PUBLIC MEETING

FLOOD MITIGATION PROJECT

DATE: MAY 27, 2026

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

Design Meeting

WELCOME

GLENN STECKMAN, CITY MANAGER

AGENDA

- **Welcome** - Glenn Steckman, City Manager
- **Our Project in Perspective** - Larry White, Project Manager
- **Flood Risk** - Dr. Kenneth Rose, Horn Point Laboratory, UMCES
- **Design Update**– Anna Johnson, PE, CC-P, Project Engineer, BayLand Consultants & Designers, Inc. & Megan Barniea, P.E., Senior Project Manager, BayLand Consultants & Designers, Inc.
- **Habitat Enhancements -** Dr. Kenneth Rose, Horn Point Laboratory, UMCES
- **Q&A Session**
- **Next Steps**

QUESTION & ANSWER SESSION

PLEASE SAVE YOUR QUESTIONS UNTIL THE Q&A SESSION.

RECORD THE SLIDE # LOCATED IN THE BOTTOM RIGHT OF EACH SLIDE FOR REFERENCE.

PROJECT PURPOSE, BENEFITS & ALTERNATIVE

LARRY WHITE, PROJECT MANAGER, PE

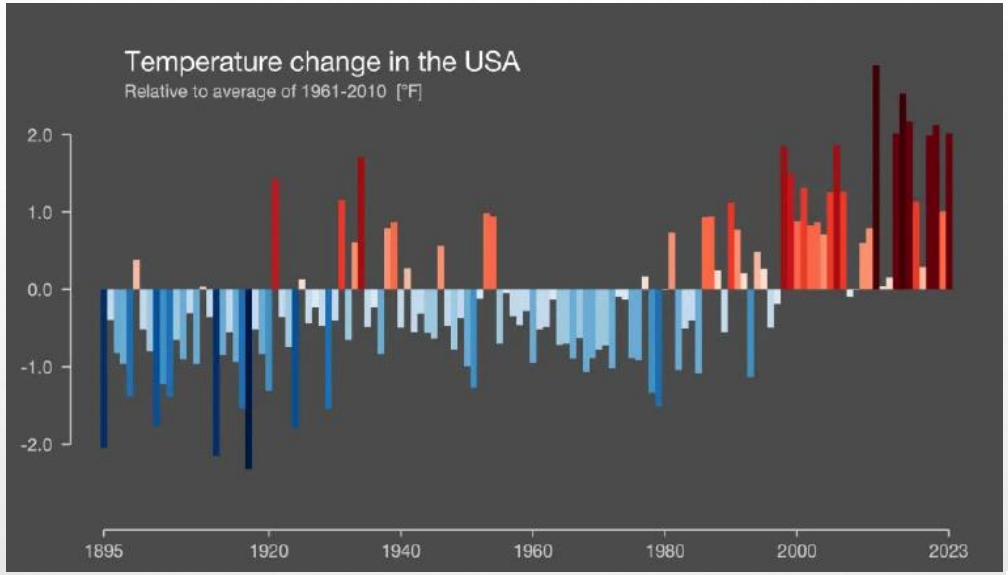
PROJECT MANAGER

OUR PROJECT IN PERSPECTIVE

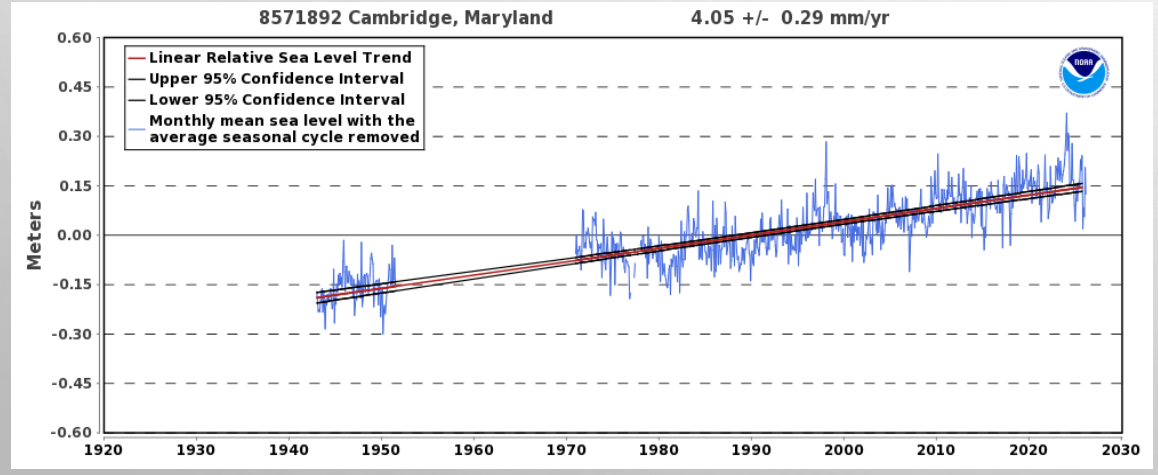
NATURE'S FORCES THAT CONTROL OUR FUTURE ENVIRONMENT

SEA LEVEL RISE & SEVER STORMS DUE TO WARMING OF OUR OCEANS AND ATMOSPHERE

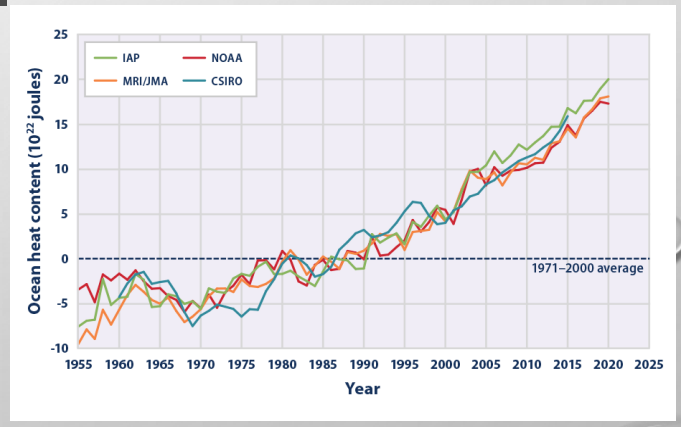
Isabel -Water Street Cambridge 2003



On August 7, 2023 Cambridge
Experienced 4 Inches of Rain in 2 hours



Sea Level Has Been Rising 3mm/Yr for 100 years

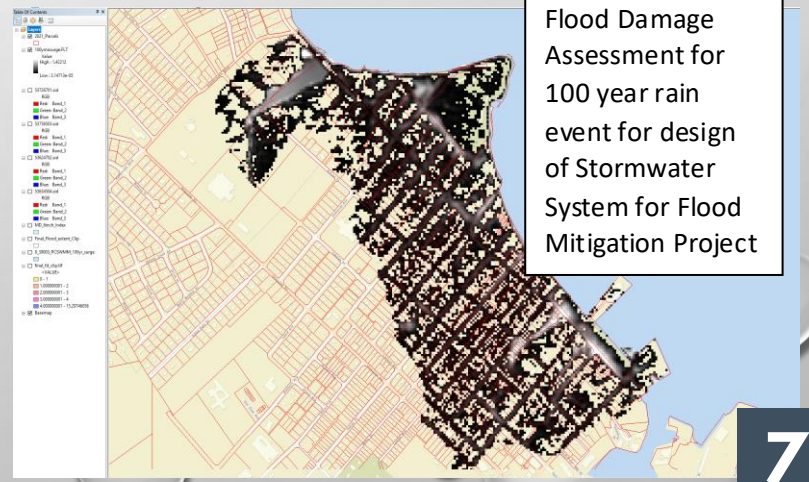


Since 1980 Ocean Temperature Increased
Significantly Above 1971-2000 Avg

OUR PROJECT IN PERSPECTIVE

WHAT DO WE KNOW ?

- SEA LEVEL RISING IN MARYLAND TWICE THE GLOBAL AVERAGE
- SEA LEVEL ROSE 18 INCHES SINCE 1900 AND RATE IS ACCELERATING
- HIGH TIDES INCREASING IN FREQUENCY/ELEVATION FLOODING NEIGHBORHOODS
- INTENSITY OF STORMS INCREASING BY 20 % DUE TO WARMING OF ATMOSPHERE
- EXISTING STORMWATER SYSTEM IS UNDERSIZED
- CITY EXPERIENCING FLOOD DAMAGES TO HOMES/PUBLIC INFRASTRUCTURE
- COASTAL & SEVERE RAIN STORMS INCREASING RISK OF FLOODING & CATASTROPHIC DAMAGE



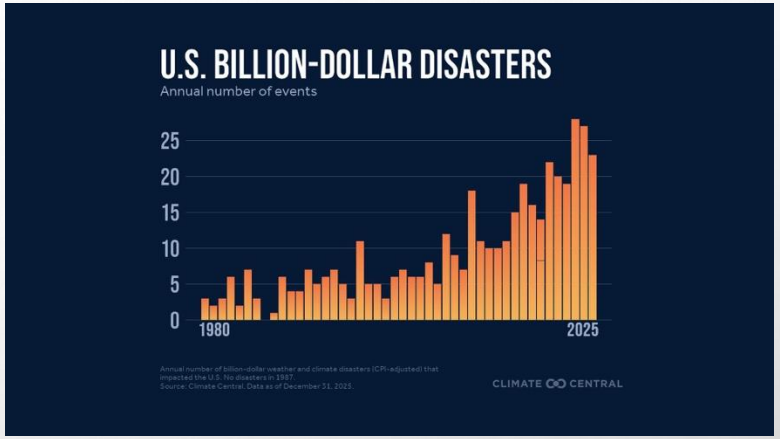
Flood Damage Assessment for 100 year rain event for design of Stormwater System for Flood Mitigation Project

OUR PROJECT IN PERSPECTIVE

WHAT IS UNCERTAIN ?

WE DO NOT KNOW WHEN THE NEXT MAJOR STORM WILL OCCUR?
WE DO NOT KNOW ITS MAGNITUDE?

- ✓ PEOPLE FORGOT ABOUT THE LAST MAJOR STORM
- ✓ MAJOR STORMS HAVE OCCURRED ABOUT EVERY 20-30 YEARS
- ✓ ISABEL WAS ONLY A TROPICAL STORM WHEN IT HIT CAMBRIDGE
- ✓ NEXT ONE COULD BE MORE SEVERE DUE TO SLR AND WARMING ATMOSPHERE
- ✓ US EXPERIENCING SIGNIFICANT INCREASE IN DISASTERS SINCE 1980



1933 Chesapeake & Potomac

1954 Hurricane Hazel

1972 Tropical Storm Agnes

2003 Isabel –Cambridge MD

OUR PROJECT IN PERSPECTIVE

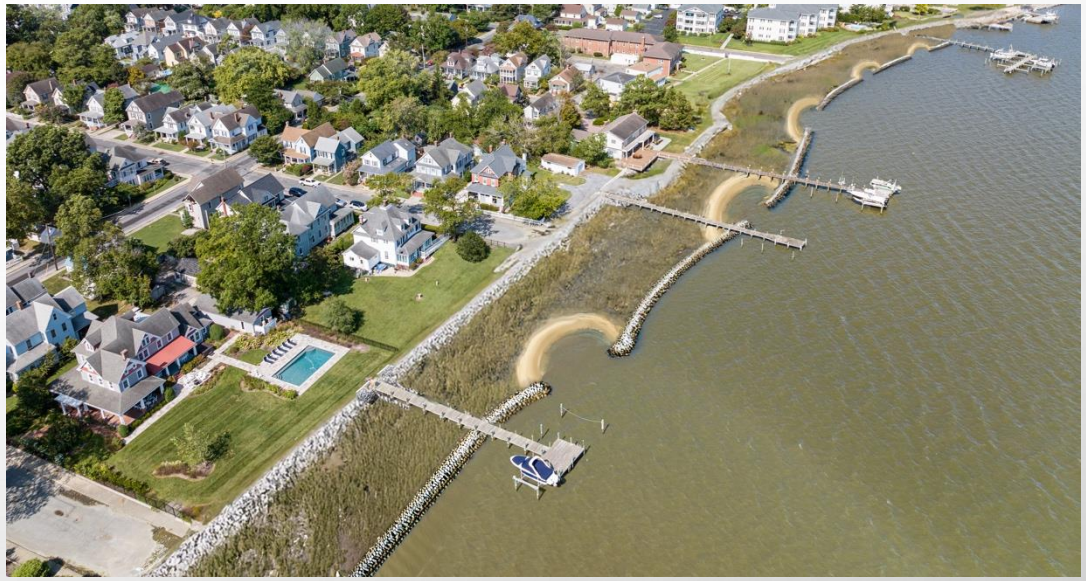
IMPACTS OF NOT DOING ANYTHING

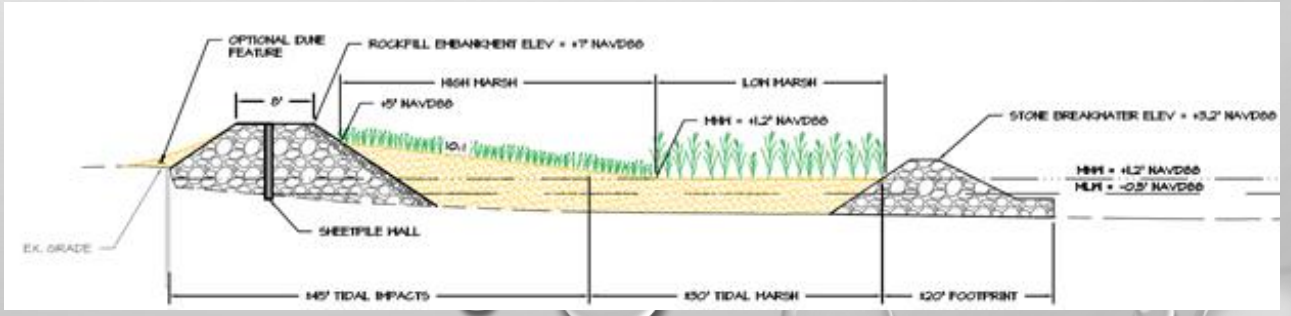
- HIGH TIDES CONTINUE TO INCREASE IN FREQUENCY AND ELEVATION
- FLOODING OF HOMES AND DAMAGE TO CITY INFRASTRUCTURE
- MAJOR STORMS DESTROY EVERYTHING IN ITS PATH
- COST OF FLOOD INSURANCE INCREASES OR IS NOT AVAILABLE
- PROPERTY VALUES DECLINE DUE TO FLOOD RISK
- CITY BUDGET & TAX BASE JEOPARDIZED DUE TO RECOVERY COST AND CITIZEN RETREAT
- PROJECT COSTS INCREASES SIGNIFICANTLY DUE TO INFLATION
- PUBLIC FINANCING NOT AVAILABLE DUE TO FED BUDGET DEFICITS & $40T PUBLIC DEBT

