South Breeze Beach Restoration

Fishing Creek Farms - Annapolis, Maryland

March 5, 2024

Project Descriptive

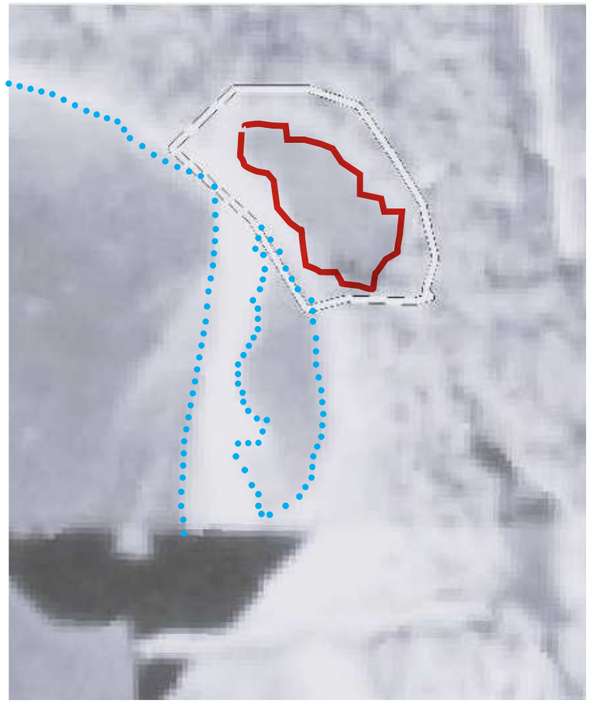
Over the past 60 years Southbreeze Beach has experienced continued erosion that now threatens to destroy both the beach shoreline and the adjacent pond habitat.

The Fishing Creek Farms community has spent two years researching possible solutions to mitigate this loss. Meeting with experts and advisors to understand the causes for this, developing a community plan to save and restore this amenity for generations to come.

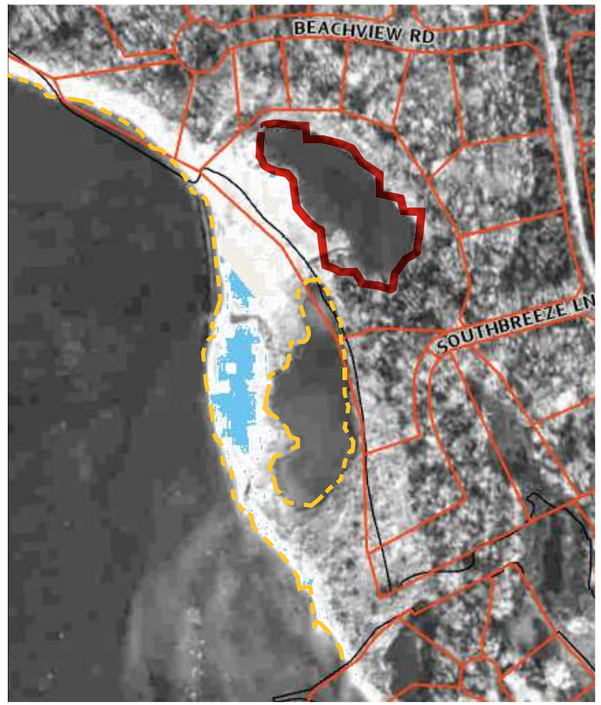
Project Goals

- Preserve and restore the beach and adjacent pond habitats while optimizing both habitat protection and community recreational beach usage and water access.
- Provide a dry, safe walkway to the Beach via Southbreeze Road.
- Provide a long-term solution that is fiscally responsible.

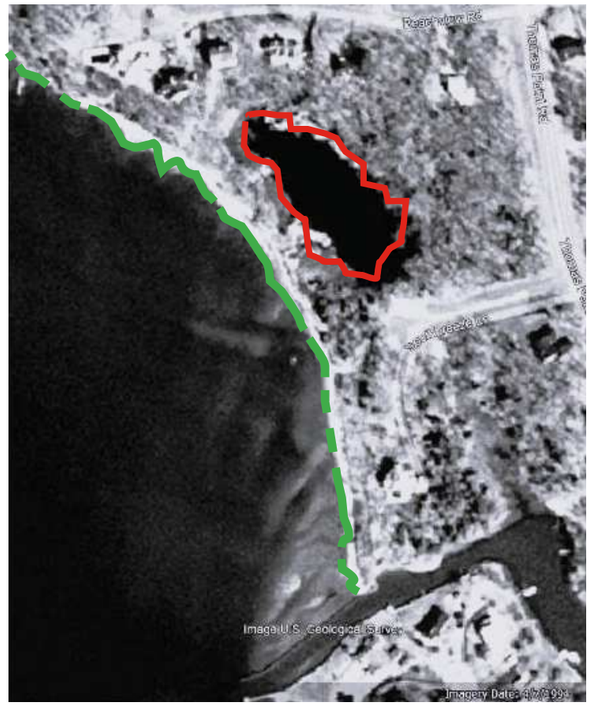
Aerial Photographs | Erosion Progression - 1954 through 2023



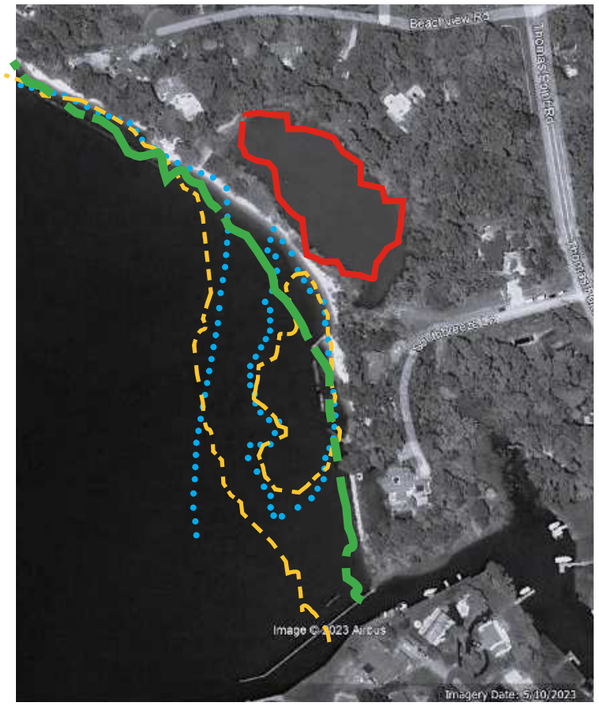
1954



1962



1994



2023

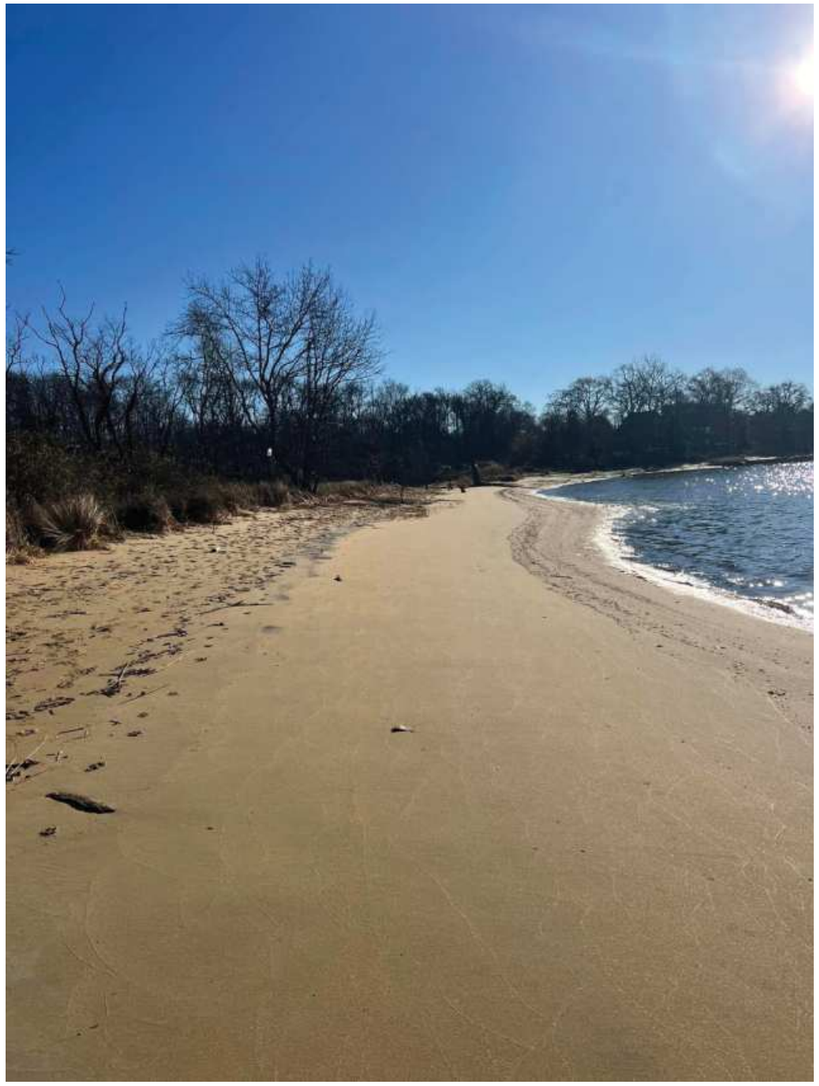
Annually, the natural cove that South Breeze Beach surrounds provides a sheltered winter habitat for migrating birds, while the pond and surrounding wooded space provides a year round environment for multiple wildlife species. *(see the Appendix for complete listing)*

- Whistling Swans (Tundra Swans)
- Canadian Geese
- Mallard + Wood Ducks
- Great Blue Herons
- Common Box + Snapping Turtles
- Osprey
- Bald Eagles
- Red Foxes
- Brown Bats
- Racoons
- Eastern Screech Owls

Through the 2023 - 2024 winter season the berm that lies between the fresh water still pond and the South River was breached allowing brackish water to enter the pond's fresh water environment.

Emergency funding was approved by the Fishing Creek Farm community to reconstruct and reinforce the berm, once again separating the two distinct environments.

The new berm will be planted with indigenous plants and grasses in the spring of 2024.

