

Hog Island Shore Protection and Habitat Restoration Living Shoreline Project



**Shoreline Studies Program
Virginia Institute of Marine Science
William & Mary**

December 2020

Hog Island Shore Protection and Habitat Restoration Living Shoreline Project Summary Report

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This project was funded by the Virginia Coastal Zone Management Program at the Department of Environmental Quality through Grant # NA18NOS4190152 Task 89.01 of the U.S. Department of Commerce, National Oceanic and Atmospheric Administration, under the Coastal Zone Management Act of 1972, as amended. The views expressed herein are those of the authors and do not necessarily reflect the views of the U.S. Department of Commerce, NOAA, or any of its subagencies.

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Table of Contents

- Table of Contents 1
- Site Assessment 2
 - Shoreline Change 4
 - Assessment 4
- Living Shoreline Project..... 7
- Appendix A
 - Final Plans..... 10
- Appendix B
 - Joint Permit Application 13
- Appendix C
 - 2020 Approximate project costs.....30.

Site Assessment

Hog Island is an emergent estuarine marsh complex that is part of the overall Guinea marshes (Figure 1). These marshes are located at the confluence of Mobjack Bay and the York River in Gloucester County, Virginia. Hog Island is a high wave energy eroding shoreline along its south-face on the York River, and lower wave energy along its west and east flanks that occur on Monday Creek (Figure 2). The marsh consists mainly of grasses such as *Spartina alterniflora* and *Spartina patens*. A higher, sandy area along the higher energy shorelines has some scrub shrub. Two small ponds and a small creek occur on the interior of the marsh. The edge of the island is irregularly shaped with exposed peat and peat scarps along the shoreline (Figure 3).

Hog Island is critical for several reasons including: (1) Guinea Marsh Islands are important maritime habitats for shorebirds, waterfowl, as well as many important marine species; (2) Guinea Marsh Islands provide a storm surge break to the marsh complex inside Monday Creek and down the Mobjack Bay side towards the Severn, which will soon be marshes owned by the Virginia Department of Wildlife Resources; (3) Monday Creek has two aquaculture operations inside of the creek and the uplands provide a storm break for growing oysters; and (4) There are many FEMA repetitive loss structures in Guinea. Protecting these islands reduces the amount of storm surge energy entering the creek and thus reduces flood damage. As such, this project took conservation, resiliency, and protection aspects into consideration when assessing Hog Island for shore protection and habitat restoration. To determine management strategy suitability, the site assessment included hydrodynamic, physical, and biotic conditions existing at the site.

