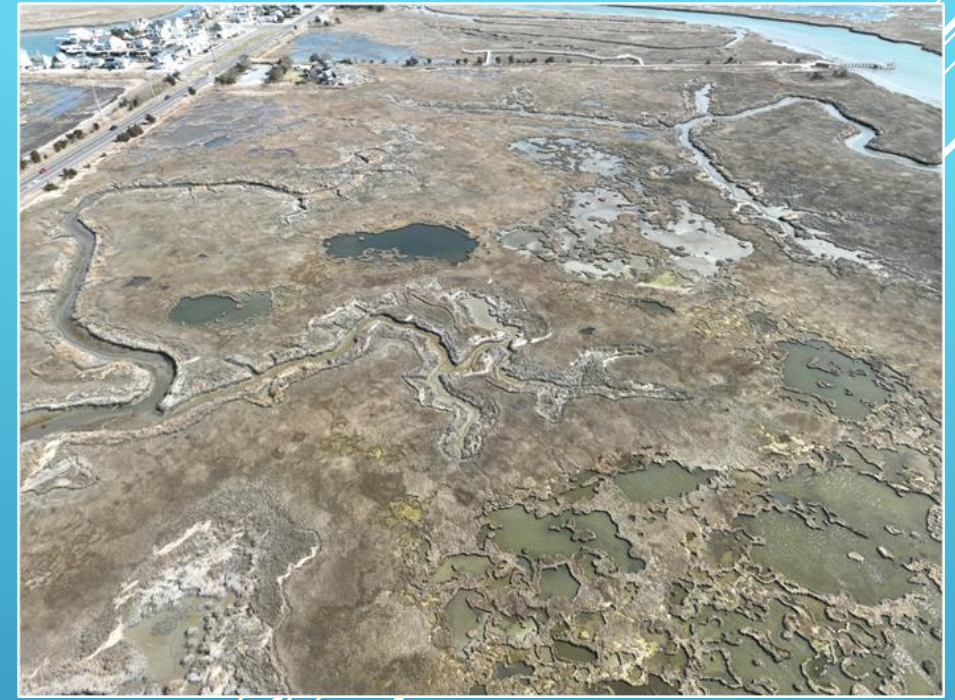


# Scotch Bonnet Island Marsh Elevation Enhancement: Beneficially Using Dredged Sediments to Stabilize Drowning Marshes



Lenore P. Tedesco, The Wetlands Institute  
Monica Chasten, Jeff McAleer - USACE – Philadelphia District  
Julie Blum, Amanda Lyons, Lisa Ferguson, Samantha Collins,  
Brian Williamson - The Wetlands Institute  
Jason Hearon, Ginger Kopkash - NJ Fish and Wildlife  
Brian Harris – USACE – ERDC  
Keith VanDerSys and Sean Burkholder – University of Pennsylvania

