PUBLIC MEETING

FLOOD MITIGATION PROJECT - 30% Design

DATE: SEPTEMBER 9, 2025

START TIME: 6-7:30 PM

LOCATION: DORCHESTER COUNTY PUBLIC LIBRARY, CAMBRIDGE BRANCH, MEETING ROOM

Thank you for joining us!

MAKE CAMBRIDGE RESILIENT

WWW.MAKECAMBRIDGERESILIENT.ORG

30% DESIGN

WELCOME

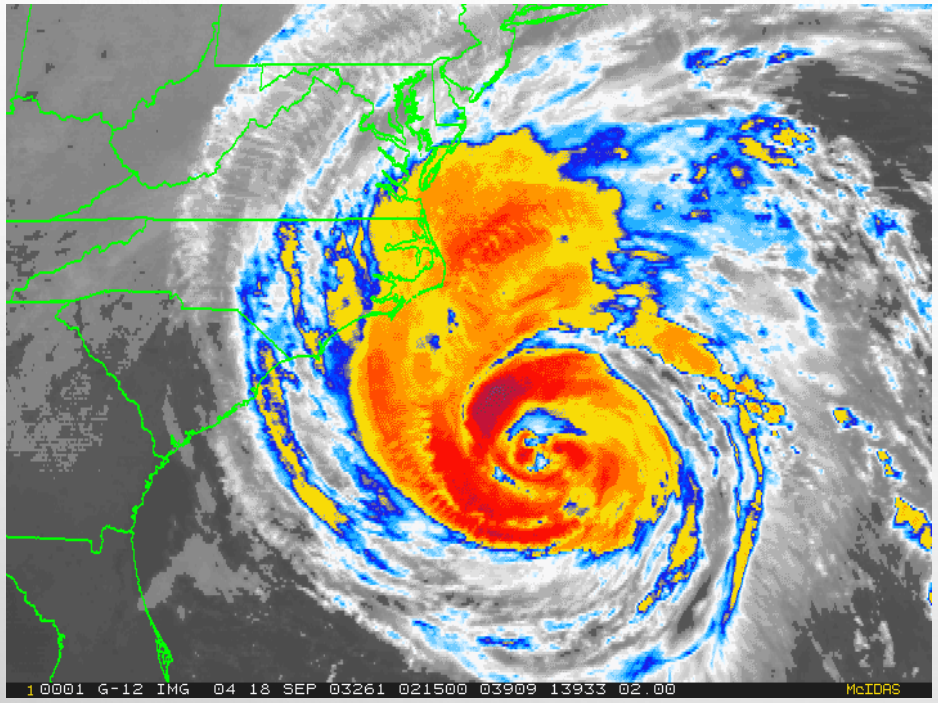
GLENN STECKMAN
CITY MANAGER

FLOOD MITIGATION PROJECT UPDATE

LARRY WHITE, PROJECT MANAGER

- PROJECT TEAM
- DESIGN STATUS SINCE PRELIMINARY ALIGNMENT PUBLIC MEETING
- OVERALL SCHEDULE AND FUNDING
- TODAY WE ARE REVIEWING AND REQUESTING FEEDBACK ON OUR 30 PERCENT DESIGN
- BENEFIT-COST ANALYSIS

UMCES ASSESSMENT OF IMPACTS OF ISABEL-LIKE STORMS ON CAMBRIDGE IN 2050 and 2100 WITH HIGHER SEA LEVEL

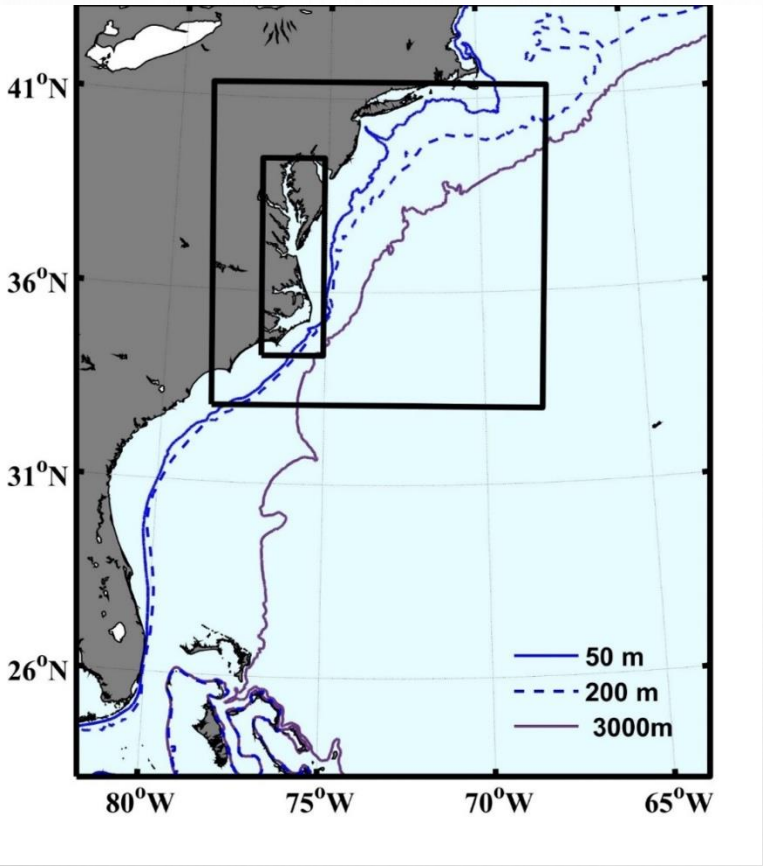


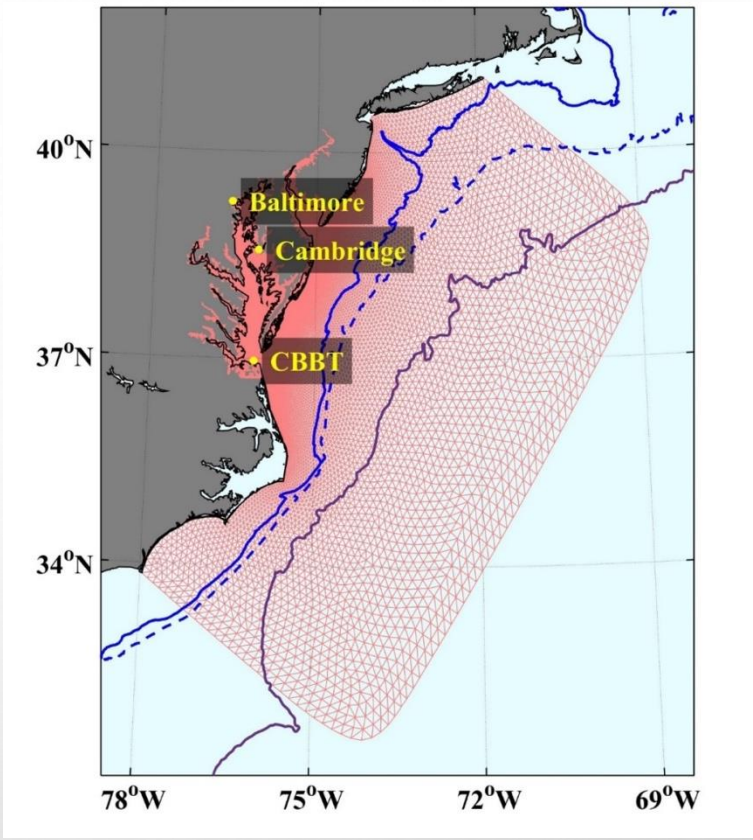
Hurricane Isabel (2003)

Zhang & Li (2019, JGR)
Li et al. (2020, Nat. Haz.)

Flooding in Washington D.C., Baltimore, Annapolis, Eastern Shore of MD etc.

Regional Atmosphere (WRF)-Ocean (FVCOM) Models

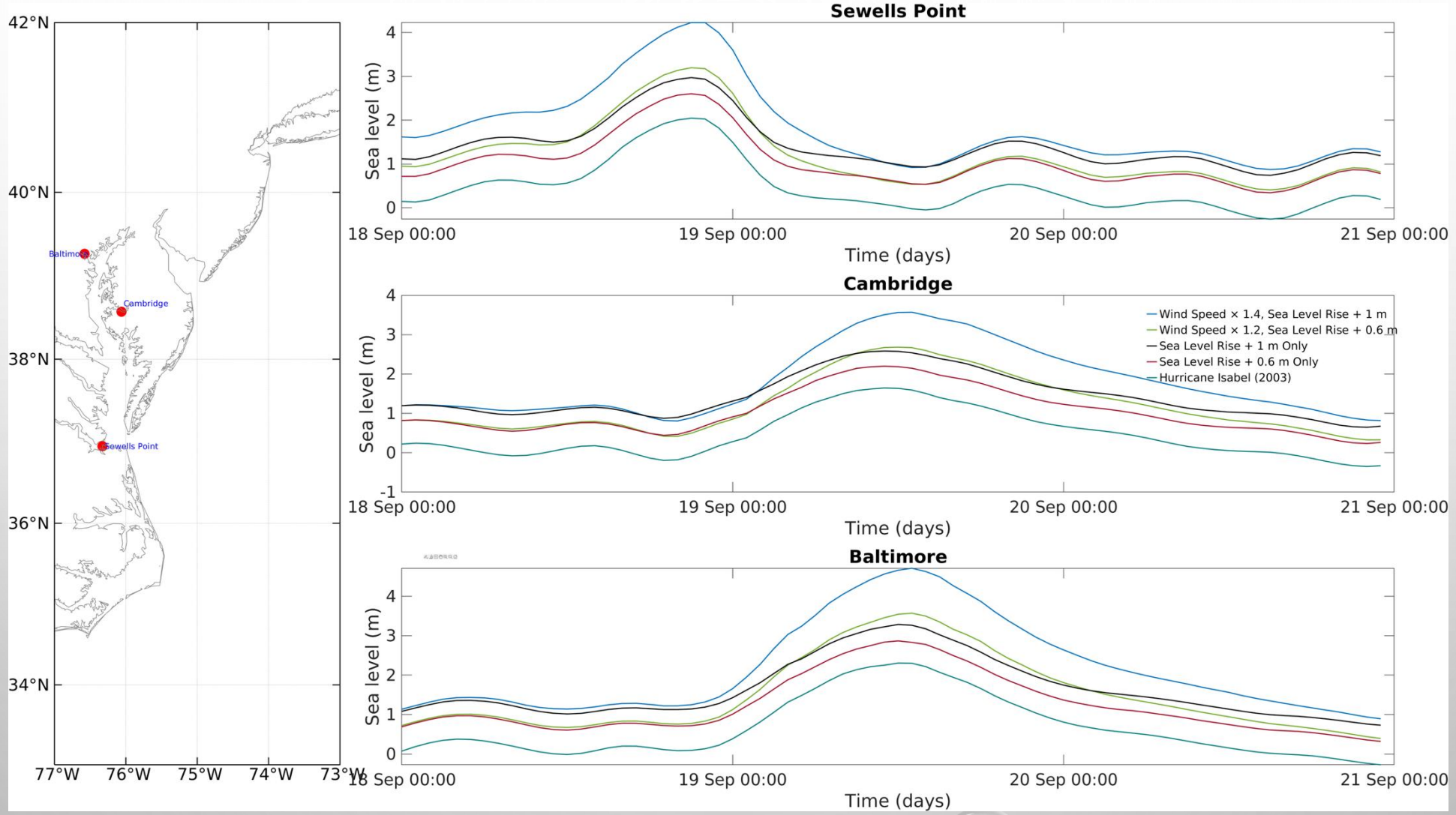




Weather Research Forecasting Model
Triply nested domain: 12, 4 and 1.3 km
40 sigma levels
Forced by GFS outputs at lateral boundary
Forced by SST at ocean surface