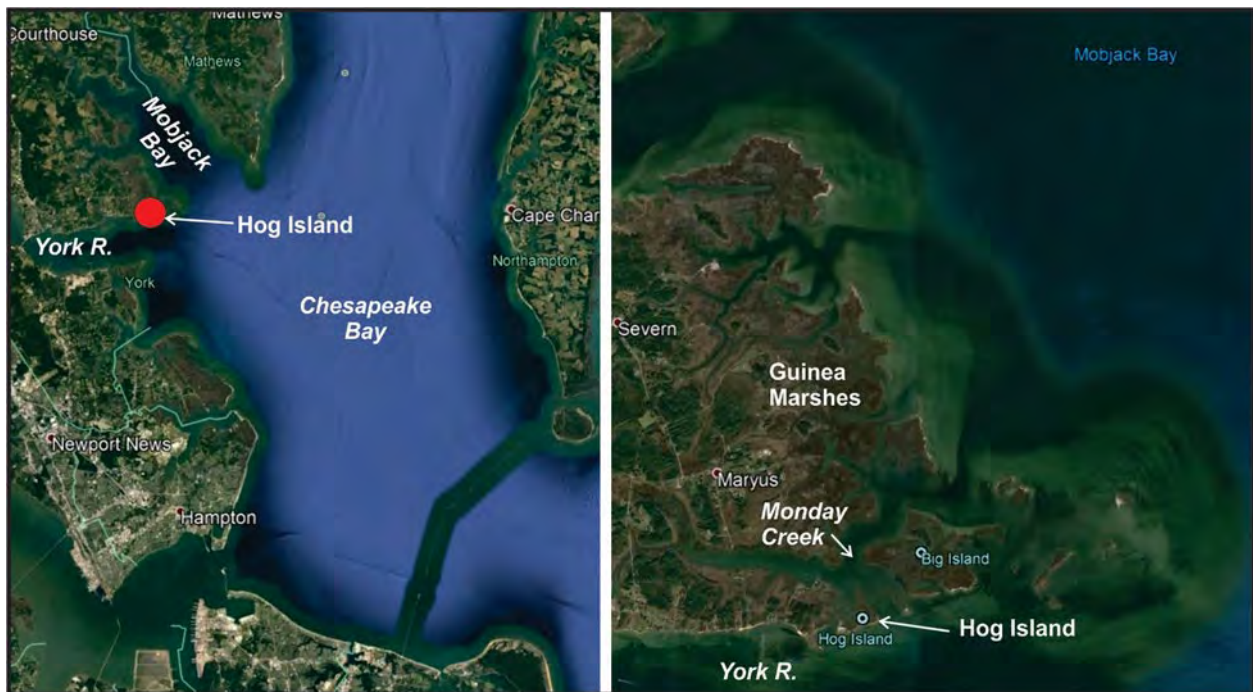


Figure 1. Location of Hog Island in Gloucester County, Virginia.

The physical assessment of the shore zone included shoreline type, stability, width, and the location of natural resources, such as SAV. In addition, native sediment type along the shoreline and the nature of the underlying strata was sampled to determine its suitability to sustain stone structures. This was done using hand augers, and the sampled sediment was classified using ASTM field classification methods. Using Real-Time Kinematic GPS and Robotic Total Station technology, the beach, marsh, and nearshore were surveyed for elevation and areal extent of habitat. The survey was tied into horizontal and vertical survey control systems (NAD 83 horizontal datum/NAVD 88 vertical datum) on 1 Oct 2020 and adjusted to mean low water (MLW). The conversion from NAVD88 to MLW at the site is 1.5 ft. Low-level, near vertical drone imagery of the site was taken on 27 Aug 2020 and rectified in GIS to provide a baseline of existing conditions for the plan.



Figure 2. Drone image of Hog Island taken 27 August 2020.



Figure 3. Physical features of Hog Island.

Shoreline Change

Hog Island’s south-facing shoreline on the York River is exposed to large waves coming from the Atlantic Ocean through the mouth of Chesapeake Bay as well as Bay-generated waves coming from the east and east-southeast. It is eroding at a high rate of -4 to -5 ft per year (Figure 4). The east and west-facing Hog Island shorelines along Monday Creek have lower fetch exposures (0.2 to 0.5 miles) and erosion rates of about - 1 ft/yr. In 1937, the island was much larger with the highest erosion along the south-facing shoreline. Nearly 400 ft of shoreline has been lost in 83 years. The east-facing shoreline has lost about 60 ft and the west-facing shoreline about 40 ft in that same time period. The result is that about ½ of the area that existed in 1937 has eroded (Figure 5). The island has lost about 15 acres.

Assessment

An elevation survey in the area of the proposed structures included the marsh and nearshore (Figure 6). The nearshore zone was assessed to determine the nature of the underlying strata in the areas where structures are proposed. Also, a suitable location for access to the shoreline during construction was assessed. The island is low. The top of the peat scarp ranges from about +1.5 to +2.5 ft MLW where the mean tide range is 2.3 ft at this site. The highest point on the sandy berm area is +4.7 ft MLW. The nearshore is shallow with the deepest section occurring in the southeast corner. Depths around this point are about -2 ft MLW about 175 ft from the shoreline. The southwest corner of the island is slightly shallower.

The nearshore has sand bars along the York River side of the island. These bars vary from 50 to 100 feet apart and are about 0.5 ft in elevation.

Augers taken along the shoreline show the nearshore and subsurface sediment at the site. The auger taken on the southwest area of the site (B1) has stiff, sandy silt (ML) from the surface to about 1 ft down. From 1-2 feet below the bottom of the nearshore, the material is silty, fine sand (SM). At B2, the material between the bottom and 2 feet below is silty, very fine sand (SM).

The areas around Hog Island on Monday Creek have extensive submerged aquatic vegetation (SAV) beds (Figure 7) as mapped by the VIMS SAV mapping program. The nearshore on the western side of the island seems to have more extensive marsh than in 2019. In addition, several small stands of SAV exist in the sand bars that occur in the sandy nearshore.



Figure 4. Shore change and long-term rates of change along Hog Island from SSP online shore change viewer.



Figure 7. Submerged aquatic vegetation (SAV) mapped in 2019 by the VIMS SAV mapping program.