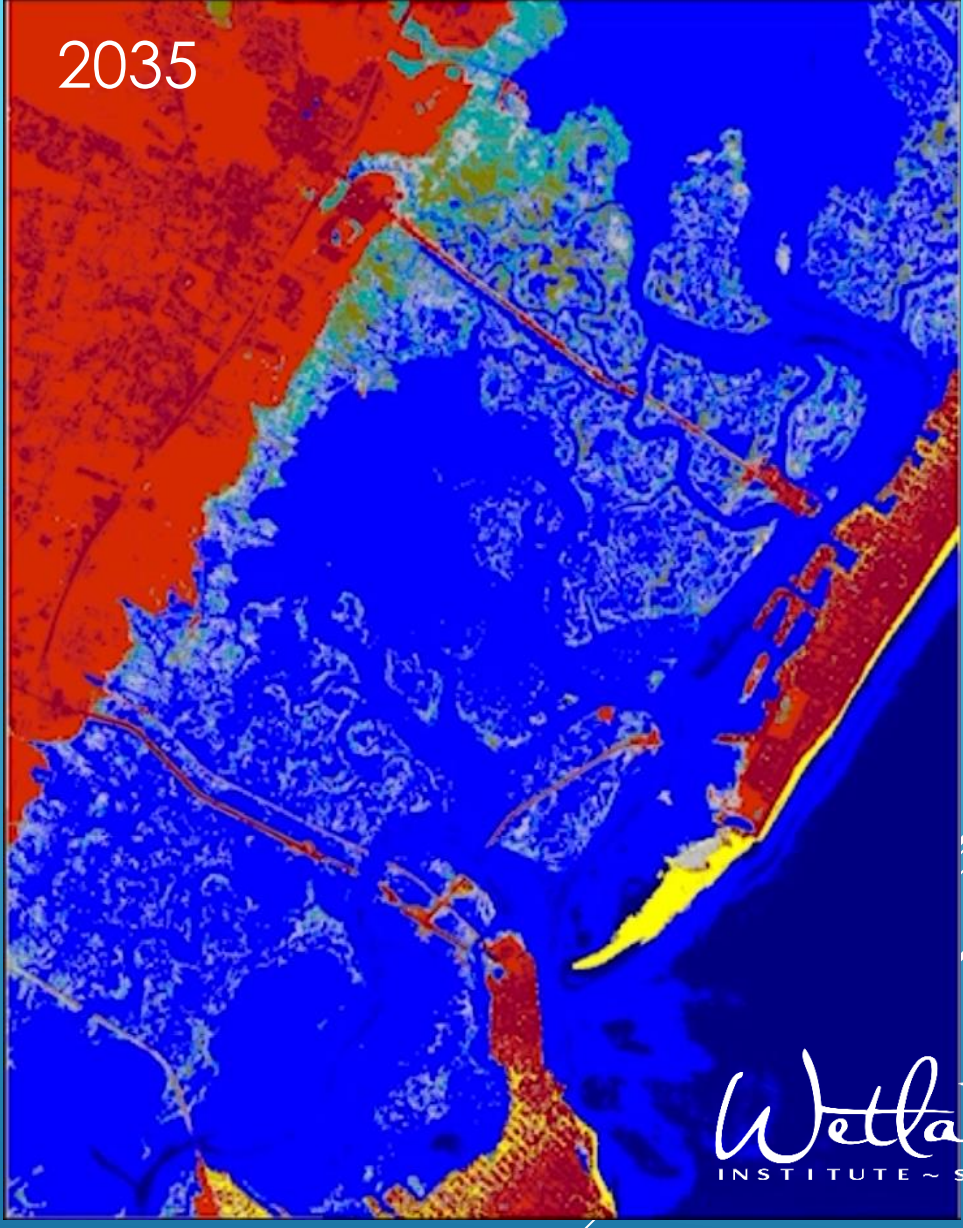
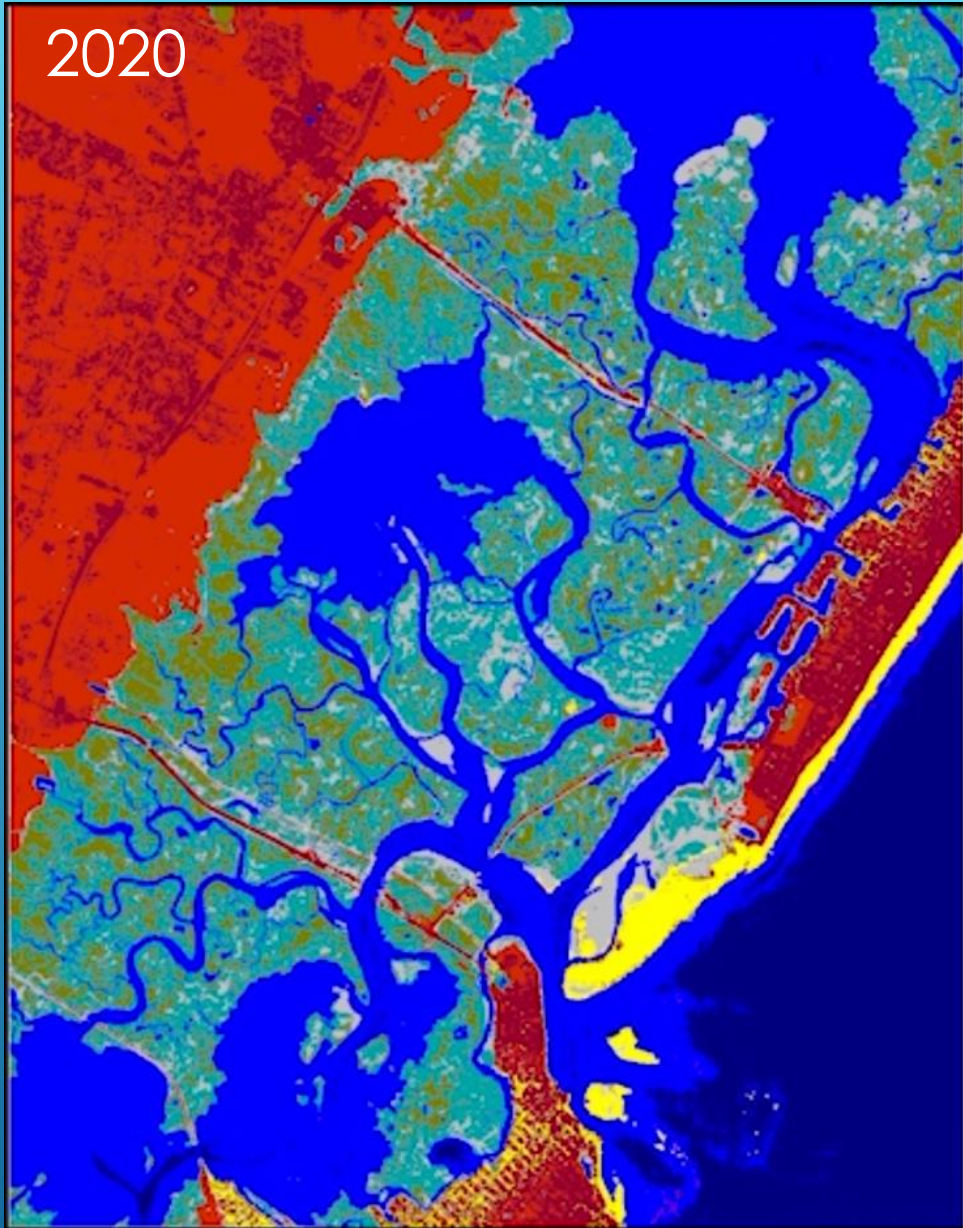


