# SOUTHBREEZE COMMUNITY SHORELINE STABILIZATION FINAL DESIGN PLAN SEQUENCE OF CONSTRUCTION:

#### **GENERAL NOTES**

- 1. OWNER/DEVELOPER/ **FISHING CREEK FARMS HOA** ESC APPLICANT 1222 CHERRY TREE LANE ANNAPOLIS, MD 21403 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: TOTAL SITE AREA: 3.90 ACRES TOTAL DISTURBED AREA\*: 2.05 ACRES TOTAL AREA TO BE VEGETATIVELY STABILIZED: 1.08 ACRES TOTAL AREA TO BE PERMANENTLY STABILIZED: 2.05 ACRES TOTAL PROPOSED IMPERVIOUS 0.0 ACRES 6. RIVER: SOUTH RIVER WATERSHED: SOUTH RIVER MD 8-DIGIT BASIN CODE: 02131003 02060004 8-DIGIT HUC: 0.3 FT MEAN HIGH WATER (MHW) MEAN LOW WATER (MLW): -0.7 FT
- STREAM USE CLASS IS USE II, NO INSTREAM WORK IS PERMITTED DURING THE PERIOD OF FEBRUARY 15 THROUGH JUNE 15, INCLUSIVE, DURING ANY GIVEN YEAR.
- THE SITE IS AN ASSUMED HISTORIC WATERFOWL CONCENTRATION AREA. NO INSTREAM CONSTRUCTION ACTIVITY IS PERMITTED WITHIN THE BOUNDARIES OF A HISTORIC WATERFOWL CONCENTRATION AREA DURING THE PERIOD OF NOVEMBER 15 THROUGH MARCH 1. INCLUSIVE, DURING ANY GIVEN YEAR, EXCEPT FOR MARSH RESTORATION LESS THAN OR EQUAL TO 375 FEET IN LENGTH.
- 10. REFER TO PERMITS FOR CONFIRMATION OF TIME OF YEAR RESTRICTIONS.
- 11. CONSTRUCTION SHALL BE LIMITED TO NO MORE THAN 20 ACRES OF DISTURBANCE AT ANY TIME
- 12. NO OTHER WORK OUTSIDE OF THE SHOWN LIMITS OF DISTURBANCE AND LIMITS OF PLANTING SHALL TAKE PLACE
- 13. ALL STAGING/STOCKPILE AREAS, SOIL BORROW, AND SPOIL SITES MUST HAVE AN APPROVED EROSION AND SEDIMENT CONTROL PLAN AND A VALID GRADING PERMIT.

#### **CONSULTANT'S 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 # <u>46317</u>

MD Land Surveyor License # \_\_\_\_

MD Landscape Architect # \_\_\_\_ <sub>Name</sub> Ingrid Bauer, P.E.

Firm Name Wetland Studies & Solutions, Inc.

Address 1131 Benfield Blvd. Suite L

City <u>Millersville</u> State <u>MD</u> Zip Code 21108

# SEAL NING

#### SHEET INDEX COVER SHEET 2 CONSTRUCTION NOTES AND TOLERANCES 3 GRADING PLAN 4 CROSS SECTIONS AND BREAKWATER PROFILE 5 CONSTRUCTION DETAILS 6 EROSION AND SEDIMENT CONTROL PLAN EROSIONS AND SEDIMENT CONTROL DETAILS 8 PLANTING PLAN PLANTING AND SEEDING NOTES AND DETAILS 9 10 VEGETATION SCHEDULE

- PEDESTRIAN ACCESS DETAILS AND SPECIFICATIONS 11
- **12-14 DESIGN NARRATIVE**

ANNE ARUNDEL COUNTY, MARYLAND



SOURCE: ADC 2008-2012 **USED WITH PERMISSION** 

> VICINITY MAP SCALE: 1" = 1000'

#### 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 shall 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

Name

Print

Dure
Dure

Title: Affiliation: Address: Telephone Number: Email Address:

- 1. NOTIFY THE ANNE ARUNDEL COUNTY DEPARTMENT OF INSPECTIONS AND PERMITS (410-222-7780) AT LEAST 48 HOURS BEFORE COMMENCING WORK. WORK MAY NOT COMMENCE UNTIL THE PERMITTEE OR THE RESPONSIBLE PERSONNEL HAVE MET ON SITE WITH THE EROSION AND SEDIMENT (ESC) CONTROL INSPECTOR TO REVIEW THE APPROVED PLANS. (1 DAY)
- 2. PRIOR TO THE START OF ANY EARTH DISTURBANCE, THE CONTRACTOR SHALL NOTIFY THE U.S. ARMY CORPS OF ENGINEERS (USACE) AND MARYLAND DEPARTMENT OF THE ENVIRONMENT (MDE) IN ACCORDANCE WITH THE APPROVED PERMITS. IN ADDITION, AN ON-SITE PRE-CONSTRUCTION MEETING SHALL BE HELD TO ENSURE THAT ALL AFFECTED PARTIES (AT A MINIMUM: PROJECT OWNER, DESIGN ENGINEER, CONTRACTOR, USACE, MDE, AND ANNE ARUNDEL COUNTY DEPARTMENT OF INSPECTIONS AND PERMITS) FULLY UNDERSTAND THE CONSTRUCTION SEQUENCING. (1 DAY)
- A. PROJECT OWNER REPRESENTATIVE SEE CONSTRUCTION CONTRACT FOR CONTACT
- B. DESIGN ENGINEER (WSSI) 410-672-5990

  - 3. THE CONTRACTOR SHALL BE RESPONSIBLE FOR CONTACTING MISS UTILITY AT 1-800-257-7777 FOR THE LOCATION OF ALL PUBLIC AND PRIVATE UTILITY LINES, PIPES, CABLES, AND ASSOCIATED FEATURES PRIOR TO ANY CONSTRUCTION WORK; ALL UTILITIES SHALL BE CLEARLY IDENTIFIED PRIOR TO CONSTRUCTION. (1 DAY)
  - 4. STAKE OUT THE LIMITS OF DISTURBANCE (LOD) AS SHOWN ON THE ESC PLAN USING STAKES AND FLAGGING PRIOR TO THE CLEARING OF TREES, INSTALLATION OF ESC MEASURES, OR OTHER EARTH DISTURBING ACTIVITIES. AS APPLICABLE, CLEARLY MARK AREAS TO BE PROTECTED. THE LOD AND EXISTING CONDITIONS MUST BE APPROVED BY THE SEDIMENT CONTROL INSPECTOR PRIOR TO COMMENCING WORK. (1 DAY)
  - 5. PRIOR TO ANY EARTH DISTURBING ACTIVITIES, ALL TERRESTRIAL PERIMETER ESC MEASURES AND DEVICES SHALL BE INSTALLED AS SPECIFIED ON THE ESC PLAN SHEETS. CLEAR THE MINIMUM AREA NECESSARY TO INSTALL SEDIMENT CONTROL AND STAGING AREA.
  - A. INSTALL SUPER SILT FENCE (SSF) ON POND SIDE OF SITE, JUST INSIDE THE LOD. (1 DAY) B. INSTALL TEMPORARY ORANGE CONSTRUCTION FENCE ALONG ANY PORTION OF LOD THAT DOES NOT HAVE SSF AND IS ABOVE 1.5' ELEVATION. (1 DAY)
  - C. FLAG PLANNED ANCHOR POINTS FOR TURBIDITY CURTAIN. (1 DAY)
- 6. ONCE TERRESTRIAL PERIMETER SEDIMENT CONTROLS HAVE BEEN INSTALLED, CONTACT THE SEDIMENT CONTROL INSPECTOR FOR APPROVAL PRIOR TO COMMENCING WORK. (1 DAY)
  - 7. PRIOR TO ANY ADDITIONAL EARTH DISTURBING ACTIVITIES, ALL REMAINING NECESSARY ESC MEASURES AND DEVICES SHALL BE INSTALLED AS SPECIFIED ON THE ESC PLAN SHEETS. CLEAR THE MINIMUM AREA NECESSARY TO INSTALL SEDIMENT CONTROL AND STAGING AREA.
  - A. INSTALL STABILIZED CONSTRUCTION ENTRANCE (SCE). (1 DAY) B. IF CONTRACTOR PLANS TO USE THE STAGING AND STOCKPILING AREA, INSTALL TEMPORARY ACCESS WATER CROSSING AND ESTABLISH STAGING/STOCKPILE AREA. THIS AREA SHALL BE FOR TEMPORARY USE ONLY AND SHALL BE RETURNED TO EXISTING CONDITIONS AT THE END OF CONSTRUCTION. (1 DAY)
  - D. INSTALL TURBIDITY CURTAIN. (1 DAY)
  - 8. ALL NECESSARY ESC AND TREE PROTECTION MEASURES MUST BE IMPLEMENTED PRIOR TO THE COMMENCEMENT OF GRADING WORK AND MAINTAINED THROUGH THE COMPLETION OF CONSTRUCTION UNLESS OTHERWISE DIRECTED BY AN ENGINEER OR SEDIMENT CONTROL INSPECTOR
  - 9. STAKE OUT THE BREAKWATER ALIGNMENT AS SHOWN ON THE GRADING PLAN. (1 DAY) 10. INSTALL STONE BREAKWATERS ACCORDING TO LOCATIONS, ELEVATIONS, AND CONSTRUCTION DETAILS SHOWN ON PLANS (20 DAYS):
  - A. DIG TRENCH FOR STONE TOE WITHIN AREA OF PLANNED WORK.
  - B. LAY GEOTEXTILE ON EXISTING GRADE AND WITHIN TRENCH IN ACCORDANCE WITH CONSTRUCTION DETAIL
  - C. CONSTRUCT THE BREAKWATER CORE IN ACCORDANCE WITH THE GRADING PLAN, SECTIONS, PROFILE, AND CONSTRUCTION DETAIL
  - D. CONSTRUCT THE STONE TOE AND BREAKWATER ARMOR LAYER IN ACCORDANCE WITH THE GRADING PLAN AND CONSTRUCTION DETAIL.
  - E. CHINK VOIDS.