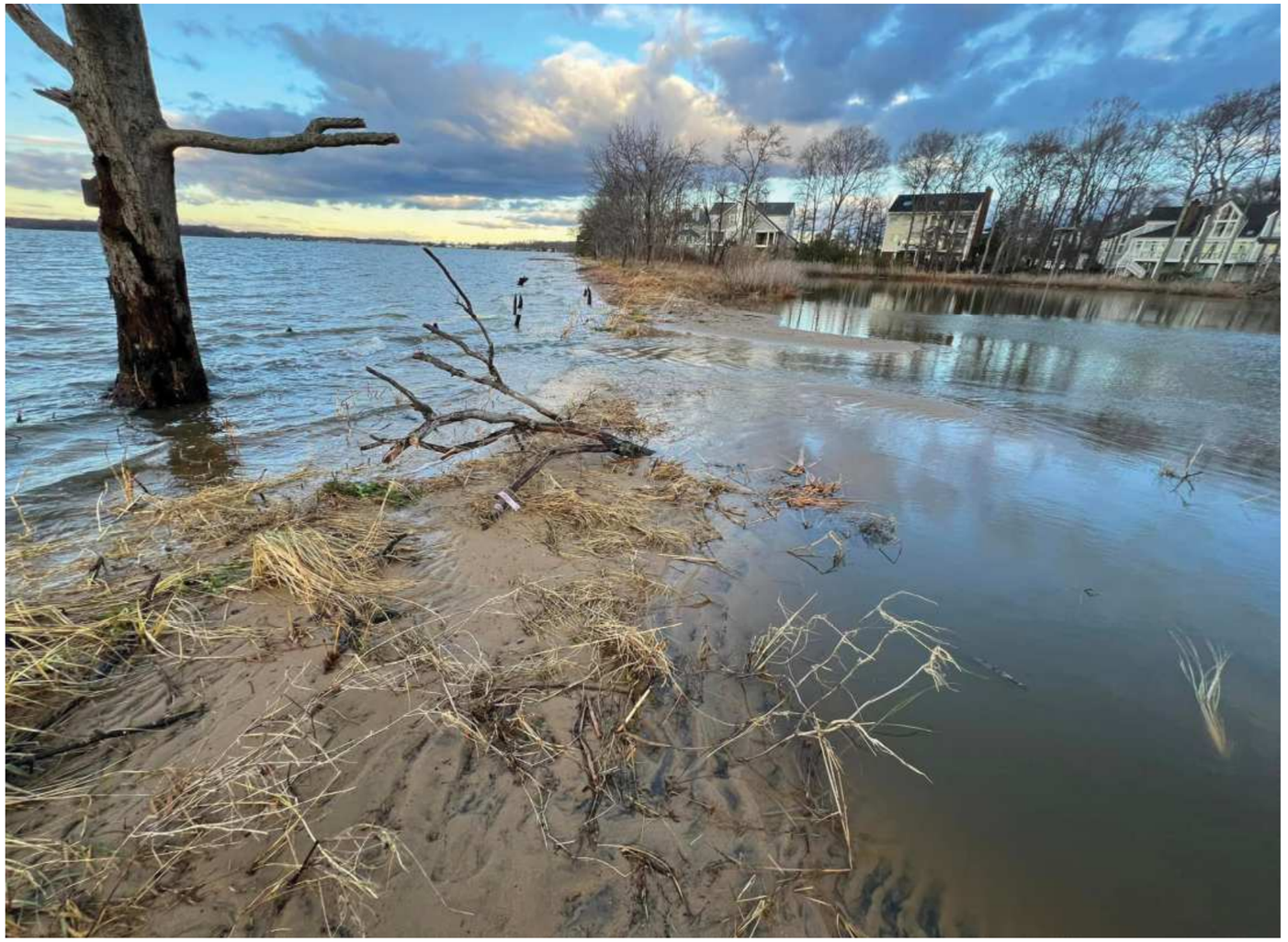


Looking towards the Chesapeake Bay

Berm Breach the day after the storm

Berm Breach Photos | January 10, 2024 Breach

Looking towards the Chesapeake Bay



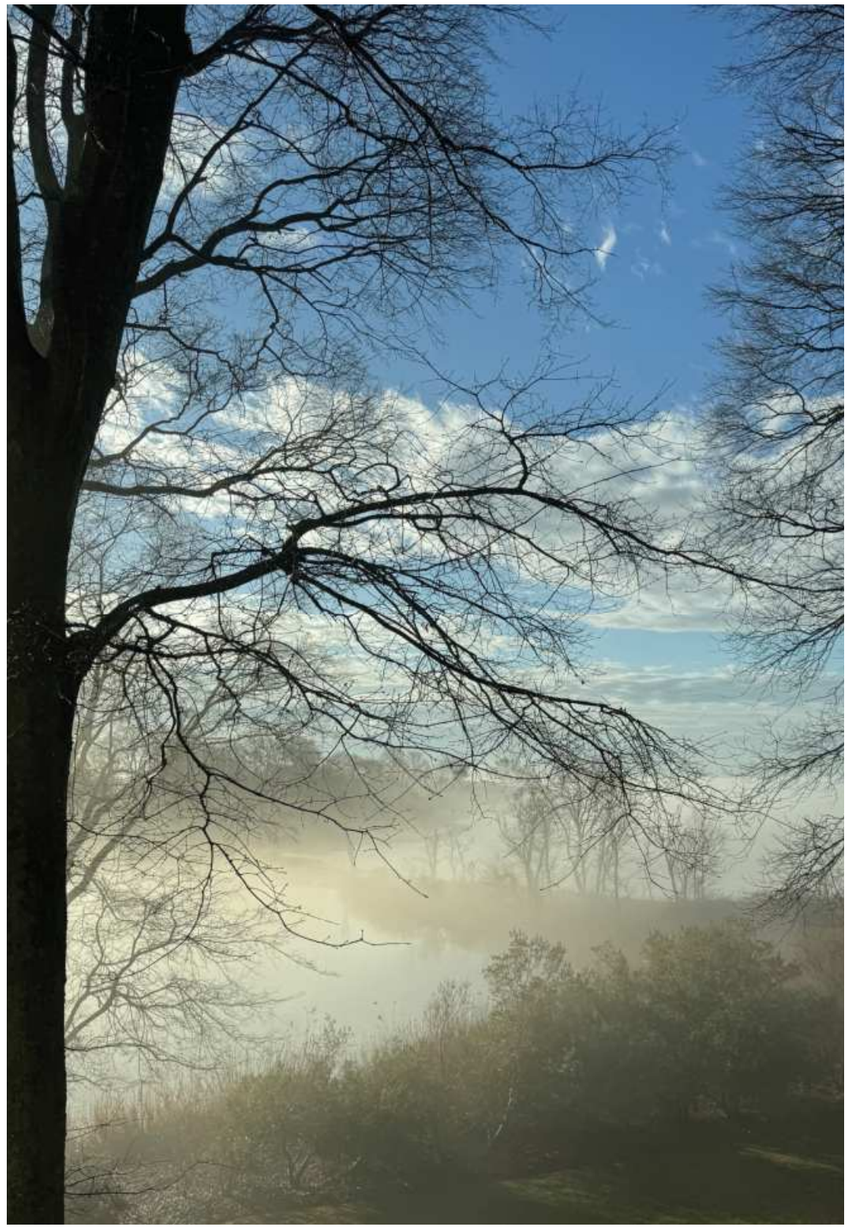
Looking North up the South River

Berm Breach Photos | November 13 + December 18, 2023 Breaches

Looking towards the Chesapeake Bay

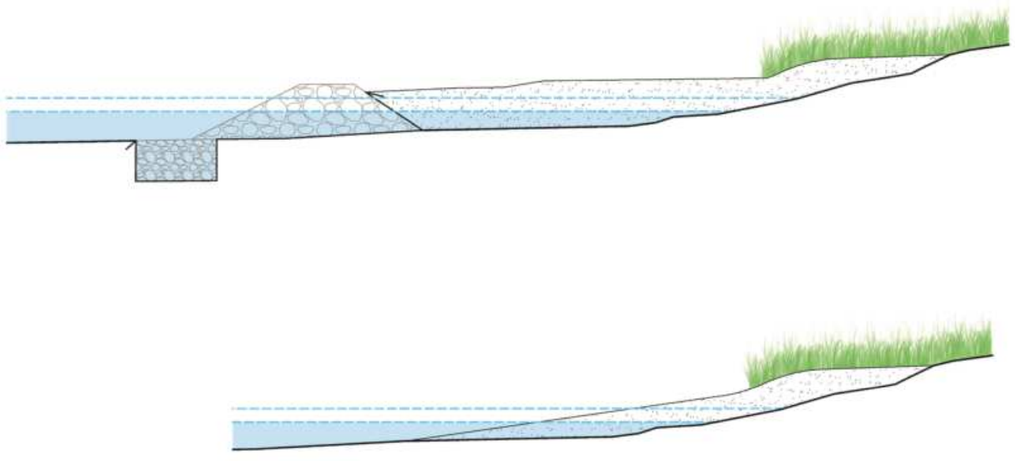
11/13 - Breach location w/ water flowing into the Chesapeake / South River

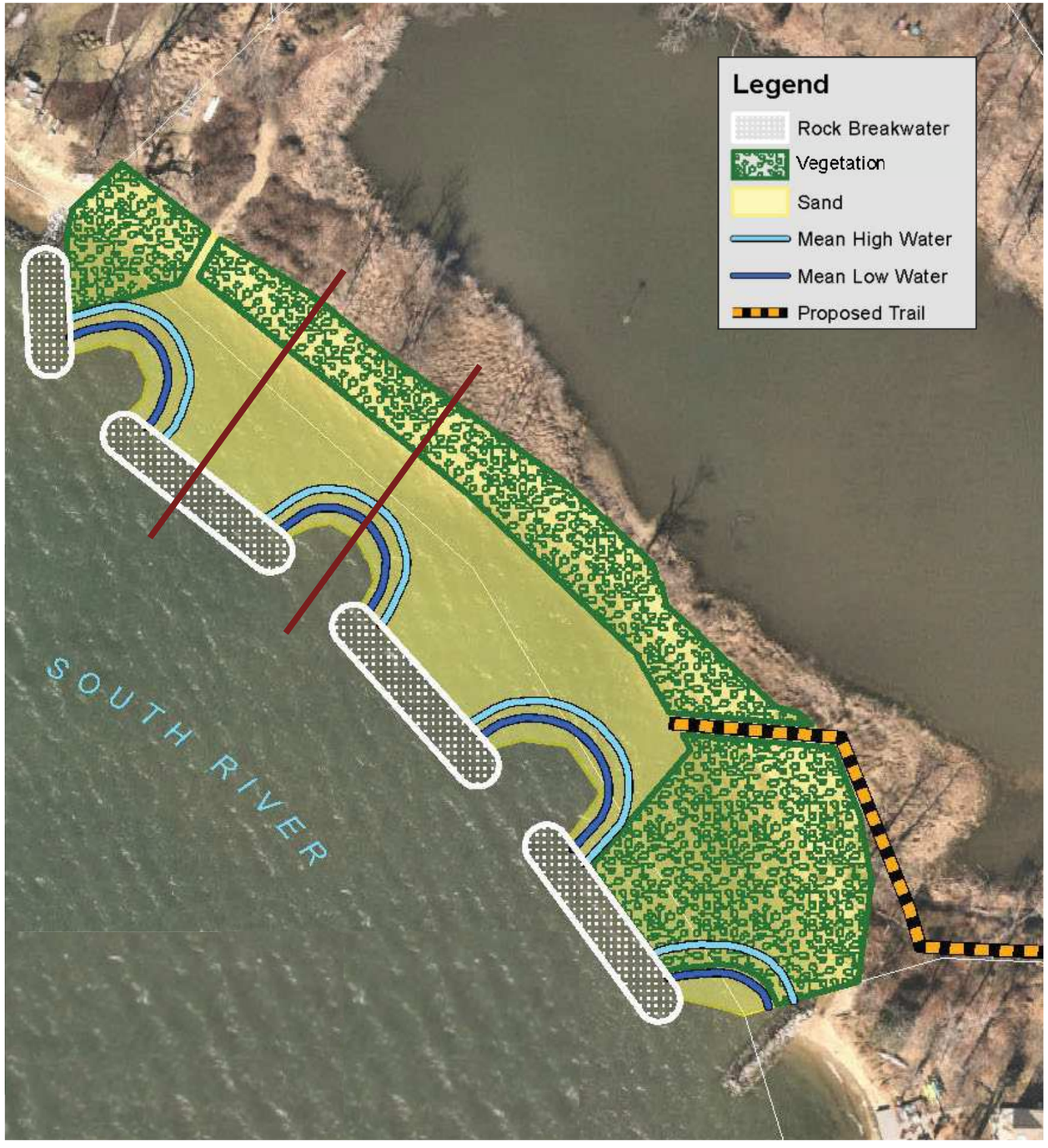
12/18 - Breach location with water flowing to the Chesapeake Bay / South River



- Sand beach is restored, breakwaters provide shoreline protection.
- The incorporation of plantings on the dune provides habitat protection by stablizing the dune and protecting the unique still water pond while abating pollutant runoff into the South River and Chesapeake Bay environments.
- A marsh stabilization area protects the previous breach area.
- Open connection between the land and the water provides access for humans and as well as migrating and indigenous animals.
- Approach would be categorized as a living shorline project and could be design to qualify for faster and simpler permitting under MDSPGP-6.