# PRESENTATION OUTLINE

- ▶ Establishing Need for Marsh Restoration Through Elevation Capital
  - ▶ Historic Marsh Loss
  - ▶ Modeling Future Trends
- ▶ Project Goals and Ecologic Targets
- ▶ Construction Overview
- ▶ Pre- and Post Placement Monitoring
- ▶ Education and Outreach







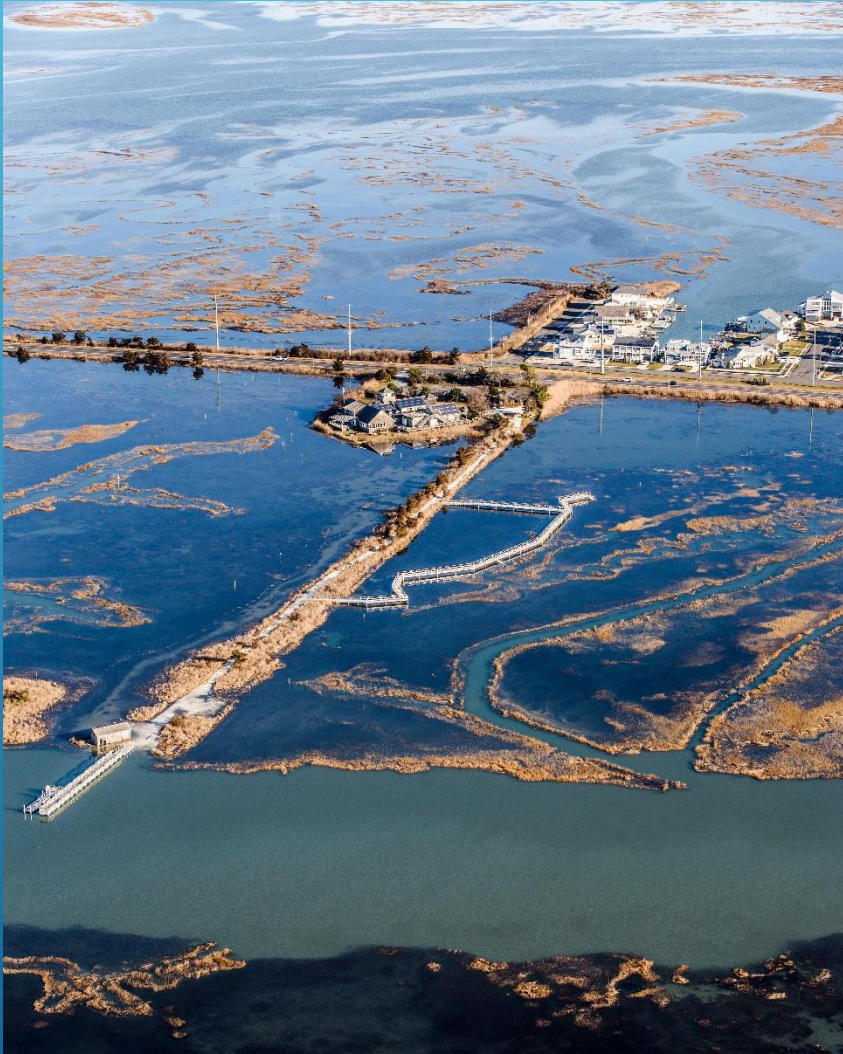
HIGH TIDE FLOODING (MHW SLAMM) AND COASTAL RESILIENCE