Finite Volume Coastal Ocean Model
200-500 m resolution in estuaries
1 – 10 km resolution on the shelf
2D barotropic mode
Forced by WRF winds and air pressure
Forced by tides at open boundary

Storm surge height in 2075 and 2100



AGENDA

- 30% Design: Embankment and Living Shoreline – Anna Johnson, PE, CC-P, Project Engineer, BayLand Consultants & Designers, Inc.
- 30% Design Stormwater Management – Megan Barniea, P.E., Senior Project Manager, BayLand Consultants & Designers, Inc.
- Living Shoreline and Habitat Enhancements - Dr. Kenneth Rose, Horn Point Laboratory, University of Maryland Center for Environmental Science

NOTE: SLIDES ARE NUMBERED FOR REFERENCE – USE FOR Q&A SESSION AT THE END OF THE PRESENTATIONS

HOLD QUESTIONS UNTIL END – TAKE OF NOTE OF SLIDE #S

30% DESIGN REVIEW

1. **AUGUST 2025 -** STAKEHOLDER GROUP MEETING, WHICH INCLUDES STATE AND FEDERAL AGENCY REPRESENTATIVES TO REVIEW THE DRAFT 30% DESIGN AND PROVIDE FEEDBACK.
2. **AGENCY REVIEW JULY THRU SEPTEMBER 2025 -** US ARMY CORP. OF ENGINEER, CENTER FOR WATERSHED PROTECTION, UMCES
3. **SEPTEMBER 2025 –** 30% DESIGN PUBLIC OUTREACH SESSION

30% DESIGN – EMBANKMENT AND LIVING SHORELINE

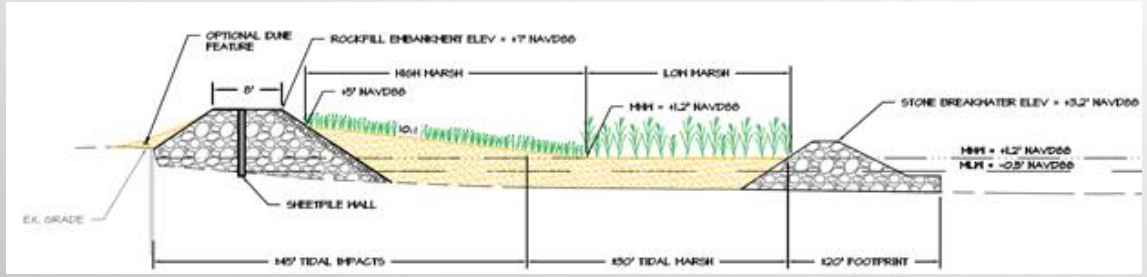
ANNA JOHNSON, PE, CC-P

PROJECT ENGINEER

BAYLAND CONSULTANTS & DESIGNERS, INC.

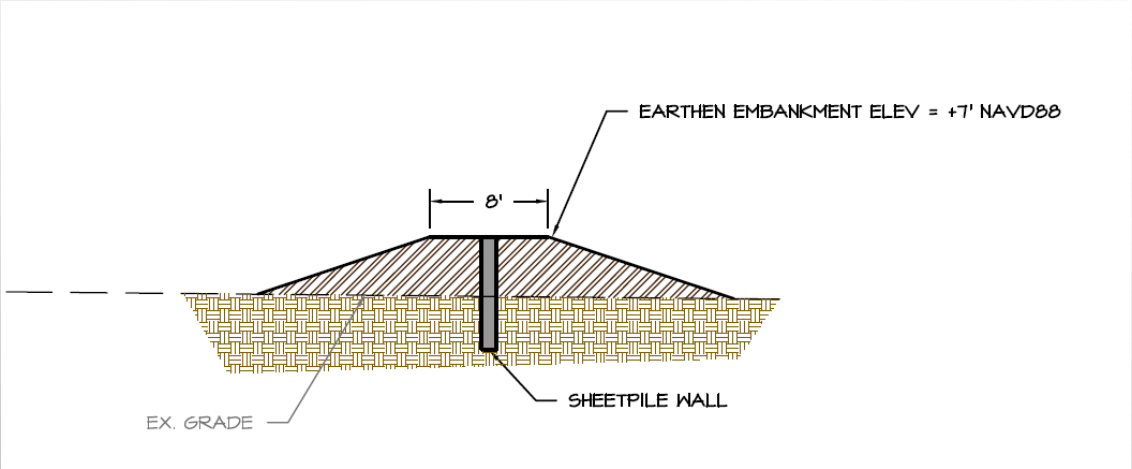
EMBANKMENT + LIVING SHORELINE

- PROPOSED FLOOD PROTECTION INCLUDES AN EMBANKMENT AND LIVING SHORELINE:



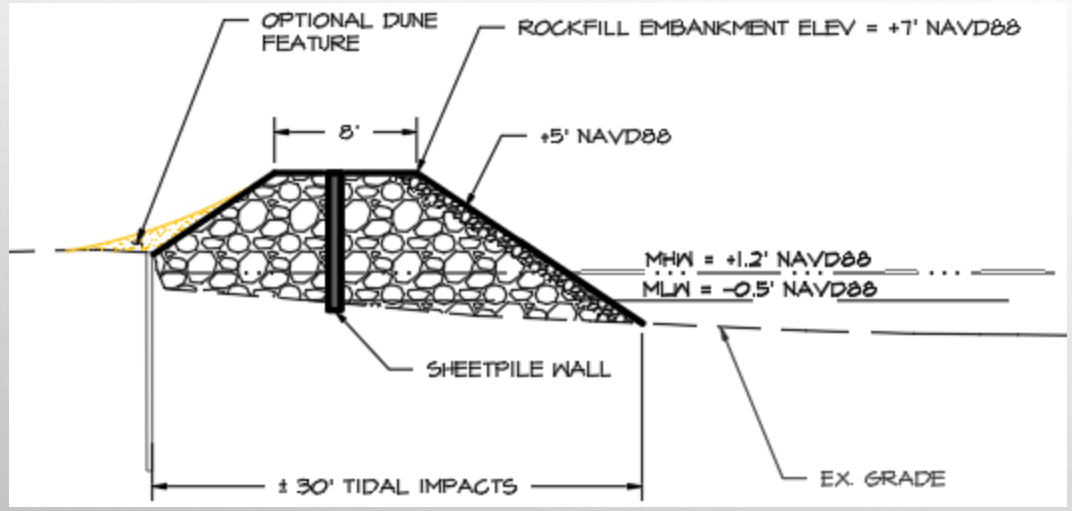
EMBANKMENT DESIGN

- EARTHEN EMBANKMENT:



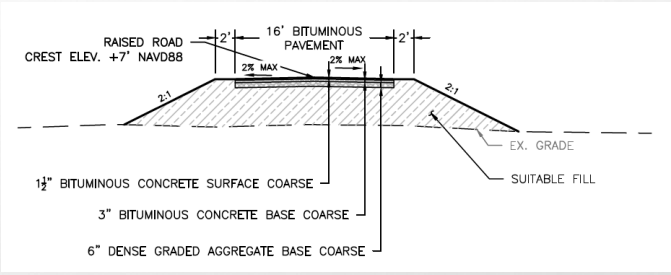
EMBANKMENT DESIGN

- ROCKFILL EMBANKMENT

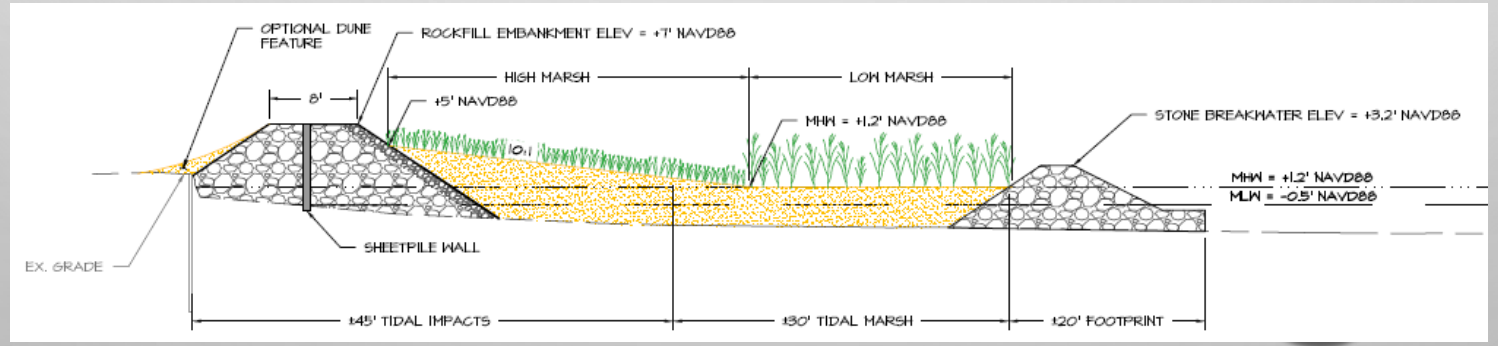


EMBANKMENT DESIGN

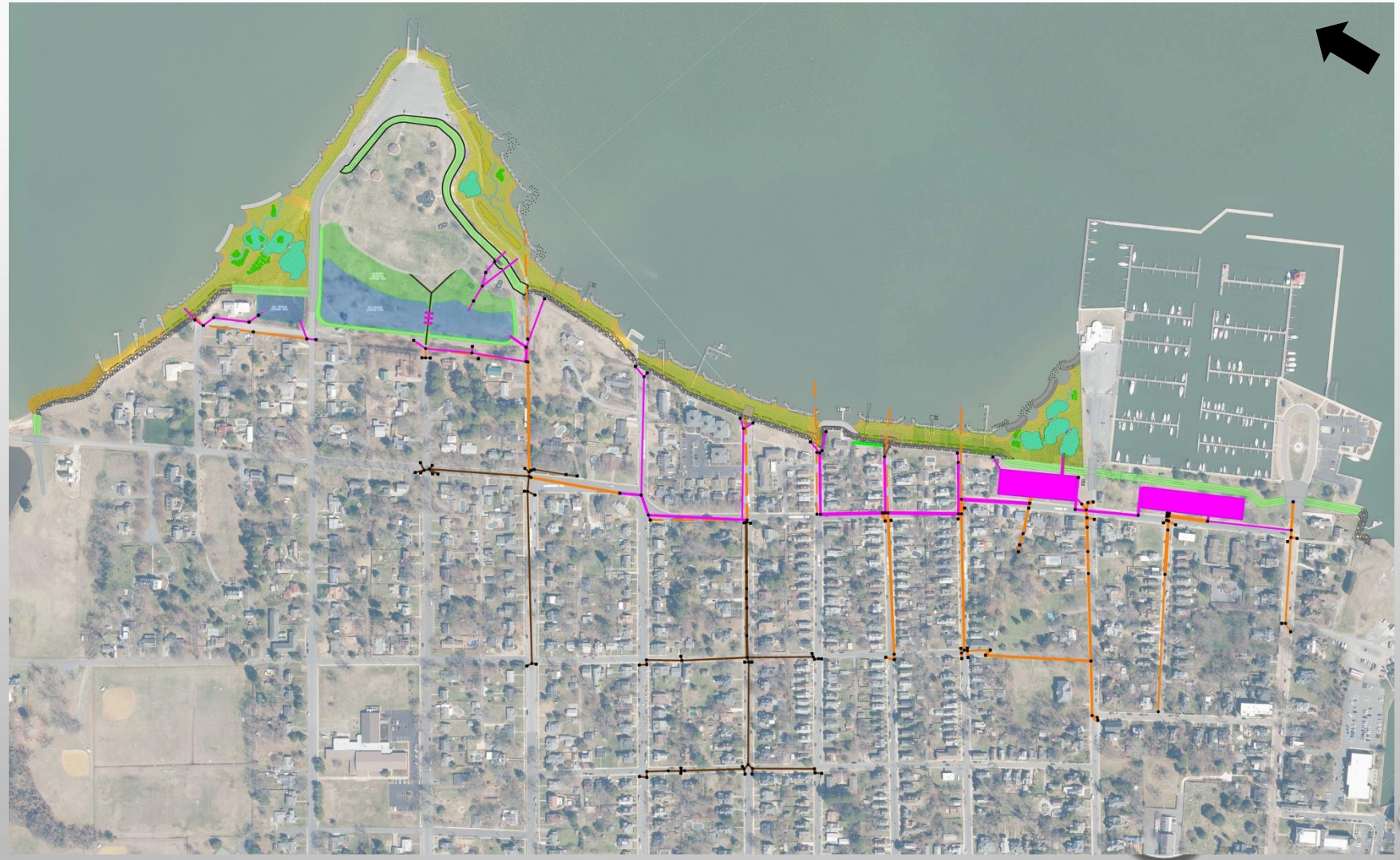
- ROAD RAISING AS EMBANKMENT



LIVING SHORELINE DESIGN



30% DESIGN ALIGNMENT

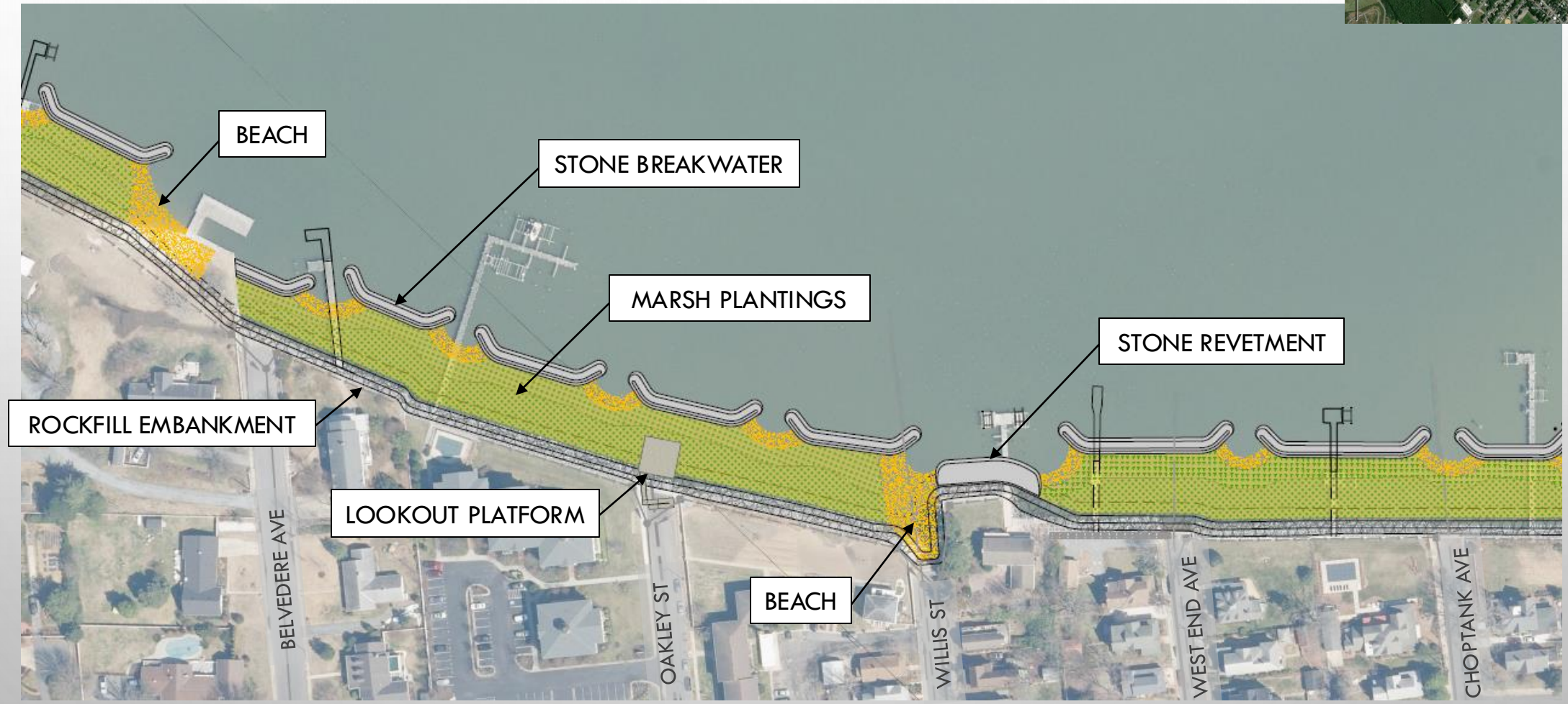


30% DESIGN ALIGNMENT

HUMMOCK/NESTING FEATURE
REEF PROTECTION STRUCTURE
STONE BREAKWATER
EXTENDED GROIN
BEACH
SHINGLE BEACH
ROCKFILL EMBANKMENT
EMBANKMENT TIE-IN
BEACH ACCESS
SHALLOW WATER HABITAT
ROAD RAISING
EARTHEN EMBANKMENT
STORMWATER MANAGMENT
BAY ST
SOMERSET AVE
HAMBROOKS BLVD