Breakwater Tombolos
with Beach, Dune + Plantings





With a stablilized beach environment indigenous grasses and plantings will take hold to further support and the enhanced dune structure.

Open beach space with direct water access supports wildlife such as horseshoe crabs, racoons, deer, fox and snapping turtles providing continued access to the pond and South River food sources.

Enhanced Design Option Rendering

- Over the last 18 months the community Tiger Team (13 members) was formed and developed project goals, invited design contractors for site visits to discuss the condition of the beach, potential restorative options for this historically sand depositional area and natural still pond.
- The Tiger Team visited beach restoration projects in a number of local communities including Bay Ridge and Cape St. Claire.
- An RFP document for design services was developed by the Tiger Team and submitted to three Design Contractors. Once the proposal responses were received, ranging in cost from $115K to $180K, each Design Contractor presented their proposals / solutions to the Team which included design approach options. WSSI was selected to proceed with the design process.
- Upon receipt of a grant from the Watershed Assistance Grant Program a project design has been developed (see attached drawings in the Appendix).
- Ultimate project implementation funding will be a combination of grant funding and community funding efforts. Maintenance expenses will be built into the FCF HOA operating budget.

Chesapeake Bay Trust | Key Notes - Watershed Assistant Grant Program Proposal

- Southbreeze Shoreline Stabilization project will ultimately provide water quality improvements at the mouth of the South River by stabilizing 540 linear feet of tidal shoreline eroding at +2 feet annually, retreating more than 25 feet since 2009.
- Ultimate project implementation funding will be a combination of grant funding and community funding efforts. Maintenance expenses will be built into the FCF HOA operating budget.
- Changes in community interest or in land use are not considered threats to the value or longevity of this project.
- The protecting pond stabilizes a non-tidal environment which provides sheltered habitat for transient bird populations in addition to local wildlife of all sorts.
- The Tiger Team reports current activities to the community on a regular basis.

Appendix

SOUTHBREEZE COMMUNITY SHORELINE STABILIZATION

30% DESIGN PLAN

WITH FUNDAMENTAL ALTERNATIVE

ANNE ARUNDEL COUNTY, MARYLAND

STANDARD RESPONSIBILITY NOTES

1. I (We) certify that:
   a. All development and construction will be done in accordance with this sediment and erosion control plan, and further, authorize the right of entry for periodic on-site evaluation by the Anne Arundel Soil Conservation District (AASCD) Board of Supervisors or their authorized agents.
   b. Any responsible personnel involved in the construction project will have a certificate of attendance from the Maryland Department of the Environment's approved training program for the control of sediment and erosion before beginning the project.

      Responsible personnel on site: _____

   c. If applicable, the appropriate enclosure will be constructed and maintained on sediment basin(s) included in this plan. Such structure(s) will be in compliance with the Anne Arundel County Code.
2. The developer is responsible for the acquisition of all easements, right, and/or rights-of-way that may be required for the sediment and erosion control practices, storm water management practices and the discharge of storm water onto or across adjacent or downstream properties included in the plan.
3. For initial soil disturbance or re-disturbance, permanent and/or temporary stabilization per the AASCD Vegetative Establishment shall be completed within three calendar days for the surface of all controls, dikes, swales, ditches, perimeter slopes and all slopes greater than 3 horizontal to 1 vertical (3:1); and seven days for all other disturbed or graded areas on the project site.
4. The grading and sediment control approval on this plan extends only to those areas within the limits of disturbance.
5. The approval of this plan for sediment and erosion control does not relieve the developer/consultant from complying with Federal, State or County requirements pertaining to environmental issues.
6. The developer must request that the sediment and erosion control inspector approve work completed in accordance with the approved erosion and sediment control plan, the grading or building permit, and the ordinance.
7. All material shall be taken to a site with an approved sediment and erosion control plan.
8. First phase inspection and approval of the sediment and erosion control inspector will be required upon completion of the installation of erosion and sediment controls prior to proceeding with any other earth disturbance or grading. Other building or grading inspection approvals may not be authorized until the initial approval by the sediment and erosion control inspector is given. Inspection and Permits may also require that an inspection and certification of the installation of sediment control also be performed by a design professional prior to construction commencing.
9. Approval from the inspector must be requested on final stabilization of all sites prior to removal of sediment and erosion controls.
10. Existing topography must be field verified by responsible personnel to the satisfaction of the sediment control inspector prior to commencing work.

Signature of Developer/Owner _____ Date _____

Print: Name: _____
Title: _____
Affiliation: _____
Address: _____
Telephone Number: _____
Email Address: _____

CONSULTANTS CERTIFICATION

The Developer's plan to control silt and erosion is adequate to contain the silt and erosion on the property covered by the plan. I certify that this plan of erosion and sediment control represents a practical and workable plan based on my personal knowledge of this site and was prepared in accordance with the requirements of the AASCD Plan Submittal Guidelines and the current Maryland Standards and Specifications for Soil Erosion and Sediment Control. I have reviewed this erosion and sediment control plan with the owner/developer.

MD P.E. License # _____

MD Land Surveyor License # _____

SEAL

MD Landscape Architect # _____

Name _____

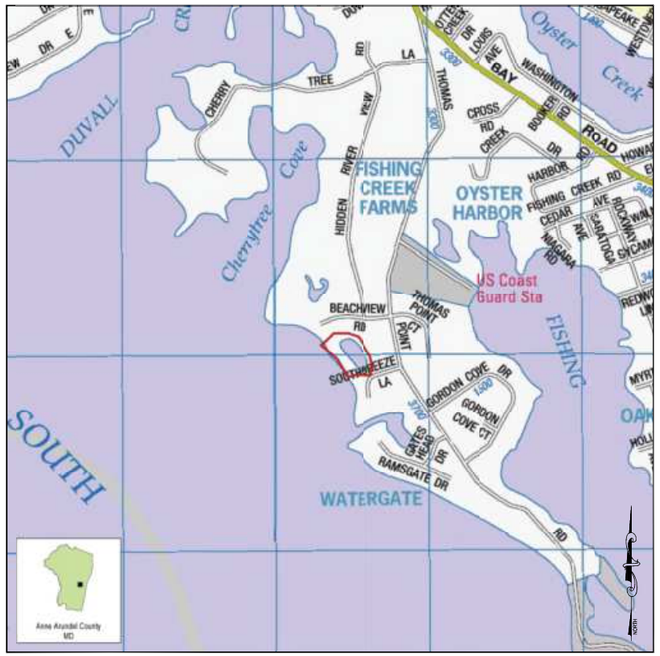
Firm Name _____

Address _____

City _____ **State** ____ **Zip Code** _____

Signature

Date



VICINITY MAP

SCALE: 1" = 1000'

GENERAL NOTES

1.	OWNER/DEVELOPER/ ESC APPLICANT	FISHING CREEK FARMS HOA 1222 CHERRY TREE LANE ANNAPOLIS, MD
2.	ENGINEER:	WETLAND STUDIES AND SOLUTIONS, INC. 1131 BENFIELD BOULEVARD, SUITE L MILLERSVILLE, MARYLAND 21108 TELEPHONE: 410-672-5990 ATTN: INGRID BAUER, P.E.
3.	CHESAPEAKE BAY CRITICAL AREA:	THIS PROJECT SITE IS LOCATED WITHIN THE CHESAPEAKE BAY CRITICAL AREA.
4.	100-YEAR FLOODPLAIN DESIGNATION:	THE PROJECT AREA IS DESIGNATED AS FEMA ZONES "VE" AND "AE".
5.	SITE ANALYSIS: 5.1. TOTAL SITE AREA: 5.2. TOTAL DISTURBED AREA*: 5.3. TOTAL AREA TO BE VEGETATIVELY STABILIZED: 5.4. TOTAL PROPOSED IMPERVIOUS:	 XXXX ACRES XXXX ACRES XXXX ACRES XXXX ACRES
6.	RIVER: SOUTH RIVER WATERSHED: SOUTH RIVER MD 8-DIGIT BASIN CODE: 02131003 8-DIGIT HUC: 02060004	

SHEET INDEX

MISS UTILITY

Call "Miss Utility" at 1-800-257-7777, 48 hours prior to the start of work. The excavator must notify all public utility companies with under ground facilities in the area of proposed excavation and have those facilities located by the utility companies prior to commencing excavation.

Wetland Studies and Solutions, Inc. | a Kimley-Horn company
1131 Benfield Boulevard • Suite L
Millersville, Maryland 21108
Phone: 410-672-5990 • Fax: 410-672-5993
www.wetlandstudies.com

Southbreeze Community Shoreline Stabilization
30% Design Plan
Anne Arundel County, MD