# SUNNY DAY FLOODING

▶ Backbay Marshes in SMIL have been inundated 21 of 31 days in January



1/12/2024 3.01' NAVD88



1/12/2024 2.68' NAVD88



# SUNNY DAY FLOODING



6/2/2023 2.86'NAVD88

Image Courtesy Ted Kingston

10/30/2023 3.89'NAVD88  
Photo: Devin Griffiths





1956

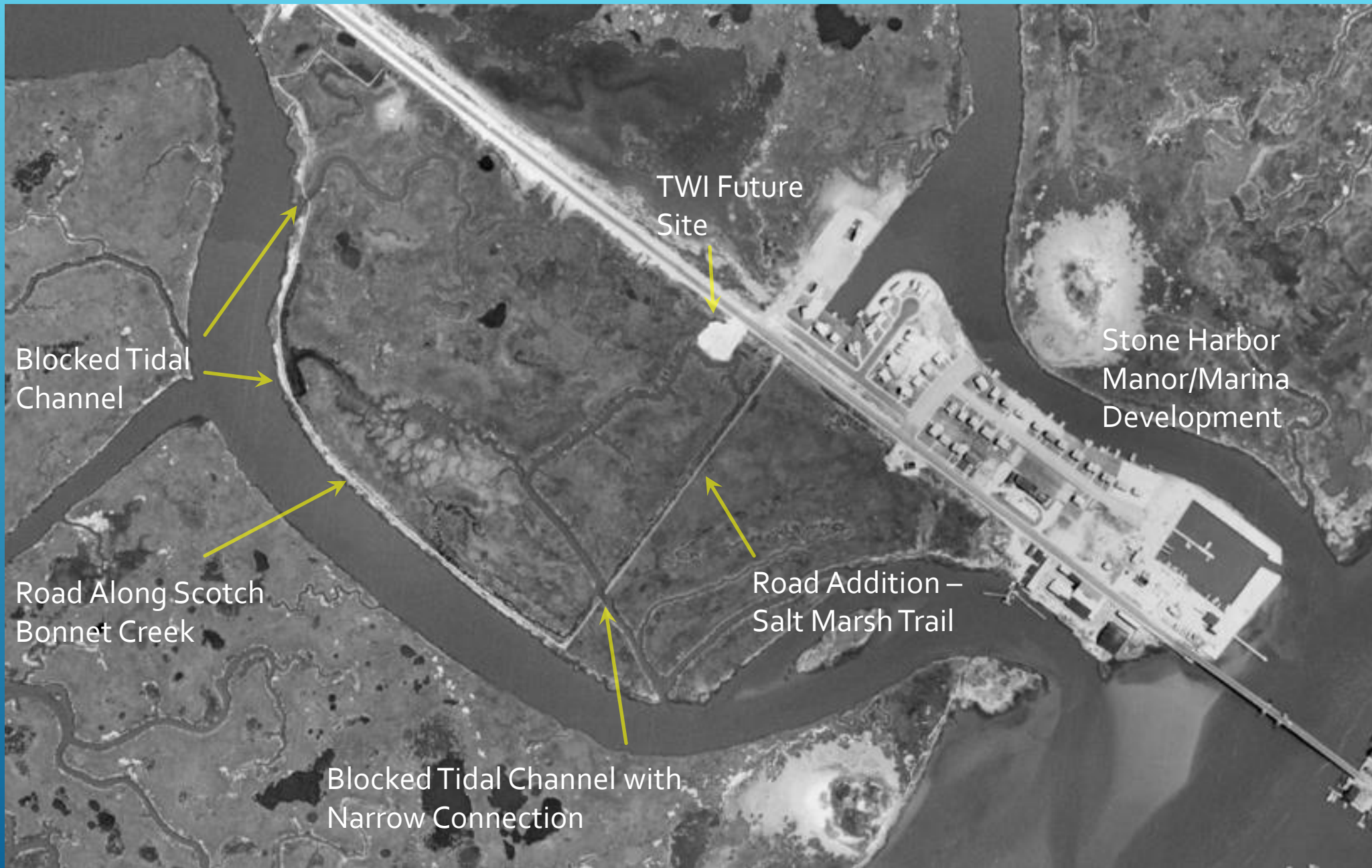
Cape May Wetlands Wildlife Management Area