Living Shoreline Project

This project focuses on designing a resilient, nature-based shoreline strategy along Hog Island in Gloucester County, Virginia which historically has experienced severe erosion. The Living Shoreline project includes a completed plan and permit so that the restoration and implementation of the shoreline management strategy for Hog Island can occur. The original conceptual design of the project included rock sills along the south-facing shoreline with potential access from Monday Creek. However, assessment of the site revealed that the nearshore around the entire island is extremely shallow and is likely not accessible by barge. Getting materials and machinery to the site would be difficult and impractical. As such, other types of structures were considered. When oyster castles or equivalent are constructed as a low reef, they have been shown to be very successful in oyster recruitment which is necessary for long-term stability of the reefs (Figure 8). This is particularly important in a high energy environment as the stability is needed for the reef to withstand strong storms.

Oyster castles are concrete blocks with oyster shells incorporated into it. They are placed in the water along shorelines and mimic oyster reefs by providing a habitat for oysters and potentially also reducing erosion (Figure 8). Smaller, lighter boats/barges can be used to bring in the oyster castles and oyster bags and they can be placed by hand, not requiring heavy machinery. No grading will occur, and no sand is being placed.

The proposed living shoreline project protects a total of about 3,000 ft of low marsh shoreline and consists of 8 oyster castle breakwaters and 9 oyster bag sills (Figure 9). The total structure length is 1,400 ft. The oyster castles can be stacked so that they are 10 ft wide and +2.5 ft MLW high. The crest elevation is just above mean high water to help reduce the effects of larger waves that impact the site during storms. They are placed strategically at existing marsh headlands along the south and east facing shoreline. Oyster castle breakwaters 1 (100 ft long), 2 (100 ft long), 4 (100 ft long), and 8 (100 ft long) consist of one row of oyster castles while reefs 3 (140 ft long), 5 (150 ft long), 6 (80 ft long), and 7 (80 ft long) consist of two rows of stacked oyster castles about 5 ft apart. The double row breakwaters are proposed to better withstand the higher energy environment so that the structures will better secure the most exposed marsh headlands along the Hog Island coast. All oyster castle reef material will be placed below MLW to maximize oyster colonization covering about 0.34 acres of subaqueous bottom. The oyster bag sills will be constructed along the east-facing shoreline and will consist of 6 bags stacked in a pyramid shape. The oyster bag sills are 100 ft long with 15 ft gaps and placed at MLW to avoid impacts to SAV. Hog Island is only accessible by water. Oyster castles and bags will be brought in by boat and hand-placed along the shoreline.



Figure 8. Example of oyster castle placement in an estuarine environment (Photo from Allied Concrete). The top image shows what the reefs look like when first placed. The bottom shows the reefs after oyster recruitment. The proposed structures for Hog Island are higher and wider than this oyster castle sill.

The final plan set is shown in Appendix A, and the draft Joint Permit Application with associated drawings are shown in Appendix B. Approximate 2020 project completion costs are