30% DESIGN ALIGNMENT

30% DESIGN ALIGNMENT



30% DESIGN ALIGNMENT

HABITAT BALLS

LIVING BREAKWATER

HUMMOCK/NESTING FEATURE

SAND DUNES WITH PLANTINGS

SHALLOW WATER HABITAT

CHOPTANK AVE

STORMWATER MANAGMENT

STORMWATER MANAGMENT

MILL ST

WATER ST

HIGH ST

ROAD RAISING

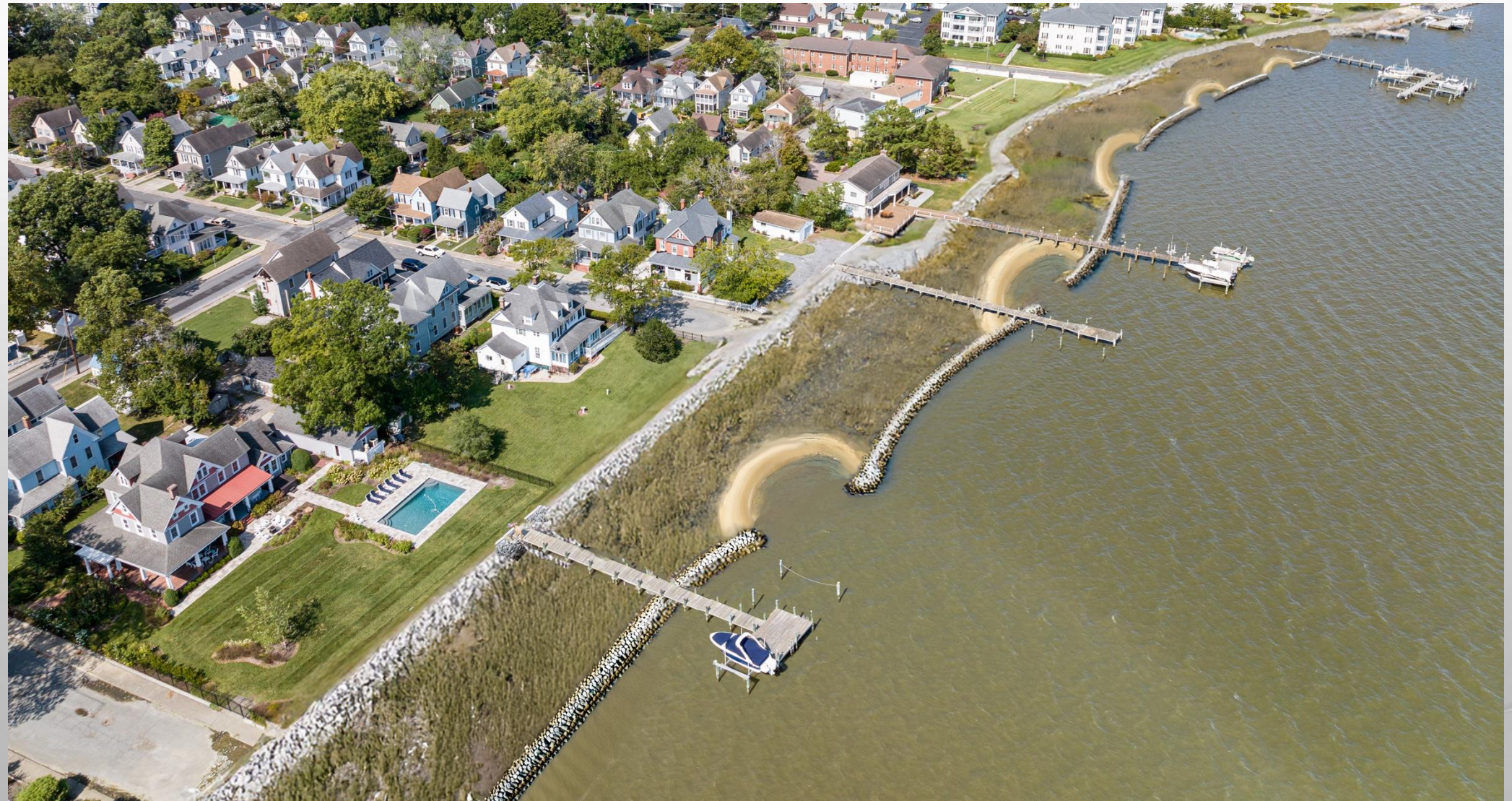
EARTHEN EMBANKMENT

ROAD RAISING

ROCKFILL EMBANKMENT

30% DESIGN ALIGNMENT - BEFORE

30% DESIGN ALIGNMENT - AFTER



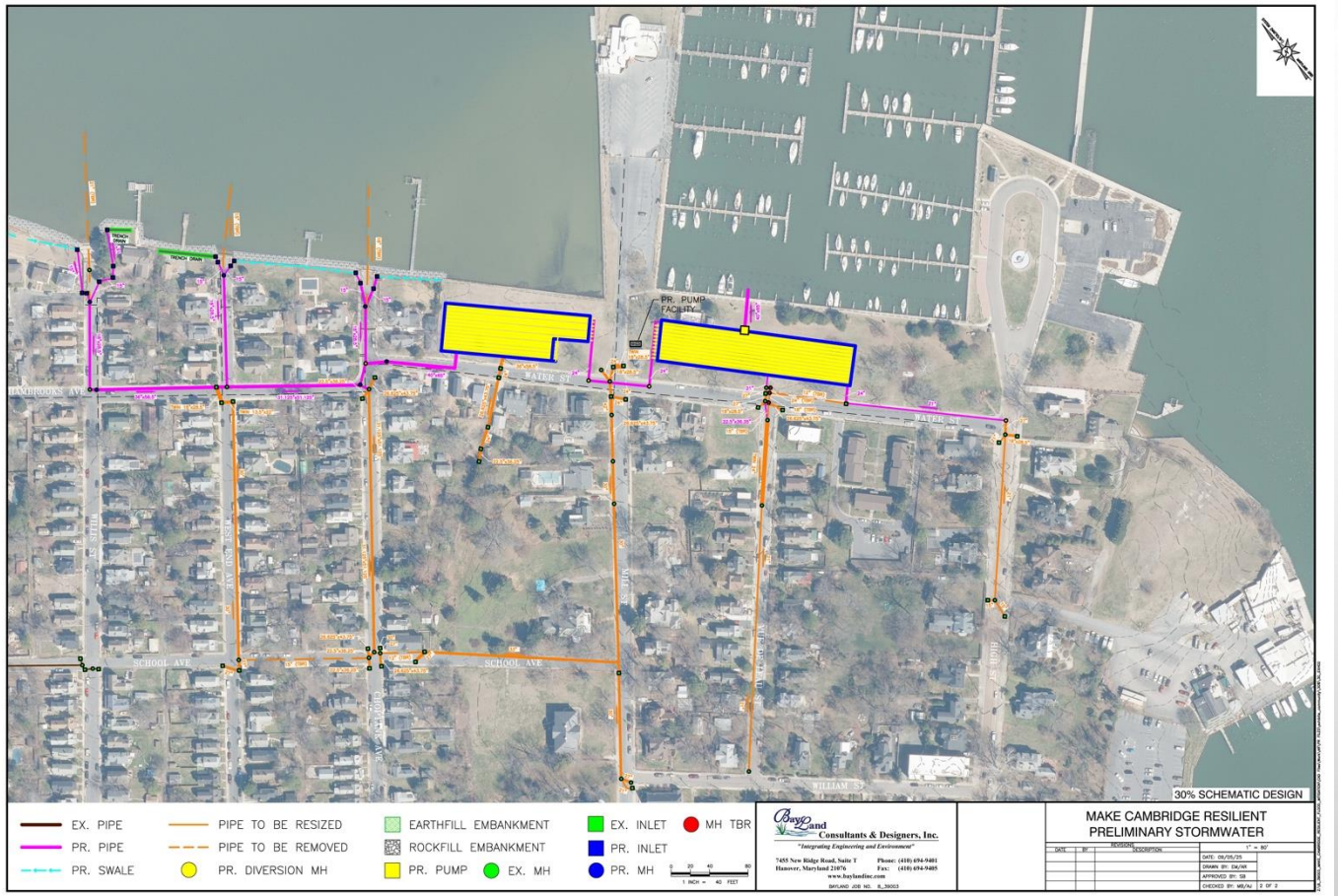
30% DESIGN
STORMWATER MANAGEMENT

MEGAN BARNIEA, P.E.

SENIOR PROJECT MANAGER

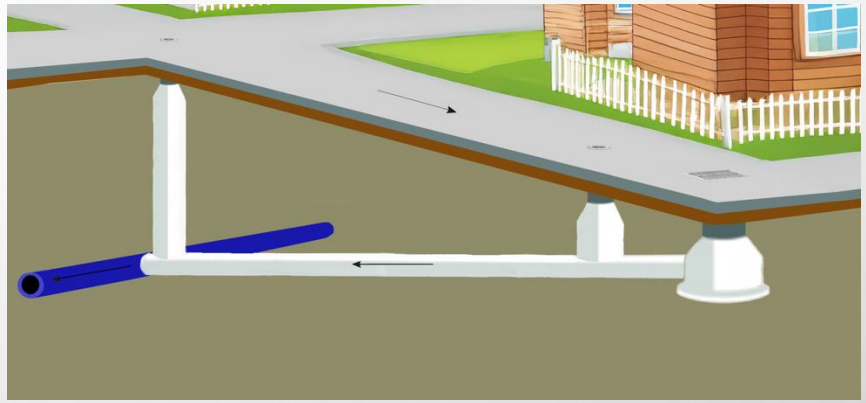
BAYLAND CONSULTANTS & DESIGNERS, INC.

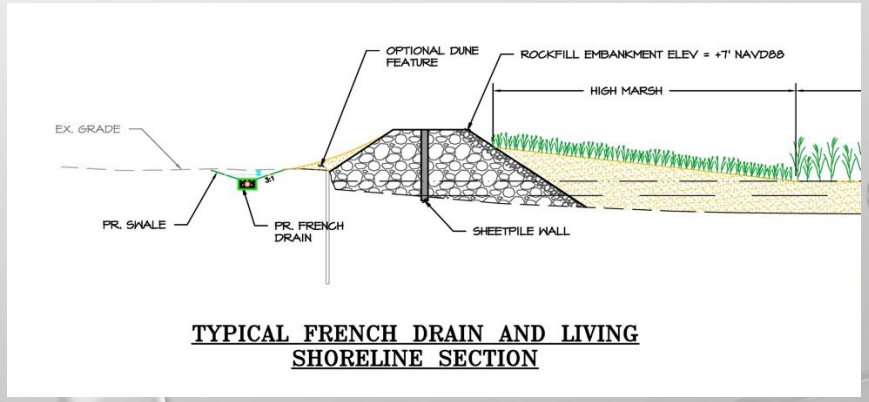
30% DESIGN - STORMWATER



WILLIS STREET, WEST END AVENUE, CHOPTANK AVENUE

- **MAXIMIZE GRAVITY FLOW AND STORAGE WITHIN THE SYSTEM TO MINIMIZE PUMPING**





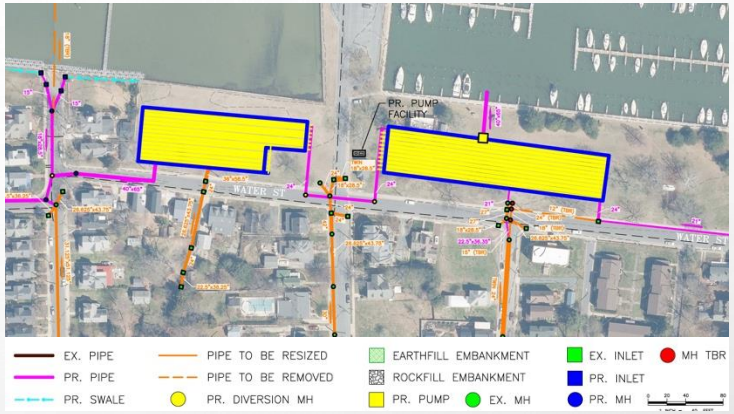
30% DESIGN - STORMWATER

WATER STREET – EXISTING CONDITIONS

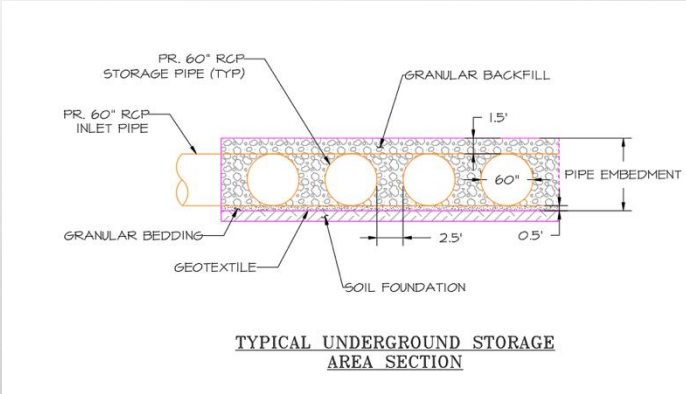
WATER STREET – WITH EARTHEN EMABNKMENT

30% DESIGN - STORMWATER

- UNDERGROUND STORAGE AREAS
  - INCLUDE STORAGE PIPES WITH STONE BEDDING
  - DRAIN VIA GRAVITY FOR SMALLER RAINFALL EVENTS
  - PUMP STATION KICK ON FOR LARGER STORM EVENTS
  - TIDE GATE INSTALLED AT GRAVITY OUTFALL
- PUMP STATIONS
  - LOCATED IN UNDERGROUND WET WELLS
  - PUMP STATIONS DISCHARGE OVER EARTHEN BERMS
  - CONTROL PANELS AND BACKUP GENERATOR SCREENED WITH FENCE ENCLOSURE