  - 11. AS APPLICABLE, SELECTIVELY REMOVE TREE STUMPS AND BRUSH WITHIN THE LIMITS OF DISTURBANCE. CLEAR THE MINIMUM AREA NECESSARY TO ACHIEVE PROPOSED DESIGN. (2 DAYS)
  - 12. STAKE OUT THE DUNE REFERENCE POINTS AS SHOWN ON THE GRADING PLAN. (1 DAY) 13. CONSTRUCT DUNE AND BERM ACCORDING TO LOCATIONS, ELEVATIONS, AND CONSTRUCTION DETAILS SHOWN ON PLANS (15 DAYS).
  - 14. ONCE CONSTRUCTION OF BREAKWATER, DUNE, AND BERM IS COMPLETE, PERFORM AN INITIAL INSPECTION OF THESE FEATURES WITH THE ENGINEER AND PROJECT OWNER. REPAIR AND ADDRESS DEFICIENCIES IDENTIFIED DURING THE INSPECTION. (5 DAYS) 15. AFTER PLACEMENT, ALL GRADED ZONES SHALL BE ALLOWED TO ADJUST INTO FINAL POSITION BY TIDAL AND WAVE ACTION. PLANTING ACTIVITIES SHALL BE PERFORMED A MINIMUM OF TWO WEEKS AFTER SAND PLACEMENT. (10 DAYS)

  - 16. WITH APPROVAL OF THE COUNTY INSPECTOR, REMOVE ESC ONLY AS REQUIRED TO INSTALL GEOGRID PEDESTRIAN ACCESS. RESTORE GRADES WITHIN THIS AREA AS NECESSARY. INSTALL PEDESTRIAN ACCESS IN ACCORDANCE WITH GRADING PLAN, DETAILS. AND SPECIFICATIONS. NO HEAVY MACHINERY SHALL BE DRIVEN ON GEOGRID PEDESTRIAN ACCESS. (5 DAYS)
  - 17. INSTALL ALL LANDSCAPING IN CONFORMANCE WITH THE LANDSCAPE PLAN SHEETS. (5 DAYS)
  - 18. REMOVE TRASH AND EXCESS MATERIALS FORM SITE. (1 DAY)
  - 19. CONDUCT FINAL INSPECTION PRIOR TO DE-MOBILIZING FROM THE SITE. REPAIR AND ADDRESS DEFICIENCIES IDENTIFIED DURING THE FINAL INSPECTION WITHIN 5 DAYS OF RECEIPT PUNCH LIST. (10 DAYS)
  - 20. UPON APPROVAL OF COUNTY INSPECTOR, REMOVE ESC MEASURES. (1 DAY)

MISS UTILITY CALL "MISS UTILITY" AT 1-800-257 PRIOR TO THE START OF WORK. MUST NOTIFY ALL PUBLIC UTILIT UNDER GROUND FACILITIES IN T PROPOSED EXCAVATION AND HA FACILITIES LOCATED BY THE UTIL PRIOR TO COMMENCING EXCAVA

- C. USACE SEE PERMIT FOR CONTACT
- D. MDE INSPECTION AND COMPLIANCE 410-537-3510
- E. ANNE ARUNDEL COUNTY DEPARTMENT OF INSPECTIONS AND PERMITS 410-222-7780

- C. CLEAR PATH FOR ACCESS ROAD, THEN INSTALL ROAD AND ASSOCIATED SSF. (1 DAY)
- F. TRIM AND KEY-IN GEOTEXTILE IN ACCORDANCE WITH THE CONSTRUCTION DETAIL.

-7777,401100K3	
THE EXCAVATOR	
Y COMPANIES WITH	
HE AREA OF	
AVE THOSE	
LITY COMPANIES	
ATION.	

	(Wetland)	Studies and Solutions, Inc.®	1131 Benfield Boulevard • Suite L Milloweille Mosellond 21108	Phone: 410-672-5990 • Fax: 410-672-5993	www.wetlandstudies.com	that of the way and the start of the	
Southbreeze Community Shoreline Stabilization	Final Design Plan		Anne Arundel County, Maryland			COVER SHEEL	Copyright (C) 2024 Wetland Studies and Solutions, Inc.
MAP DI			al marting the marting of the	11/5500AL EVG 4/17/2024	Professional Certification   hereby certify that these	documents were prepared or approved by me, and that I am a duly licensed professional engineer under the	laws of the State of Maryland, License No. 46317, Expiration Date: 12/29/2024.
REVISIONS	otion Rev. App. By By						SCALE: AS NOTED
	No. Date Descri						DATE: APRIL 2024
Horiz	zontal	Dati	ım:	NA	D83		
Verti Boun	dary	atum	: Горс	NA So	vD8 urce	58 :: 	
w SSI	& Ani	ne Ar	unde		unty	Data	ved
IH	B	N	/CJ		[	HB	
		S 1	sheet	:# 1 ∕	1		
Comp	outer F	I ile N	ame	14	r		

#### GENERAL NOTES:

- 1. PLANS ARE HORIZONTALLY REFERENCED TO THE NORTH AMERICAN DATUM OF 1983, MARYLAND STATE PLANE, U.S. SURVEY FOOT (MD83F) AND VERTICALLY REFERENCED TO THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88).
- 2. EXISTING TOPOGRAPHIC AND BATHYMETRIC CONDITIONS DISPLAYED ON THE PLANS WITHIN THE PROJECT AREA ARE FROM A FIELD RUN GROUND SURVEY PERFORMED ON JULY 19 & 20, 2023. IT IS DISPLAYED AT 1' CONTOUR INTERVALS. THE INFORMATION SHOWN IS TO BE EXCLUSIVELY USED FOR THE SHORELINE STABILIZATION DESIGN. EXISTING CONDITIONS AT THE TIME OF CONSTRUCTION MAY VARY FROM THE SURVEY DUE TO ONGOING EROSION AT THE SITE.
- 3. THE BOUNDARY AND EXISTING EASEMENT INFORMATION WAS COMPILED FROM EXISTING LAND RECORDS SUPPLIED TO WSSI BY THE CLIENT AND DOES NOT REPRESENT THE RESULTS OF AN ACTUAL FIELD RUN BOUNDARY SURVEY.
- 4. TOPOGRAPHIC CONTOUR DATA OUTSIDE THE SURVEYED AREA WAS DERIVED FROM LIDAR DATA PRODUCED FOR THE USGS AND FEMA IN 2011, IT I DISPLAYED AT 2' CONTOUR INTERVALS.
- 5. FLOODZONE DATA IS SOURCED FROM 2015 FEMA DIGITAL FLOOD INSURANCE RATE MAPS, INSERTED IN MD83D COORDINATES.
- 6. THE TIDAL DATUM ELEVATIONS, MEAN HIGH WATER (MHW) AND MEAN LOW WATER (MLW), WERE OBTAINED USING NOAA'S ONLINE VERTICAL DATA TRANSFORMATION TOOL, VDATUM ONLINE, ACCESSED OCTOBER 2023, USING LATITUDE: 38.9191320084 AND LONGITUDE: -76.4786642350.
- 7. ALL OTHER DATA IS SOURCED FROM ANNE ARUNDEL COUNTY DIGITAL DATA.
- 8. THE PRIMARY WORK HOURS FOR DELIVERIES AND OPERATION OF HEAVY MACHINERY SHALL BE BETWEEN 8AM AND 6PM, MONDAY THROUGH FRIDAY. IF CONTRACTOR WISHES TO OPERATE HEAVY MACHINERY OR RECEIVE DELIVERIES OUTSIDE OF THIS TIMEFRAME, THEY SHOULD REQUEST THIS THROUGH THE PROJECT OWNER AT LEAST 24 HOURS IN ADVANCE.
- 9. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE REPAIR OR REPLACEMENT OF ALL PUBLIC AND PRIVATE FEATURES DAMAGED AS A RESULT OF PROJECT CONSTRUCTION. FEATURES INCLUDE, BUT ARE NOT LIMITED TO: ROADWAYS, ROADWAY SHOULDER, RIPRAP SWALES, STORMWATER FEATURES, PRIVATE SHORELINE FEATURES, AND EXISTING BRICK COLUMN. REPAIR OF ROADWAY AND SWALE SHALL MATCH EXISTING IN MATERIAL AND CONSTRUCTION. DETERMINATION OF WHETHER A REPAIR ORE REPLACEMENT IS ACCEPTABLE SHALL BE MADE BY THE ENGINEER, PROJECT OWNER, OR OWNER OF THE PARTICULAR FEATURE. PRIOR TO MOBILIZATION, CONTRACTOR SHOULD PHOTOGRAPHICALLY DOCUMENT EXISTING CONDITIONS.
- 10. THE CONTRACTOR SHALL REMOVE ANY/ALL REFUSE FROM THE WORK AREA. THIS REFUSE SHALL BE HAULED OFF SITE AND DISPOSED OF AT APPROVED SITE.