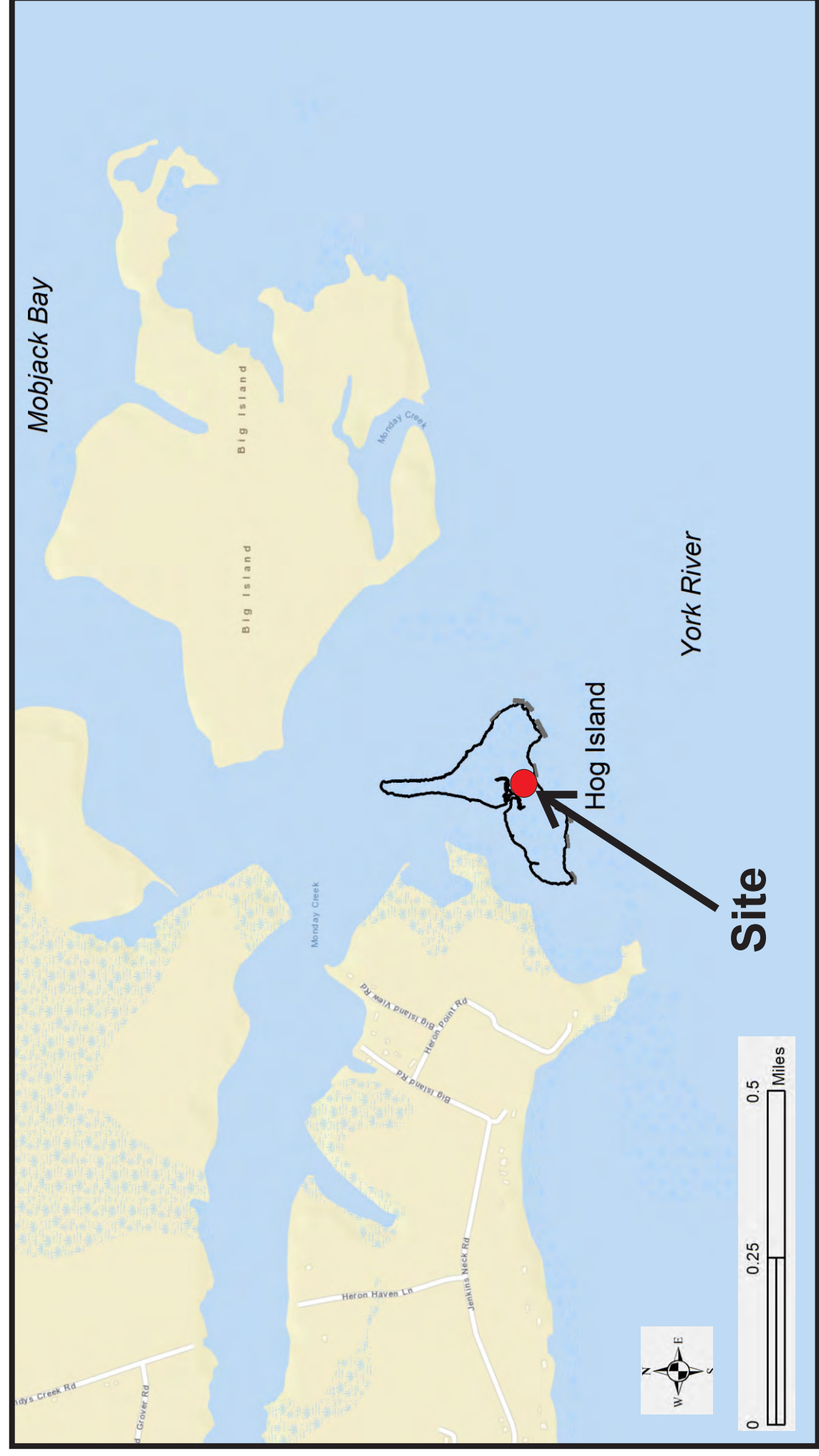
located in Appendix C. In addition, an application has been submitted to FEMA BRIC for flood mitigation funding for a portion of the project funding..



Figure 9. Proposed living shoreline project at Hog Island using oyster castles and oyster bags to create living sills along the shoreline for habitat restoration and shoreline protection.

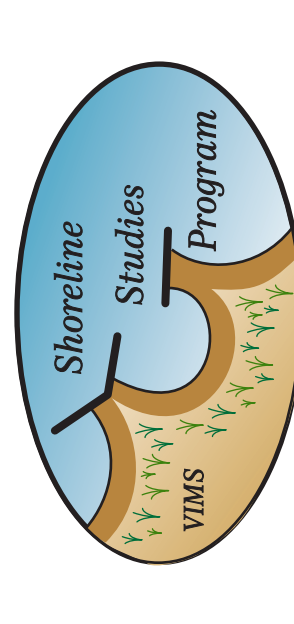
Appendix A
Final Plans

Hog Island Living Shoreline Project



GENERAL NOTES

1. Mean tide range is 2.3 ft (1983-2001)
2. Horizontal control was established by Real Time Kinematic Global Positioning System (RTK-GPS) and is shown in UTM, zone 18, NAD83, ift. End of structure points shown in Latitude/Longitude.
3. Vertical control is MLW. MLW (1983-2001) was determined to be 1.5 ft below NAVD88 at Hog Island.
4. Topographic data obtained on 1 October 2020 using RTK-GPS and Total Station. Drone imagery was captured on 27 Aug 2020.
5. All dimensions and coordinates are given in feet.
6. Plans were created in Esri ArcGIS.