OUR PROJECT IN PERSPECTIVE

BENEFITS OF MOVING FORWARD

- PROTECTS RESIDENTS AND CITY AGAINST DAMAGES DUE TO MAJOR STORMS/CATOSTROPHIC EVENTS
- DESIGN PROVIDES MULTIPLE LEVELS OF PROTECTION
- LIVING SHORELINE ENHANCES VIEW AND HABITAT
- PROTECTS PROPERTY VALUES AND ENCOURAGES DEVELOPMENT
- FLOOD INSURANCE AVAILABLE /AFFORDABLE
- PUBLIC FUNDING IS AVAILABLE (NOW)
- REGULATORS SUPPORT
- STATE OF MD SUPPORTS





FLOOD RISK

DR. KENNETH ROSE,

HORN POINT LABORATORY, UMCES

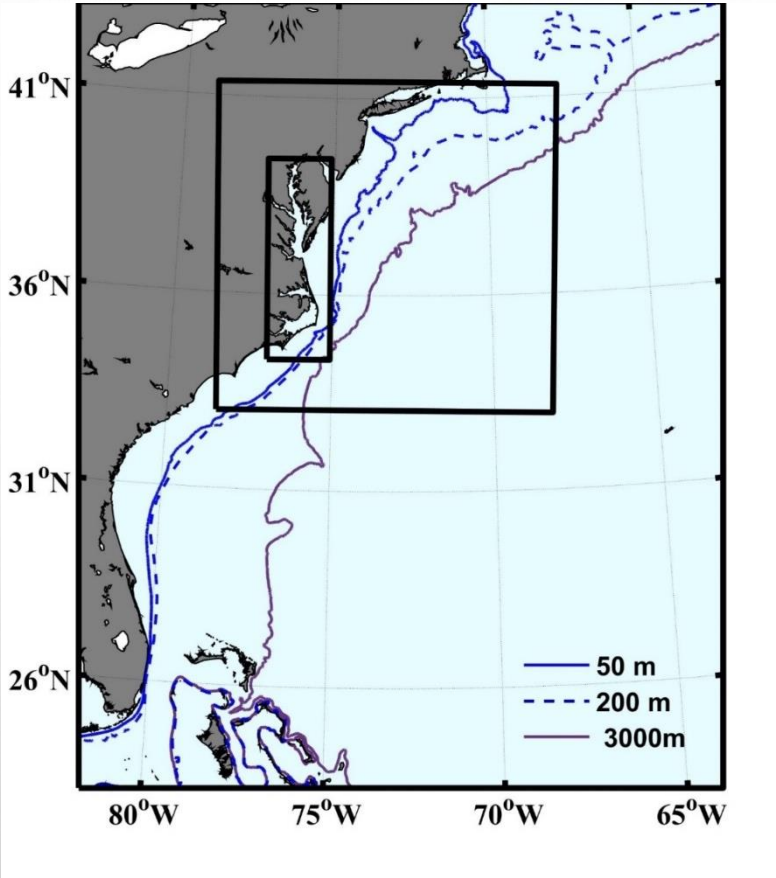
STORM SURGE MODELING, INUNDATION VISUALIZATION AND COST-BENEFIT ANALYSIS

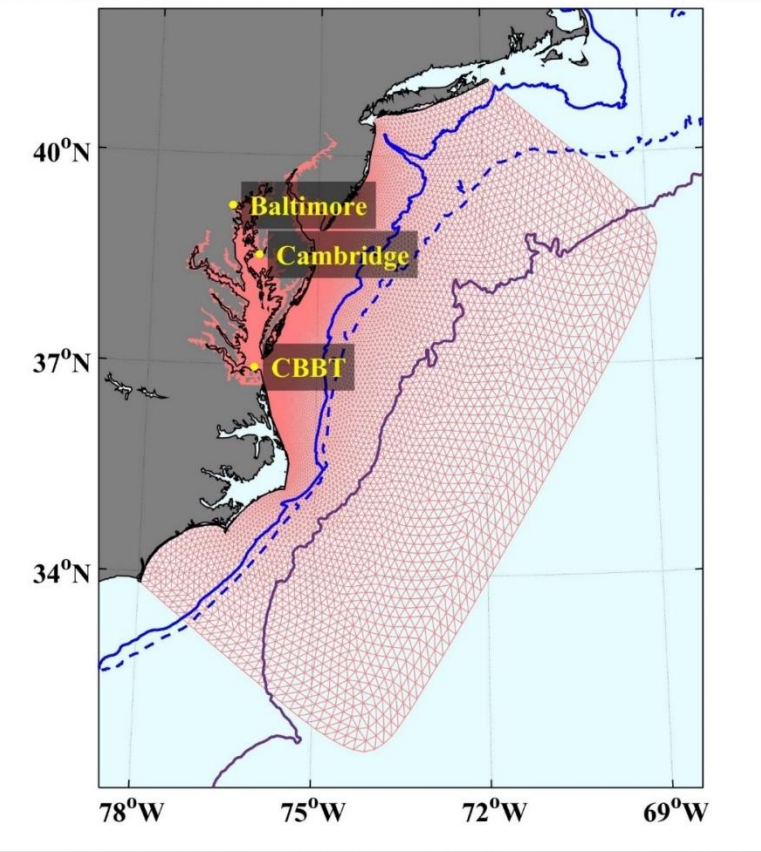
MING LI, VINCENT PHAM, NICHOLAS GAMMEL, XIAOHONG WANG

UNIVERSITY OF MARYLAND CENTER FOR ENVIRONMENTAL SCIENCE

SALISBURY UNIVERSITY

Regional Atmosphere-Ocean Models

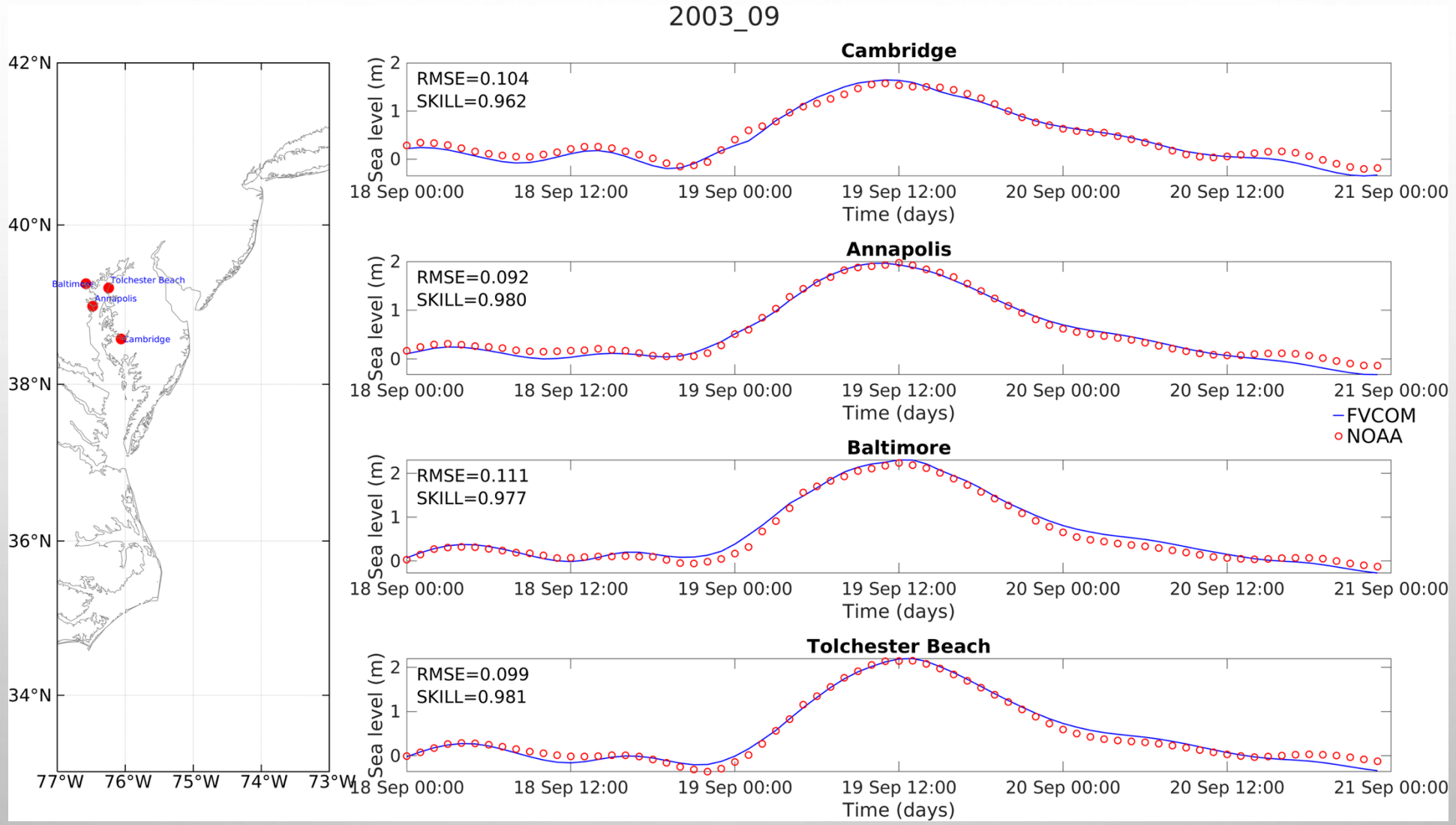




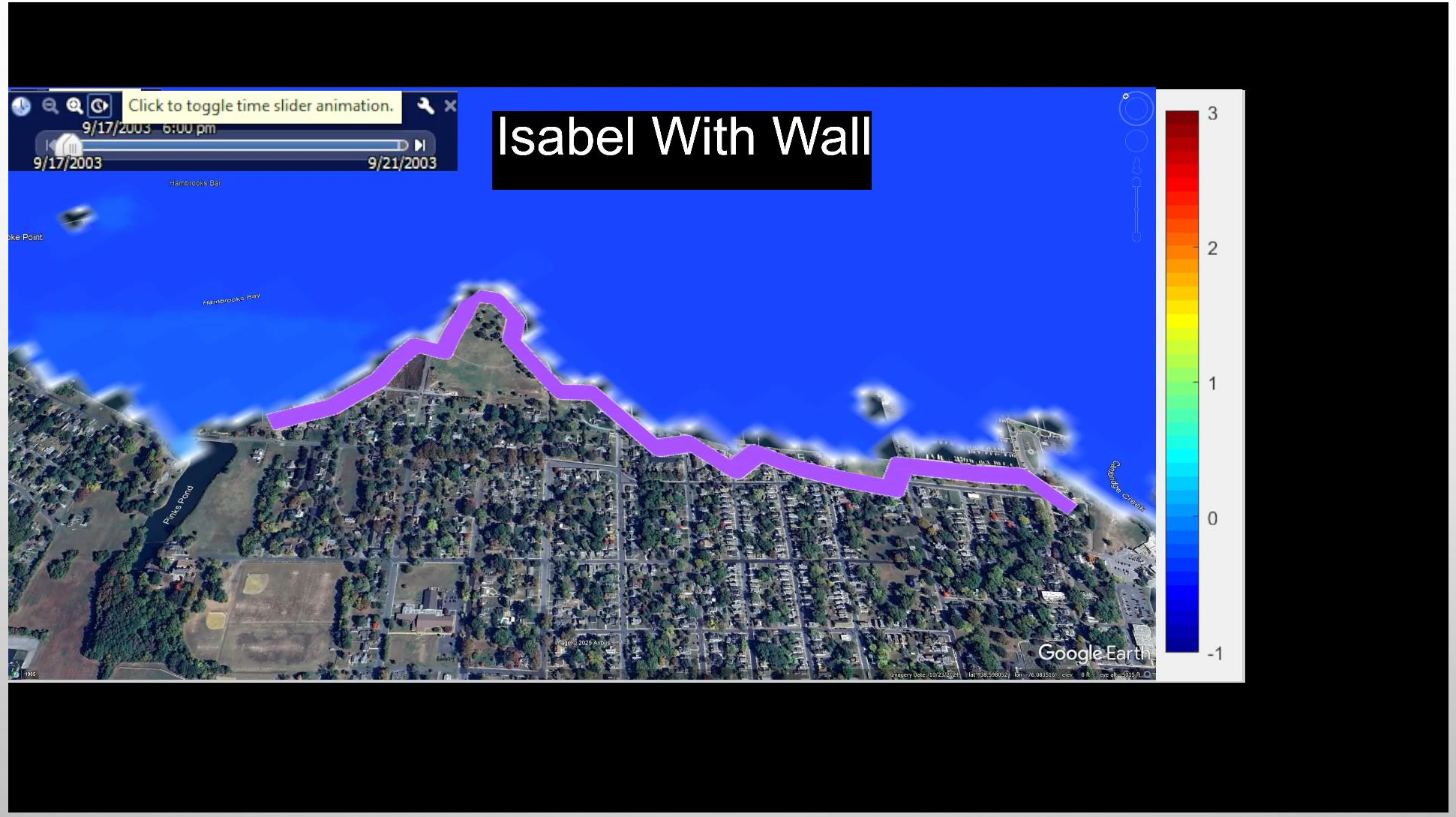
Weather Research Forecasting Model
Triply nested domain: 12, 4 and 1.3 km
40 sigma levels
Forced by GFS outputs at lateral boundary
Forced by SST at ocean surface