Cover Sheet

STATE OF MARYLAND · INGRID H. BAUER · 46317 · PROFESSIONAL ENGINEER

REVISIONS

No.	Date	Description	Rev. by	App. by

SCALE: AS NOTED

DATE: OCTOBER, 2023

Horizontal Datum: NAD 83

Vertical Datum: NAVD 88

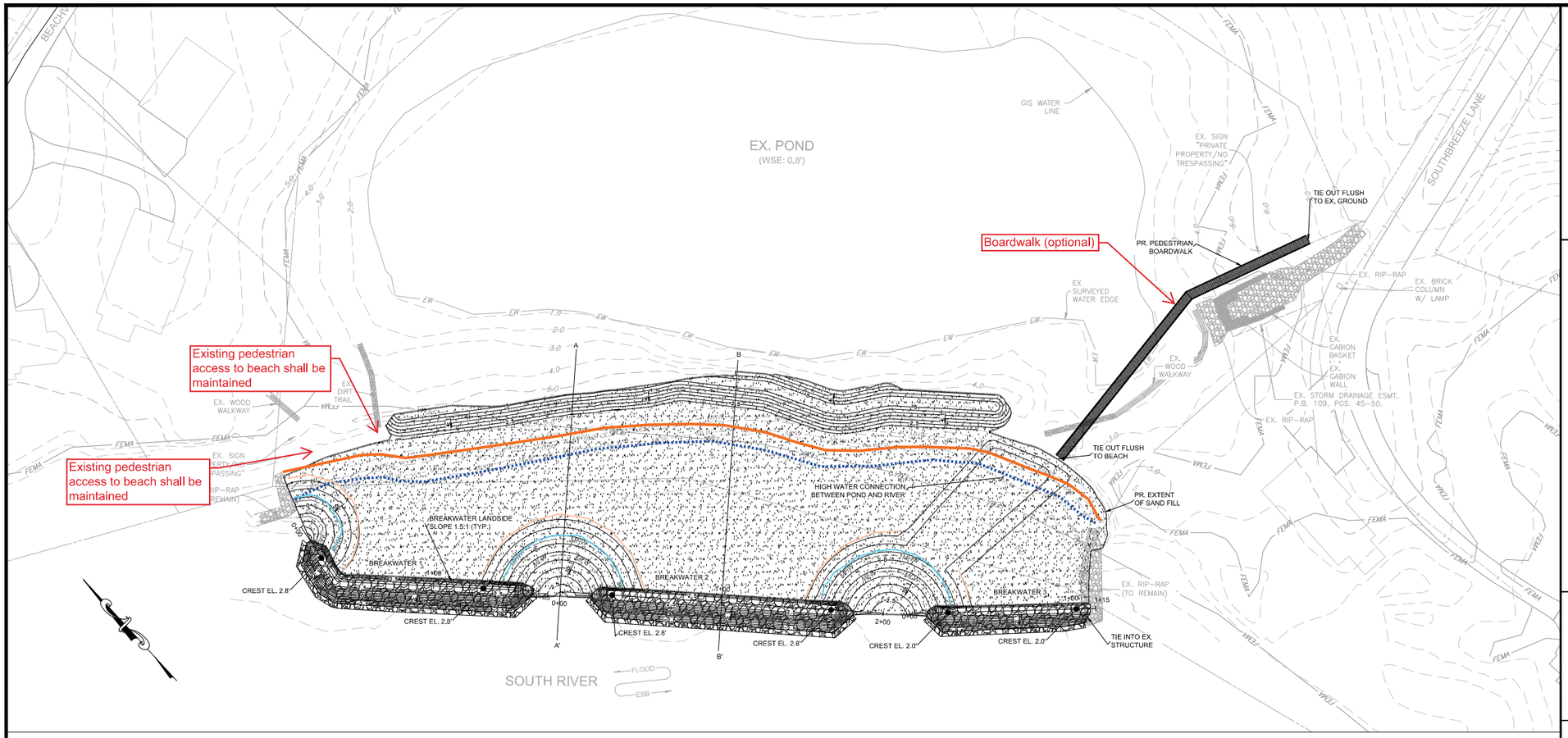
Boundary and Topo Source:
WSSI & Anne Arundel County Data

Design	Draft	Approved
MCJ	MCJ	IHB

Sheet #
1 of 9

Computer File Name:

Wetlands 30% Design Package | Grading Plan



LEGEND

PROPERTY BOUNDARIES	PROPOSED GRADING (0.5')
EASEMENT BOUNDARIES	PROPOSED MEAN HIGH WATER LINE (0.3' EL.)
EXISTING INFRASTRUCTURE	PROPOSED MEAN LOW WATER LINE (-0.7' EL.)
EXISTING CONTOURS (1.0')	PROPOSED SAND FILL
EXISTING MEAN HIGH WATER LINE (0.3' EL.)	PROPOSED BREAKWATER
EXISTING MEAN LOW WATER LINE (-0.7' EL.)	PROPOSED BOARDWALK
EX. POND EDGE OF WATER	
FEMA FLOODPLAIN	

30 15 0 30 60 90
SCALE: 1"=30'

Legend

- Fundamental 1.5' Elevation
- Fundamental MHW
- Enhanced (30%) 1.5' Elevation
- Enhanced (30%) MHW

Wetland Studies and Solutions, Inc. — a DAVEY company
1131 Benfield Boulevard • Suite L
Millersville, Maryland 21108
Phone: 410.672.5990 • Fax: 410.672.5993
www.wetlands.com

Southbreeze Community Shoreline Stabilization
30% Design Plan
Anne Arundel County, MD

Grading Plan

SILVIA OF MARYLAND
HOWARD H. BAKER
46317
PROFESSIONAL ENGINEER

No.	Date	Description	Rev. By	App. By

SCALE: 1" = 30'
DATE: OCTOBER, 2023

Horizontal Datum: NAD 83
Vertical Datum: NAVD 88
Boundary and Topo Source: WSSI & Anne Arundel County Data

Design	Draft	Approved
IHB	AMS	IHB

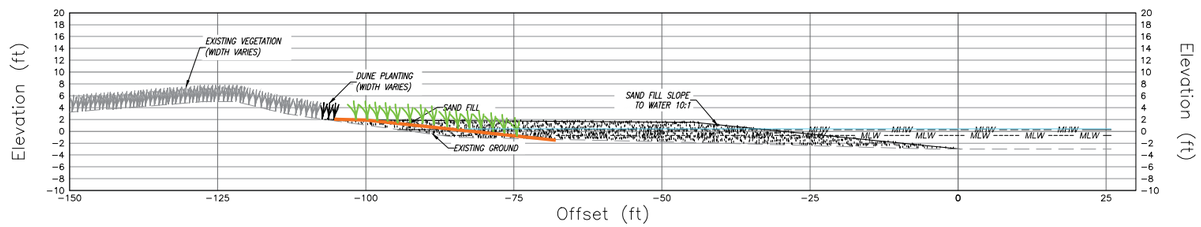
Sheet #
2 of 9

Computer File Name:

Wetlands 30% Design Package | Typical Sections

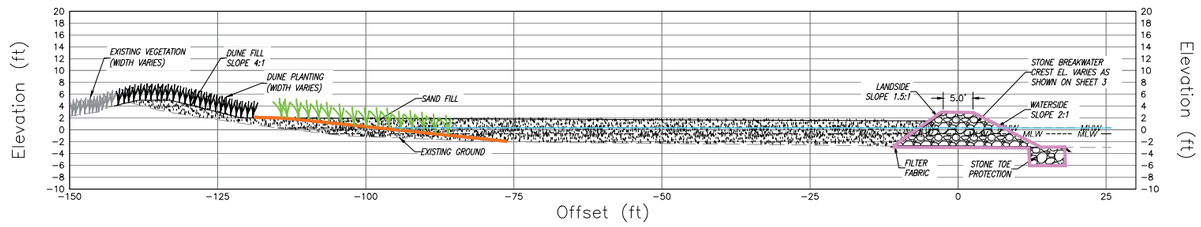
SECTION A–A': TYPICAL BREAKWATER OPENING

SCALE: 1" = 10'



SECTION B–B': TYPICAL BREAKWATER

SCALE: 1" = 10'

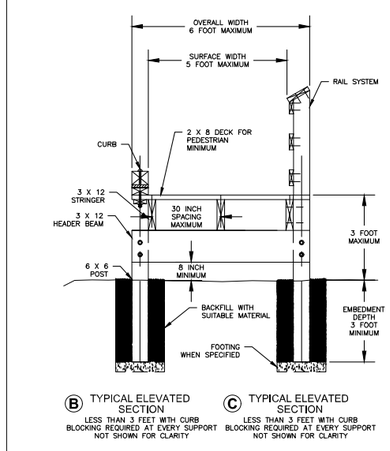


10 5 0 10 20 30

SCALE: 1"=10'

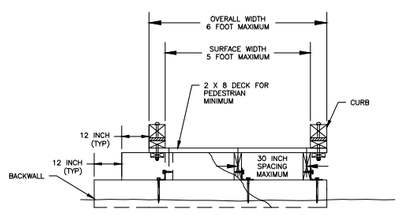
Legend

- MHW (0.3' Elevation)
- Fundamental Sand Profile
- Fundamental Planting (optional)
- Breakwaters

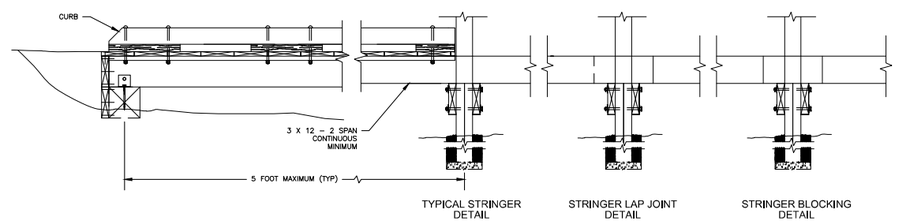


Ⓑ TYPICAL ELEVATED SECTION
LESS THAN 3 FEET WITH CURB
BLOCKING REQUIRED AT EVERY SUPPORT NOT SHOWN FOR CLARITY

Ⓒ TYPICAL ELEVATED SECTION
LESS THAN 3 FEET WITH CURB
BLOCKING REQUIRED AT EVERY SUPPORT NOT SHOWN FOR CLARITY



Ⓐ TYPICAL GROUND SECTION
BLOCKING REQUIRED AT EVERY SUPPORT NOT SHOWN FOR CLARITY



ABUTMENT PROFILE VIEW

TYPICAL STRINGER DETAIL

STRINGER LAP JOINT DETAIL

STRINGER BLOCKING DETAIL

PIER PROFILE VIEW
BLOCKING, CROSS BRACING, DECKING AND RAIL SYSTEM NOT SHOWN FOR CLARITY

TYPICAL BOARDWALK SECTIONS

NOT TO SCALE

FROM: USDA FOREST SERVICE STANDARD TRAIL PLANS AND DETAILS

Wetland Studies and Solutions, Inc. — DAVEY RESOURCE GROUP company
1131 Benfield Boulevard • Suite L
Millersville, Maryland 21108
Phone: 410.672.5990 • Fax: 410.672.5993
www.wetlands.com

Southbreeze Community Shoreline Stabilization
30% Design Plan
Anne Arundel County, MD

Typical Sections

STATE OF MARYLAND — INGRID H. WAGNER — 46317 — PROFESSIONAL ENGINEER

No.	Date	Description	Rev. By	App. By
		REVISIONS		

SCALE: AS NOTED

DATE: OCTOBER, 2023

Horizontal Datum: NAD 83

Vertical Datum: NAVD 88

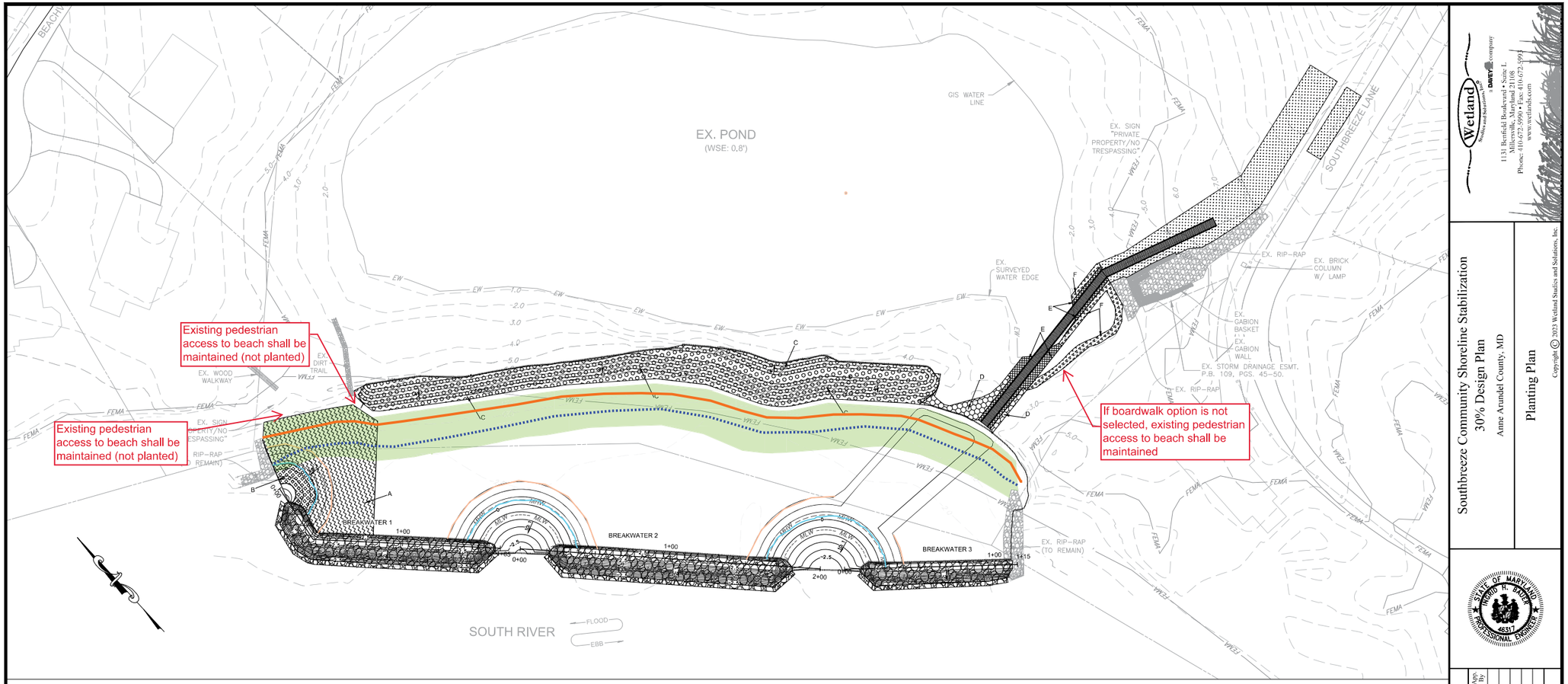
Boundary and Topo Source:
WSSI & Anne Arundel County Data