Project Title	Hog Island Living Shoreline Project
Issued for	Final Plan
Drawing Title	Cover Sheet
Date	12/16/2020
Scale	
Sheet	1 of 2

Index No.	Drawing Title
Sheet 1	Cover Sheet
Sheet 2	Proposed Plan

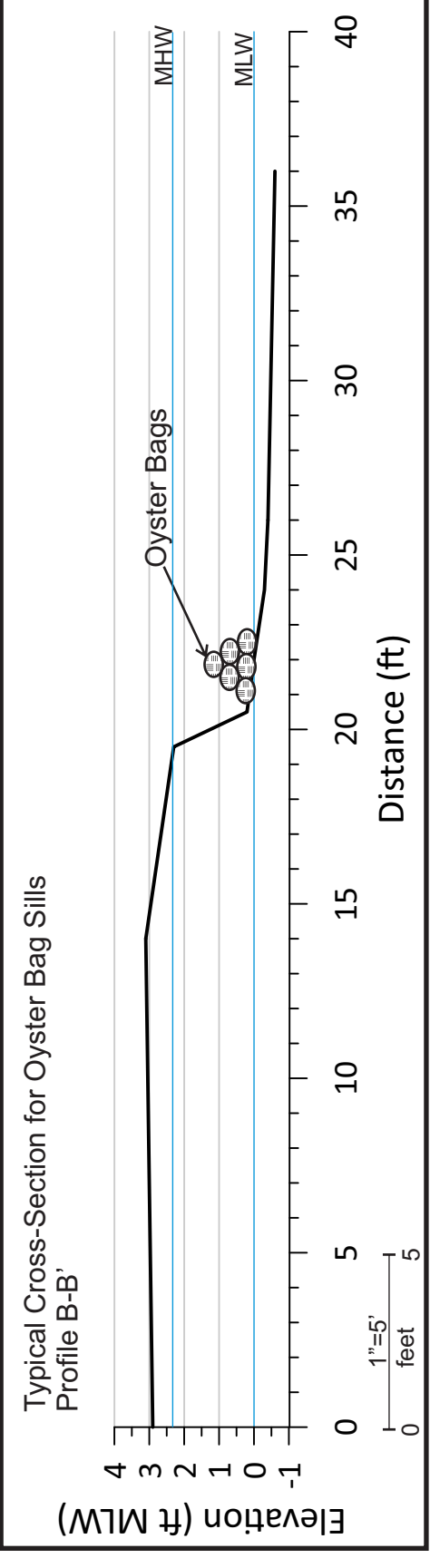
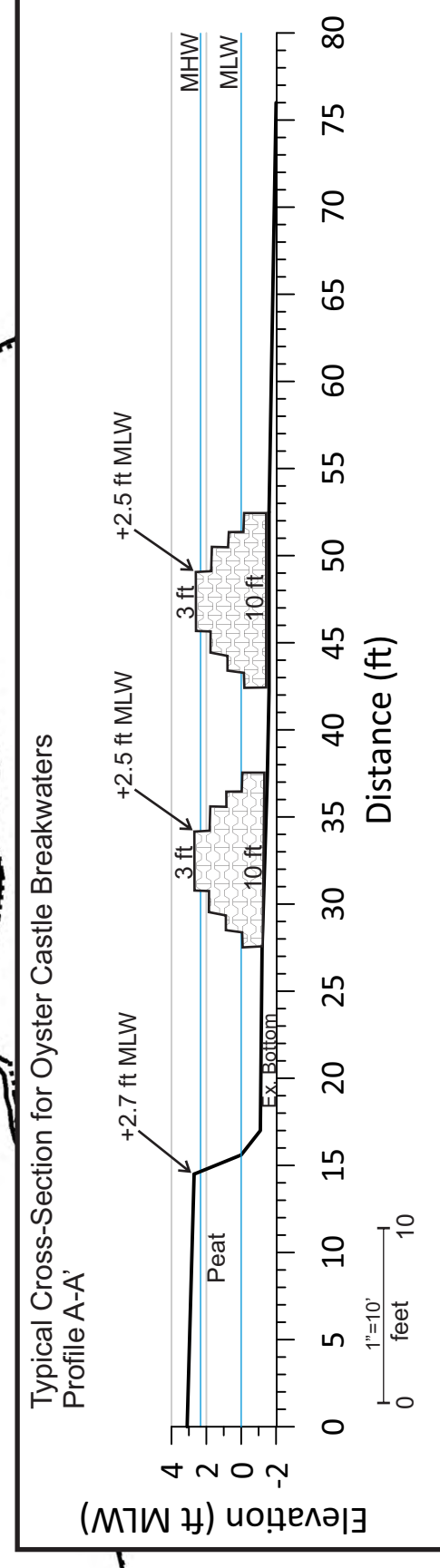