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

Predicted vs observed storm surge during Isabel



Flooding at the project site during Hurricane Isabel


Click to toggle time slider animation.
9/17/2003 6:00 pm
9/17/2003
9/21/2003
Isabel With Wall
Hambrooks Bar
Hambrooks Bay
Pinks Pond
Google Earth
3
2
1
0
-1

Flooding for 2 feet sea level rise + Hurricane Isabel

Flood Wall for 2 feet sea level rise + Hurricane Isabel

DESIGN UPDATE

ANNA JOHNSON, PE, CC-P

PROJECT ENGINEER &

MEGAN BARNIEA, P.E.

SENIOR PROJECT MANAGER

BAYLAND CONSULTANTS & DESIGNERS, INC.

DESIGN FLOOD RISK – 2050 'HURRICANE ISABEL'

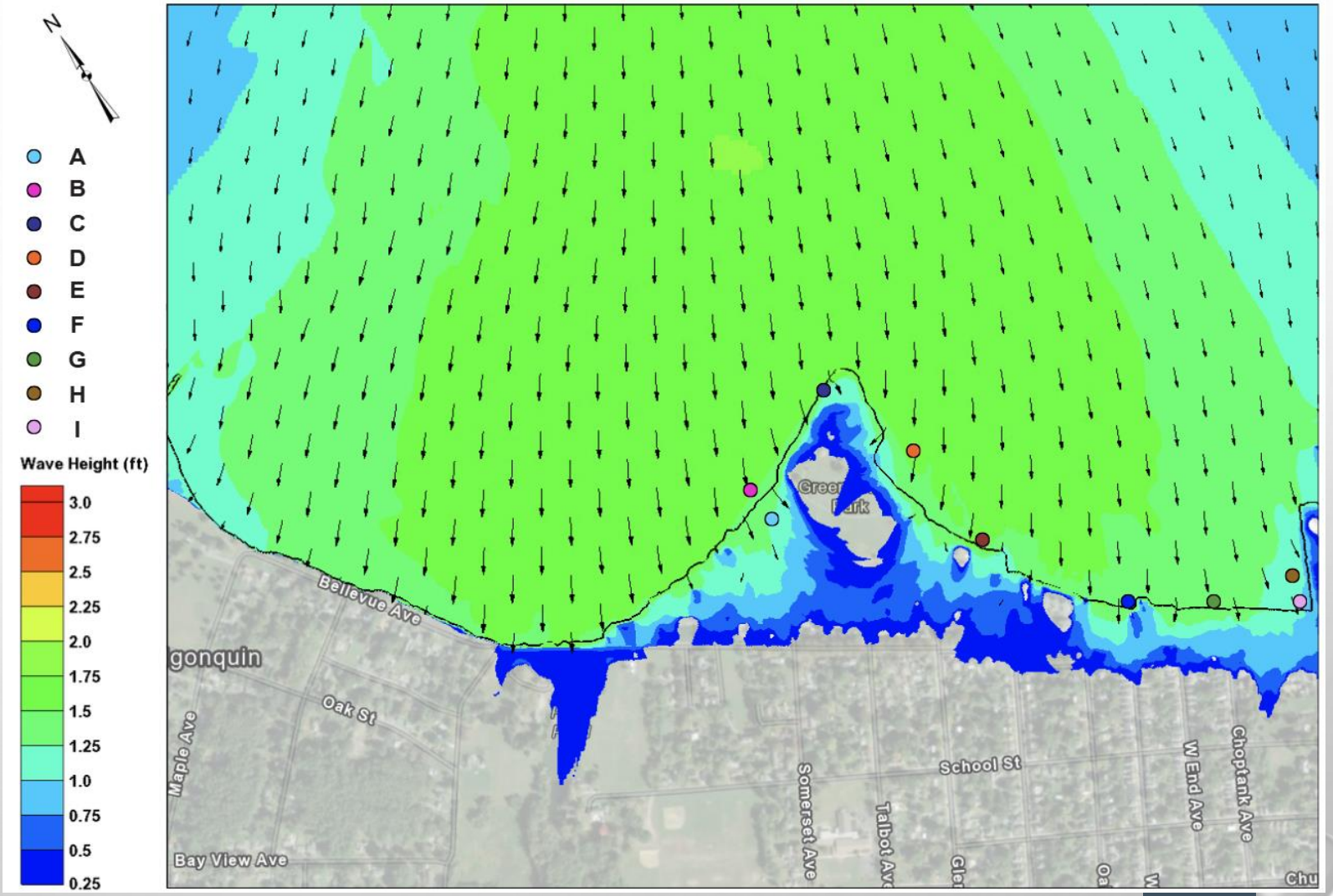
Maryland Flood Explorer: https://dnr.geodata.md.gov/mdfloodexplorer/

DESIGN FLOOD RISK – 2050 'HURRICANE ISABEL'

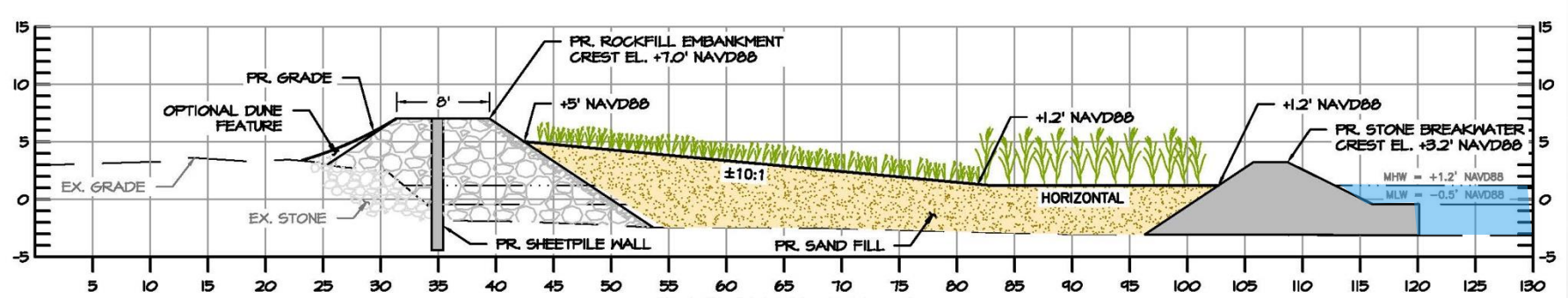
- "STILL WATER LEVEL" = ±7 ABOVE MSL
- ±120 RESIDENCES WITH FLOODING
- SOME WITH 4+ FEET OF WATER

DESIGN FLOOD RISK – HURRICANE WAVES

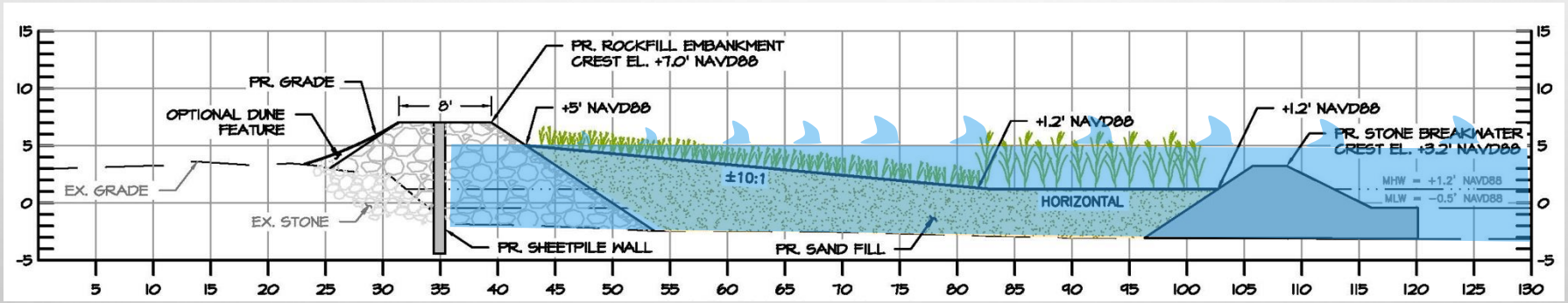
- FOR HOMES ABOVE THE ‘STILL WATER’ ELEVATION – STILL EXPOSED TO WAVES
- FLOODING AND DAMAGE COULD STILL HAPPEN EVEN IF FFE > 7 WITHOUT PROJECT



DESIGN FLOOD RISK – HURRICANE WAVES



Rockfilled Embankment + Living Shoreline – Normal Conditions



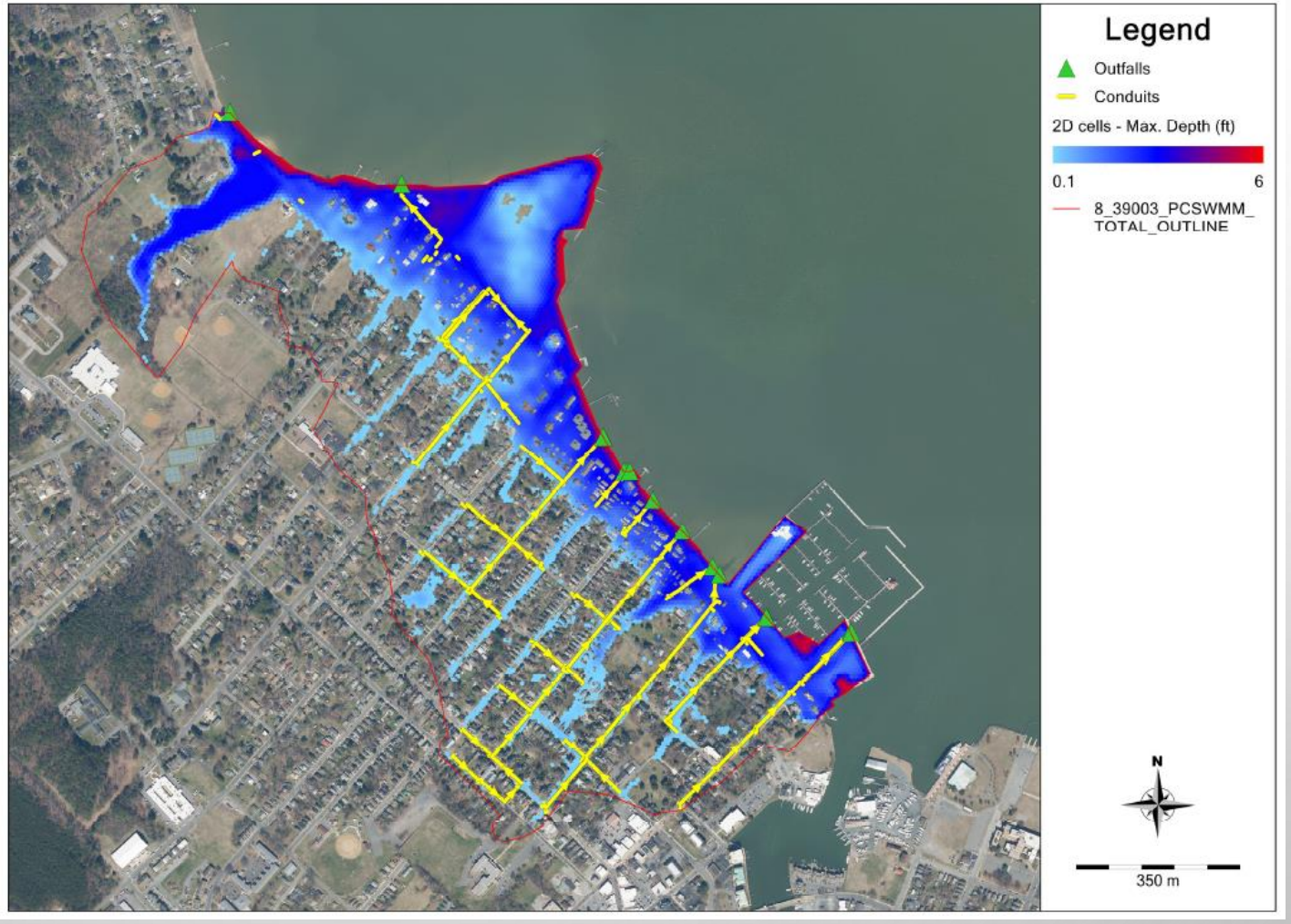
Rockfilled Embankment + Living Shoreline – Storm Conditions