#### GRADING NOTES

- 1. THIS PROJECT IS BEING AUTHORIZED UNDER A USACE INDIVIDUAL PERMIT AND MDE LETTER OF AUTHORIZATION. REFER TO PERMITS, AUTHORIZATIONS, AND APPROVALS FROM USACE, MDE, AND ANNE ARUNDEL COUNTY FOR ADDITIONAL CONDITIONS.
- 2. CONTRACTOR SHALL COORDINATE SITE ACCESS WITH ENGINEER AND PROJECT OWNER PRIOR TO CONSTRUCTION.
- 3. CONTACT MISS UTILITY (800-257-7777 OR 811) PRIOR TO COMMENCING ANY WORK.
- THE EXISTING UTILITIES SHOWN ON THE SURVEY WERE TAKEN FROM THE BEST AVAILABLE INFORMATION AND ARE NOT GUARANTEED TO BE ACCURATE. FIELD CONDITIONS MAY VARY. THE CONTRACTOR SHALL LOCATE AND PROTECT ALL EXISTING UTILITIES, SURFACES, AND SITE FEATURES PRIOR TO CONSTRUCTION.
- EXISTING CONDITIONS AT THE TIME OF CONSTRUCTION MAY VARY SIGNIFICANTLY FROM THE SURVEY DUE TO ONGOING EROSION AT THE SITE. GPS SURVEY BY WSSI ON FEBRUARY 17, 2024, INDICATED ELEVATIONS ALONG THE DUNE CREST WERE HALF A FOOT OR MORE LOWER THAN AT THE TIME OF THE EXISTING CONDITIONS SURVEY.
- CONTRACTOR SHALL REVIEW AND CONFIRM THE EXISTING CONDITIONS AND SUBSOIL SUPPORTING QUALITIES PRIOR TO PREPARING A PROPOSAL AND SHALL INCLUDE IN THE SUBMITTED BID ESTIMATE ANY AND ALL CHANGES THAT WOULD BE NECESSARY TO FULLY ACCOMPLISH THE SHOWN CONSTRUCTION.
  - A. IT SHOULD BE EXPECTED THAT SOME SETTLEMENT AND DISPLACEMENT OF THE STONE STRUCTURES MAY OCCUR DURING CONSTRUCTION AND SHOULD BE TAKEN INTO ACCOUNT IN DETERMINING THE TOTAL VOLUME OF STONE REQUIRED. NO ADDITIONAL PAYMENT WILL BE MADE FOR ADDITIONAL STONE REQUIRED DUE TO SETTLEMENT OR DISPLACEMENT.
  - B. FINAL VOLUME OF SAND FILL FOR BEACH AND DUNE MAY BE REVISED ONCE AFTER CONTRACT AWARD. THIS CHANGE IN QUANTITY MUST BE SUBMITTED TO PROJECT OWNER WITH JUSTIFICATION AT LEAST ONE MONTH PRIOR TO MOBILIZATION. NO SAND PLACEMENT SHALL OCCUR PRIOR TO WRITTEN APPROVAL OF REVISED QUANTITY FROM PROJECT OWNER.
- THE SOURCE MATERIAL USED FOR SAND FILL MUST BE QUALITY BEACH SAND. GRAINS SHALL BE ROUND OR SEMI-ROUND WITH A MEDIAN DIAMETER THAT IS THE SIZE OR SLIGHTLY LARGER (+/- 0.3 MM) THAN THAT OF THE NATIVE BEACH MATERIAL. SAND SHALL BE FREE FROM PERCEPTIBLE AMOUNTS OF WOOD AND DEBRIS. IT SHALL BE FREE OF FROST AT THE TIME OF PLACEMENT AND SHALL NOT CONTAIN MARL OR OTHER ELEMENTS WHICH TEND TO KEEP IT IN A PLASTIC STATE. SAND MATERIAL SHALL HAVE NO MORE THAN 10% PASSING A #100 SIEVE AND NO MORE THAN 5% PASSING A #200 SIEVE.
- 8. NO FILLS MAY BE PLACED ON FROZEN GROUND. EVERY EFFORT SHALL BE MADE TO PERFORM SAND GRADING WORK BELOW MHW DURING LOW TIDE. ALL FILL IS TO BE PLACED IN APPROXIMATELY HORIZONTAL LAYERS, EACH LAYER HAVING A LOOSE THICKNESS OF NOT MORE THAN 8 INCHES. ALL COMPACTION REQUIREMENTS ARE IN ACCORDANCE TO ANNE ARUNDEL COUNTY STANDARD SPECIFICATIONS FOR CONSTRUCTION AS AS THE AA COUNTY DESIGN MANUAL AND STANDARD DETAILS. ALL FILLS SHALL BE COMPACTED SUFFICIENTLY SO AS TO BE STABLE AND PREVENT EROSION AND SLIPPAGE.
- 9. EVERY EFFORT SHALL BE MADE TO PERFORM SAND GRADING WORK BELOW MHW DURING LOW TIDE.
- 10. LOCATION OF TIE-IN WITH EXISTING GRADE WILL VARY BASED ON CONDITIONS IN THE FIELD AT THE TIME OF CONSTRUCTION.
- 11. THE CONTRACTOR SHALL MAINTAIN STRUCTURES UNTIL THEY ARE ACCEPTED AND ANY MATERIAL DISPLACED BY ANY CAUSE SHALL BE REPLACED AT THE CONTRACTOR'S EXPENSE TO THE LINES AND GRADES SHOWN ON THE DRAWINGS.
- 12. PROVIDE STABLE CONNECTION WITH EXISTING GRADES. PROPOSED GRADING SHALL TIE INTO EXISTING GRADE AT THE SLOPES INDICATED ON THE PLANS, LOCATION OF FILL EXTENTS VARY FROM THAT SHOWN IN THE PLANS BUT SHALL STAY WITHIN THE LOD.
- 13. THE CONTRACTOR SHALL MAINTAIN STRUCTURES UNTIL THEY ARE ACCEPTED AND ANY MATERIAL DISPLACED BY ANY CAUSE SHALL BE REPLACED AT THE CONTRACTOR'S EXPENSE TO THE LINES AND GRADES SHOWN ON THE DRAWINGS.
- 14. THE PROPOSED RESTORATION AREAS SHALL BE STABILIZED AT THE END OF EACH WORKDAY.
- 15. FOLLOWING CONSTRUCTION, ALL GRADES (OUTSIDE OF SPECIFIED RESTORATION AREAS) SHALL BE RETURNED TO EXISTING CONDITIONS AND ANY OTHER DAMAGE TO EXISTING STRUCTURES SHALL BE REPAIRED BY THE CONTRACTOR.
- 16. REFER TO SEQUENCE OF CONSTRUCTION AND CONSTRUCTION DETAILS FOR ADDITIONAL INFORMATION.
- 17. SEE EROSION AND SEDIMENT CONTROL PLAN SHEETS FOR FULL ACCESS DETAILS.

#### CONSTRUCTION TOLERANCES

- 1. DURING CONSTRUCTION, THE CONTRACTOR SHALL ADHERE TO THE FOLLOWING CONSTRUCTION GRADING TOLERANCES NOTED AS FOLLOWS:
  - A. LOCATIONS, ELEVATIONS, AND DIMENSIONS OF STONE STRUCTURES SHALL BE:
  - VERTICAL TOLERANCE: +/- 0.1' MAXIMUM; AND,
  - HORIZONTAL TOLERANCE: +/- 0.5' MAXIMUM
  - NO NEGATIVE OR POSITIVE TOLERANCE WILL BE ALLOWED OVER AN AREA GREATER THAN FIFTY SQUARE FEET.
  - B. LOCATIONS, ELEVATIONS, AND DIMENSIONS OF ALL GRADING FEATURES SHALL BE:
  - VERTICAL TOLERANCE: +/- 0.2' MAXIMUM; AND,
  - HORIZONTAL TOLERANCE: +/- 0.5' MAXIMUM
- 2. SHOULD THE CONTRACTOR ENCOUNTER A SITUATION WHERE THEY BELIEVE TOLERANCES OVERLAP AND/OR CONFLICT, THE CONTRACTOR SHALL REQUEST CLARIFICATION OF THE TOLERANCE PRIORITY FROM ENGINEER.
- 3. IT IS RECOGNIZED THAT FIELD CONDITIONS MAY WARRANT ADJUSTMENTS TO DESIGN ELEMENTS. SUCH AN ADJUSTMENT SHOULD BE CONFIRMED BY THE ENGINEER. IF A TOLERANCE IS ADJUSTED, SUBSEQUENT POINTS WITHIN A GIVEN STRUCTURE AND/OR CROSS SECTION MUST BE SHIFTED EQUALLY TO MAINTAIN DIMENSIONAL INTEGRITY. THE RESTORED DIMENSIONS CANNOT VARY FROM THE DESIGN DIMENSIONS WITHOUT ENGINEER APPROVAL.

ANY SUCH CHANGE SHALL BE NOTED ON THE FINAL AS-BUILT DRAWING AS WELL AS ON THE PRELIMINARY AS-BUILT FORMS WITH JUSTIFICATION FOR CHANGE. ACCEPTANCE OF FIELD CHANGES AND/OR AREAS OUTSIDE OF TOLERANCES DOES NOT RELIEVE THE CONTRACTOR OF LIABILITY FOR THE STRUCTURES OR GARDING FEATURES DURING THE WARRANTY PERIOD.

4. ADHERENCE TO THE TOLERANCES SHALL BE DOCUMENTED AS SPECIFIED IN THE 'SHORELINE STABILIZATION CERTIFICATION AS-BUILT SURVEY' DOCUMENT FOR THIS PROJECT.





	ALIGNMENT	T VERTEX BEA	RINGS
	NORTHING	EASTING	STATION (FT)
1 1	455697.1	1456641.9	0+00.00
	455667.3	1456637.08	0+30.18
C 1	455664.2	1456656.82	0+39.57
1.2	455650.1	1456642.58	0+48.96
	455549.7	1456741.65	1+90.40
13	455549.7	1456741.65	1+90.40
LU	455409.6	1456874.46	3+83.06
	455409.6	1456874.46	3+83.06
	455327.4	1456968.52	5+08.00

			GEOMETRY
NO.	LENGTH	RADIUS	BEARING/DELTA
L1	30.18'		N 09°11'38"E
C1	18.78'	20.00'	53°48'03"
L2	141.08'		N 44°36'25"W
L3	193.02'		N 43°28'30"W
L4	124.94'		N 48°50'22" W









STRUCTION DETAILS.dwg



IMMEDIATELY STABILIZED.

EGEND	
	PROPOSED GRADING (0.5')
·— MHW ——	PROPOSED MEAN HIGH WATER LINE (0.3' EL.)
MLW	PROPOSED MEAN LOW WATER LINE (-0.7' EL.)
	PROPOSED WATER CROSSING
B3333333	PROPOSED REINFORCED CONSTRUCTION ENTRANCE
	PROPOSED ACCESS ROAD
	PROPOSED BREAKWATER
	STOCKPILE/STAGING AREA



CONSTRUCTION SPECIFICATIONS

#### MATERIALS

- THE ATTENTION OF NEARBY BOATERS.
- FABRIC.
- PLATE 3.27-2).
- PORTRAY THIS ORIENTATION).
- USED, BOTTOM ANCHORS SHOULD BE USED.
- INSTALLATION IN F°LATE 3.27-2.