Design	Draft	Approved
IHB	MCJ	IHB

Sheet #
3 of 9

Computer File Name:

Wetlands 30% Design Package | Planting Plan



PLANTING AREAS

- ZONE A
- ZONE B
- ZONE C
- ZONE D
- ZONE E
- ZONE F
- TURFGRASS SEEDING

LEGEND

- PROPERTY BOUNDARIES
- EASEMENT BOUNDARIES
- EXISTING INFRASTRUCTURE
- 350 EXISTING CONTOURS (1.0')
- MHW EXISTING MEAN HIGH WATER LINE (0.3' EL.)
- MLW EXISTING MEAN LOW WATER LINE (-0.7' EL.)
- EW EX. POND EDGE OF WATER
- FEMA FEMA FLOODPLAIN
- PROPOSED GRADING (0.5')
- MHW PROPOSED MEAN HIGH WATER LINE (0.3' EL.)
- MLW PROPOSED MEAN LOW WATER LINE (-0.7' EL.)
- PROPOSED SAND FILL
- PROPOSED BREAKWATER
- PROPOSED BOARDWALK

Legend

- Fundamental 1.5' Elevation
- Fundamental MHW
- Fundamental Planting (optional)
- Enhanced (30%) 1.5' Elevation
- Enhanced (30%) MHW

30 15 0 30 60 90
SCALE: 1"=30'

Wetland Studies and Solutions, Inc. — a DAVEY company
1131 Benfield Boulevard • Suite L
Millersville, Maryland 21108
Phone: 410.672.5990 • Fax: 410.672.5993
www.wetlands.com

Southbreeze Community Shoreline Stabilization
30% Design Plan
Anne Arundel County, MD

Planting Plan

STATE OF MARYLAND — HOWARD H. HAINER — 4631 — PROFESSIONAL ENGINEER

REVISIONS

No.	Date	Description	Rev. By	App. By

SCALE: 1" = 30'
DATE: OCTOBER, 2023

Horizontal Datum: NAD 83
Vertical Datum: NAVD 88
Boundary and Topo Source: WSSI & Anne Arundel County Data

Design	Draft	Approved
HB	MCJ	HB

Sheet #
4 of 9

Computer File Name:

PLANTING SCHEDULE

PLANTING ZONES	ZONE	SPECIES	INDICATOR STATUS (AGCP)	INDICATOR STATUS (EMP)	WILDLIFE VALUE FUNCTIONS	PRIMARY SPECIES	PLANT PART	SEASON	PLANT SPACING	PLANTS PER ACRE	# OF PLANTS
A	BEACH/MARSH (-1' TO MHW)	SPARTINA ALTERNIFLORA (SALTMARSH CORDGRASS)	OBL	OBL	Food, shelter	Waterfowl, songbirds, small mammals	Seeds, leaves, flower	Spring, summer, fall			
B	BEACH/MARSH (MHW TO +2')	SPARTINA PATENS (SALTMEADOW CORDGRASS)	FACW	FACW	Food, shelter	Songbirds, waterfowl, small mammals, marshbirds	Seeds, leaves, flower	Spring, summer, fall			
		JUNCUS EFFUSUS (SOFT RUSH)	OBL	FACW	Food, shelter	Waterfowl, songbirds, small mammals, amphibians	Seeds, leaves, flower	Spring, summer, fall			
C, D	DUNE HERBACEOUS (+2' TO +5')	AMMOPHILA BREVILIGULATA (AMERICAN BEACHGRASS)	UPL	FACU	Food, shelter	Shorebirds, small mammals, insects	Seeds, leaves, flower	Spring, summer, fall			
		PANICUM AMARUM (COASTAL PANICGRASS)	FAC	FACU	Food, shelter	Songbirds, waterfowl, small mammals	Seeds, leaves, flower	Spring, summer, fall			
C, F	TREES/SHRUBS (+2' TO +5')	BACCHARIS HALIMIFOLIA (GROUNDSEL)	FAC	FACW	Food, cover	Birds, insect pollinators	Seeds, fruit	All			
		DIOSPYROS VIRGINIANA (PERSIMMON)	FAC	FAC	Food, cover	Fruit birds, small mammals, honey bees, luna moths	Seeds, fruit	All			
		LIQUIDAMBAR STYRACIFLUA (SWEET GUM)	FAC	FAC	Food, cover	Finches, cardinals, chickadees, sparrows, squirrels	Seeds, fruit	All			
		MORELLA PENSYLVANICA (NORTHERN BAYBERRY)	FAC	FAC	Food, cover	Songbirds, waterbirds, butterflies, Columbia's moth	Seeds, fruit	All			
		PRUNUS MARITIMA (BEACH PLUM)	UPL	UPL	Food, cover	Glossy ibises, small mammals, birds, pollinators	Seeds, fruit	All			
E, F	BOARDWALK	CAREX STRICTA (TUSSOCK SEDGE)	OBL	OBL	Food, shelter	Small birds, butterflies, Mulberry Wing butterfly, waterfowl	Seeds, leaves, flower, roots	Spring, summer, fall			
		CONOCLINIUM COELESTINUM (BLUE MISTFLOWER)	FAC	FAC	Food, shelter	Butterflies, bees, moths	Seeds, leaves, flower	Spring, summer, fall			
		JUNCUS EFFUSUS (SOFT RUSH)	OBL	FACW	Food, shelter	Waterfowl, songbirds, small mammals, amphibians	Seeds, leaves, flower	Spring, summer, fall			
		LOBELIA CARDINALIS (CARDINAL FLOWER)	FACW	FACW	Food, shelter	Songbirds, butterflies, hummingbirds	Seeds, leaves, flower	Spring, summer, fall			
		SCHIZACHYRIUM LITTORALE (SHORE LITTLE BLUESTEM)	FAC	FACW	Food, shelter	Songbirds, game birds, small mammals, butterflies	Seeds, leaves, flower	Spring, summer, fall			
		SOLIDAGO SEMPERVIRENS (SEASIDE GOLDENROD)	FACW	FACW	Food, shelter	Bees, birds, small mammals, monarch butterflies	Seeds, leaves, flower	Spring, summer, fall			

QUANTITIES AND SPACING TO BE SPECIFIED ON 60% DESIGN PLAN

Wetland Studies and Solutions, Inc. — a DAVEY company
1131 Benfield Boulevard • Suite L
Millersville, Maryland 21108
Phone: 410-672-5990 • Fax: 410-672-5993
www.wetlands.com

Southbreeze Community Shoreline Stabilization
30% Design Plan
Anne Arundel County, MD

Vegetation Schedule

REVISIONS

No.	Date	Description	Rev. By	App. By

DATE: OCTOBER, 2023 SCALE: N/A

Horizontal Datum: N/A
Vertical Datum: N/A
Boundary and Topo Source: N/A

Design	Draft	Approved
DMC	MCJ	IHB

Sheet # 5 of 9

Computer File Name:

DESIGN NARRATIVE

A. Background

The Southbreeze Shoreline Stabilization Project is located on a parcel owned by the Fishing Creek Farm (FCF) HOA. While a 1986 plat lists the property area as 4.6 acres, including a natural 2-acre pond, active shoreline erosion has shrunk the parcel to approximately 3.9 acres. The goal of the proposed project is to stop the ongoing detrimental erosion by restoring the beach and dune and adding protection for these features in the form of breakwaters. These steps will provide water quality and recreational benefits in addition to habitat benefits for the numerous species that visit the site throughout the year, including herons, osprey, other waterfowl, horseshoe crabs, and even the occasional terrapin.

The property is designated as Open Space and its use is limited to passive recreation as defined in the original FCF development plan and covenants. It has approximately 540 linear feet of tidal shoreline along the South River, which is comprised of a beach leading into a low, vegetated natural dune. The beach and dune serve as a divider between the river and the pond, helping to protect it as sheltered non-tidal habitat. A small portion of the shoreline at the southern end of the property is forested, as is most of the property behind the pond.

B. Site Conditions

The shoreline is eroding laterally at an average rate of 2.0 ft/yr. With each passing year, the beach and dune offer less protection to the pond and more of the trees along the southern shoreline are washed away. In 2016, erosive forces generated by severe weather breached the dune, leading to regular tidal exchange between the pond and the South River. Fortunately, over the next couple of years, sand filled in the breach and the pond is once again sheltered and non-tidal, connecting with the South River only during particularly high river flows or storm surges.

With increasing storm severity due to climate change, the likelihood of another pond breach also rises. Additionally, the ability of the beach and dune to self-heal again should that occur is questionable. Based on mapped shoreline and littoral drift conditions documented by Wang et al. (1982, Exhibit A), sediment supply for the Southbreeze site should travel upstream along the South River shoreline from the direction of the Chesapeake Bay. However, nearly the entire shoreline in that updrift direction has been hardened, which has severely limited the site's littoral sediment supply, interfering with the natural balance of sand at Southbreeze beach.

The following sections discuss in more detail findings of the site assessments and desktop analysis that feed into the engineering design.

1. Regulatory Considerations

Site assessments indicate that the project will not impact SAV or sensitive species. Wetlands have been delineated and WSSI has worked to minimize wetland impacts; permanent impacts are expected to be mitigated on site. While the project will require some tree removal, the project's net impact to the Chesapeake Bay Critical Area will be positive as it will stabilize the shoreline, protecting existing shore, nearshore forest, and pond habitat. Impacts to vegetation within the Critical Area will be offset with proposed vegetation on site.

2. Tides

WSSI used NOAA's Online Vertical Datum Transformation application (VDatum) to determine local tidal characteristics for the Southbreeze site (Table 1). This data is used in conjunction with topographic and bathymetric survey data to delineate jurisdictional limits, inform design elevations of constructed features, and determine the extents and species selected for planting.