DESIGN FLOOD RISK – HURRICANE WAVES

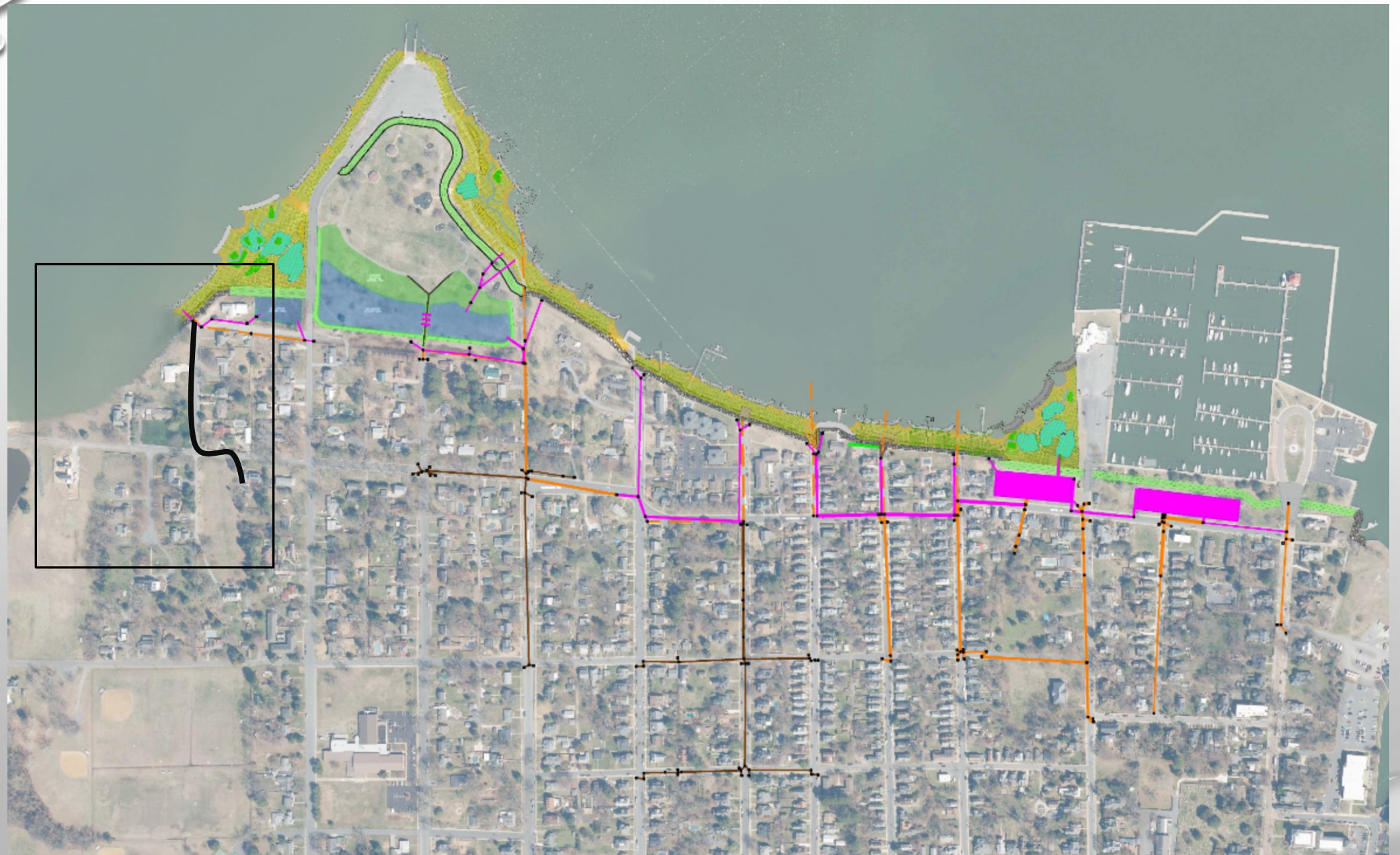
- DAMAGE TO:
  - UTILITIES
  - WINDOWS
  - DOORS
  - LANDSCAPING
  - FENCING
  - ACCESSORY STRUCTURES (SHEDS/PATIOS)
  - OUTDOOR FURNITURE
  - DRIVEWAY/ ROADWAYS

DESIGN FLOOD RISK – STORMWATER

- RISK FROM SEVERE RAIN EVENT
- CURRENT CONDITIONS 1% PROBABILITY
- AUGUST 7TH 2023 EVENT
  - 4.1 INCHES OVER 3 HOURS
  - 3.55 INCHES OVER 1 HOUR
  - EQUATES TO 0.5% PROBABILITY
- PROPOSED DESIGN MITIGATES IMPACTS FROM SEVERE RAIN EVENTS



DESIGN UPDATE – ALIGNMENT CHANGE



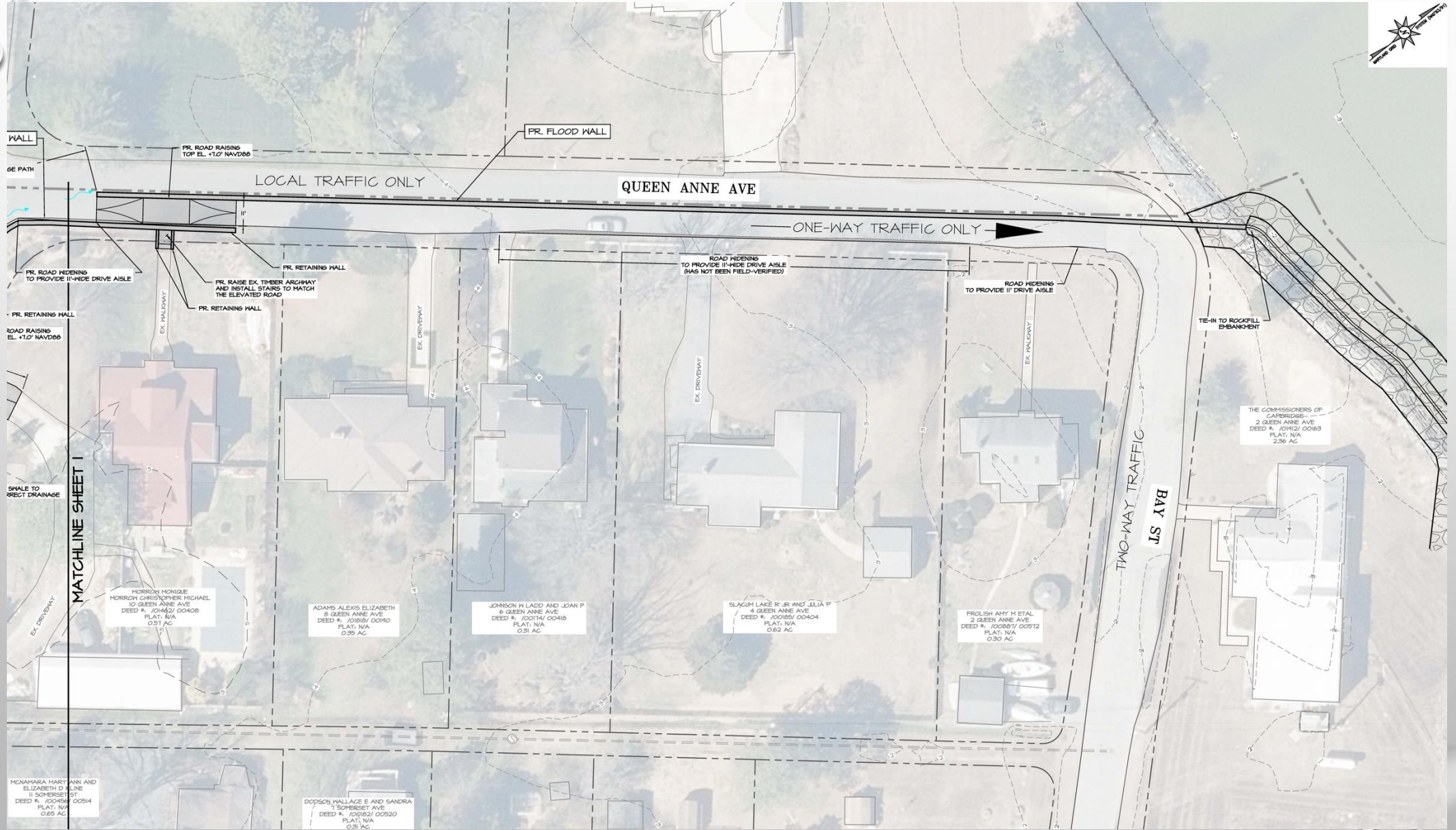
DESIGN UPDATE - ALIGNMENT CHANGE

INSUFFICIENT DOCO RESIDENT SUPPORT FOR PROJECT

RESIDENTS REMOVED FROM PROJECT

DESIGN UPDATE - ALIGNMENT

EMBANKMENT TRANSITIONS TO FLOODWALL CENTER OF QUEEN ANNE AVE



DESIGN UPDATE - ALIGNMENT

EMBANKMENT TRANSITIONS TO FLOODWALL CENTER OF QUEEN ANNE AVE

DESIGN UPDATE - ALIGNMENT

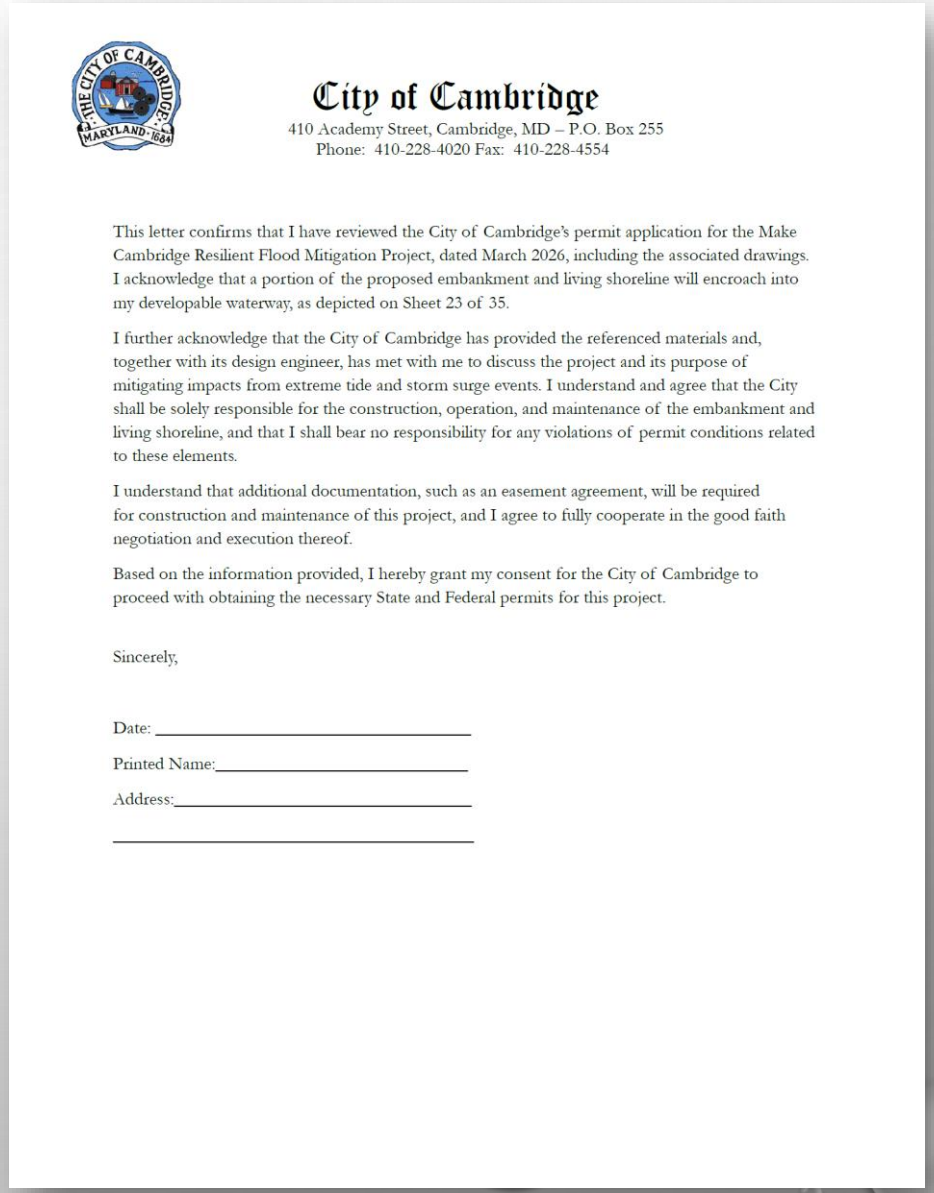
EMBANKMENT TRANSITIONS TO FLOODWALL CENTER OF QUEEN ANNE AVE

Artist Rendition of Brick Floodwall

JOINT PERMIT APPLICATION FOR STATE & FEDERAL PERMITS

REQUEST FOR SIGNATURES FROM CO-APPLICANTS

- LETTERS SENT OUT TO CO-APPLICANTS IN EARLY MAY
- SIGNING OF LETTER IS NOT AN AGREEMENT TO CONSTRUCTION. EASEMENTS FOR CONSTRUCTION WILL BE REQUIRED LATER.
- ONCE ALL SIGNED LETTERS ARE RECEIVED, WILL SUBMIT APPLICATION TO REGULATORS



City of Cambridge
410 Academy Street, Cambridge, MD – P.O. Box 255
Phone: 410-228-4020 Fax: 410-228-4554

This letter confirms that I have reviewed the City of Cambridge's permit application for the Make Cambridge Resilient Flood Mitigation Project, dated March 2026, including the associated drawings. I acknowledge that a portion of the proposed embankment and living shoreline will encroach into my developable waterway, as depicted on Sheet 23 of 35.