#### INSTALLATION

- DROP

#### REMOVAI

- WATER.

- MAINTENANCE





![](_page_7_Figure_0.jpeg)

PLANTING AREAS					
	LOW MARSH				
FFF5BFFF5	HIGH MARSH				
o°o <b>Ĉ</b> ⊃°o	DUNE STABILIZATION*				
	PATH BORDER*				
22 <b>E</b> 22	POND TRANSITION ZONE*				
<b>F</b>	TURFGRASS SEEDING*				
*APPROPRIATE SEED MIXES SHALL BE DISTRIBUTED EVENLY THROUGHOUT ALL					

![](_page_7_Figure_3.jpeg)

Computer File Name: :\\_maryland\Projects\MD02000s\MD02100\MD2148.02\CADD\04-EN LANTING PLAN\_SEH2.dwg

![](_page_8_Figure_0.jpeg)

7. IF CONTAINER IS NON-ORGANIC, REMOVE CONTAINER COMPLETELY.

8. FIRMLY COMPACT THE PLANT INTO THE HOLE AND BACKFILL TO ELIMINATE ANY AIR POCKETS AND ENSURE THE PLANT IS ANCHORED WELL INTO PLANTING HOLE.

#### ANNE ARUNDEL COUNTY VEGETATIVE ESTABLISHMENT NOTES

FOLLOWING INITIAL SOIL DISTURBANCES OR REDISTURBANCE, PERMANENT OR TEMPORARY STABILIZATION SHALL BE COMPLETED WITHIN THREE CALENDAR DAYS FOR THE SURFACE OF ALL PERIMETER 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.

1. PERMANENT SEEDING\*

- B. SEEDBED PREPARATION: AREA TO BE SEEDED SHALL BE LOOSE AND FRIABLE TO A DEPTH OF AT LEAST 3-5 INCHES. THE TOP LAYER SHALL BE LOOSENED BY RAKING, DISKING OR OTHER ACCEPTABLE MEANS BEFORE SEEDING OCCURS. FOR SITES LESS THAN 5 ACRES, APPLY 100 POUNDS DOLOMITIC LIMESTONE AND 21 POUNDS OF 10-10-10 FERTILIZER PER 1,000 SQUARE FEET. HARROW OR DISK LIME AND FERTILIZER INTO THE SOIL TO A DEPTH OF AT LEAST 3-5 INCHES ON SLOPES FLATTER THAN 3:1.
- D. MULCHING: MULCH SHALL BE APPLIED TO ALL SEEDED AREAS IMMEDIATELY AFTER SEEDING. DURING THE TIME PERIODS WHEN SEEDING IS NOT PERMITTED, MULCH SHALL BE APPLIED IMMEDIATELY AFTER GRADING. MULCH SHALL BE UNROTTED, UNCHOPPED, SMALL GRAIN STRAW APPLIED AT A RATE OF 2 TONS PER ACRE OR 90 POUNDS PER 1,000 SQUARE FEET (2 BALES). APPLY MULCH TO ACHIEVE A UNIFORM DISTRIBUTION AND DEPTH SO THAT THE SOIL SURFACE IS NOT EXPOSED. IF A MULCH-ANCHORING TOOL IS USED, APPLY 2.5 TONS PER ACRE. MULCH MATERIALS SHALL BE RELATIVELY FREE OF ALL KINDS OF WEEDS AND SHALL BE COMPLETELY FREE OF PROHIBITED NOXIOUS WEEDS. SPREAD MULCH UNIFORMLY, MECHANICALLY OR BY HAND, TO A DEPTH OF 1-2 INCHES.
- E. SECURING STRAW MULCH: STRAW MULCH SHALL BE SECURED IMMEDIATELY FOLLOWING MULCH APPLICATION TO MINIMIZE MOVEMENT BY WIND OR WATER. THE FOLLOWING METHODS ARE PERMITTED:

I. USE A MULCH-ANCHORING TOOL WHICH IS DESIGNED TO PUNCH AND ANCHOR MULCH INTO THE SOIL SURFACE TO A MINIMUM DEPTH OF 2 INCHES. THIS IS THE MOST EFFECTIVE METHOD FOR SECURING MULCH, HOWEVER, IT IS LIMITED TO RELATIVELY FLAT AREAS WHERE EQUIPMENT CAN OPERATE SAFELY.

II. WOOD CELLULOSE FIBER MAY BE USED FOR ANCHORING STRAW. APPLY THE FIBER BINDER AT A NET DRY WEIGHT OF 750 POUNDS PER ACRE. IF MIXED WITH WATER, USE 50 POUNDS OF WOOD CELLULOSE FIBER PER 100 GALLONS OF WATER.

III. LIQUID BINDERS MAY BE USED. APPLY AT HIGHER RATES AT THE EDGES WHERE WIND CATCHES MULCH, SUCH AS IN VALLEYS AND ON CRESTS OF SLOPES. THE REMAINDER OF THE AREA SHOULD APPEAR UNIFORM AFTER BINDER APPLICATION. BINDERS LISTED IN THE 2011 MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL OR APPROVED EQUAL SHALL BE APPLIED AT RATES RECOMMENDED BY THE MANUFACTURERS.

IV. LIGHTWEIGHT PLASTIC NETTING MAY BE USED TO SECURE MULCH. THE NETTING WILL BE STAPLED TO THE GROUND ACCORDING TO MANUFACTURER'S RECOMMENDATIONS.

\* STANDARD NOTES A AND C DO NOT APPLY AND HAVE NOT BEEN INCLUDED

#### PLANTING NOTES

- 1. CONTRACTOR SHALL USE CURRENT ANNE ARUNDEL COUNTY LANDSCAPE SPECIFICATIONS AND THOSE SPECIFICATIONS SHALL GOVERN IN ALL QUESTIONS WHERE THERE ARE CONFLICTS BETWEEN THE PLANS AND THE LANDSCAPE SPECIFICATIONS.
- 2. ALL PLANT MATERIALS SHALL BE WARRANTED FOR ONE YEAR.
- 3. ALL PLANT MATERIALS SHALL BE IN A HEALTHY CONDITION AND SHALL CONFORM TO THE STANDARDS OF THE MOST RECENT EDITION OF THE AMERICAN STANDARD OF NURSERY STOCK, PUBLISHED BY THE AMERICAN NURSERY AND LANDSCAPE ASSOCIATION, AND SHALL BE INSTALLED ACCORDING TO STANDARD PLANTING PRACTICES AND PROCEDURES.
- 4. ALL PLANTING SHALL BE INSTALLED IN A SOUND, WORKMANSHIP-LIKE MANNER AND ACCORDING TO ACCEPTED, GOOD PLANTING PRACTICES AND PROCEDURES.
- 5. ALL PLANT MATERIAL SHALL BE TRANSPORTED AND STORED OUT OF DIRECT EXPOSURE TO SUN AND WIND AND SHALL BE KEPT MOIST THROUGH PERIODIC WATERING UNTIL THE TIME OF PLANTING. THE PLANTS SHALL BE PROTECTED BY COVERING WITH STRAW, PEAT MOSS, COMPOST, OR OTHER SUITABLE MATERIALS AND SHALL BE MAINTAINED MOIST THROUGH PERIODIC WATERING, UNTIL THE TIME OF PLANTING.
- 6. ALL REQUIRED PLANTINGS MUST BE APPROVED AT THE END OF THE FIRST PLANTING SEASON FOLLOWING CONSTRUCTION.
- 7. THE OWNER SHALL BE RESPONSIBLE FOR THE CONTINUED PROPER MAINTENANCE FOLLOWING THE ORIGINAL WARRANTY, REPAIR, AND REPLACEMENT OF ALL LANDSCAPING MATERIALS.
- 8. REPLACEMENT OF NEW PLANTINGS: AT THE END OF THE WARRANTY PERIOD OR AT ANY TIME DURING THE WARRANTY PERIOD, INSPECTIONS WILL BE MADE BY THE OWNER, OR HIS DESIGNEE, AT HIS DISCRETION. ANY PLANT REQUIRED UNDER THIS CONTRACT THAT IS DEAD, UNHEALTHY, UNSIGHTLY, OR IN A BADLY IMPAIRED CONDITION, AS DETERMINED BY THE OWNER, OR HIS DESIGNEE, SHALL BE REMOVED FROM THE SITE AND REPLACED WITHIN TEN (10) WORKING DAYS, WEATHER CONDITIONS PERMITTING, AT NO ADDITIONAL COST TO THE OWNER. ALL REPLACEMENTS SHALL BE IN COMPLIANCE WITH PLANS AND SPECIFICATIONS.
- 9. REPLACEMENT PLANT WARRANTY: ALL PLANTS REPLACED SHALL BE WARRANTED FOR ONE YEAR. THE MAINTENANCE OF THESE PLANTS WILL BE THE RESPONSIBILITY OF THE PLANTING CONTRACTOR UNTIL THE ORIGINAL ONE YEAR WARRANTY PERIOD EXPIRES. AFTER THE EXPIRATION OF THE ORIGINAL WARRANTY PERIOD, THE OWNER WILL PROVIDE MAINTENANCE FOR THE REMAINDER OF THE REPLACEMENT PLANT WARRANTY PERIOD.
- 10. IN-SITU SOIL AND/OR SAND FROM PLANTING HOLES SHALL BE COMBINED WITH ONE PART COMPOST PER TWO PARTS IN-SITU SOIL/SAND BEFORE USING BACKFILLING PLANTING HOLE WITH MIXTURE.

LOW AND HIGH MARSH PLANTING NOTES

1. A MINIMUM OF 1-FOOT OF CLEAN SAND SHALL BE APPLIED TO THE GRADED WETLAND PLANTING AREA. SEE CLEAN SAND NOTES BELOW.

2. WHEN PURCHASING PLANT SPECIES THE CONTRACTOR SHALL TEST WATER SALINITY AT THE SITE AND ADVISE THE NURSERY OF SITE SALINITY TO OBTAIN PLANTS CONDITIONED TO SITE SALINITY CONDITIONS.