The nearest NOAA Gauge Station is Station #8575512, Annapolis, MD, located at the U.S. Naval Academy on the Severn River, approximately 4.7 miles north of the Southbreeze site. The tidal characteristics of this station are shown in Table 2. WSSI will refer to records for this station for historic water level data and trends.

3. Fetch

Fetch is the distance wind travels over water in the generation of waves. During design, the two primary assessments of fetch considered are average fetch and longest fetch. In accordance with the *Living Shoreline Design Guidelines for Shore Protection in Virginia's Estuarine Environments* (Hardaway et al., 2017), WSSI calculated average fetch using five measurements, one perpendicular to the shoreline, and two additional measurements to either side that are 22.5° and 45° from perpendicular. The longest fetch is the farthest distance across open water in any direction. In the case of this site, the longest fetch coincides with the average fetch measurement 45° clockwise of perpendicular.

Due to the curved orientation of the shoreline at the Southbreeze site, fetch characteristics at the northern end differ significantly from those at the southern end, so WSSI assessed fetch for both ends of the project separately. Table 3 summarizes the results of WSSI's fetch assessment, and Exhibits B and C show the directions and distances measured during this analysis. WSSI initially performed the assessment from points on the shoreline, and once we determined the breakwater alignment, we repeated it from points along the alignment to confirm the values were still applicable offshore; there was no significant difference in the measurements taken from the proposed breakwater alignment.

The Southbreeze shoreline is considered to have medium to high\-\- exposure due to the range of average fetch results (Hardaway et al., 2017). WSSI used the fetch calculation results and historical wind observations to calculate the design wave for project features.

4. Winds

WSSI downloaded wind data records for the U.S. Naval Academy from the Iowa State University Iowa Environmental Mesonet (IEM) site, which works with various partners to compile environmental datasets and make them publicly available in one location (Iowa State University). IEM has data records available from December 1947 to present for the Maryland Automated Surface Observing System (ASOS) Station NAK, Annapolis, located on the Severn River, approximately 4.7 miles north of the Southbreeze site. WSSI analyzed data for the period between October 1, 1948, and September 30, 2023. WSSI selected a period starting October 1st and ending September 30th to provide equal representation of the seasonal variations in wind speed and direction, and we used as many full years of data as were available to include as many low-frequency events in our analysis as possible. Figure 1 shows a windrose plot, a visual summary of historical wind direction and speed, for the data within this period, and Table 4 summarizes the information in tabular form using slightly different wind speed categories. These show winds coming primarily from the south northwest, and west-northwest, and that roughly 42% of the winds from these directions were greater than 10 mph.

WSSI also analyzed wind data from NOAA's Chesapeake Bay Interpretive Buoy System's Annapolis buoy (NOAA Chesapeake), which is located in the middle of the mouth of the Severn River. We performed this analysis to verify whether winds collected at the Annapolis ASOS station could accurately represent conditions at the Southbreeze site, which is closer to the mouth of the South River. The Annapolis Interpretive Buoy has data records available from September 2010 to present, and we analyzed data between October 1, 2010, and September 30, 2023. Table 5 shows the percentage of wind readings by direction and speed at the Annapolis Interpretive Buoy for this period. WSSI's analysis shows that winds at the buoy also come primarily from the south, northwest, and west-northwest but that windspeeds tend to be slightly higher at the buoy compared to the more inland Naval Academy location. 40.5% of wind reading at the buoy were between 10 and 20 miles per hour, compared to only 26.5% of winds at the Naval Academy.

WSSI then analyzed average wind speed for the Naval Academy and Annapolis Buoy datasets, considering only readings greater than 5 mph to exclude winds that would cause only minor water surface disturbance. The results of this analysis are summarized in Table 6. WSSI used these average wind speeds in conjunction with fetch characteristics to calculate the design wave for the proposed breakwaters.

C. Engineering Design

WSSI used the results of the above analyses to perform several engineering analyses detailed below. These findings, in conjunction with the documented site conditions, were then used to establish the proposed site design.

1. Design Wave

The U.S. Army Corps of Engineers (USACE) produced nomographs that relate fetch, wind speed, and wind duration to significant wave height and peak spectral period (USACE, 1984). The significant wave height is the average height of the largest on third of waves. A wave period is the time it takes for two successive crests to pass a specified point, and the peak spectral period is the period associated with the highest-energy waves. While this nomograph was produced nearly 40 years ago, its use is still standard for predicting design wave characteristics, and WSSI used the Southbreeze site's average and longest fetch characteristics at both the north and south ends of the project in conjunction with the average wind speeds from those directions (both from the Naval Academy and the Annapolis Buoy) to evaluate design wave characteristics. Table 7 summarizes the results. To be conservative, WSSI assumed wind duration was sufficient to produce maximum height for the given speed and fetch; the duration listed in Table 7 is the minimum length of time the specified windspeed must be sustained to produce full-height waves.

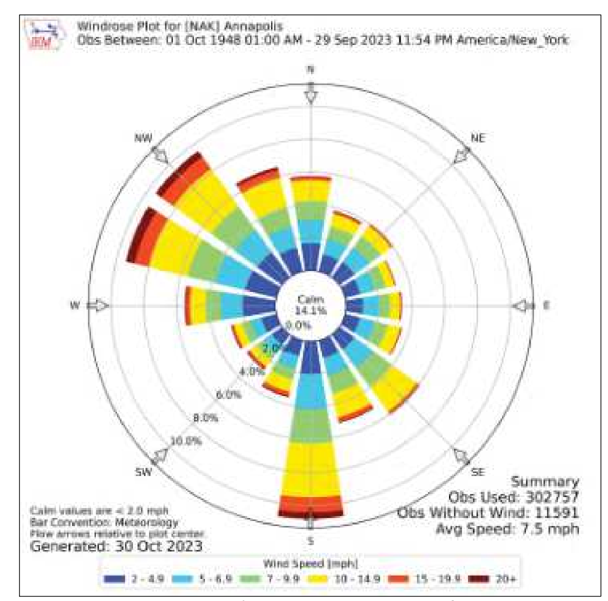


Figure 1 - Windrose plot of historical data at the U.S. Naval Academy for October 1, 1948, through September 30, 2023 (Iowa State University).

Wetland Studies and Solutions, Inc.® a DAVEY company
1131 Benfield Boulevard • Suite L
Millersville, Maryland 21108
Phone: 410-672-5990 • Fax: 410-672-5993
www.wetlands.com

Southbreeze Community Shoreline Stabilization
30% Design Plan
Anne Arundel County, MD

Design Narrative

STATE OF MARYLAND INGRID H. BAUER 46317 PROFESSIONAL ENGINEER

REVISIONS

No.	Date	Description	Rev. By	App. By

DATE: OCTOBER, 2023
SCALE: AS NOTED

Horizontal Datum: NAD 83
Vertical Datum: NAVD 88
Boundary and Topo Source: WSSI & Anne Arundel County Data

Design	Draft	Approved
IHB	MCJ	IHB

Sheet #
6 of 9

Computer File Name:
L:_Maryland\Projects\MD02000s\MD02100\MD2148.02\CADD 04-ENGR\10 0% Planset DESIGN NARRATIVE.dwg

It should be noted that the angle of winds from the WNW and NW is too oblique to the shore to produce impactful waves at the northernmost end of the site; however characteristics are such that the resulting waves for the southern assessment point can be applied to the full project length.

Significant wave heights ranged from 0.5 feet to 1.1 feet with the exception of those generated at the northern end of the site by winds from the south, which were approximately 2 feet. Further analysis showed that these 2-foot waves would break at a depth of approximately 4.5 feet, which is beyond the project area unless water levels are more than 1 foot above MHW. Waves resulting from the other sets of characteristics presented in Table 7 would reach the project area before breaking, so WSSI used characteristics for the largest of these to estimate wave runup on the proposed breakwater structures. Runup is the maximum elevation a wave reaches on a structure or shoreline relative to the still water level. Using the Delft Hydraulics equation (USACE, 2002) to calculate wave runup, WSSI calculated the average wave runup as 1.32 feet with only 2% of waves exceeding 1.82 feet of runup for the northern end of the site and an average wave runup of 0.97 feet with 2% of waves exceeding 1.35 feet for the southern end.

1. Breakwater Crest Elevations

WSSI selected design elevations for the Southbreeze breakwater crests by considering tide levels at the site, projected wave runup, and allowing freeboard to offset potential storm surges in the short term and sea level rise in the long term. WSSI also considered the elevation of the existing structure the proposed southern breakwater will tie into; since the southern end of the project has much shorter maximum and average fetches, WSSI has proposed a lower elevation for the southern sill. Table 8 summarizes the elevations and heights involved in the selection of breakwater heights.

2. Rock Sizing

The Virginia Department of Transportation (VDOT) Drainage Manual (VDOT, 2002) contains an extensive chapter dedicated to the design of Shore Protection. In the absence of similarly detailed guidance for Maryland agencies, WSSI referred to the VDOT Drainage Manual (2002) to determine preliminary rock size for the Southbreeze breakwaters. Based on the manual's Nomographs for Design of Rock slope Shore Protection (for Shoal Water) and for Riprap Size to Resist Wave action, WSSI preliminarily recommends using stone Maryland Class III riprap. Rock sizing may change with future design iterations.

3. Dune

The existing dune between the Southbreeze shoreline and the non-tidal pond has grown narrower over the course of the past 10 to 20 years and was even breached in 2016. The vegetated dune plays an important role in maintaining separation between the pond and the South River during high water events, and it also helps minimize windblown migration of sand into the pond. WSSI's proposed design brings the full length of the dune up to an elevation of 5 feet, matching the existing elevation of the portion that did not breach.

The proposed dune design maintains a lower elevation at the southern end of the pond as a planned area for overflow during infrequent high-water events where the South River floods into the pond. This area was selected because it has the lowest elevation under existing conditions and is the most sheltered portion of the shoreline with respect to potential wave exposure under proposed conditions. This area will be stabilized by planting dense herbaceous shoreline vegetation.

4. Boardwalk

Community members currently access the beach via an improvised boardwalk from Southbreeze Lane that skirts the stormwater riprap and gabion spreader and the pond. To provide safe, permanent access to the shoreline, WSSI proposes a permanent 6-foot-wide boardwalk from the northern side of the spreader, over the southern end of the pond, connecting to the southern end of the beach within the lower overflow area. A short span of similar construction can also be added to cross the riprap stormwater channel along Southbreeze Ln, though it appears to be outside of HOA property.

Table 1 - [illegible]

Tidal Characteristic	Feet (NAVD 88)
Mean Higher High Water (MHHW) Elevation	[illegible]
Mean High Water (MHW) Elevation	[illegible]
Mean Low Water (MLW) Elevation	[illegible]
Tide Range	[illegible]

Table 2 - [illegible]

Tidal Characteristic	Feet (NAVD 88)
Mean Higher High Water (MHHW) Elevation	[illegible]
Mean High Water (MHW) Elevation	[illegible]
Mean Low Water (MLW) Elevation	[illegible]
Tide Range	[illegible]

Table 3 - Fetch assessment results

Assessment Point	Fetch Characteristic	Distance (miles)	Longest Fetch Direction
North	Average Fetch	[illegible]	–
North	Longest Fetch	[illegible]	S
South	Average Fetch	[illegible]	
South	Longest Fetch	[illegible]	[illegible]

D. REFERENCES

Hardaway, Jr., C.S., et al. 2017. *Living Shoreline Design Guidelines for Shore Protection In Virginia's Estuarine Environment* (SRAMSOE #463). Gloucester Point, VA: Virginia Institute of Marine Science. https://doi.org/10.21220/V5CF1N.