LONG WHARF PARK



TYPICAL UNDERGROUND STORAGE AREA SECTION

30% DESIGN - STORMWATER

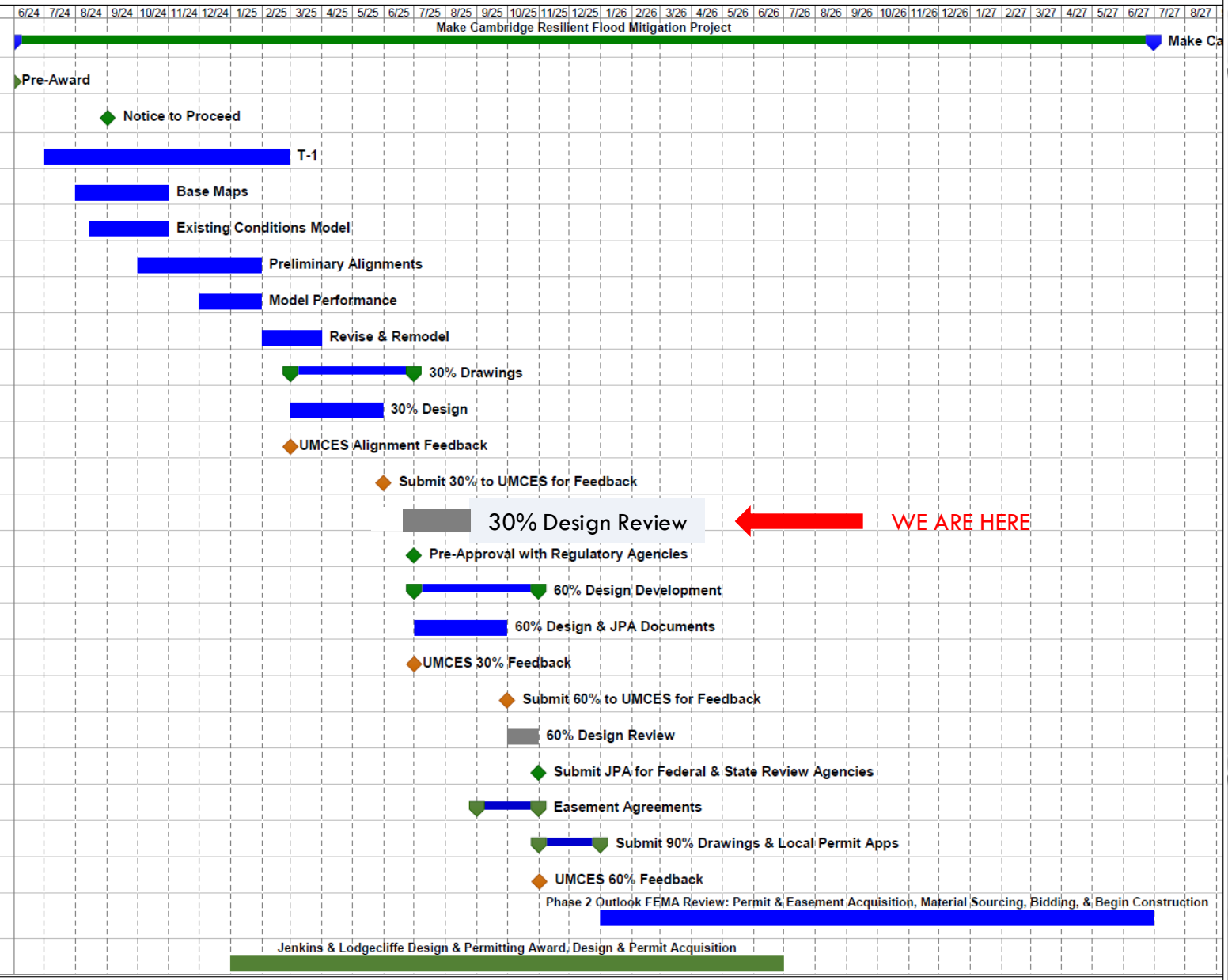
OAKELY STREET, BELVEDERE AVENUE, GERRY BOYLE PARK

- **NEW MAIN COLLECTOR PIPE WITHIN HAMBROOKS AVENUE TO DIRECT ALL RUNOFF INTO GERRY BOYLE PARK STORMWATER FACILITY VIA GRAVITY AND PUMPING**
- **EXTENDED DETENTION WETLAND POND TO PROVIDE WATER QUALITY AND HABITAT ENHANCEMENT**
- **RUNOFF FROM OAKLEY STREET AND WEST WILL DISCHARGE INTO POND VIA GRAVITY AND PUMPING**
- **MET WITH PARK USERS (GENERAL PUBLIC, IRONMAN EAGLE, CAMBRIDGE POWERBOAT RACING ASSOCIATION)**

Make Cambridge Resilient Flood Mitigation Project

Project Schedule - December 3, 2024

Task	Task Name	Months	Start	Finish
	Make Cambridge Resilient Flood Mitigation Project	**36 Months**	**6/1/24**	**6/30/27**
	Pre-Award	1 Day	6/1/24	6/1/24
	Notice to Proceed	1 Day	9/1/24	9/1/24
T-1	**Field Work**	**8 Months**	**7/1/24**	**2/28/25**
T-2	**Base Maps**	**3 Months**	**8/1/24**	**10/31/24**
T-3	**Existing Conditions Model**	**2.5 Months**	**8/15/24**	**10/31/24**
T-4	**Preliminary Alignments**	**4 Months**	**10/1/24**	**1/31/25**
T-5	**Model Performance**	**2 Months**	**12/1/24**	**1/31/25**
T-6	**Revise & Remodel**	**2 Months**	**2/1/25**	**3/31/25**
T-7	**30% Drawings**	**4 Months**	**3/1/25**	**6/30/25**
	30% Design	3 Months	3/1/25	5/31/25
	UMCES Alignment Feedback	1 Day	3/1/25	3/1/25
	Submit 30% to UMCES for Feedback	1 Day	5/31/25	5/31/25
	30% Design Review	1 Month	6/1/25	6/30/25
	Pre-Approval with Regulatory Agencies	1 Day	6/30/25	6/30/25
T-8	**60% Design Development**	**4 Months**	**7/1/25**	**10/31/25**
	60% Design & JPA Documents	3 Months	7/1/25	9/30/25
	UMCES 30% Feedback	1 Day	7/1/25	7/1/25
	Submit 60% to UMCES for Feedback	1 Day	9/30/25	9/30/25
	60% Design Review	1 Month	10/1/25	10/31/25
	Submit JPA for Federal & State Review Agencies	1 Day	10/31/25	10/31/25
T-9	**Easement Agreements**	**2 Months**	**9/1/25**	**10/31/25**
T-10	**Submit 90% Drawings & Local Permit Apps**	**2 Months**	**11/1/25**	**12/31/25**
	UMCES 60% Feedback	1 Day	11/1/25	11/1/25
	Phase 2 Outlook FEMA Review: Permit & Easement Acquisition, Material Sourcing, Bidding, & Begin Construction	18 Months	1/1/26	6/30/27
	Jenkins & Lodgecliffe Design & Permitting Award, Design & Permit Acquisition	18 Months	1/1/25	6/30/26



Project: Low Level Make Cambridge Resilience Flood Mitigation Project Schedule - 36 Mo
Date: 12/3/24

Task | Milestone | Project Summary | External Milestone
Split | Summary | External Tasks

UMCES MODELING & DATA

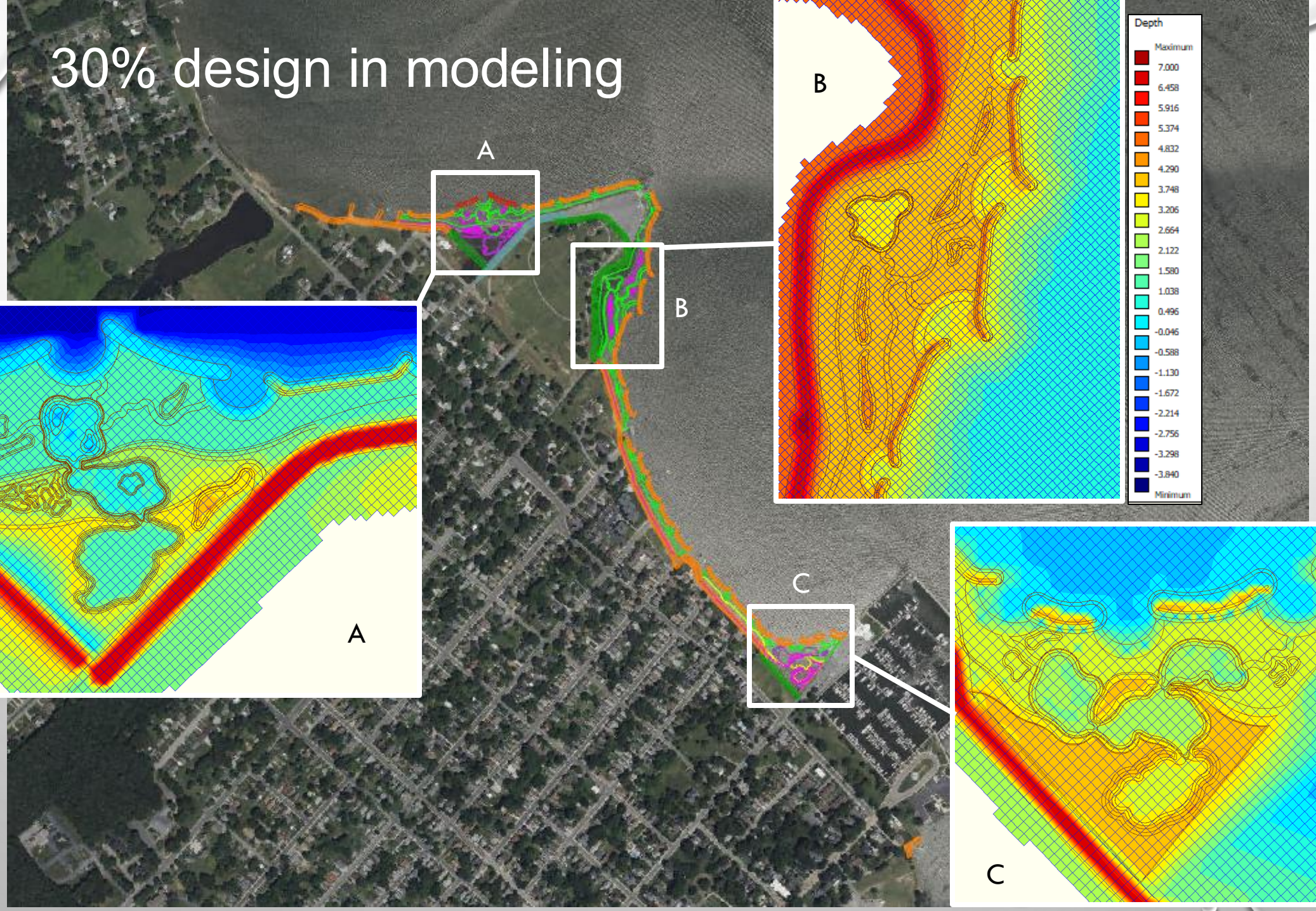
WILLIAM NARDIN
LIMIN SUN

Dr. Kenneth Rose, Horn Point Laboratory, University Of Maryland Center For Environmental Science

DELFT3D-SWAN

- PROCESSES:
  - FLOWS, WAVES, SEDIMENT TRANSPORT
  - WATER QUALITY DYNAMICS
  - VEGETATION FORCING
  - INFRASTRUCTURE (LIVING SHORELINE, EMBANKMENT)
  - COUPLED WITH STORM SURGE MODELING
- OUTPUTS:
  - WAVE ENERGY
  - EROSION/DEPOSITION
  - SEDIMENT CONCENTRATIONS
  - INUNDATION
  - WATER QUALITY AND TEMPERATURE
- PROJECTIONS WITHOUT AND WITH:
  - PROJECT
  - STORMS
  - SEA LEVEL RISE

30% design in modeling



LIVING SHORELINE AND HABITAT ENHANCEMENTS

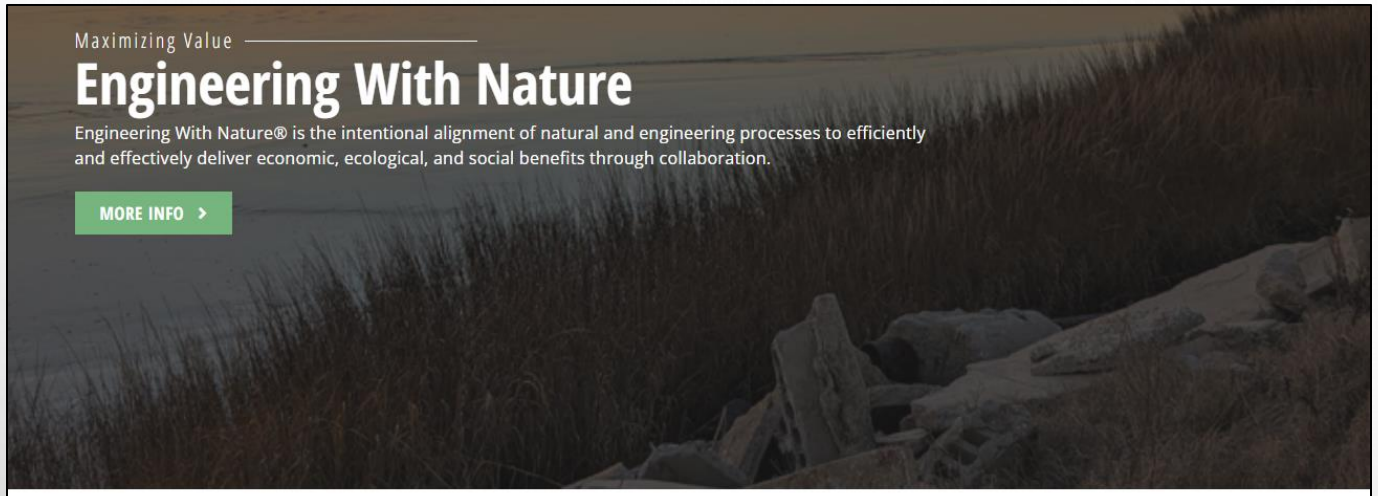
Dr. Kenneth Rose, Horn Point Laboratory, University Of Maryland Center For Environmental Science

NATIONAL COASTAL RESILIENCE FUND

INVESTS IN NATURE-BASED SOLUTIONS THAT PROTECT COASTAL COMMUNITIES WHILE ENHANCING HABITATS FOR FISH AND WILDLIFE

NFWF

National Coastal Resilience Fund 2024
City of Cambridge Habitat Restoration and Green Stormwater Management



"We absolutely want to do more engineering with nature everywhere we work across the Corps, you have my commitment."