3. EACH PLANT PLUG SHALL HAVE ONE OUNCE OF OSMOCOTE 18-6-12 FERTILIZER, OR A BALANCED SLOW RELEASE FERTILIZER, PLACED BENEATH IT. THE FERTILIZER SHALL BE COVERED WITH A SMALL AMOUNT OF SAND SO NOT TO BE IN DIRECT CONTACT WITH THE ROOTS.

4. SPARTINA ALTERNIFLORA PLUGS SHALL BE INSTALLED 24" ON CENTER AT THE AREA LABELED LOW MARSH PLANTING ZONE, AS SHOWN ON THE PLANTING PLAN.

5. SPARTINA PATENS AND JUNCUS EFFUSUS PLUGS SHALL BE INSTALLED 24" ON CENTER AT THE AREA LABELED HIGH MARSH PLANTING AREA, AS SHOWN ON THE PLANTING PLAN.

6. LITTER REMOVAL SHALL BE PERFORMED AS NECESSARY TO REMOVE TRASH, DEBRIS, AND FLOATABLES, WHICH SHALL NOT BE ALLOWED TO SMOTHER THE PLANTED MARSH GRASS SPECIES.

#### SEEDING NOTES

- OWNER OR OWNER'S REPRESENTATIVE PRIOR TO PLANTING.
- CORRECTED.
- BRANCHES AND OTHER MATTER DETRIMENTAL TO THE SUCCESS OF SEEDING.
- AT THE RATE SPECIFIED ON THE PLANTING SCHEDULE.
- HANDBOOK, 3RD EDITION, 1992.

1. A SEED GERMINATION AND PURITY RATE OF 75% IS REQUIRED. EVIDENCE OF SUCH SHALL BE PROVIDED TO

2. THE LANDSCAPE CONTRACTOR SHALL INSPECT THE AREAS AND CONDITIONS UNDER WHICH THE SEEDING WORK IS TO BE PERFORMED PRIOR TO COMMENCING WORK. IF CONDITIONS ARE DETRIMENTAL TO THE PROPER AND TIMELY COMPLETION OF THE WORK, HE/SHE SHALL NOTIFY THE OWNER VERBALLY AND IN WRITING AND POSTPONE COMMENCING WORK UNTIL THE UNSATISFACTORY CONDITIONS HAVE BEEN

3. PRIOR TO SEEDING, THE SEEDING AREA SHALL BE RAKED SMOOTH AND CLEARED OF ALL TRASH, DEBRIS,

4. CARE SHOULD BE EXERCISED TO INSURE UNIFORM SEED COVERAGE IS OBTAINED. SEED SHALL BE APPLIED

5. THE SPECIFIED SEED SHALL BE BROADCAST IN AREAS SPECIFIED ON THE PLANTING PLAN.FOLLOWING SEEDING, MECHANICALLY SOW SEED TO THE MAXIMUM DEPTH OF AN INCH BY THE USE OF A HAND RAKE.

6. APPLY STRAW MULCH ABOVE MHW AT A RATE SPECIFIED BY THE VIRGINIA EROSION AND SEDIMENT CONTROL

![](_page_8_Figure_45.jpeg)

	SOUTHBREEZE SHORE	ELINE ST	ABILIZ	ZATION	VEGE1	TATION S	CHED	ULE			
	STABILIZATION PLANTING	S SCHEDU	JLE				PLANT	ING QU	JANTIT	IES	
CONTAINER PLANTING ZONE	SPECIES <sup>1,2</sup>	INDICATOR STATUS (AGCP)	STOCK SIZE	PLANT SPACING <sup>3</sup>	QUANTITY	AREA (SF): AREA (AC):	<b>A</b> 2,013 0.05	<b>B</b> 3,128 0.07	<b>C</b> 22,124 0.51	<b>D</b> 2,141 0.05	<b>E</b> 8,517 0.20
LOW MARSH (-1' TO MHW)	SPARTINA ALTERNIFLORA (SALTMARSH CORDGRASS)	OBL	PLUGS	24" O.C.	504		504	-	-	-	-
HIGH MARSH (MHW TO +2')	SPARTINA PATENS (SALTMEADOW CORDGRASS) JUNCUS EFFUSUS (SOFT RUSH)	FACW OBL	PLUGS	24" O.C.	782		-	391 391	-	-	-
DUNE	AMMOPHILA BREVILIGULATA (AMERICAN BEACHGRASS) PANICUM AMARUM (COASTAL PANICGRASS) PANICUM VIRGATUM (SWITCHGRASS) SCHIZACHYRIUM LITTORALE (SHORE LITTLE BLUESTEM)	UPL FAC FAC FAC	PLUGS	24" O.C.	5,532				1383 1383 1383 1383		- - -
(+2' TO +5')	AMORPHA FRUTICOSA (FALSE INDIGO) BACCHARIS HALIMIFOLIA (GROUNDSEL) CLETHRA ALNIFOLIA (COASTAL SWEET PEPPERBUSH) MORELLA PENSYLVANICA (NORTHERN BAYBERRY)	FACW FAC FACW FAC	1-GAL.	16' O.C.	88		- - -	- - -	22 22 22 22 22	- - -	
PATH BORDER (ELEV. VARIES)	AMMOPHILA BREVILIGULATA (AMERICAN BEACHGRASS) CONOCLINIUM COELESTINUM (BLUE MISTFLOWER) JUNCUS EFFUSUS (SOFT RUSH) SCHIZACHYRIUM LITTORALE (SHORE LITTLE BLUESTEM)	UPL FAC OBL FAC	PLUGS	18" O.C.	952		- - -	- - -	- - -	238 238 238 238 238	- - -
POND TRANSITION ZONE (+0.8' TO +2')	ASCLEPIAS INCARNATA (SWAMP MILKWEED) EUTROCHIUM DUBIUM (COASTAL PLAIN JOE PYE WEED) LOBELIA SIPHLITICA (GREAT BLUE LOBELIA) PANICUM AMARUM (COASTAL PANICGRASS) PANICUM VIRGATUM (SWITCHGRASS) SCHIZACHYRIUM LITTORALE (SHORE LITTLE BLUESTEM) SOLIDAGO SEMPERVIRENS (SEASIDE GOLDENROD)	OBL FACW OBL FAC FAC FAC FAC	PLUGS	24" O.C.	2,135						305 305 305 305 305 305 305
	ALNUS SERRULATA (SMOOTH ALDER) AMORPHA FRUTICOSA (FALSE INDIGO) ARONIA MELANOCARPA (BLACK CHOKEBERRY) CLETHRA ALNIFOLIA (COASTAL SWEET PEPPERBUSH)	FACW FACW FACW FACW	1-GAL.	16' O.C.	36					- - -	9 9 9 9
		STABILIZATIO	NPLANIIN	GIUTALS	10,029		504	782	5,620	952	2,171

	SOUTHBREEZE SHORELINE STABILIZATION VEGETATION SCHEDULE							
	RESTORATION SEEDING SCHEDULE							ES
SEED MIX	SPECIES1	INDICATOR STATUS (AGCP)	SEEDING RATE <sup>2</sup> (LBS/AC)	QUANTITY (LBS)	AREA (SF): AREA (AC):	<b>C</b> 22,124 0.51	<b>D</b> 2,141 0.05	<b>E</b> 8,517 0.20
E&S	SECALE CEREALE (GRAIN RYE)	NI	45.00	34.20		22.95	2.25	9.00
COVER CROP	CHAMAECRISTA FASCICULATA (PARTRIDGE PEA)	FACU	5.00	3.80		2.55	0.25	1.00
NATIVE	PANICUM AMARUM (COASTAL PANICGRASS)	FAC	5.00	3.80		2.55	0.25	1.00
GRASSES	PANICUM VIRGATUM 'HIGH TIDE' (SWITCHGRASS, 'HIGH TIDE')	FAC	5.00	3.80		2.55	0.25	1.00
SEEDING TO	TALS		60.00	45.60		30.60	3.00	12.00

# **SEEDING NOTES:**

1. Substitutions based upon availability shall be requested in writing to engineer, documenting the lack of availability.

2. All seeding rates are expressed in pounds of pure live seed (PLS).

# PLANTING NOTES:

# incorporate flexibility according to species availability. At a minimum, Contractor is to provide at least:

- a) All of the species in the Low Marsh and High Marsh zones.
- b) 3 of the 4 herbaceous (plug) species in the Dune zone. c) 3 of the 4 shrub (1-gallon) species in the Dune zone.
- d) 3 of the 4 species in the Path Border zone.
- e) 6 of the 7 herbaceous (plug) species in the Pond Transition zone.
- f) 3 of the 4 shrub (1-gallon) species in the Pond Transition zone.

2. Substitutions for selected species based upon availability shall be requested in writing to engineer, documenting the lack of availability. If the flexibility inherent in the above schedule is still not sufficient, Engineer is under no obligation to approve substitutions.

3. The planted forb, grass, and shrub species shall be randomly mixed at the spacing specified throughout the planting areas.

# SUPPLEMENTARY OVERSTORY TREE PLANTING SCHEDULE

SYMBOL	CODE	SPECIES	STOCK SIZE	QTY	
	DIVI	DIOPSYROS VIRGINIANA (COMMON PERSIMMON)	1" CAL.	3	
	NYSY	NYSSA SYLVATICA (BLACKGUM)	1" CAL.	3	
	PITA	PINUS TAEDA (LOBLOLLY PINE)	1" CAL.	3	
SUPPLEMENTARY TREE PLANTING TOTAL					

# SOUTHBREEZE TURFGRASS SEEDING SCHEDULE

SEED PLANTING ZONE	SPECIES <sup>1,2</sup>	INDICATOR STATUS (AGCP)	SEEDING RATE <sup>3</sup> (LBS/AC)	PERCENT OF MIX	AREA (SF): AREA (AC):	F 8,664 0.20
TURFGRASS	TURF-TYPE TALL FESCUE CULTIVAR	FACW	210.00	95%		41.77
SEEDING AND GRASSPAVE 2	KENTUCKY BLUE GRASS CULTIVAR	FACW	10.00	5%		1.99
SEEDING TOT	ALS		220.00	100%		43.76

# TURFGRASS SEEDING NOTES:

Substitutions for selected species based upon availability shall be requested in writing to engineer, documenting the lack of availability.
 All cultivars shall be selected from the most current University of Maryland Agronomy Memo #77, "Turfgrass Cultivar Recommendations for Maryland"

- and certified by the Maryland Department of Agriculture, Turf and Seed Section.
- 3. All seeding rates are expressed in pounds of pure live seed (PLS).