I further acknowledge that the City of Cambridge has provided the referenced materials and, together with its design engineer, has met with me to discuss the project and its purpose of mitigating impacts from extreme tide and storm surge events. I understand and agree that the City shall be solely responsible for the construction, operation, and maintenance of the embankment and living shoreline, and that I shall bear no responsibility for any violations of permit conditions related to these elements.

I understand that additional documentation, such as an easement agreement, will be required for construction and maintenance of this project, and I agree to fully cooperate in the good faith negotiation and execution thereof.

Based on the information provided, I hereby grant my consent for the City of Cambridge to proceed with obtaining the necessary State and Federal permits for this project.

Sincerely,

Date: _____

Printed Name:_____

Address:_____

_____

HABITAT ENHANCEMENTS

DR. KENNETH ROSE,

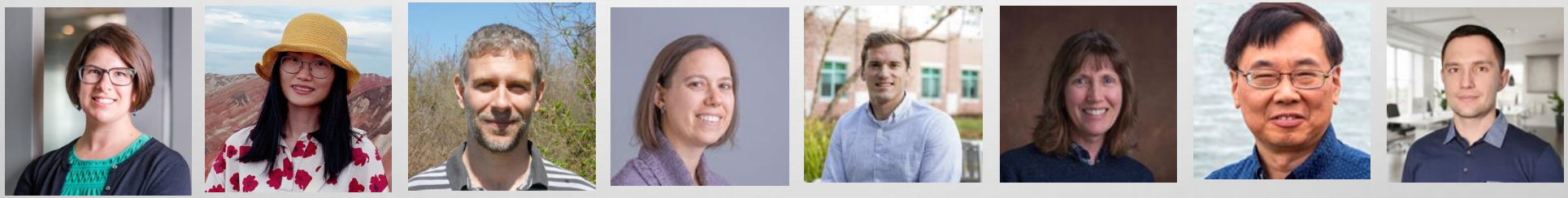
HORN POINT LABORATORY, UMCES

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



Bay Land Consultants & Designers, Inc.

SP&D SMITH PLANNING AND DESIGN

TODAY

- UPDATE ON HABITAT ANALYSIS
  - PROGRESS ON METHODS
  - PRELIMINARY RESULTS FOR A FEW SPECIES
- INPUT AND FEEDBACK ON THE SPECIES TO BE ANALYZED

PROGRESS: METHODS

- COUPLED MODELS
- DELFT3D GENERATES OUTPUTS
  - WITHOUT PROJECT
  - WITH PROJECT
- INPUTS TO HABITAT MODELS
  - SPECIES-SPECIFIC
  - USING EXISTING MODELS

https://www.chesapeakebay.net/discover/field-guide/entry/mummichog

EXAMPLES

MUMMICHOG

- TEMPERATURE
- SALINITY
- WATER DEPTH
- BOTTOM TYPE

North American Journal of Fisheries Management 20:408–435, 2000
American Fisheries Society 2000

Habitat Suitability Index Models for Eight Fish and Invertebrate Species in Casco and Sheepscot Bays, Maine

STEPHEN K. BROWN,*[1] KENNETH R. BUJA, STEVEN H. JURY,[2] AND MARK E. MONACO

Biogeographic Characterization Branch, Strategic Environmental Assessments Division, National Oceanic and Atmospheric Administration, 1305 East-West Highway, Silver Spring, Maryland 20910, USA

ARNOLD BANNER

Gulf of Maine Coastal and Estuary Program, U.S. Fish and Wildlife Service, 4R Fundy Road, Falmouth, Maine 04105, USA

Coastal Fisheries - Texas Parks and Wildlife

BAY ANCHOVY

- TEMPERATURE
- SALINITY
- DISTANCE TO MARSH

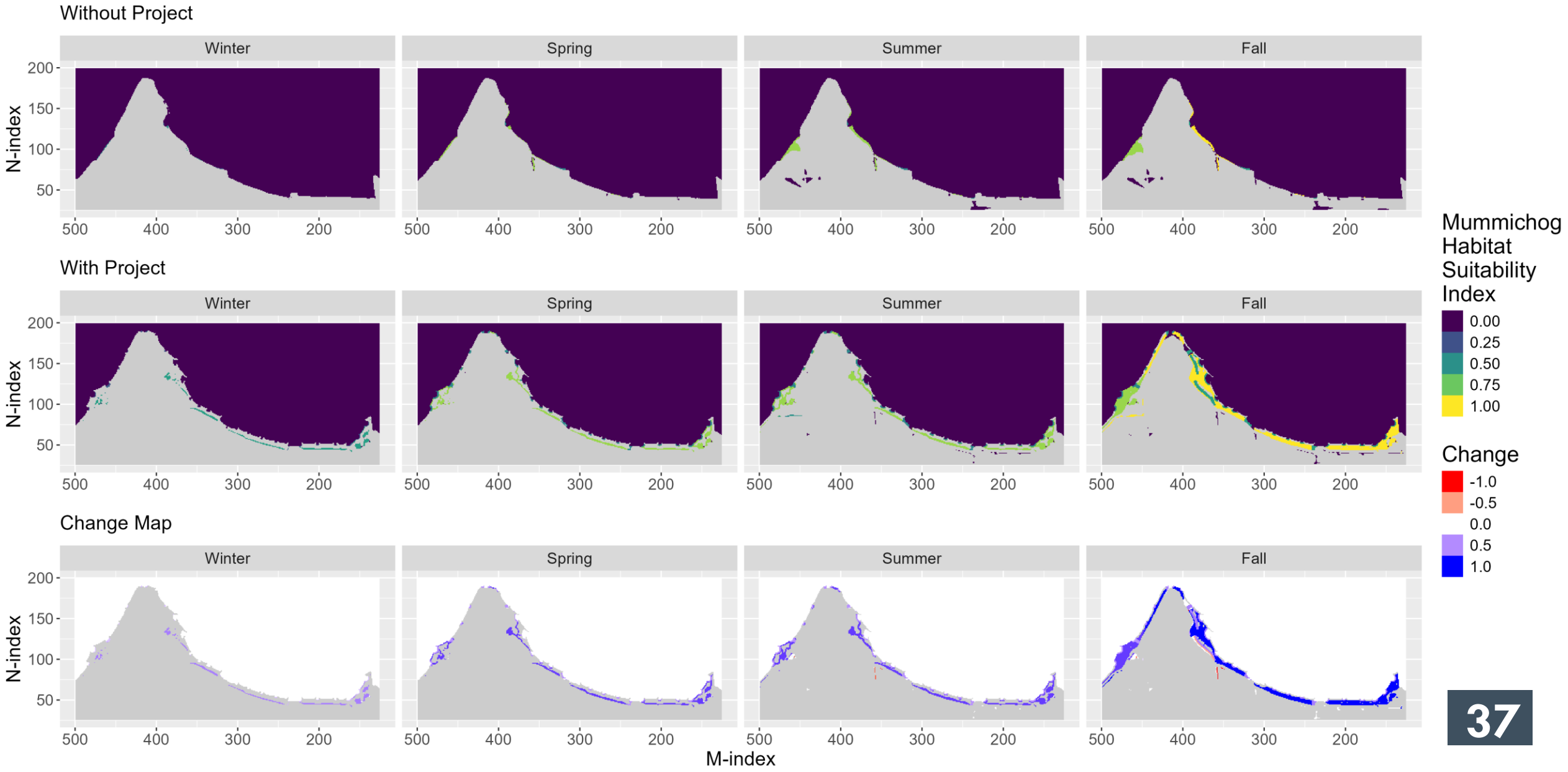
2017 Coastal Master Plan

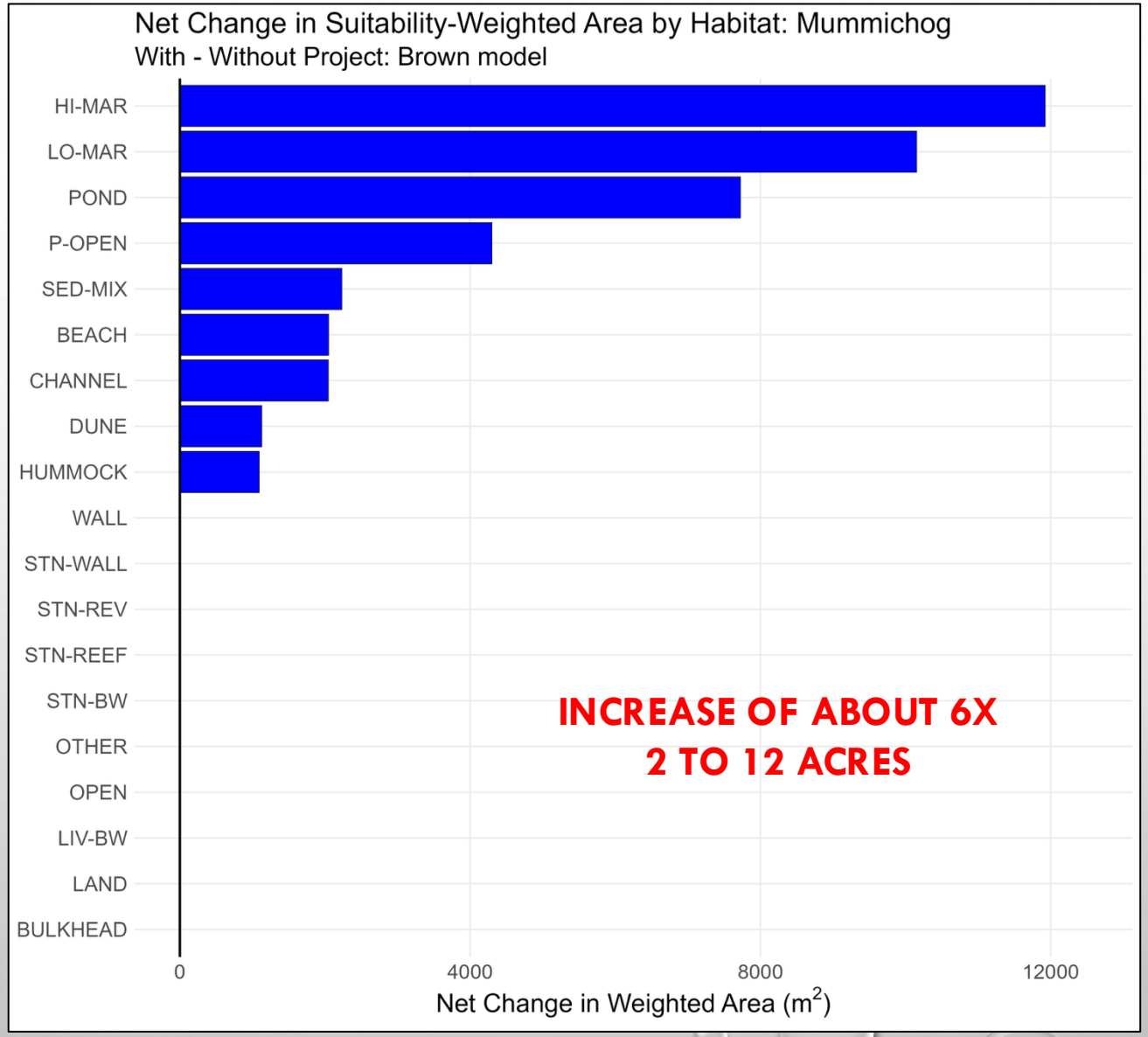
Attachment C3-17: Bay Anchovy, *Anchoa mitchilli*, Habitat Suitability Index Model