Fresh Placement  
and Early Fill

Broad marsh plain  
with a few  
isolated pools

Relatively narrow  
tidal channels





1963



1970





Low Tide  
Image So  
Waterways  
Show as  
Mudflats

Tidal Creek  
Widening and  
Expansion

Significant Pool  
Expansion/New  
Pool  
Development  
and Marsh Loss

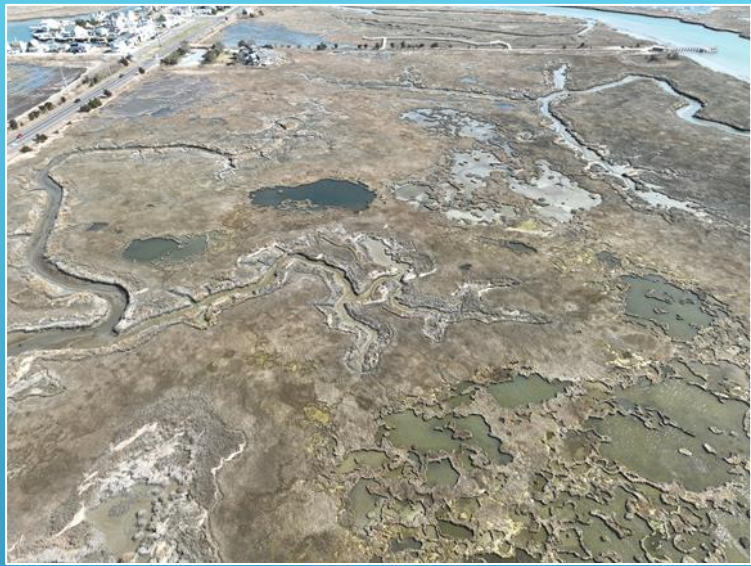
Tidal Creek  
Widening and  
Expansion

5/2009



Image © 2022 Maxar Technologies





New Pools/Pool Expansion



Tidal Creek Widening and Expansion



May 2021

# CURRENT MARSH PLATFORM CONDITIONS



Breached Pools



New Pools/Pool Expansion



Expanding Creek Network

Channel 70' Wider since 1970





# MODELLING FUTURE MARSH TRAJECTORY: SEA LEVEL RISE FRAMEWORK

		2030	2050	2070		
				Emissions		
	Chance SLR Exceeds	feet	feet	Low	Mod.	High
Low End	>95% Chance	0.3	0.7	0.9	1.0	1.1
Likely Range	>83% Chance	0.5	0.9	1.3	1.4	1.5
	~50% Chance	0.8	1.4	1.9	2.2	2.4
	<17% Chance	1.1	2.1	2.7	3.1	3.5
High End	<5% Chance	1.3	2.6	3.2	3.8	4.4

- ▶ Utilizing SLR Predictions from Rutgers University
  - ▶ Values are above the year 2000 (1991-2009 average) baseline
  - ▶ 2000 – 2022 (2001-2019 average) Observed 4" (0.3')
- ▶ Planning based on <17% Chance
- ▶ Focused on 2030 and 2050 Time Horizons



# EVOLUTION OF HABITAT ELEVATION RANGES

	2019 TWI		2030 Rutgers		2050 Rutgers	
<b>SLR</b>	n/a		0.8 - 1.1		1.1 - 2.1	
	<b>Elevation Range</b>					
<b>Habitat</b>	Low	High	Low	High	Low	High
<b>UP</b>	3.281	-	3.961	-	4.893	-
<b>HM</b>	2.953	3.281	3.493	3.961	4.275	4.893
<b>LM</b>	2.297	2.953	2.857	3.493	3.417	4.275
<b>MF</b>	0.656	2.297	1.616	2.857	2.116	3.417
<b>OW</b>	-	0.656	-	1.616	-	2.116