1. It is expected and preferred that all species in each of the Species Groups are planted. The tolerances listed in this note are intended to

SEEDING QUANTITIES
--------------------

	Studie	1131 Benfield Bo Millerswille M	Phone: 410-672-5990 • F. www.wetlands	c. Minter and a set of the set of
Southbreeze Community Shoreline Stabilization	Southbreeze Final Sheetset	Anne Arundel County, Maryland	Vegetation Schedule	Copyright $\bigcirc$ 2024 Wetland Studies and Solutions, Inc
MARKING H. BARKIN	NU VER VI VI	Contraction of the second s	Professional Certification. I hereby certify that these documents were prepared or approved by me, and that	I am a duly licensed professional engineer under the laws of the State of Maryland, License No. 46317, Expiration Date: 12/29/2024.
	By By By			_
EVISIONS				SCALE: N/A
R	No. Date Description			DATE: APRIL 2024
Horizon Vertica	ntal D I Datu	atum: N 1m: N	N/A N/A	
Bounda N/A	ary and	d Topo	Source:	
l	n	Draft	Appr	oved
Desig		MCT	ні	B
Desig IHB		MCJ Sheet 7	IH #	B

![](_page_10_Figure_0.jpeg)

Base course shall have a depth of 2 inches \* THESE DEPTH RECOMMENDATIONS SHOULD BE VERIFIED BY THE PROJECT ENGINEER AND LOCAL AUTHORITIES

![](_page_10_Picture_2.jpeg)

![](_page_10_Picture_3.jpeg)

#### **INSTALLATION GUIDE - Grasspave2 Porous Grass Pavement** Introduction

A. This document describes step-by-step information on how to properly install the Grasspave2 Porous Pavement System. Grasspave2 provides vehicular and pedestrian load support for grass areas, while protecting grass roots from harmful effects of traffic. The major components of the complete system are the Grasspave2 units, an engineered base course, Hydrogrow soil amendment/fertilizer, sand, and grass from seed, hydromulch, or sod.

B. Contractors: Only licensed contractors should install the Grasspave2 system. The contractor should have a good performance record with similar construction projects. Homeowners should only attempt installation after they have read and understood fully this installation guide and/or our Technical Specifications.

C. Landscaping: Plant a g receive the necessary main wear resistant to hold up to shade tolerant (if applicable)

F. Warning: Unless there is an emergency, DO NOT DRIVE, PARK ON, or use Grasspave2 system for two or three mowing cycles until grass root system has matured (about 3 to 4 weeks for sod or 6 to 8 weeks for seeded areas). Any barricades constructed to prevent traffic flow must still be accessible by emergency and fire equipment during and after installation.

G. Warranty: Invisible Structures, Inc. (ISI) warrants to its purchasers that all products furnished by ISI will be free from defects in material and/or workmanship. This warranty shall be extended for a period of five (5) years following the date of shipment by ISI. Providing a written claim is presented to ISI within the warranty period and after inspection by ISI showing the materials have failed under this warranty, all defective materials shall be refurnished under this warranty, at no charge, excluding re-installation costs. This in lieu of all other warranties expressed or implied and is the sole warranty extended by ISI. Our liability under this warranty is limited to the refurnishing of materials and does not include any responsibility for incidental, consequential, or other damages of any nature.

#### **Delivery, Storage, and Handling**

B. Protect Grasspave2 units/rolls from damage during delivery and store rolls upright (like a soda can), and under a tarp to protect from sunlight when time for delivery to installation exceeds one week. Do not store rolls on their sides.

Installation Considerations

- A. Examine subgrade and base course installed conditions. Do not start porous paving installation until unsatisfactory conditions are corrected. Check for improperly compacted trenches, debris, and improper gradients.
- local fire authorities of sub-base.
- C. Start of installation constitutes acceptance of existing conditions and responsibility for satisfactory performance. If existing conditions are found unsatisfactory, contact Architect for resolution

#### **Preparation**

drainage)

- A. Subgrade Preparation:

- (when applicable).
- 6. Uniformly grade base.

#### **B.** Base Preparation:

- - subdrains (if necessary).

  - 3. If required, place a geotextile separation layer between the natural ground and the 'engineered base'. 4. If required, install the specified sub-drain and outlet

  - according to construction drawings. 5. Coordinate base installation and preparation with
  - 6. Place engineered base in lifts not to exceed 6 inches

  - percent Modified Proctor. 7. Leave 1 inch (2.5 cm) of depth below final grade for porous paver unit and sand fill and
  - applicable).

#### **Hydrogrow Installation**

Spread all Hydrogrow mix provided (spreader rate = 4.53kg per 100 m2 (10 lbs per 1076 ft2) evenly over the surface of the base course with a hand-held, or wheeled, rotary spreader.

may require modifications, such as geotextiles, geogrids, and/or compaction (not to exceed 90%). Ensure that grading and soil porosity of the subbase will provide adequate subsurface

 Prepare subgrade as specified for project.
 Proper subgrade preparation will enable the Grasspave2 rolls/units to connect properly and remain level and stationary after installation. 3. Excavate area allowing for unit thickness (1 in), the engineered base depth (where

- 5. Ensure in-place soil is relatively dry and free from standing water.

#### . Install Base as specified.

- irrigation and drip irrigation lines.
- (150 mm), compacting each lift separately to 95

SEE PLANTING	is climate appropriate, 2) will
SHEETS	and fertilizer support), 3) is in a sand-based root zone, 5) is

A. Store products in manufacturer's unopened packaging until ready for installation.

C. Store Hydrogrow in a dark and dry location.

D. Handling: Protect materials during handling and installation to prevent damage.

B. For fire lane installations: prior to installing base course for turf paving, obtain approval of

## (Ensure that subbase materials are structurally adequate to receive designed base course, wearing course, and designed loads. Generally, excavation into undisturbed normal strength soils will require no additional modification. Fill soils and otherwise structurally weak soils

required), and 0.5 inch (1.25 cm) for depth of sod root zone or topsoil germination area 4. Provide adequate drainage from excavated area if area has potential to collect water,

when working with in-place soils that have poor permeability.

7. Level and clear base of large objects, such as rocks and pieces of wood.

2. Coordinate base installation and preparation with

![](_page_10_Picture_64.jpeg)

0.5 inch (1.25 cm) for depth of sod root zone or topsoil germination area (when

![](_page_10_Picture_66.jpeg)

A. Review installation procedures and coordinate Grasspave2 work with other work affected. Generally, Grasspave2 is installed at the same time as project grass installation, nearly the last site construction activity.

B. Do not begin installation of porous pavements until all hard surface paving adjacent to porous pavement areas, including concrete walks and asphalt paving, is completed.

- C. Install turf when ambient air temperatures is at least 55 degrees F (13 degrees C).
- D. In cold weather, do not use frozen materials or materials mixed or coated with ice or frost, and do not build on frozen base or wet, saturated or muddy subgrade.
- E. Protect partially completed paving against damage from other construction traffic when work is in progress.

F. Adequately water sod or grass seed to assure germination of seed and growth of root system.

G. Grass coverage on the sand-filled Grasspave2 rings must be completed within one week.

H. DO NOT DRIVE, PARK ON, or use Grasspave2 system for two or three mowing cycles until grass root system has matured (about 3 to 4 weeks for sod or 6 to 8 weeks for seeded areas). Any barricades constructed must still be accessible by emergency and fire equipment during and after installation.

#### Materials A. Grasspave2 Porous Paving Rolls

- B. Base Course: Sandy gravel material from local sources commonly used for road base construction (recycled materials such as crushed concrete or crushed
- aggregate are NOT acceptable). 1. Conforming to the following sieve analysis and requirements:
- 100 percent passing sieve size 1 inch (25 mm).
- 90-100 percent passing sieve size 3/4 inch (19 mm). 70-80 percent passing sieve size 3/8 inch (9 mm).
- 55-70 percent passing sieve size #4.
- 45-55 percent passing sieve size #10. 25-35 percent passing sieve size #40.
- 3-8 percent passing sieve size #200.
- 2. Provide a base course material nearly neutral in pH (range from 6.5 to 7.2) to provide
- adequate root zone development for turf. Material may be either "pit run" or "crusher run." Avoid using clay based crusher run/pit run. Crusher run material will generally require coarse, well-draining sand conforming to AASHTO M6 or ASTM C 33 to be added to mixture (20 to 30 percent by volume) to
- ensure long-term porosity. 4. Alternative materials such as crushed shell, limerock, or crushed lava may be used for base course use, provided they are mixed with sharp sand (20 to 30 percent by volume) to ensure long-term porosity, and are brought to proper compaction. Without added sand, crushed shell and limerock set up like concrete and become impervious. 5. Alternative size and/or composition of base course materials should be submitted to Invisible Structures, Inc. (Manufacturer) for approval.

B. The Hydrogrow mix should be placed **immediately** before installing the Grasspave2.

#### Grasspave2 Unit Installation

A. Install the Grasspave2 units by placing units with rings facing up, and using snap-fit connectors, pegs and holes, provided to maintain proper spacing and interlock the units. Units can be easily shaped with pruning shears or knife. Units placed on curves, slopes, and high traffic areas shall be anchored to the base course, using 40d common nails with fender washer, as required to secure units in place. Tops of rings shall be between 6 mm to 13 mm (0.25" to 0.5") below the surface of adjacent hard-surface pavements.