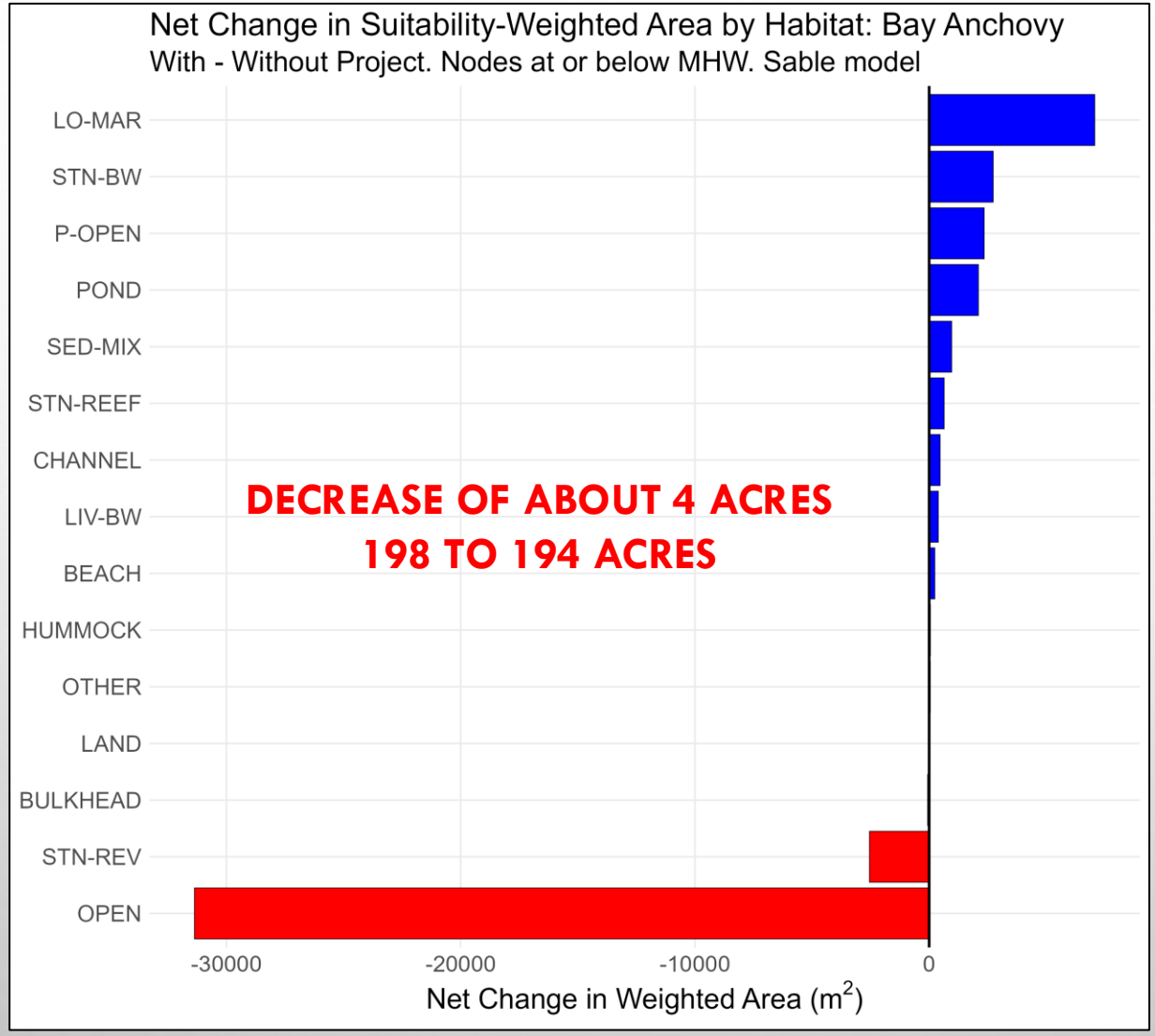
Report: Final

Date: April 2017

Prepared By: Shaye E. Sable (Dynamic Solutions), Ann C. Hijuelos (The Water Inst
Ann M. O'Connell (University of New Orleans), and James P. Geaghan (Louisian
University)

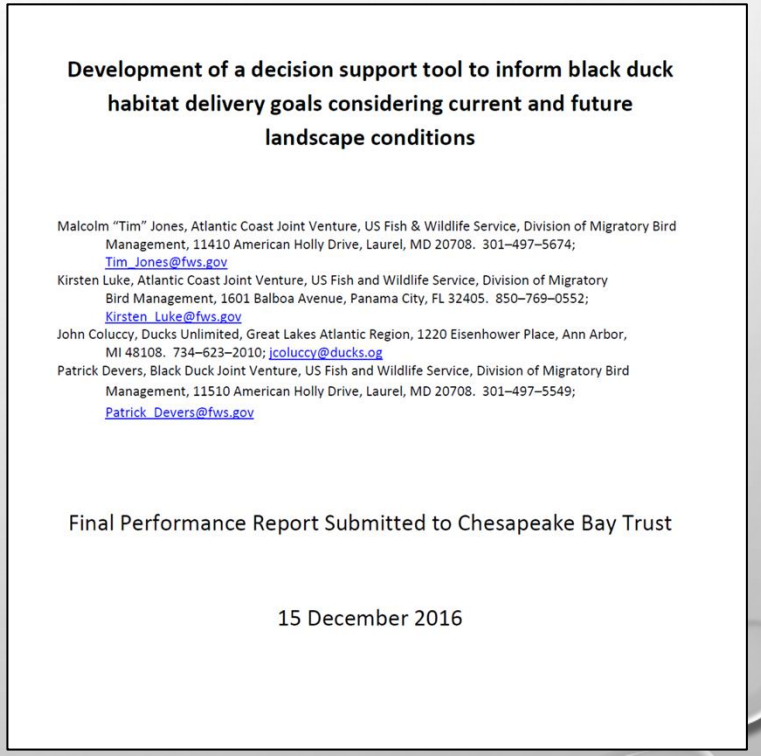

Without Project
Winter
Spring
Summer
Fall
N-index
200
150
100
50
500
400
300
200
With Project
Change Map
M-index
Mummichog Habitat Suitability Index
0.00
0.25
0.50
0.75
1.00
Change
-1.0
-0.5
0.0
0.5
1.0


Net Change in Suitability-Weighted Area by Habitat: Mummichog
With - Without Project: Brown model
HI-MAR
LO-MAR
POND
P-OPEN
SED-MIX
BEACH
CHANNEL
DUNE
HUMMOCK
WALL
STN-WALL
STN-REV
STN-REEF
STN-BW
OTHER
OPEN
LIV-BW
LAND
BULKHEAD
0
4000
8000
12000
Net Change in Weighted Area (m2)
INCREASE OF ABOUT 6X
2 TO 12 ACRES


Net Change in Suitability-Weighted Area by Habitat: Bay Anchovy
With - Without Project. Nodes at or below MHW. Sable model
LO-MAR
STN-BW
P-OPEN
POND
SED-MIX
STN-REEF
CHANNEL
LIV-BW
BEACH
HUMMOCK
OTHER
LAND
BULKHEAD
STN-REV
OPEN
DECREASE OF ABOUT 4 ACRES
198 TO 194 ACRES
-30000
-20000
-10000
0
Net Change in Weighted Area (m2)

EXAMPLE: AMERICAN BLACK DUCK

- "DUCK-DAYS"
- GAINS WITH PROJECT (INCOMPLETE)
- LIVING SHORELINE WILL SUPPORT:
  - ~1,400 DD – LOW MARSH
  - ~600 DD – HIGH MARSH & SHALLOW OPEN WATER



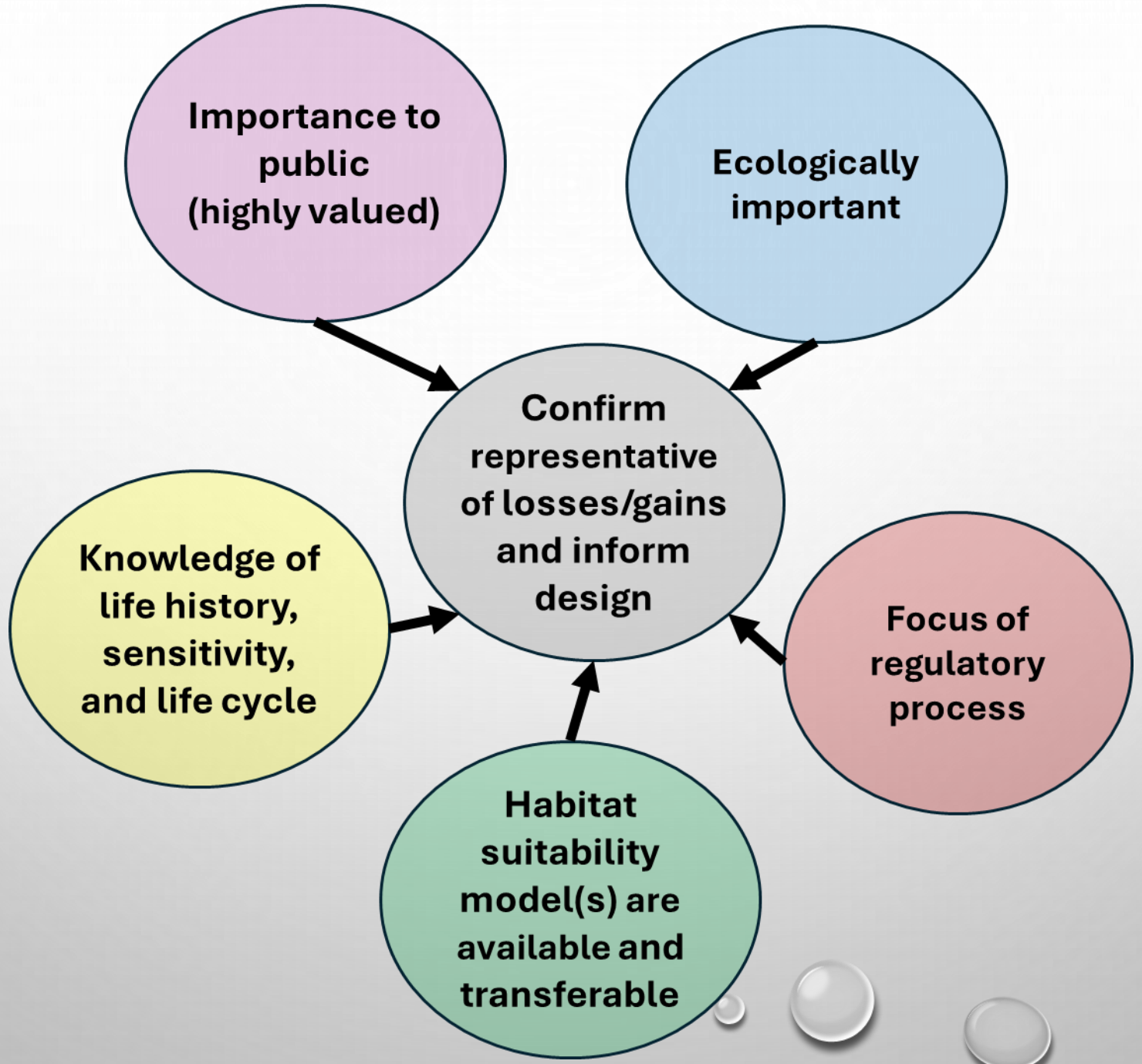
Development of a decision support tool to inform black duck habitat delivery goals considering current and future landscape conditions

Malcolm "Tim" Jones, Atlantic Coast Joint Venture, US Fish & Wildlife Service, Division of Migratory Bird Management, 11410 American Holly Drive, Laurel, MD 20708. 301–497–5674; Tim_Jones@fws.gov
Kirsten Luke, Atlantic Coast Joint Venture, US Fish and Wildlife Service, Division of Migratory Bird Management, 1601 Balboa Avenue, Panama City, FL 32405. 850–769–0552; Kirsten_Luke@fws.gov
John Coluccy, Ducks Unlimited, Great Lakes Atlantic Region, 1220 Eisenhower Place, Ann Arbor, MI 48108. 734–623–2010; jcoluccy@ducks.og
Patrick Devers, Black Duck Joint Venture, US Fish and Wildlife Service, Division of Migratory Bird Management, 11510 American Holly Drive, Laurel, MD 20708. 301–497–5549; Patrick_Devers@fws.gov