Iowa State University, IEM. MD ASOS Station NAK, Annapolis. Last accessed October 2023, https://mesonet.agron.iastate.edu/sites/site.php?station=NAK&network=MD_ASOS.

NOAA. Chesapeake Bay Interpretive Buoy System, Annapolis. Last accessed October 2023, https://buoybay.noaa.gov/locations/annapolis.

NOAA. Datums for Station #8578812, Annapolis, MD. Last accessed October 2023, https://tidesandcurrents.noaa.gov/datums.html?id=8575512.

NOAA. VDatum. Last accessed October 2023, https://vdatum.noaa.gov/vdatumweb/.

USACE. 1984. *Shore Protection Manual.* Vol 1. Vicksburg, MS: Corps of Engineers Research Center, U.S. Army Corps of Engineers.

USACE. 2002. Coastal Engineering Manual. Vol VI. EM 1110-2-1100. Rev 2011. Washington, DC: U.S. Army Corps of Engineers.

USACE. 2002. Drainage Manual. *Chapter 13 - Shore Protection*. Rev. 2021. Last accessed October 2023, https://www.virginiadot.org/business/locdes/hydra-drainage-manual.asp.

Wang, H. et al. 1982. *An Assessment of Shore Erosion in Northern Chesapeake Bay and of the Performance of Erosion-Control Structures*. Annapolis, MD: Department of Natural Resources, Tidewater Administration.

Table 4 - [illegible]

Speed (mph)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
0	[illegible]	[illegible]	[illegible]	1.0	1.1	[illegible]	[illegible]	1.1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.0	[illegible]	[illegible]
0-5	[illegible]	[illegible]	[illegible]	1.9	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.6	1.1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
5-10	1.7	[illegible]	1.0	0.7	[illegible]	[illegible]	2.2	1.8	4.1	1.0	0.6	0.6	[illegible]	3.0	3.5	2.5	26.5
10-20	0.1	[illegible]	0.0	0.0	[illegible]	[illegible]	0.0	0.1	0.4	[illegible]	0.1	0.1	[illegible]	[illegible]	0.4	0.2	2.0
20-30	0.0	[illegible]	0.0	0.0	0.0	[illegible]	0.0	0.0	0.0	[illegible]	0.0	0.0	[illegible]	[illegible]	0.0	0.0	0.1
30-40	0.0	[illegible]	0.0	0.0	0.0	[illegible]	0.0	0.0	[illegible]	[illegible]	0.0	0.0	[illegible]	[illegible]	0.0	0.0	0.0
Total	20.4	4.1	4.3	3.5	5.8	3.6	6.2	5.3	10.6	3.4	2.5	2.6	5.2	8.7	9.0	6.6	100.0

Table 5 - [illegible]

Speed (mph)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
0	2.1	[illegible]	[illegible]	1.0	1.0	[illegible]	[illegible]	1.3	1.5	[illegible]	[illegible]	1.4	[illegible]	[illegible]	[illegible]	1.2	20.3
0-5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
5-10	1.8	[illegible]	[illegible]	1.8	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
10-20	0.2	0.4	0.4	0.2	0.1	0.1	[illegible]	0.2	0.4	0.2	[illegible]	[illegible]	0.5	[illegible]	[illegible]	0.4	4.9
20-30	0.0	[illegible]	[illegible]	0.0	0.0	[illegible]	[illegible]	0.0	0.0	[illegible]	[illegible]	0.0	0.0	[illegible]	[illegible]	0.0	0.2
30-40	0.0	[illegible]	[illegible]	0.0	0.0	[illegible]	[illegible]	0.0	0.0	[illegible]	[illegible]	0.0	0.0	[illegible]	[illegible]	0.0	0.0
Total	20.4	4.1	4.3	3.5	5.8	3.9	6.2	5.3	10.6	3.4	[illegible]	2.6	5.2	[illegible]	9.0	6.6	100.0

Table 6 - [illegible]

Site	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Overall Avg
Naval Academy	9.6	[illegible]	[illegible]	[illegible]	9.1	[illegible]	[illegible]	10.2	[illegible]	[illegible]	[illegible]	[illegible]	9.6	[illegible]	[illegible]	[illegible]	10.2
Annapolis Buoy	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Table 7 - [illegible]

Inputs					Outputs		
Assessment Point	Direction (Fetch and wind)	Fetch (mi)	Windspeed (mph)	Wind Data Source	Significant Wave Height (ft)	Peak Spectral Period (s)	Storm Duration (hr)
North	[illegible]	[illegible]	[illegible]	NAK	[illegible]	[illegible]	[illegible]
North	[illegible]	[illegible]	[illegible]	Buoy	[illegible]	[illegible]	[illegible]
North	S	[illegible]	[illegible]	NAK	1.9	[illegible]	[illegible]
North	S	[illegible]	[illegible]	Buoy	[illegible]	[illegible]	[illegible]
North	WNW / NW						
South	[illegible]	[illegible]	[illegible]	NAK	[illegible]	[illegible]	[illegible]
South	[illegible]	[illegible]	[illegible]	Buoy	0.6	1.8	[illegible]
South	S	[illegible]	[illegible]	NAK	0.8	[illegible]	[illegible]
South	S	[illegible]	[illegible]	Buoy	[illegible]	[illegible]	[illegible]
South	WNW / NW	[illegible]	[illegible]	NAK	[illegible]	[illegible]	[illegible]
South	WNW / NW	[illegible]	[illegible]	Buoy	[illegible]	[illegible]	[illegible]

Table 8 - [illegible]

Design Characteristic	Elevation / Height (ft, NAVD 88)
High Tide Elevations	
Mean Higher High Water (MHHW) Elevation	[illegible]
Mean High Water (MHW) Elevation	[illegible]
Breakwaters 1 and 2	
Design Wave Height	
Wave Runup, Average Height	[illegible]
Wave Runup, 2% Exceedance Height	[illegible]
Sill Design Elevation	2.8
Breakwater 3	
Design Wave Height	[illegible]
Wave Runup, Average Height	
Wave Runup, 2% Exceedance Height	[illegible]
Sill Design Elevation	2.0

Wetland Studies and Solutions, Inc.
1131 Benfield Boulevard • Suite L
Millersville, Maryland 21108
Phone: 410-672-5990 • Fax: 410-672-5993
www.wetlands.com

Southbreeze Community Shoreline Stabilization
30% Design Plan
Anne Arundel County, MD

Design Narrative (CONT.)

STATE OF MARYLAND · INGRID H. BAUER · 46317 · PROFESSIONAL ENGINEER

REVISIONS				
No.	Date	Description	Rev. By	App. By

DATE: OCTOBER, 2023 SCALE: AS NOTED

Horizontal Datum: NAD 83
Vertical Datum: NAVD 88
Boundary and Topo Source: WSSI & Anne Arundel County Data

Design	Draft	Approved
IHB	MCJ	IHB

Sheet # 7 of 9

Computer File Name: [illegible]

EXHIBIT A: SHORELINE CONDITIONS AND LITTORAL DRIFT

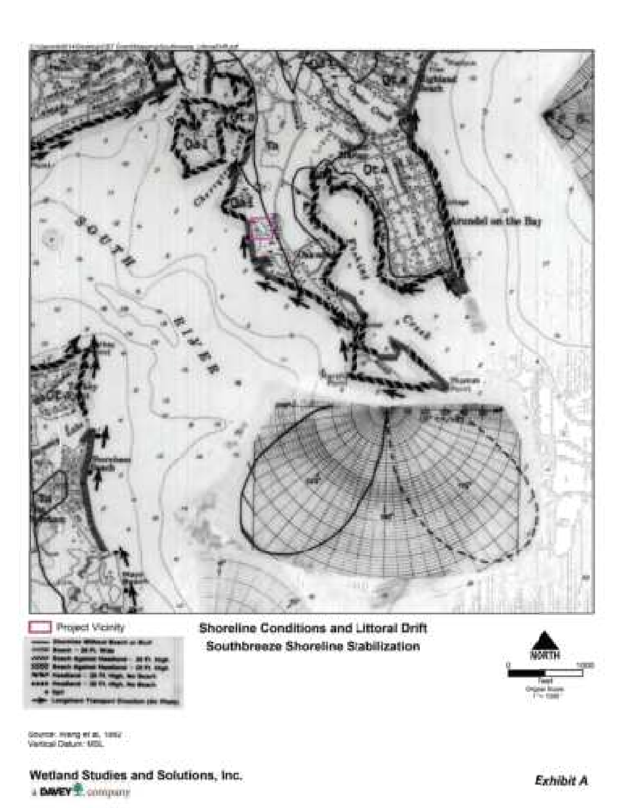


EXHIBIT B: SITE FETCH MAP - NORTH

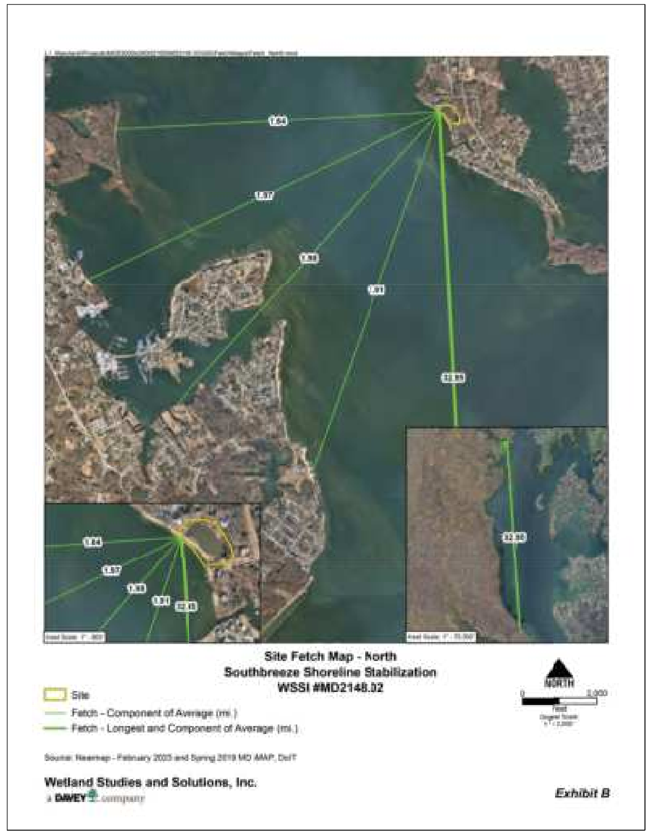
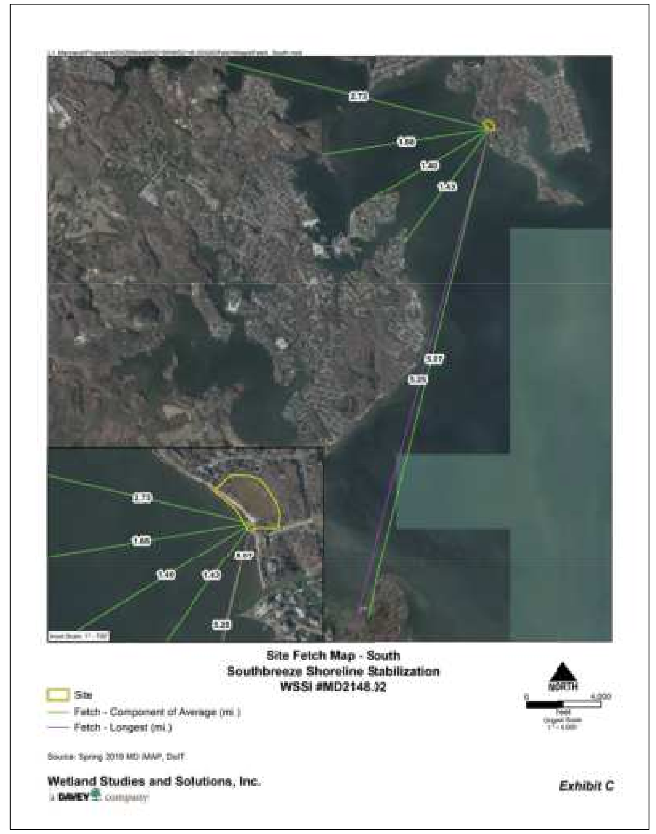