![](_page_10_Picture_89.jpeg)

B. Install sand in rings as they are laid in sections by "backdumping" directly from a dump truck, or from buckets

mounted on tractors, which then exit the site by driving over rings already filled with sand. The sand is then spread laterally from the pile using flat bottomed shovels and/or wide "asphalt rakes" to fill the rings. A stiff bristled broom should be used for final "finishing" of the sand. The sand must be "compacted" by using water from hose, irrigation heads, or rainfall, with the finish grade no less than the top of rings and no more than 6 mm (0.25") above top of rings.

**Installation of Grass** 

A. Grass coverage on the sand-filled rings **must be completed within one week**. Sand must be re-installed and leveled and Grasspave2 checked for integrity if rings become exposed due to wind, rain, traffic, or other factors.

#### Notes: Choose one paragraph below to match grass installation method

1. Preferred method: Hydroseeding/hydro-mulching - A combination of water, seed and fertilizer are homogeneously mixed in a purpose-built, truck-mounted tank. The seed mixture is sprayed onto the site at rates shown on plans and per hydroseeding manufacturer's recommendations. Coverage must be uniform and complete. Following germination of the seed, areas lacking germination larger than 20 cm x 20 cm (8" x 8") must be reseeded immediately. Seeded areas must be fertilized and kept moist during

development of the turf plants. ). DO NOT DRIVE ON SYSTEM: Hydroseeded/hydr mulch areas must be protected from any traffic, other than emergency vehicles, for a period of 6 to 8 weeks, or until the root system has penetrated and established well below the Grasspave2 units.

2. Install thin sod directly over sand filled rings, filled no higher than the top of the rings. Sod strips should be placed with very tight joints. Sodded areas must be fertilized and kept moist during root establishment (minimum of 3 weeks). DO NOT DRIVE ON SYSTEM: Sodded areas must be protected from any traffic, other than emergency vehicles, for a period of 3 to 4 weeks, or until the root system has penetrated and established well below the Grasspave2 units. **OR** 

![](_page_10_Picture_98.jpeg)

3. Install grass seed at rates per grass type. A light "dusting" of commercial topsoil mix, not to exceed 1/2" (25 mm) will be placed above the rings and seed mix to aid germination rates. Seeded

- C. Sand Fill for Rings and Spaces Between Rings: Clean sharp sand (washed concrete sand). Choose one of the following: 1. Coarse, well-draining sand, such as washed concrete sand conforming to AASHTO M6
- or ASTM C-33. 2. United States Golf Association (USGA) greens, section - sand mix "The Root Zone Mixture."

D. Turf Conditioner:

- 1. Hydrogrow a proprietary soil amendment manufactured by Invisible Structures, Inc. and provided with Grasspave2 2. NO SUBSTITUTIONS.
- E. Grass Choose either sod or seed. Use grass species resistant to wear by traffic generally a Blue/Rye/Fescue mix used for athletic fields in northern climates, and Zoysia, Fescue, or Bermuda types in southern climates. Check with local sod and seed suppliers for preferred mixtures. Dedicated fire lanes can use same grass species used on surrounding turf. Parking applications require greatest wear-resistant species possible, generally available only by seed or hydroseeding/hydro-mulching.
- 1. Sod: Use 13 mm (0.5") thick (soil thickness) rolled sod from a reputable local grower. Species should be wear resistant, free from disease, and in excellent condition. Sod shall be grown in sand or sandy loam soils only. Sod grown in soils of clay, silt, or high organic materials such as peat, will not be accepted.
- 2. Seed: Use seed materials AS SPECIFIED IN PLANTING SHEETS traffic conditions, from certified sources. Seeu snan of provided in containers crearry labeled to show seed name, lot number, net weight, % weed seed content, and guaranteed % of purity and germination. Pure Live Seed types and amount shall be as shown on
- a. Mulch needed only for hydroseeding: Wood or paper cellulose commercial mulch materials compatible with hydroseeding operations. Mulch depth according to mulch manufacturers' recommendation. DO NOT use mulch of straw, pine needles, etc., because of their low moisture holding capacity.
- b. Topsoil needed only for seeding, recommended for hydroseeding: Obtain specified topsoil for a light "dusting" (NO MORE than <sup>1</sup>/<sub>2</sub>" or 13mm) above rings filled with sand for seeding germinati

![](_page_10_Picture_109.jpeg)

SEE PLANTING SHEETS

- root development. G. Grasspave2 Sign: A sign <u>paving</u>, stating that special maintenance is required, with the Manufacturer's phone number, and made of durable materials for outdoor exposure shall be provided and installed.
- H. Fire lane Signage & Delineation: Fire lanes must be identified regarding their entrance and physical location with the placement of signs, gates, curbs, bollards, etc. Specific signage wording and other details must be coordinated with and approved by local fire authorities.

#### INSTALLATION

**Inspection** (For Fire lanes and emergency access, It is recommended that Fire Department inspectors be scheduled to inspect installation of Grasspave2 during preparation of the subbase, installation of the base course, and installation of Grasspave2 units. Most small projects can accommodate these inspections all on the same day. Verify with Fire Department if certificates of inspection are required.)

areas must be fertilized and kept moist during development of the turf plants). DO NOT DRIVE ON SYSTEM: Seeded areas must be protected from any traffic, other than emergency vehicles, for a period of 6 to 8 weeks, or until the root system has penetrated and established well below the Grasspave2 units.

B. Adequately water sod or grass seed to assure germination of seed and growth of root system.

Choose one paragraph below to match grass installation method.

A. Seeded areas must be protected from any traffic, other than emergency vehicles, for a period of 4 to 8 weeks, or until the grass is mature to handle traffic.

![](_page_10_Picture_119.jpeg)

alysis of 17-23-6, or as

#### B. Sodded areas must be protected from any traffic, other than emergency vehicles, for a period of 3 to 4 weeks, or until the root system has penetrated below the Grasspave2

#### **Field Quality Control**

- A. Remove and replace segments of Grasspave2 units where three or more adjacent rings are broken or damaged, reinstalling as specified, so no evidence of replacement is apparent.
- B. Perform cleaning during the installation of work and upon completion of the work. Remove all excess materials, debris, and equipment from site. Repair any damage to adjacent materials and surfaces resulting from installation of this work.

![](_page_10_Picture_124.jpeg)

Invisible Structures, Inc. 303.233.8383 www.invisibelstructures.com

![](_page_10_Picture_126.jpeg)

# DESIGN NARRATIVE

#### A. Background

The Southbreeze Shoreline Stabilization Project is located on a parcel owned by the Fishing Creek Farm Home Owner's Association (FCF). 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. Exhibits A, B, and C are a series of aerial images that show the progression of shoreline conditions over time.

#### 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 was once again sheltered and non-tidal, connecting with the South River only during particularly high river flows or storm surges. Another breach occurred in late 2023, worsening over the course of several severe winter storms to the point it required an emergency repair.

With increasing storm severity due to climate change, the likelihood of regular pond breaches 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 D), 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. Soils mapping (Exhibit E) indicates the prevalence of hydric soil at the site, and WSSI delineated wetlands in the vicinity of the project area. WSSI then worked to minimize wetland impacts; permanent impacts are expected to be mitigated on site. The extent of the propose design was kept within the shoreline extents mapped in the 1972 Maryland wetland inventory (Exhibit F).

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.

The project area is within FEMA Special Flood Hazard Area Zones VE with an elevation of 7' feet along the shoreline and Zone AE with an elevation of 5 feet behind the dune (Exhibit G). The Anne Arundel County Flood Insurance Study (FEMA, 2015) classifies the South River as a tidal estuary, and the project area was part of a coastal floodplain analysis. As the coastal hydraulic model used to determine flood elevations do not rely on terrain as an input, only effects of the astronomical tides, storm surge, and wave setup, the shoreline improvements will not affect the floodplain elevations. As all fill is to take place below these elevations, the project will not affect the floodplain extents either.

#### 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 H and I 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 (lowa 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 1<sup>st</sup> and ending September 30<sup>th</sup> 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. 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

2. Sea Level Rise WSSI analyzed sea level rise projections for the project area using data from the USACE Sea Level Analysis Tool (SLAT) based on historic records at NOAA Gauge 8575512 in Annapolis. After considering the results (summarized in Table 8), WSSI felt the Low through Intermediate scenarios (or Paris Agreement and Stabilized scenarios in the case of the Maryland report) were most appropriate for this site and the type of project. WSSI eliminated the USACE Low projection from consideration as it is notably lower than the values projected by the other two, more recent, studies. The final range of expected sea level rise considered was 1.3 to 1.5 feet.

3. 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. 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 9 summarizes the elevations and heights involved in the selection of breakwater heights. Proposed design elevations are 3.3 feet for Breakwaters 1 and 2, and 2.5 feet for Breakwater 3.

4. 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) and the manual's Nomographs for Design of Rock slope Shore Protection (for Shoal Water) and for Riprap Size to Resist Wave action. WSSI also referenced Hardaway et al.'s (2017) section on breakwater design, which recommends a minimum rock size of 800 to 2,000 pounds for a medium to high wave environment. Based on these analyses, WSSI has specified armor stones that weigh between 800 and 3,000 pounds. Core stone, when included in the design, is significantly smaller than the armor stone; WSSI has specified Class I riprap for this project.

5. 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; it was breached in 2016 and again in 2023 during the design process. 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 surveyed elevation of the portion that did not breach in 2016.

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.