Final Performance Report Submitted to Chesapeake Bay Trust

15 December 2016

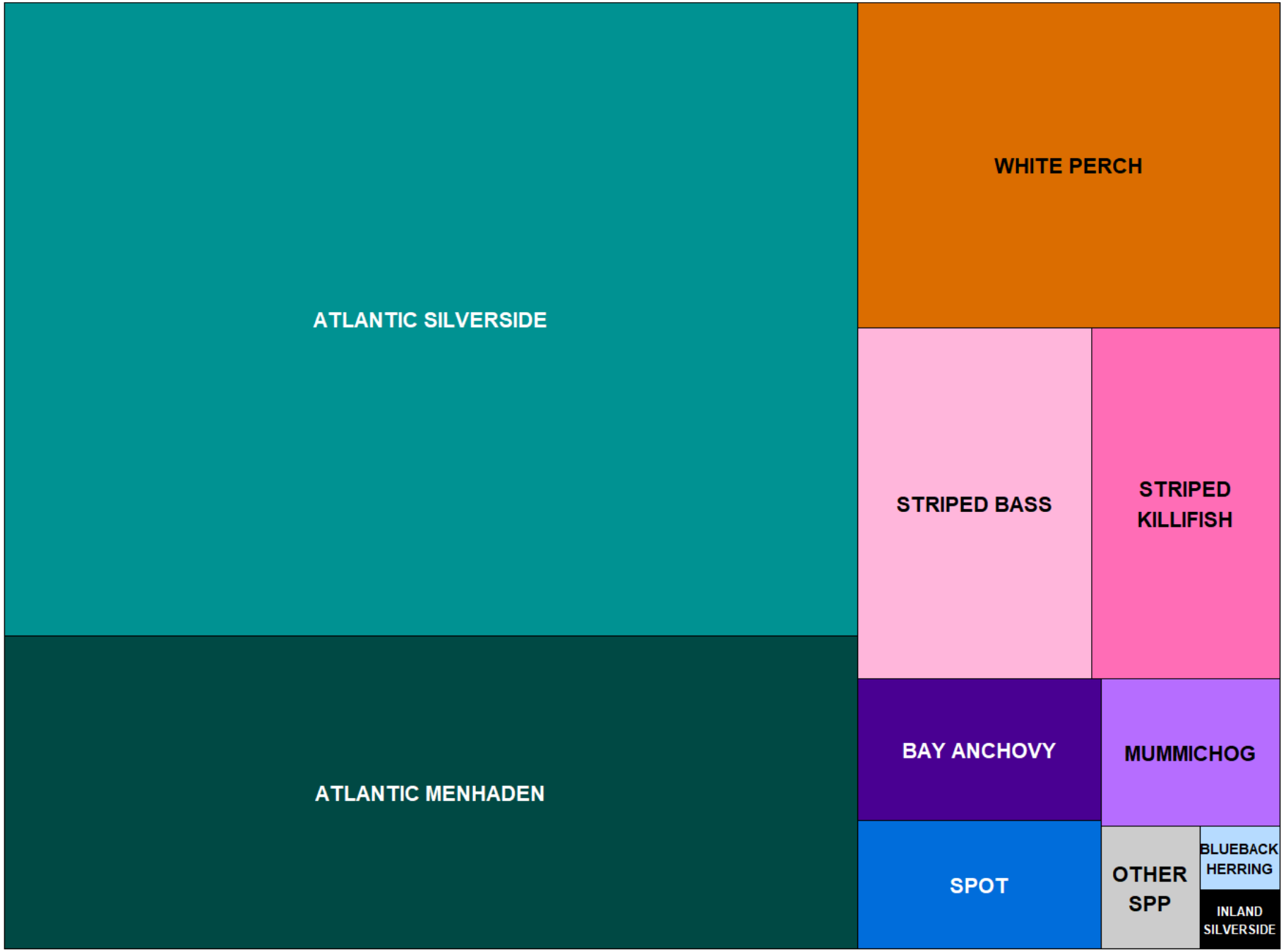
https://www.chesapeakebay.net/discover/field-guide/entry/american-black-duck

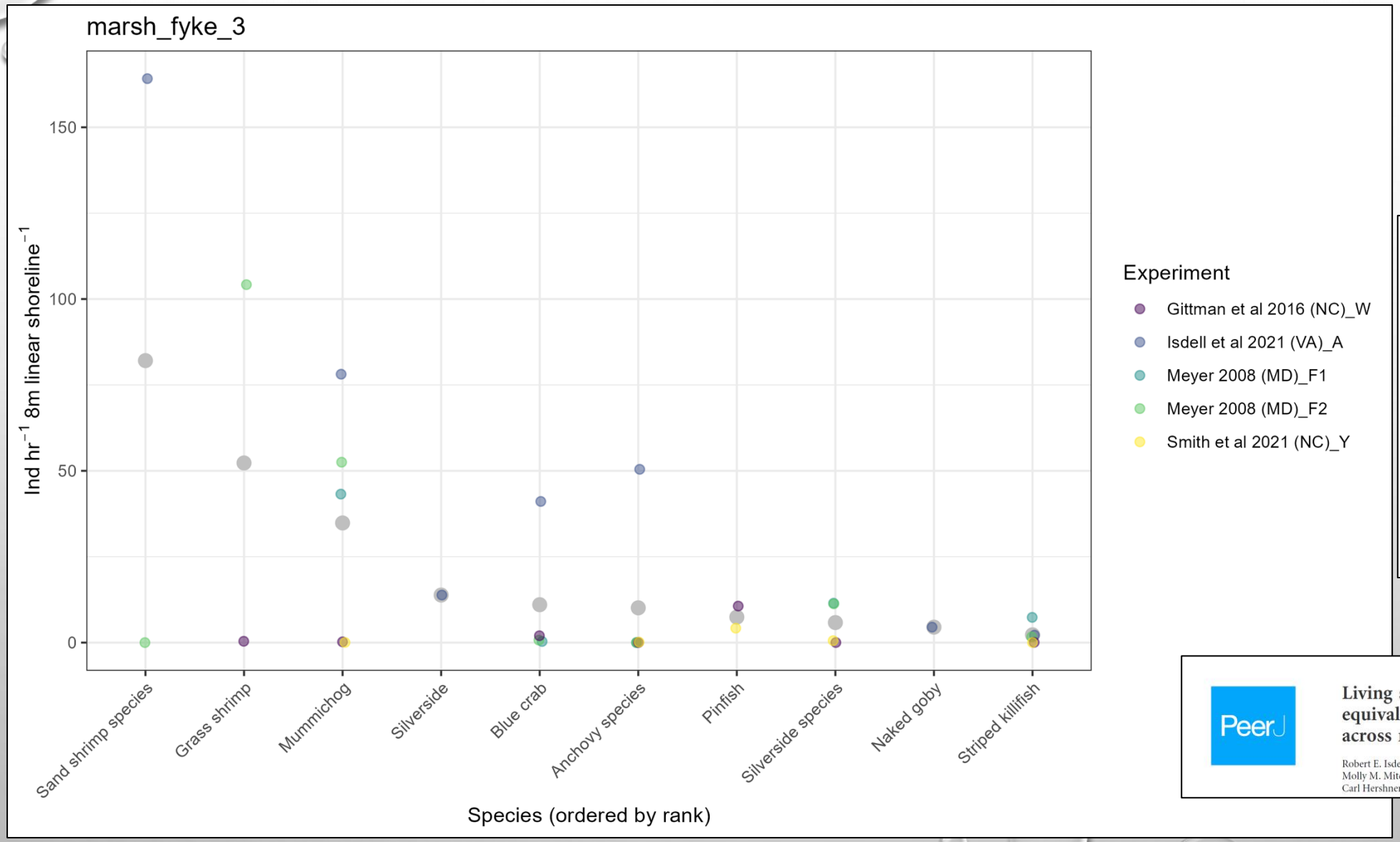

Importance to public (highly valued)
Ecologically important
Confirm representative of losses/gains and inform design
Knowledge of life history, sensitivity, and life cycle
Focus of regulatory process
Habitat suitability model(s) are available and transferable

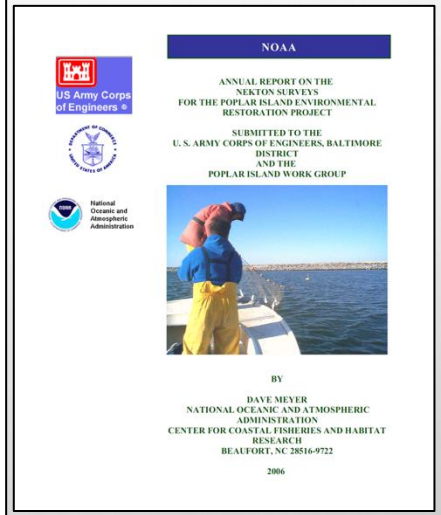
JUVENILE STRIPED BASS SURVEY

BEACH SEINE

1990-2024







PeerJ

Living shorelines achieve functional equivalence to natural fringe marshes across multiple ecological metrics

Robert E. Isdell[1], Donna Marie Bilkovic[1], Amanda G. Guthrie[1], Molly M. Mitchell[1], Randolph M. Chambers[2,3], Matthias Leu[2] and Carl Hershner[1]

Fish	Shellfish	Birds/Reptiles	Pest/Invasive
Killifish	Blue crabs	Herons	Blue catfish
Mummichog	Oysters	Snowy Egret	Mosquitoes
Sheepshead minnow	Grass shrimp	American Black Duck	Phragmites
Anchovy species		Canvasback	
Silverside species		Common/Least Terns	
Spot		Osprey	
Atlantic menhaden		Lesser Scaup	
White perch			
Atlantic croaker		Diamondback terrapin	
Weakfish			
Spotted seatrout			
Striped bass			

Sheepshead Minnow

Habitat: Inhabit very shallow waters and are very tolerant of environmental conditions.
Life History: Residents; small-sized with adults about 1.5 to 3" in length; live to about 1-3 years; eat detritus, small invertebrates, and mosquito larvae; burrow during winter; key forage part of the food web; batch spawn during April through September and males build and guard nests in shallow soft-bottomed areas.

Source: https://www.marylandbiodiversity.com/species/5195

Please indicate how important it is to consider this fish species for habitat enhancement.

1 5

Reset

SURVEY

- QR CODE
- WE WILL POST GUIDANCE DOCUMENT
- WE PLAN ON POSTING A BRIEF VIDEO EXPLAINING THE SURVEY

Living Shoreline Species Selection Survey

To participate in the survey, please use the QR code below.

The City of Cambridge Flood Mitigation Project is developing a hybrid flood protection system that combines traditional infrastructure, such as berms and floodwalls, with nature-based features like living shorelines. The project is intended to reduce flood risk while also providing environmental co-benefits, including enhanced habitat for fish, shellfish, and wildlife. To support the habitat assessment, a list of species has been identified for evaluation, and the City is seeking input on which species should be included in the analysis. The assessment will consider a broad range of species representing different habitat types, as well as selected invasive and pest species, to better understand both the potential habitat benefits and impacts associated with the living shoreline improvements.

The City of Cambridge appreciates your participation.

www.makecambridgeresilient.org

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

MOVING FORWARD

Permit Application Signatures

Inital Review & Public Notice

Final Review & Public Notice

Permit Issued

Easement Process

QUESTION & ANSWER SESSION

REFERENCE THE SLIDE # ASSOCIATED WITH YOUR QUESTION.