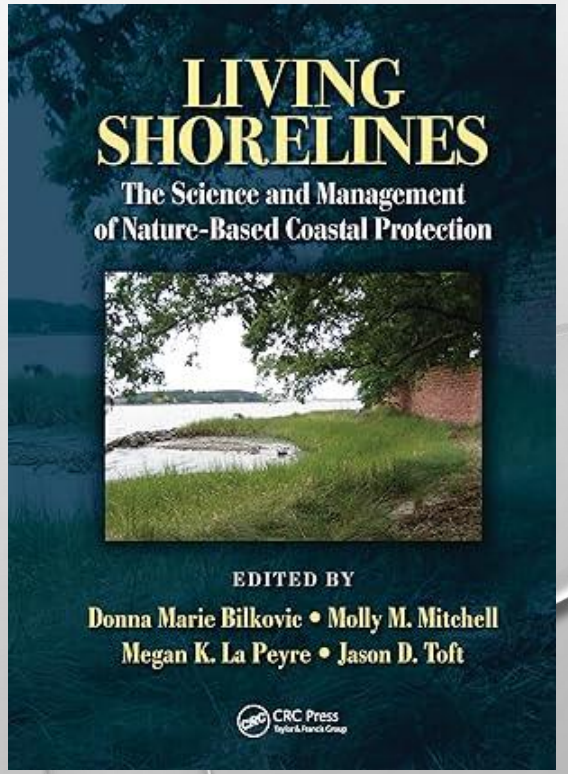
LTG SCOTT A. SPELLMON, 55TH CHIEF OF ENGINEERS, AND COMMANDING GENERAL U.S. ARMY CORPS OF ENGINEERS, HOUSE COMMITTEE ON TRANSPORTATION & INFRASTRUCTURE, WATER RESOURCES SUBCOMMITTEE (24 JUNE 2021)

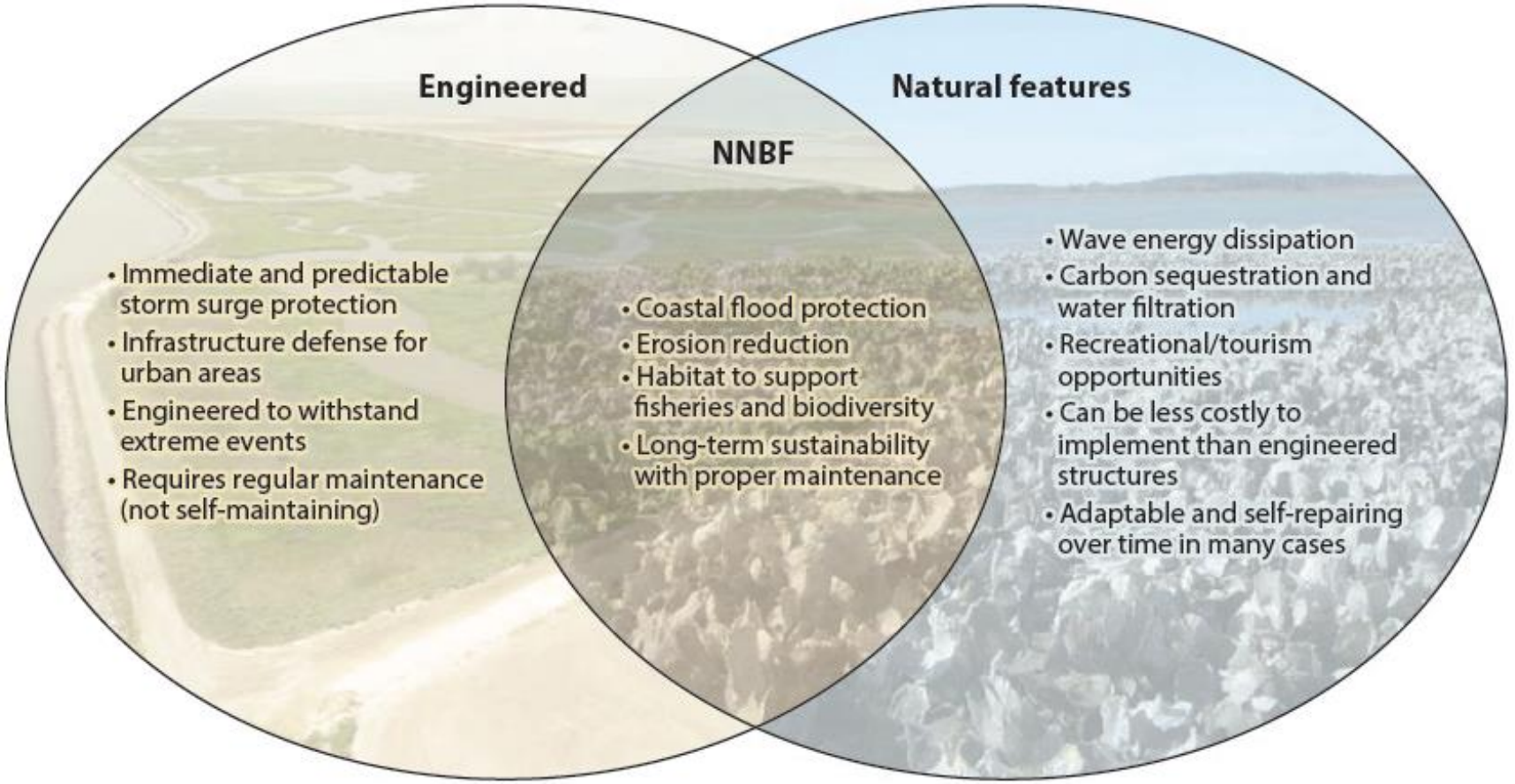
ANNUAL REVIEWS

Annual Review of Marine Science

Performance Evaluation of Natural and Nature-Based Features for Coastal Protection and Co-Benefits

Matthew A. Reidenbach,[1] Ming Li,[2] Kenneth A. Rose,[2] Tori Tomiczek,[3] James Morris,[4] Cindy M. Palinkas,[2] Lorie W. Staver,[2] William Nardin,[2] Matthew W. Gray,[2] Serena B. Lee,[5] Ariana E. Sutton-Grier,[6] and Amy M. Hruska[7]




Engineered
Natural features
NNBF
• Immediate and predictable storm surge protection
• Infrastructure defense for urban areas
• Engineered to withstand extreme events
• Requires regular maintenance (not self-maintaining)
• Coastal flood protection
• Erosion reduction
• Habitat to support fisheries and biodiversity
• Long-term sustainability with proper maintenance
• Wave energy dissipation
• Carbon sequestration and water filtration
• Recreational/tourism opportunities
• Can be less costly to implement than engineered structures
• Adaptable and self-repairing over time in many cases

CITY OF CAMBRIDGE

University of Maryland
CENTER FOR ENVIRONMENTAL SCIENCE

BayLand Consultants & Designers, Inc.

Smith Planning & Design
SP&D, LLC

NFWF PROJECT

- COMPLEMENTS THE FEMA PROJECT
- FEMA: HYBRID FLOOD MITIGATION PROJECT WITH LIVING SHORELINE DESIGNED FOR FLOOD PROTECTION
- NFWF:
  - FOCUS ON HABITAT BENEFITS OF LIVING SHORELINE (4-5 KEY AREAS)
  - GREEN SWM PROJECT THAT DISCHARGES TO LS AREA

Croaker

Grass shrimps

Atlantic silverside

Bay anchovy

Menhaden

Weakfish

Striped bass

Blue crab

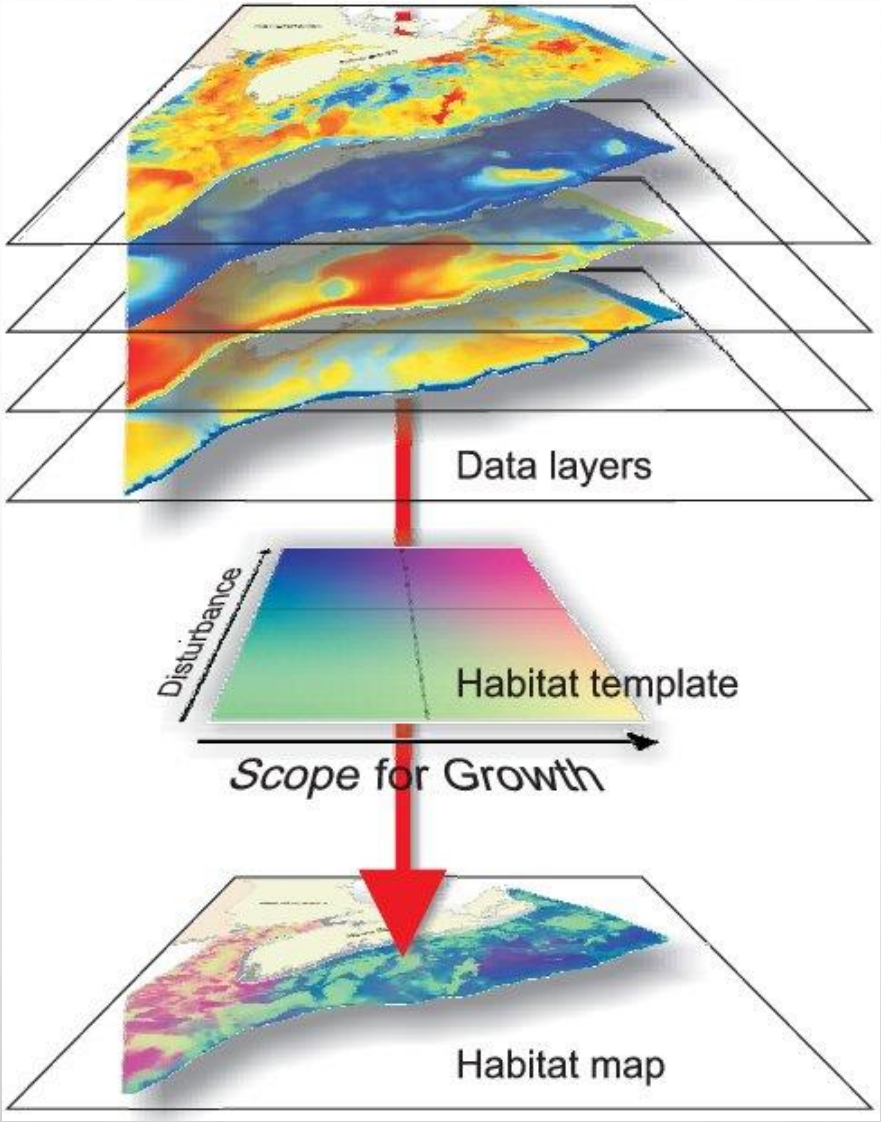
Summer flounder

Diamondback Terrapin

Canvasback duck

Bilovic & Mitchell. 2013. Mid-Atlantic Living Shorelines Summit.

coastalscience.noaa.gov/news/nccos-study-provides-evidence-better-fish-habitat-living-shoreline



Kostylev and Hannah. 2007. Process-driven characterization and mapping of seabed habitats. Geological Association of Canada.