- ▶ Habitat maintenance over time requires increasing elevations
- ▶ Presumes salt marsh habitat is primarily guided by elevation related to sea level
- ▶ TWI elevations determined via direct elevation measurements and USACE 2018 DEM via LIDAR
- ▶ Future habitat elevation ranges are via SLAMM (Sea Level Affecting Marsh Model) to account for sea level rise, accretion, and subsidence via published resources and measured values

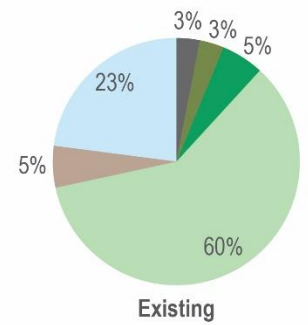


# 2020 Existing Conditions



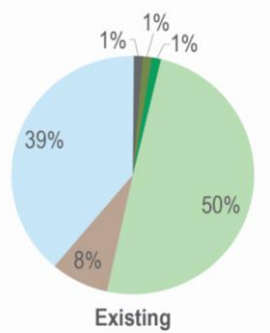
- Legend (SLAMM)
- Open Ocean
  - Estuarine Water
  - Developed Dry Land
  - Undeveloped Dry Land
  - Shrub/ Scrub
  - Regular Flooded Marsh (Low Marsh)
  - Irregular Flooded Marsh (High Marsh)
  - Tidal Flat
  - Ocean Beach

Elevation-derived habitat distributions via SLAMM\*:



Existing  
Scotch Bonnet Island

Southern SMILL



2020 Existing Condition- 2018DEM (1m)

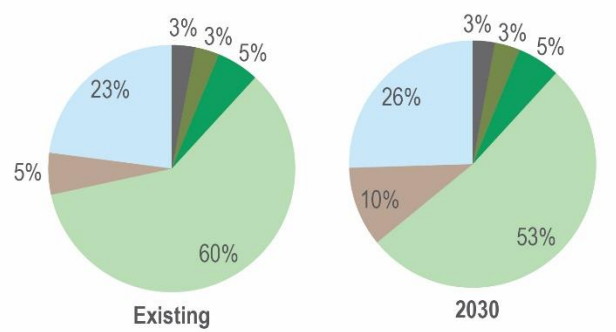


# 2030 Projected Conditions



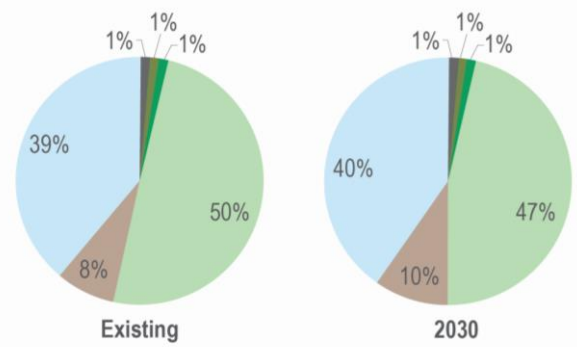
- Legend (SLAMM)**
- Open Ocean
  - Estuarine Water
  - Developed Dry Land
  - Undeveloped Dry Land
  - Shrub/ Scrub
  - Regular Flooded Marsh (Low Marsh)
  - Irregular Flooded Marsh (High Marsh)
  - Tidal Flat
  - Ocean Beach

Elevation-derived habitat distributions via SLAMM:



Scotch Bonnet Island

Southern SMIL



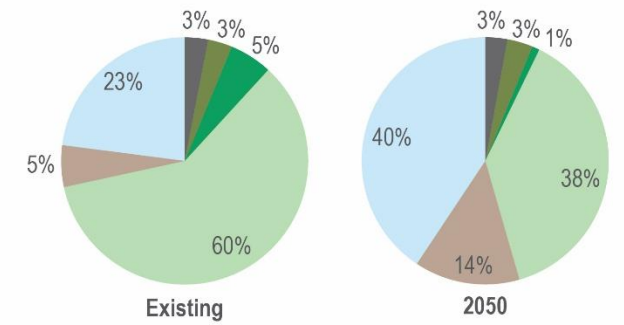
2030, 1.1ft SLR (<17%) SLAMM Simulation- 2018DEM (1m)



# 2050 Projected Conditions

- Legend (SLAMM)**
- Open Ocean
  - Estuarine Water
  - Developed Dry Land
  - Undeveloped Dry Land
  - Shrub/ Scrub
  - Regular Flooded Marsh (Low Marsh)
  - Irregular Flooded Marsh (High Marsh)
  - Tidal Flat
  - Ocean Beach