# D. Adjacent Structrues

WSSI does not anticipate that the proposed project will negatively affect the adjacent properties or their associated shoreline stabilization structures. Our design specifies that stones along the riverside faces and opening tie-out slopes of the breakwaters be placed so that the surfaces are rough with protrusions to break up wave energy, preventing its reflection to surrounding shorelines and structures. Additionally, the number, location, and size of the proposed breakwaters and the openings between balance the need for erosion protection with that for land-water connection. WSSI designed Breakwater 3 to tie into the adjacent property's existing riprap structure situated perpendicular to the shoreline to protect the southern portion of the project, notably the pedestrian access area, from waves propagating over the longest fetch to the south. (The Project Owner has obtained permission from the property owner for this to occur.) With that consideration addressed, WSSI sized and spaced the openings between structures running parallel to the shoreline (both those proposed and the existing structure to the north) to allow natural littoral drift

processes to take place at a rate that will neither starve down-drift properties of sediment nor contribute excessive loads to the surrounding environment. The existing structure to the north was built by the adjacent property owner but is situated on FCF property. Through email communications between that owner and FCF representatives that were shared with WSSI, we understand that they plan to implement updates to the existing structure. Implementation of the proposed design for the FCF property should not interfere with work on that property. To ensure the integrity of the Southbreeze Community Shoreline Stabilization Project, the portion of the existing structure on FCF property that is in-line with the proposed breakwaters should be retained in its present condition. Any proposed changes on the adjacent property should ensure appropriate openings are left between their planned structures and structures on the FCF property; care should also be taken to ensure any planned design does not reflect wave energy toward the FCF shoreline.

# (NOAA VDatum)

Tidal Characteri Mean Higher elevation Mean High Wate Mean Low Wate Tide Range

Speed (mph)	Ν	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
0	15.8	1.1	1.2	1.0	1.1	1.0	1.2	1.1	2.0	0.9	0.7	0.9	1.9	1.8	1.8	1.5	34.9
0-5	2.8	1.9	2.1	1.8	1.9	1.8	2.9	2.3	4.2	1.4	1.0	1.1	2.1	3.3	3.3	2.5	36.5
5-10	1.7	1.0	1.0	0.7	0.9	0.9	2.2	1.8	4.1	1.0	0.6	0.6	1.1	3.0	3.5	2.3	26.5
10-20	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.4	0.1	0.1	0.1	0.1	0.5	0.4	0.2	2.0
20-30	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
30-40	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	20.4	4.1	4.3	3.5	3.8	3.8	6.2	5.3	10.6	3.4	2.5	2.6	5.2	8.7	9.0	6.6	100.0

#### Table 5 - Perc Speed (mpl

0

0-5
5-10
10-20
20-30
30-40
Total

Table 6 - Ave Site Naval Acade Annapolis Bi

**Table 1 -** Local tidal characteristics for the Southbreeze site.

#### Table 2 Local tidal characteristics for NOAA Station #8578812, Annapolis, MD. (NOAA Datums)

	Feet		Feet	Assessment	Fetch	Distance	Longest Fetch
stic	(NAVD-88)	Tidal Characteristic	(NAVD-88)	Point	Characteristic	(miles)	Direction
High Water (MHHW)	0.5	Mean Higher High Water (MHHW)	0.00	North	Average Fetch	8.09	
	0.5	elevation	0.66	North	Longest Fetch	32.95	S
er (MHW) elevation	0.3	Mean High Water (MHW) elevation	0.42	South	Average Fetch	2.46	
er (MLW) elevation	-0.7	Mean Low Water (MLW) elevation	-0.55	South	Longest Fetch	5.25	SSW
	1.0	Tide Range	1.0				

Table 3 - Fetch assessment results.

Table 4 - Percent of wind occurrences by speed and direction between October 1, 1948, and September 30, 2023, at the U.S. Naval Academy.

cent	nt of wind occurrences by speed and direction between October 1, 2010, and September 30, 2023, at the Annapolis Chesapeake Bay Interpretive Buoy.																
ח)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
	2.1	1.0	1.0	1.0	1.0	1.0	1.0	1.3	1.3	1.4	1.3	1.4	1.4	1.5	1.3	1.2	20.3
	1.7	1.7	1.7	1.7	1.3	1.2	1.5	2.9	3.8	2.8	2.0	1.9	2.4	2.8	2.3	2.2	34.0
	1.8	2.4	2.4	1.8	1.2	1.0	1.2	3.2	6.1	3.9	1.5	1.3	2.0	4.0	3.9	2.8	40.5
	0.2	0.4	0.4	0.2	0.1	0.1	0.1	0.2	0.4	0.2	0.1	0.1	0.3	1.1	0.9	0.4	4.9
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.2
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	20.4	4.1	4.3	3.5	3.8	3.8	6.2	5.3	10.6	3.4	2.5	2.6	5.2	8.7	9.0	6.6	100.0

erage	age speeds of winds greater than 5 mph by direction at the U.S. Naval Academy and the Annapolis Chesapeake Bay Interpretive Buoy.																
	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	<b>Overall Avg</b>
my	9.6	9.4	9.2	8.9	9.1	9.2	9.7	10.2	10.9	10.2	10.2	9.8	9.6	11.3	11.3	10.8	10.2
uoy	12.0	12.7	12.5	11.6	10.9	10.4	10.3	11.3	12.1	11.3	10.2	10.0	11.1	13.4	13.5	12.0	11.9

#### References

Boesch, D.F., et al. 2018. Sea-level Rise: Projections for Maryland 2018. 27 pp. University of Maryland Center for Environmental Science, Cambridge, MD. https://mde.maryland.gov/programs/Air/ClimateChange/MCCC/Documents/Sea-LevelRiseProjectionsMaryland2018.pdf.

Emergency Management Agency, Federal Insurance and Mitigation Administration. 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/. Sweet, W.V., et al. 2022. Global and Regional Sea Level Rise Scenarios for the United States: Updated Mean Projections and Extreme Water Level

https://www.virginiadot.org/business/locdes/hydra-drainage-manual.asp. USACE. 2013. Incorporating Sea Level Change in Civil Works Programs. ER 1100-2-8162. https://www.publications.usace.army.mil/Portals/76/Publications/EngineerRegulations/ER\_1100-2-8162.pdf.

MD: Department of Natural Resources, Tidewater Administration.

FEMA. 2015. Flood Insurance Study: Anne Arundel County, Maryland, and Incorporated Areas. Flood Insurance Study 24003CV000B. Federal

Probabilities Along U.S. Coastlines. NOAA Technical Report NOS 01. Silver Spring, MD: National Oceanic and Atmospheric Administration, National Ocean Service. https://oceanservice.noaa.gov/hazards/sealevelrise/noaa-nostechrpt01-global-regional-SLR-scenarios-US.pdf.

USACE. Sea Level Analysis Tool (SLAT). Last Accessed March 2023. https://climate.sec.usace.army.mil/slat/.

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,

Wang, H. et al. 1982. An Assessment of Shore Erosion in Northern Chesapeake Bay and of the Performance of Erosion-Control Structures. Annapolis,

![](_page_11_Figure_67.jpeg)

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

#### Table 7 - Southbreeze wave characteristics for given data combinations.

		Outputs					
	Direction				Significant	Peak	Storm
Assessment	(fetch and		Windspeed	Wind Data	Wave	Spectral	Duration
Point	wind)	Fetch (mi)	(mph)	Source	Height (ft)	Period (s)	(hr)
North	avg	8.0	10.2	NAK	0.9	2.5	2.9
North	avg	8.0	11.9	Buoy	1.1	2.6	2.8
North	S	33.0	10.9	NAK	1.9	4.0	7.5
North	S	33.0	12.1	Buoy	2.1	4.3	7.2
North	WNW/NW						
South	avg	2.5	10.2	NAK	0.5	1.7	1.4
South	avg	2.5	11.9	Buoy	0.6	1.8	1.3
South	S	5.3	10.9	NAK	0.8	2.3	2.3
South	S	5.3	12.1	Buoy	0.8	2.3	2.2
South	WNW/NW	2.7	11.3	NAK	0.6	1.8	1.4
South	WNW/NW	2.7	13.5	Buoy	0.7	1.9	1.4

Source and Scenario	Rise (ft)
NOAA 2022	
Low	1.29
Intermediate-Low	1.42
Intermediate	1.52
Intermediate-High	1.68
High	1.88
Maryland 2018	
Paris Agreement	1.31
Stabilized	1.31
Growing	1.31
USACE 2013	
Low	1.06
Intermediate	1.36
High	2.31

**Table 9 -** Summary of the elevations and heights considered and
 the resulting breakwater design elevations.

	Elevation / Height
Design Characteristic	(ft, NAVD-88)
High Tide Elevations	
Mean Higher High Water (MHHW)	0.5
Elevation	0.5
Mean High Water (MHW) Elevation	0.3
Sea Level Rise	
Low to Intermediate SLR Range for 2050	1.3 - 1.5
Breakwaters 1 and 2	
Design Wave Height	1.4
Wave Runup, Average Height	2.1
Sill Design Elevation	3.3
Breakwater 3	
Design Wave Height	0.8
Wave Runup, Average Height	1.0
Sill Design Elevation	2.5

![](_page_11_Figure_74.jpeg)

# EXHIBIT A: 1952 AERIAL IMAGERY

![](_page_12_Picture_2.jpeg)

EXHIBIT D: SHORELINE CONDITIONS AND LITTORAL DRIFT

![](_page_12_Figure_4.jpeg)

![](_page_12_Picture_5.jpeg)

Site

Source: Aerials Express Wetland Studies and Solutions, Inc.

# EXHIBIT E: SOILS MAP

![](_page_12_Picture_9.jpeg)

## EXHIBIT B: FALL 2002 AERIAL IMAGERY

Fall 2002 Aerial Imagery Southbreeze Shoreline Stabilization

![](_page_12_Picture_13.jpeg)

![](_page_12_Figure_14.jpeg)

# EXHIBIT C: FEBRUARY 2022 AERIAL IMAGERY

![](_page_12_Picture_16.jpeg)

Site

Source: Nearmap®

Wetland Studies and Solutions, Inc. a **DAVEY** 🟝 company

February 2022 Aerial Imagery Southbreeze Shoreline Stabilization

![](_page_12_Picture_24.jpeg)

![](_page_12_Figure_25.jpeg)

![](_page_13_Picture_0.jpeg)

![](_page_13_Figure_1.jpeg)

![](_page_13_Picture_2.jpeg)

![](_page_13_Figure_9.jpeg)