SOME DESIGN KNOBS

- TIDAL OPENINGS OF ROCK SILL
- SHORE ORIENTATION
- SIZE AND DEPTH OF ROCK SILL
- RIP-RAP AND BREAKWATERS AT THE TOE OF LS
- VEGETATION DENSITY AND SEASONALITY ON MARSH
- SLOPE OF THE VEGETATION BED
- LOCATION AND 3-D SHAPE OF OYSTER REEFS

SPECIES LISTS

Abundant (or special) species by habitat type

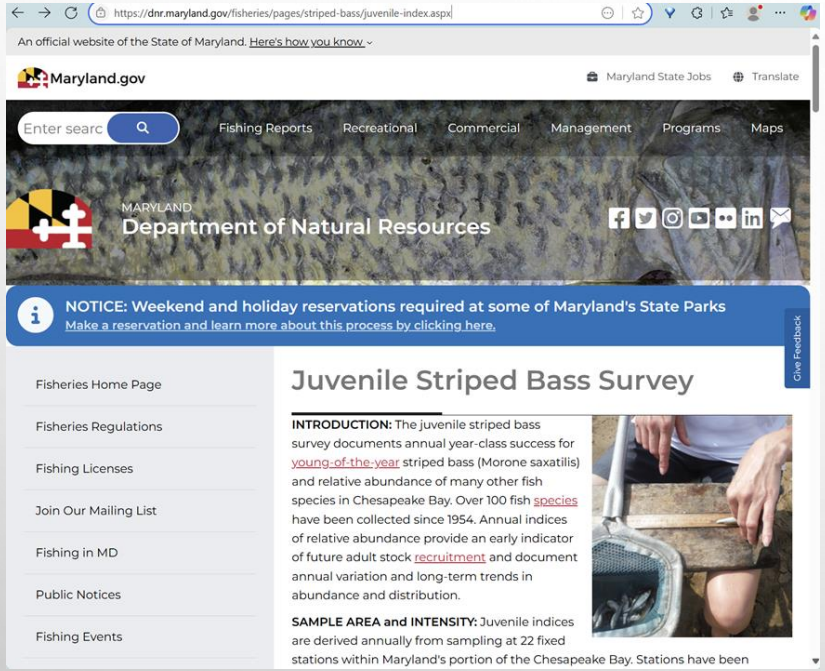
Habitats now

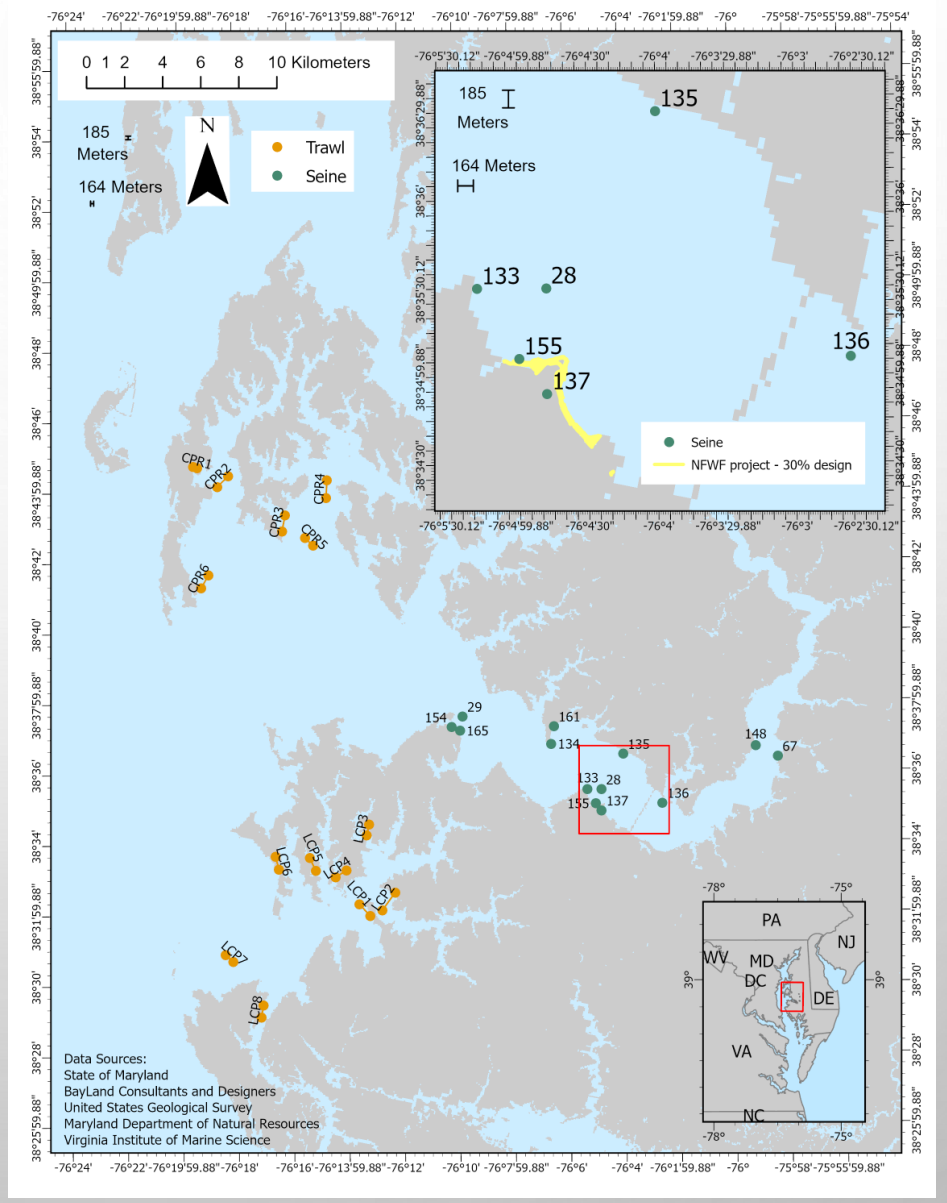
Living shoreline (projected habitats)

Stakeholders

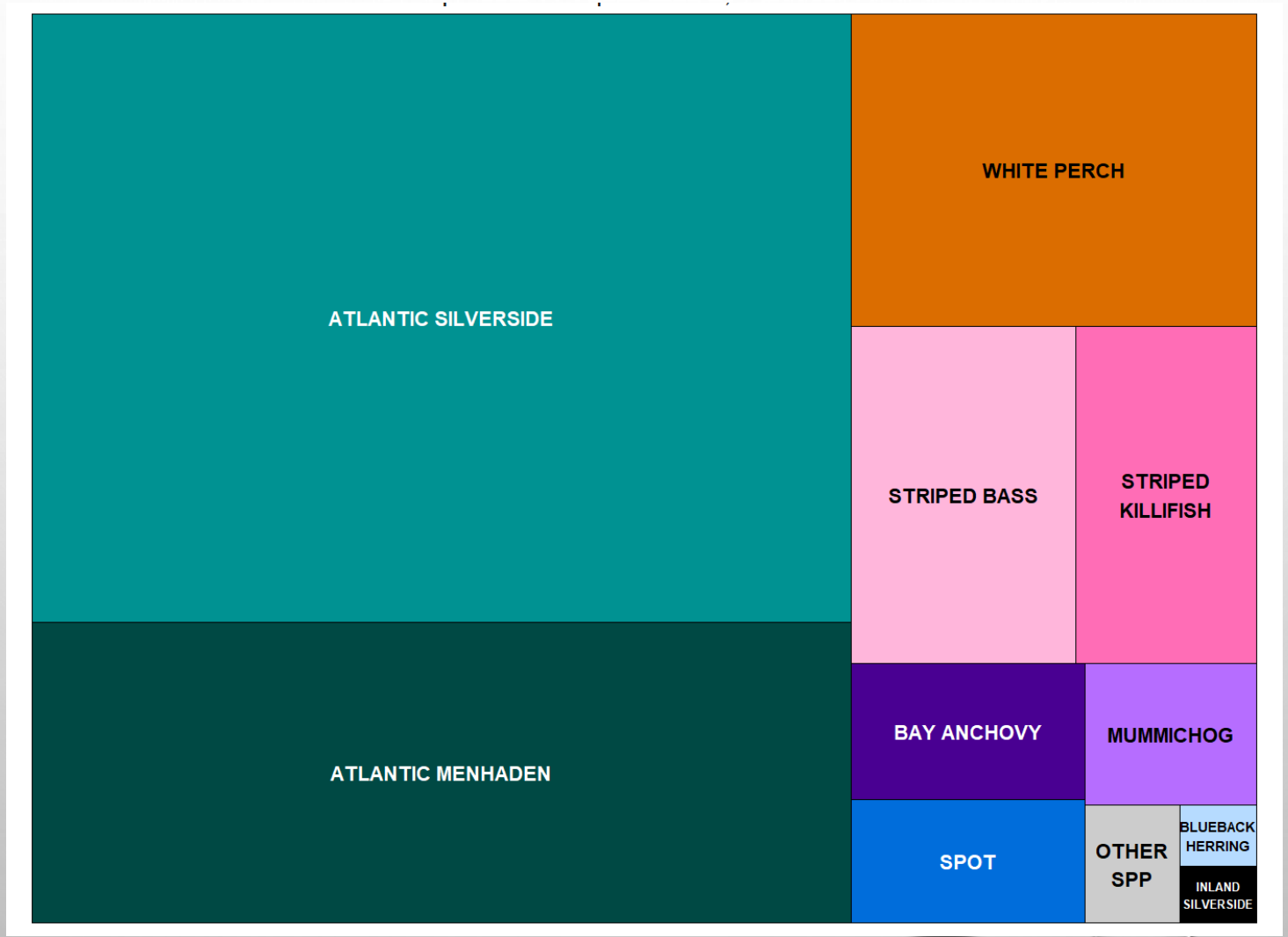
Permitting and agencies

COMMUNITY STRUCTURE





COMMUNITY STRUCTURE



LESS COMMON SPECIES

0.01 - 0.34% OF TOTAL CATCH FROM 1990-2024

ATLANTIC NEEDLEFISH	667	0.20		SILVERY MINNOW	70	0.02
ALEWIFE	377	0.11		CHANNEL CATFISH	64	0.02
STRIPED ANCHOVY	365	0.11		HOGCHOKER	42	0.01
SUMMER FLOUNDER	305	0.09		UNKNOWN CYPRINID	35	0.01
ATLANTIC CROAKER	248	0.07		SPOTTED SEATROUT	27	0.01
GIZZARD SHAD	211	0.06		COWNOSE RAY	26	0.01
ROUGH SILVERSIDE	165	0.05		HICKORY SHAD	24	0.01
BANDED KILLIFISH	150	0.04		YELLOW PERCH	20	0.01
BLUEFISH	136	0.04		CARP	19	0.01
NORTHERN PIPEFISH	114	0.03		WHITE CATFISH	18	0.01
THREADFIN SHAD	87	0.03		INSHORE LIZARDFISH	17	0.01
SHEEPSHEAD MINNOW	86	0.03				