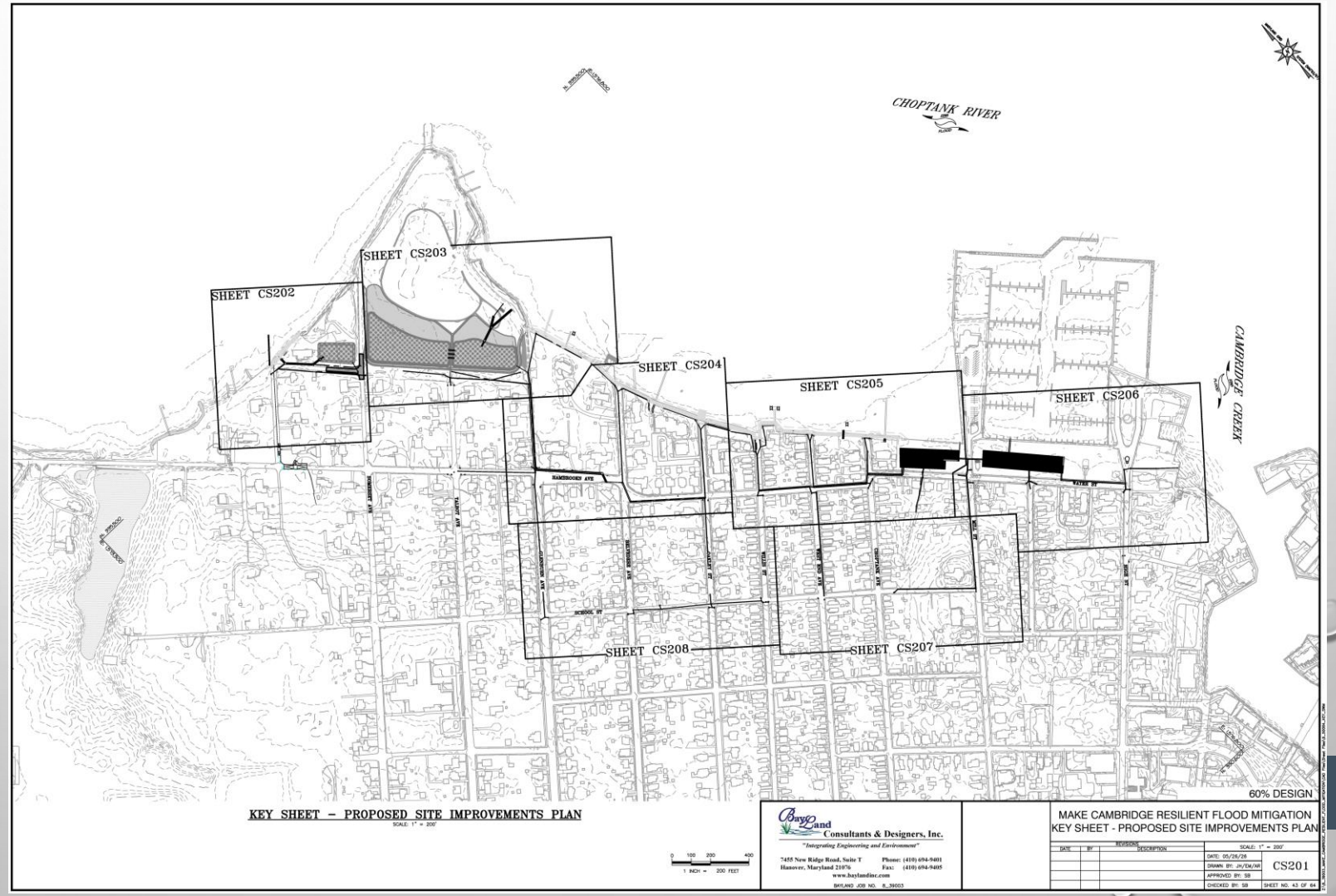
NEXT STEP

- **JOINT PERMIT APPLICATION SUBMITTAL**
  - CITY OF CAMBRIDGE & CO-APPLICANT SIGNATURES

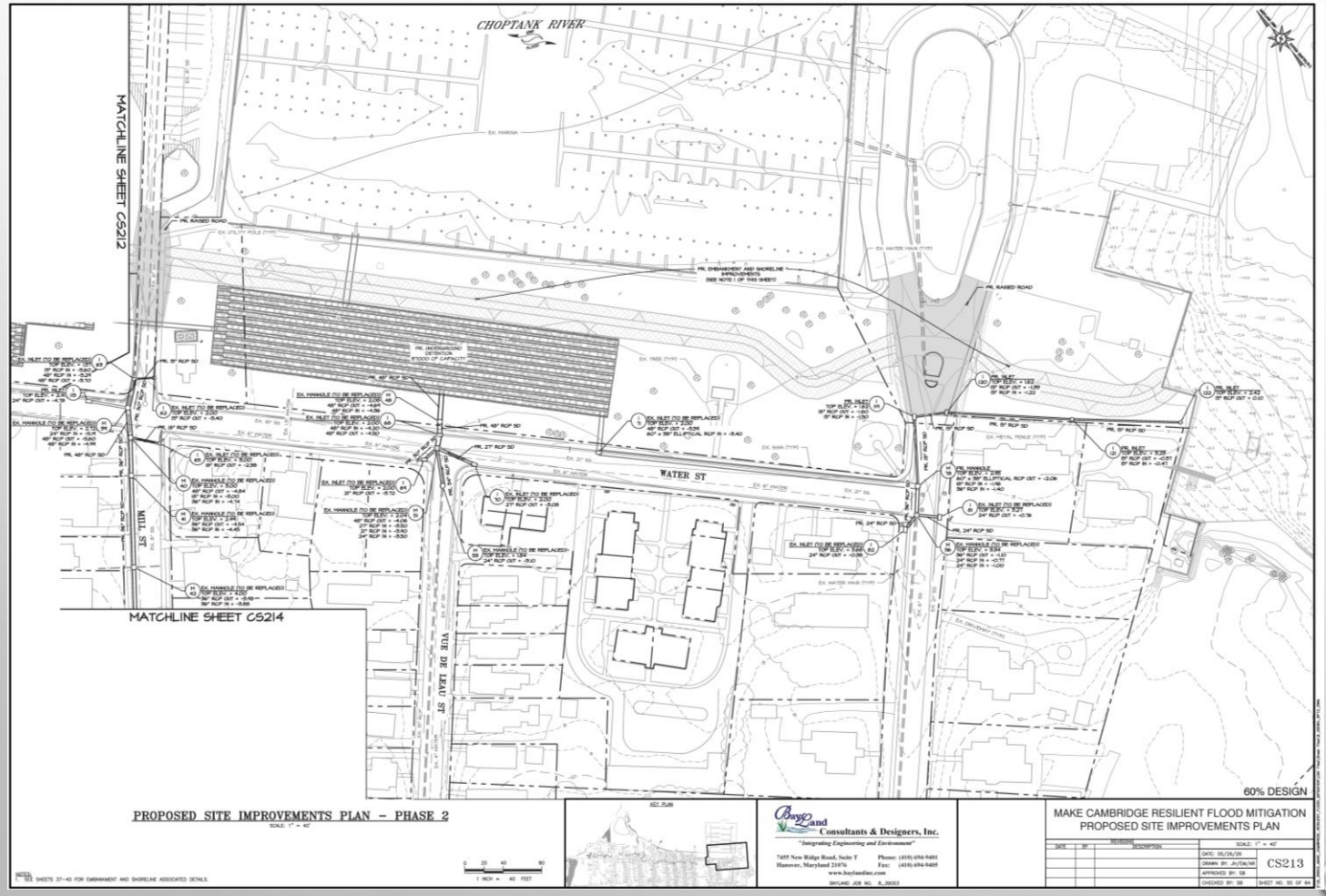
60% DESIGN – EMBANKMENT & LIVING SHORELINE

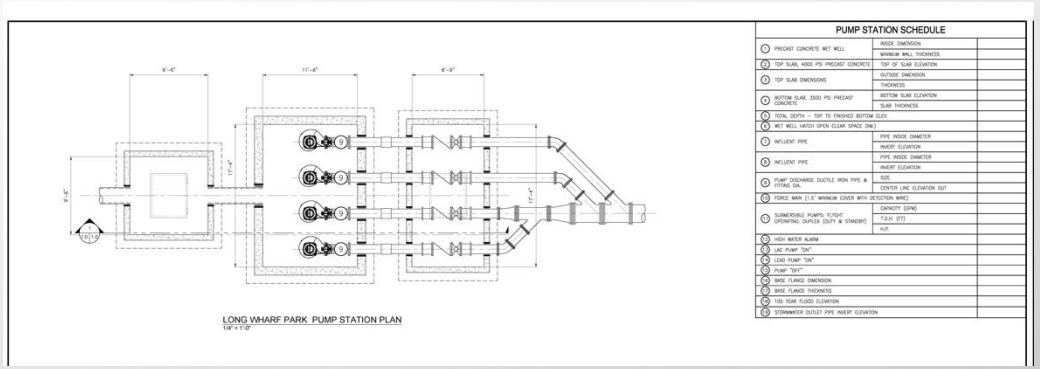
60% DESIGN – STORMWATER MANAGEMENT

- **DESIGN REFINEMENTS BASED ON:**
  - DESIGN EVOLVEMENT
  - DETAILED FLOW TABS & MODELING
  - EMBANKMENT DESIGN
  - PUBLIC ENGAGEMENT

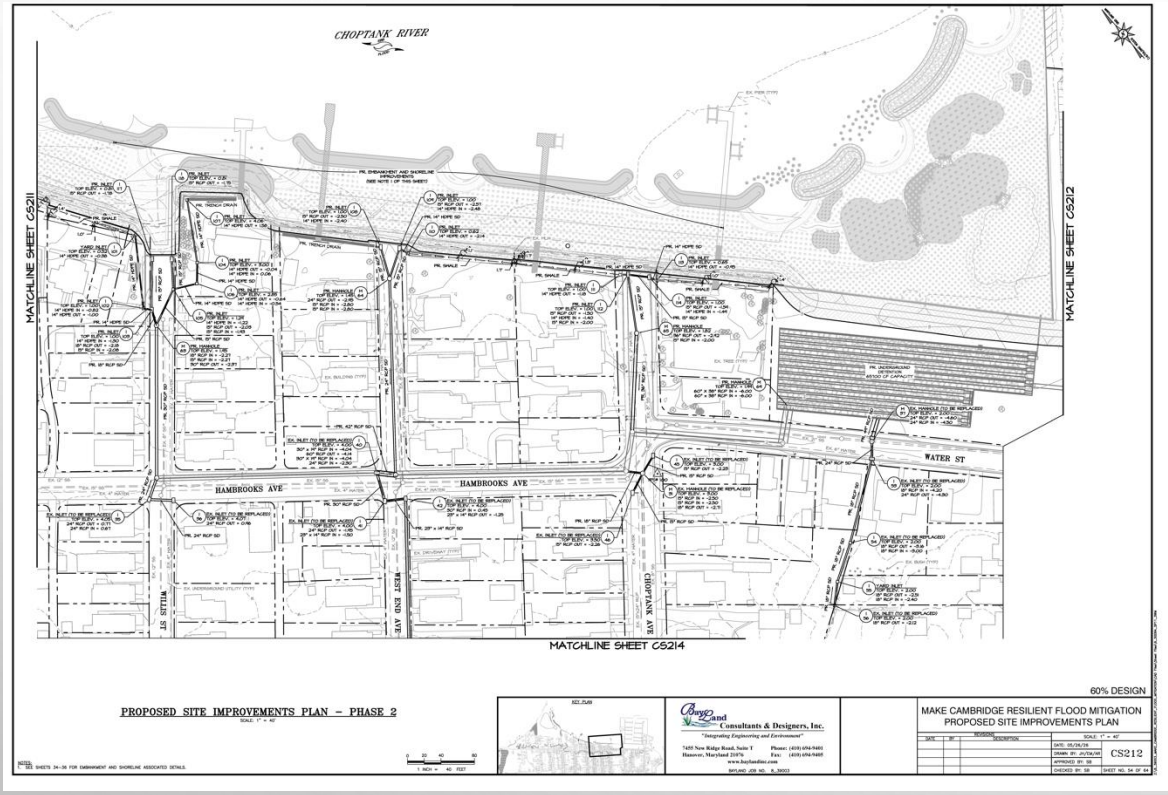


60% DESIGN – STORMWATER MANAGEMENT

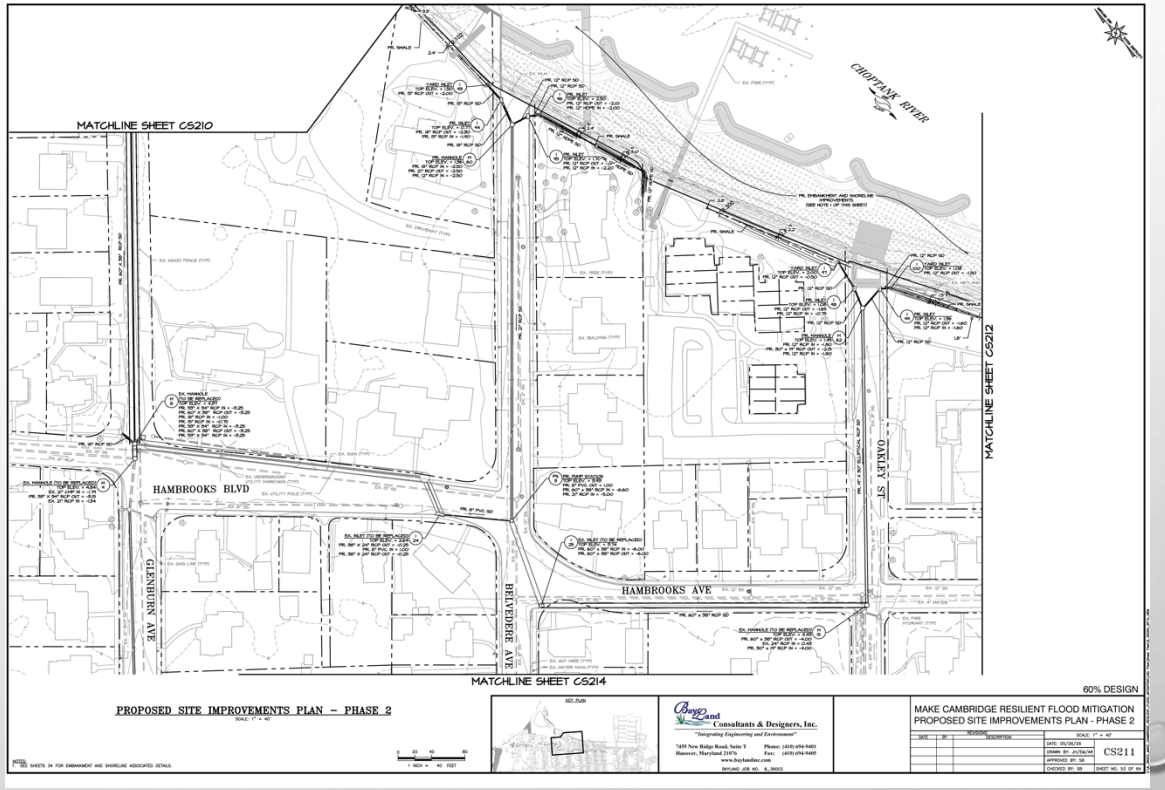




60% DESIGN – STORMWATER MANAGEMENT



WEST END COLLECTOR SYSTEM & STREET-END SYSTEM



GERRY BOYLE PARK COLLECTOR SYSTEM & STREET-END SYSTEM

60% DESIGN – STORMWATER MANAGEMENT