Elevation-derived habitat distributions via SLAMM:

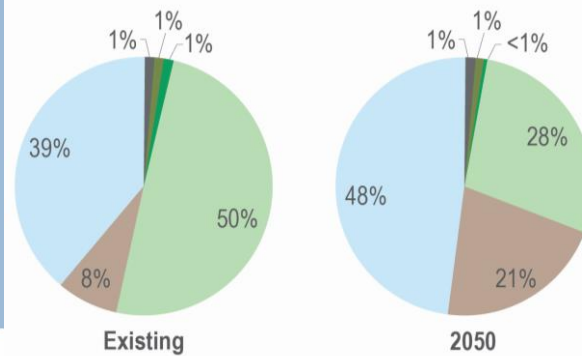


Scotch Bonnet Island



2050, 2.1ft SLR (<17%) SLAMM Simulation- 2018DEM (1m)

Southern SMILL





## ► Project Goals

### ► Stabilize Failing Marsh Platform

- Increase Marsh Elevation to Stable Low Marsh Elevation Ranges
- Slow Marsh Dissection

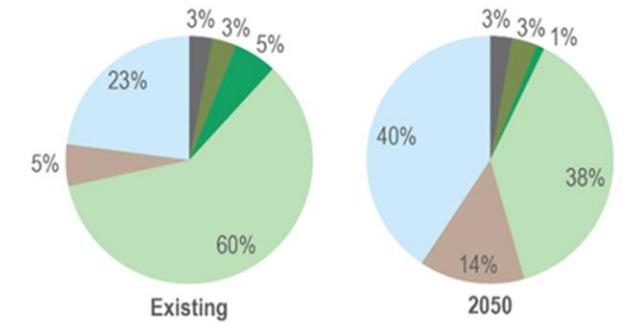
### ► Reverse Marsh Acreage Loss

- 1941 to 2019 - Lost 34% of Marsh Area (30 acres)
- Projections to 2050 – Lose Additional 33% (20 acres)

# SCOTCH BONNET ISLAND MARSH ELEVATION ENHANCEMENT PROJECT

## 2050 Projected Marsh

Elevation-derived habitat distributions via SLAMM:



Legend (SLAMM)

- Open Ocean
- Estuarine Water
- Developed Dry Land
- Undeveloped Dry Land
- Shrub/ Scrub
- Regular Flooded Marsh (Low Marsh)
- Irregular Flooded Marsh (High Marsh)
- Tidal Flat
- Ocean Beach



## ► Ecological Targets

- Increase Marsh Platform Resilience by Raising Marsh Elevation into 2030 Low Marsh Elevation Range
  - Currently at the Lower Limit of Low Marsh (2.3' NAVD88) near Mudflat Boundary (<2.3' NAVD88)
  - Target 2030 Low Marsh Elevations (2.8' – 3.5' NAVD88)
  - Maximize Area above 1.8' NAVD88
- Increase Low Marsh Acreage by Up to 12 acres
- Slow and Reverse Tidal Channel Widening and Expansion

# SCOTCH BONNET ISLAND MARSH ELEVATION ENHANCEMENT PROJECT





## ► Placement Method

- Hydraulic cutterhead dredge pumping 25,000 cy of mixed fine sand and mud to site
- Pipeline from dredge site to placement site
- Nozzle outlet pumping onto marsh surface
- Partial coir log containment to direct flows

## ► Timing and Timeline

- Late September - October 2024

## ► USACE Philadelphia District NJIWW Maintenance Dredging

- Critical shoal



# SCOTCH BONNET ISLAND MARSH ELEVATION ENHANCEMENT PROJECT





- ▶ TWI conducting pre- and post-construction monitoring for:
  - ▶ Elevation enhancement and evolution – multispectral UAV (UPenn)
  - ▶ Water chemistry impact and evolution
  - ▶ Pool aquatic habitat surveys
  - ▶ Vegetation impact and response
  - ▶ Coastal bird site usage and response to restoration
  - ▶ Diamondback terrapin site usage and response to restoration
- ▶ Funding from USACE – Philadelphia District
- ▶ Additional USACE ERDC/USNA Research
  - ▶ Hydrodynamics of creeks and tidal channels
  - ▶ Geotechnical response of platform to placement and compaction