Rare Species

<0.01% of total catch from 1990-2024; ≤ 16 observations

HARVESTFISH	16		WINTER FLOUNDER	4
AMERICAN EEL	14		DUSKY PIPEFISH	3
HALFBEAK	13		RAINWATER KILLIFISH	3
NORTHERN PUFFER	11		ATLANTIC THREAD HERRING	2
SKILLETFISH	11		BLACK DRUM	2
STRIPED BASS, HATCHERY	10		BLUE CATFISH	2
WEAKFISH	8		STRIPED BLENNY	2
NAKED GOBY	7		NORTHERN KINGFISH	1
SOUTHERN KINGFISH	6		RED DRUM	1
BLUEGILL	5		SILVER PERCH	1
FOURSPINE STICKLEBACK	5		SPANISH MACKEREL	1
PUMPKINSEED	5		SPOTTAIL SHINER	1
STRIPED MULLET	5			

Square meters of suitable-weighted habitat

		Now (Losses)			With Living Shoreline (Gains)						
Species	Stage	Open	Bulk-head	Shore rip-rap	SAV	Marsh	Protected open	Beach	Offshore Rip-rap	Oyster	Pond

Area x Suitability of each cell, summed over cells in Delft3D grid

(a) Region altered by living shoreline (losses)

(b) Region influenced by the living shoreline (gains)

Plus,

Screen stormwater discharge into living shoreline

Screen for adequate connectivity

Assess resilience of living shoreline and its habitats

FIELD SAMPLING - NFWF

- BEACH SEINES THE SAME WAY AS DNR SO CAN COMPARE TO THEIR 20+ YEARS OF DATA
- WITHIN PROJECT FOOTPRINT
- GOPRO TRANSECTS TO LOOK AT VIABILITY OF OYSTERS

NEXT AND LATER

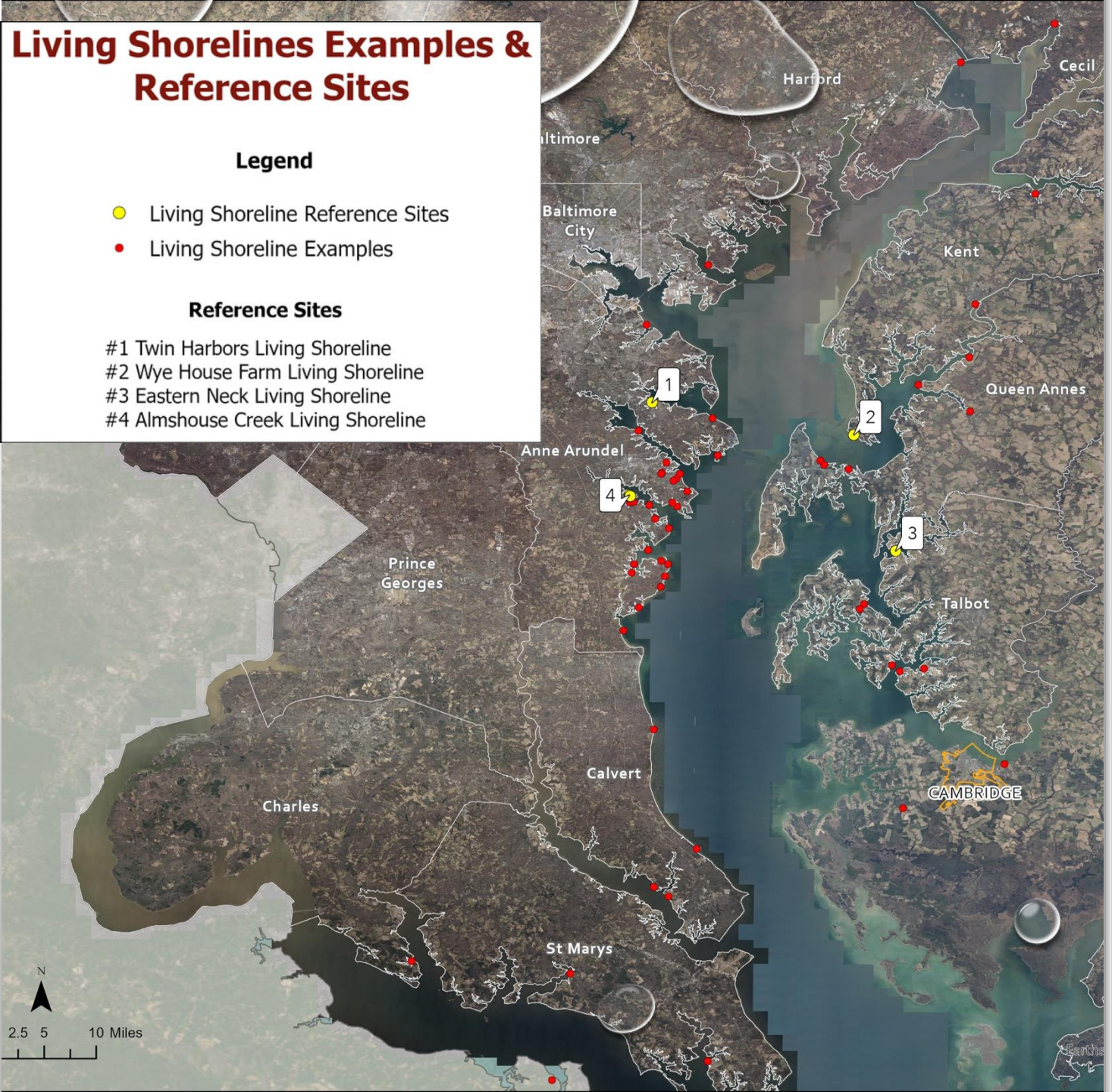
NEXT

- ONE (AVERAGE) YEAR
- HABITAT MODELS FOR 3 SPECIES-STAGES
- INITIAL HABITAT PERFORMANCE OF 30% DESIGN
- SPECIES LISTS
  - MD SURVEYS
  - NEW HABITATS FROM LS
- INITIAL FIELD SAMPLING (SEPT)
  - TEST SEINE (LIKE DNR) AND GOPRO
  - OYSTERS PRESENT, HEALTHY, REPRO
  - FISH (CONFIRM DNR SURVEYS)

AFTER NEXT

- ADD MORE YEARS
- EXPAND TO 6-9 SPECIES-STAGES
- EXAMINE PERFORMANCE OF DESIGN OPTIONS
- SCREEN STORMWATER DISCHARGE
  - TRACER IN DELFT3D
- SCREEN CONNECTIVITY (PTM) AND RESILIENCE (10 YRS, STORMS)
- FIELD SAMPLING
  - JULY AND AUGUST

Public and Regulator Engagement



LIVING SHORELINES EXAMPLES & REFERENCE SITES

Requested From Previous Public Outreach Sessions – Elements of the Cambridge Flood Mitigation Project included in reference sites – see handout.

LIVING SHORELINE REFERENCE SITES

#1 TWIN HARBORS LIVING SHORELINE 181 BAYBOURNE DR., ARNOLD, MD 21012 (ANNE ARUNDEL COUNTY)

Faced with a failing bulkhead, the community worked with South River Federation to replace approximately 390 linear feet of existing bulkhead with a living shoreline along Mill Creek of the Magothy River. Additionally, this project includes a 4,200 square foot bioretention facility located between a parking lot and the shoreline to capture runoff, as well as 0.25 acres of voluntary reforestation. A dense native planting and use of woody debris helped achieve new habitat zones to support a variety of Bay flora and fauna.

For more information, visit: Chesapeake Bay Trust Project Highlight: Twin Harbors Living Shoreline

#2 WYE HOUSE FARM LIVING SHORELINE 26080 BRUFFS ISLAND RD, EASTON, MD 21601 (TALBOT COUNTY)

The Tilghman family has owned 1,200 acres of land that is home to miles of shoreline on the Wye River, Lloyds Creek and Shaw Bay and the property is losing acres each year. The family has been working on building living shorelines to protect their fields and the Bay. The site has been used as a demonstration for education and outreach and has Interpretive signs that were installed on site. A brochure, open house visits and workshops are tools that have been used to share information about this living shoreline.

For more information, visit: Chesapeake Bay Program With conservation, a 12th-generation Maryland family holds on to its historic property

#3 EASTERN NECK LIVING SHORELINE EASTERN NECK ISLAND RD, ROCK HALL, MD 21661 (KENT COUNTY)

The Eastern Neck Living Shoreline refers to a restoration project at the Eastern Neck National Wildlife Refuge in Rock Hall, Maryland, that uses a combination of engineered structures and natural materials to protect the shoreline from erosion and enhance habitat for wildlife. The project involves building artificial breakwaters, creating oyster reefs and marsh grass plantings to stabilize the banks and provide habitat for fish, birds, and other species.

For more information, visit: USACE Eastern Neck Wildlife Refuge Public Notice

#4 ALMSHOUSE CREEK LIVING SHORELINE SHORE DR, EDGEWATER, MD 21037 (ANNE ARUNDEL COUNTY)

There are 3 separate living shoreline projects located along Shore Drive. Each one involved London Towne Property Owner's Association obtaining funding to create living shorelines along approximately 1,400 linear feet of severely eroding shorelines. The projects included constructing segmented stone sills filled with sand and planted with native wetland vegetation.

For more information, visit: NOAA Fisheries Living Shorelines -
Site 1: Almshouse Creek Living Shoreline
Site 2: Londontowne Phase 4 Living Shoreline
Site 3: Almshouse Creek Living Shoreline

HANDOUT

SEE QR CODES FOR ADDITIONAL INFORMATION ON EACH REFERENCE SITE

Q & A SESSION

NOTE: REFER TO SLIDE # AND WE WILL DISPLAY SPECIFIC SLIDE FOR YOUR REFERENCE

NEXT STEPS

- MEETING PRESENTATION POSTED TO PROJECT WEBSITE
- AGENCY REVIEW & COMMENT
- 60% DESIGN – LATE FALL/WINTER