EXHIBIT C: SITE FETCH MAP - SOUTH



Wetland Studies and Solutions, Inc. a DAVEY company
1131 Benfield Boulevard • Suite L
Millersville, Maryland 21108
Phone: 410-672-5990 • Fax: 410-672-5993
www.wetlands.com

Southbreeze Community Shoreline Stabilization
30% Design Plan
Anne Arundel County, MD

Design Narrative Exhibits

STATE OF MARYLAND · INGRID H. BAUER · 46317 · PROFESSIONAL ENGINEER

REVISIONS

No.	Date	Description	Rev. By	App. By

DATE: OCTOBER, 2023
SCALE: AS NOTED

Horizontal Datum: NAD 83
Vertical Datum: NAVD 88
Boundary and Topo Source: WSSI & Anne Arundel County Data

Design	Draft	Approved
IHB	MCJ	IHB

Sheet #
8 of 9

Computer File Name:

EXHIBIT D: 1952 AERIAL IMAGERY

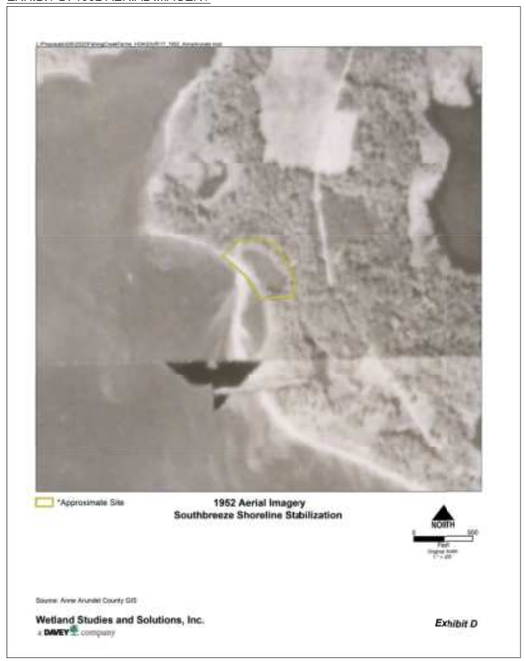


EXHIBIT E: FALL 2002 AERIAL IMAGERY

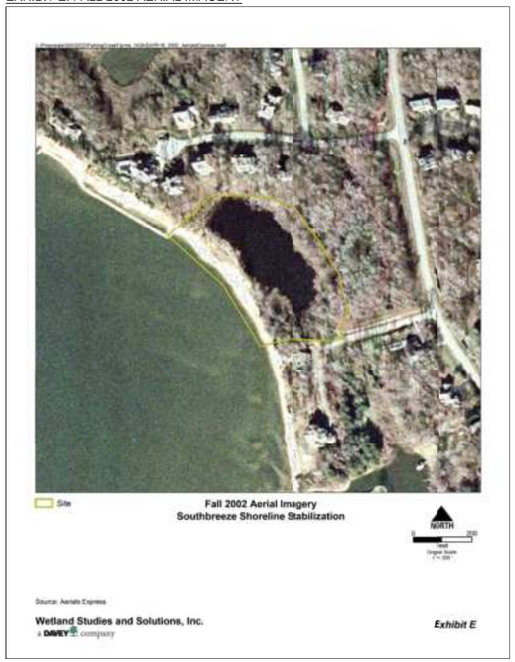


EXHIBIT F: FEBRUARY 2022 AERIAL IMAGERY

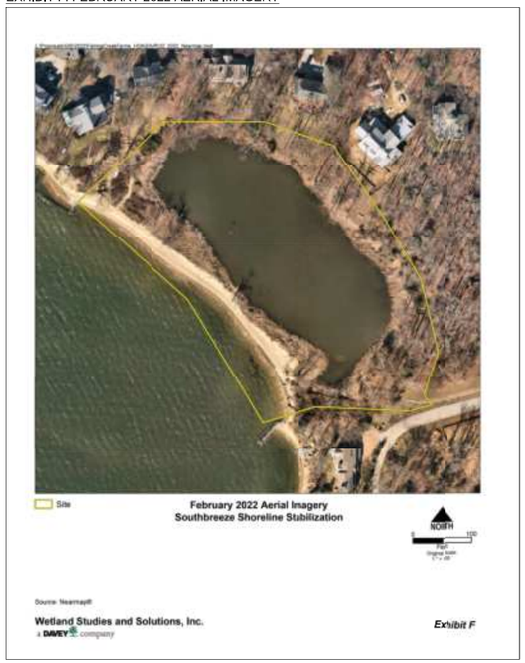


EXHIBIT G: FEMA FLOOD INSURANCE MAP

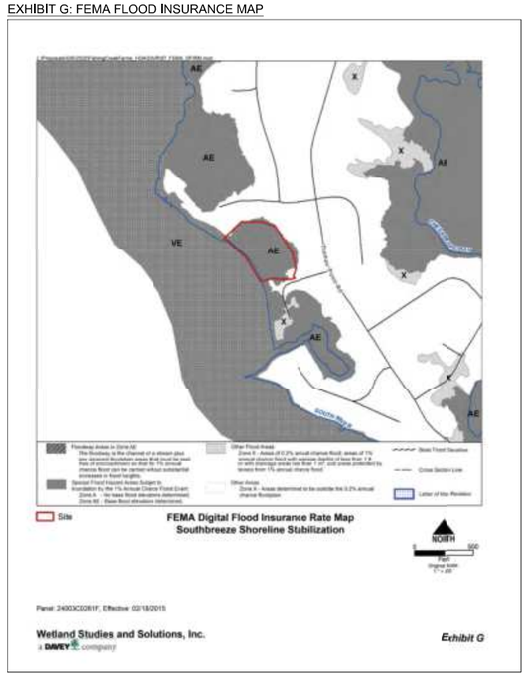
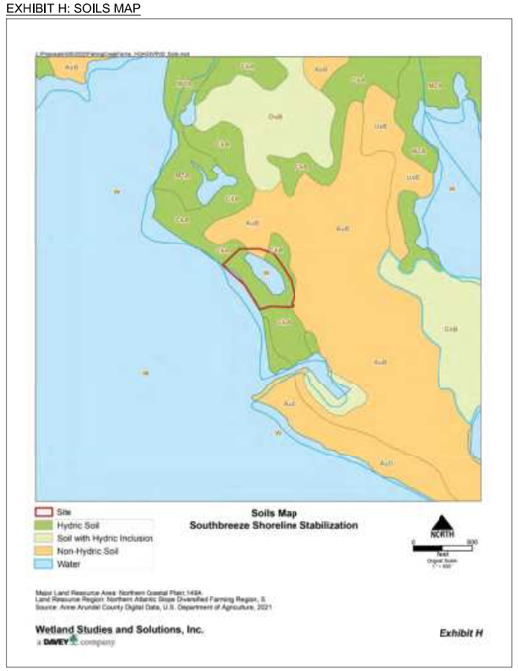


EXHIBIT H: SOILS MAP



FID	MUSYM	HYDRIC_RAT	muname	Acreage
0	AuB	0	Annapolis-Urban land complex, 0 to 5 percent slopes	0.001188442
1	AuB	0	Annapolis-Urban land complex, 0 to 5 percent slopes	0.002049741
2	AuB	0	Annapolis-Urban land complex, 0 to 5 percent slopes	0.202204186
3	CkA	95	Colemantown fine sandy loam, 0 to 2 percent slopes	2.731405271
4	W	0	Water	0.117566341
5	W	0	Water	1.328014745

Wetland Studies and Solutions, Inc. a DAVEY company
1131 Benfield Boulevard • Suite L
Millersville, Maryland 21108
Phone: 410.672.5990 • Fax: 410.672.5993
www.wetlands.com

Southbreeze Community Shoreline Stabilization
30% Design Plan
Anne Arundel County, MD

Design Narrative Exhibits (CONT.)

STATE OF MARYLAND · INGRID H. BYRDEN · 46317 · PROFESSIONAL ENGINEER

REVISIONS

No.	Date	Description	Rev. By	App. By

SCALE: AS NOTED
DATE: OCTOBER, 2023

Horizontal Datum: NAD 83
Vertical Datum: NAVD 88
Boundary and Topo Source: WSSI & Anne Arundel County Data

Design	Draft	Approved
IHB	MCJ	IHB

Sheet # 9 of 9

Computer File Name:

South Breeze Beach + Pond | Wild Life Listing

BIRDS *(Resident - Birds on and around Pond)*

- Mallard Ducks
- Canada geese - resident & migratory
- Great Blue Heron
- Belted Kingfisher
- Mourning Dove
- Bald Eagle
- Cooper's Hawk
- Red-tailed Hawk
- Eastern Screech Owl
- Great Horned Owl
- Barred Owl
- Red-bellied Woodpecker
- Downy Woodpecker
- Northern Flicker
- Pileated Woodpecker
- Blue Jay
- American Crow
- Black-capped Chicadee
- Tufted Titmouse
- Red-breasted Nuthatch
- White-breasted Nuthatch
- Carolina Wren
- Eastern Bluebird
- American Robin
- Northern Mockingbird
- European starling
- House Sparrow
- House Finch
- American Goldfinch
- Red-winged Blackbird
- Common Grackle
- Northern Cardinal

BIRDS *(Summer/migratory)*

- Wood Ducks
- Ruby-throated Hummingbird
- Great Egret
- Snowy Egret
- Green Heron
- Black-crowned Night Heron
- Osprey*
- Eastern Wood-Pewee
- Flycatcher (not sure of species)
- Barn Swallow
- Yellow-throated Warbler
- Black-throated Green Warbler

BIRDS *(Winter/Spring/Migratory)*

- American Wigeon
- Green-winged Teal
- American Bittern
- Hooded Merganser
- Cedar Waxwing
- Purple Finch
- Dark-eyed Junco
- White-throated Sparrow
- Eastern Towhee

BIRDS *(Rare)*

- Eastern Whip-poor-will

MAMMALS

- Raccoon
- Eastern Grey Squirrels
- Opossum
- Southern Flying Squirrels
- River Otters (historical)
- Red Fox
- Muskrat
- Eastern Cottontail
- White-tailed Deer

AMPHIBIANS

- Wood Frog
- American Bullfrog
- Leopard Frog
- Spring Peeper
- Green Tree Frog
- Blue-tailed Skink

REPTILES

- Common Black Snake
- Garter Snake
- Northern Water Snake
- King Snake
- Common Snapping Turtle
- Red-eared Slider - none observed since early spring

Thank you.