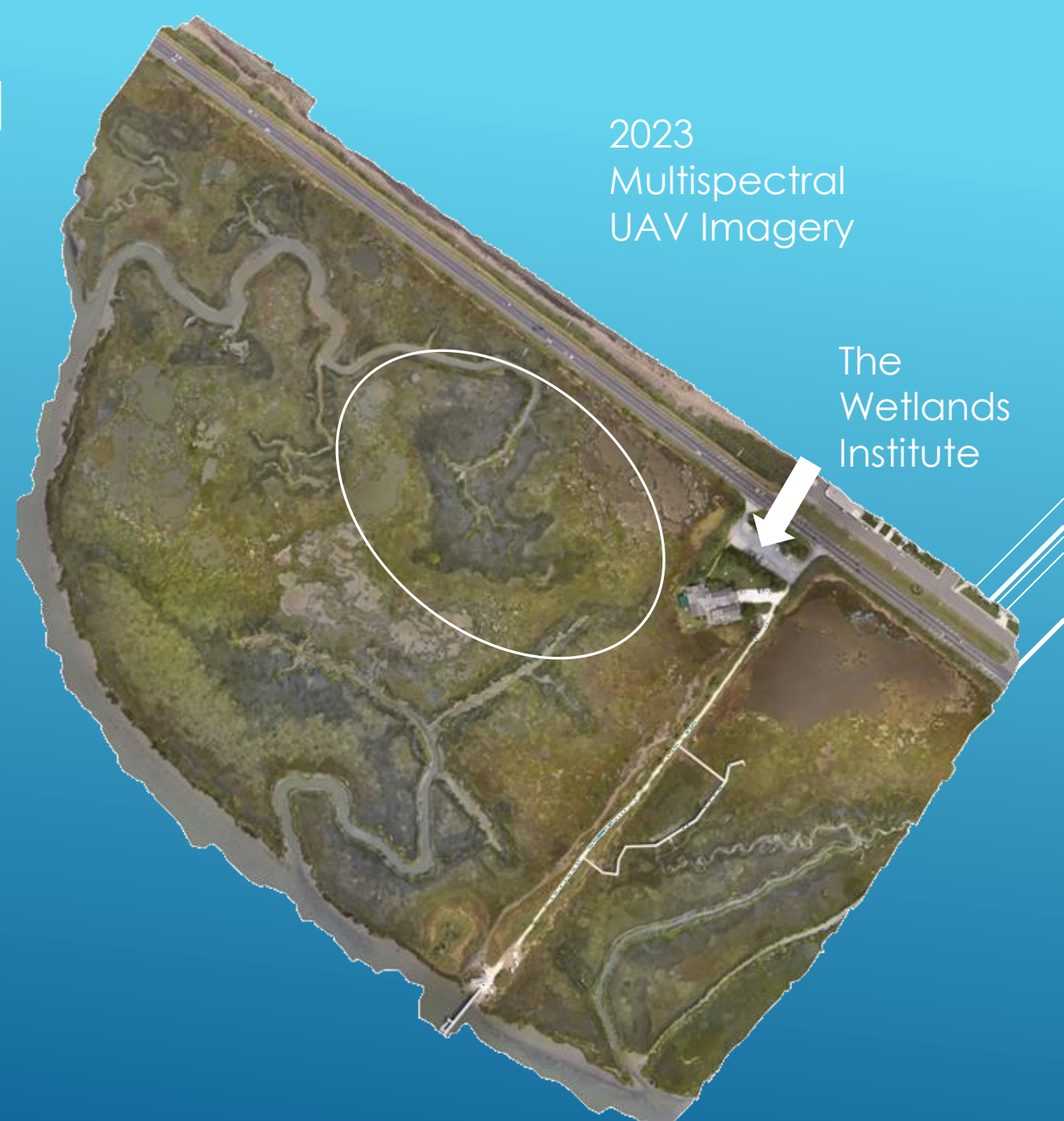


# SCOTCH BONNET ISLAND MARSH ELEVATION ENHANCEMENT PROJECT



# EDUCATION AND OUTREACH

- ▶ Education and outreach will be an important component of the project given the proximity to TWI
- ▶ Site signage for the trail system
- ▶ Educational materials for onsite programming and public education
  - ▶ 16,000 school children annually
  - ▶ 18,000 visitors annually
- ▶ Funding provided by NJ Coastal Wetland Restoration Partnership





# BUILDING RESILIENCE FOR CAPE MAY WETLAND WILDLIFE MANAGEMENT AREA AND THE WETLANDS INSTITUTE