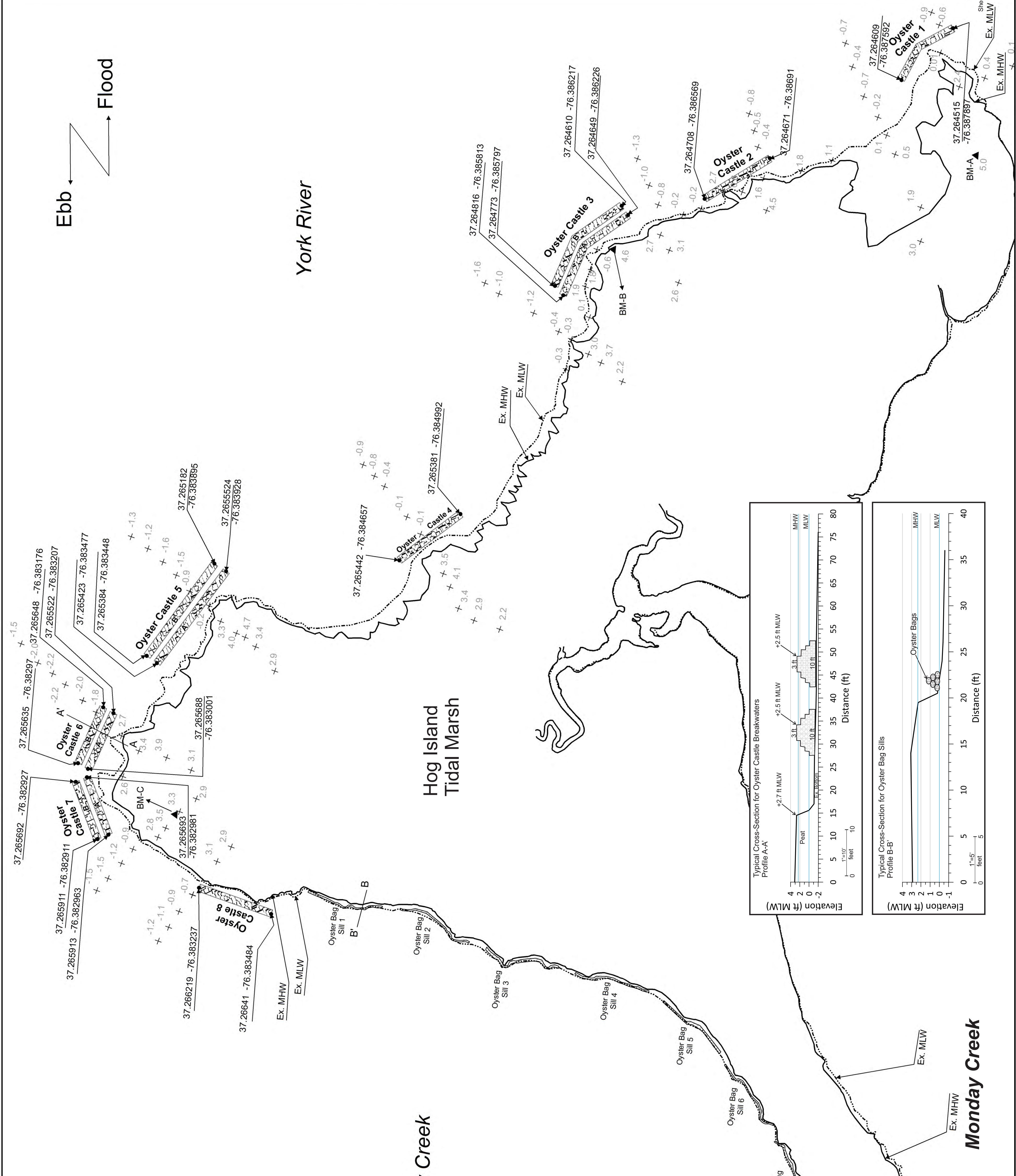
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Benchmarks

Name	Northing	Easting	Elev. ft MLW
A	13,534,020.75	1,236,709.96	5.0
B	13,533,931.76	1,237,190.50	4.6
C	13,534,358.11	1,238,020.14	5.1

Proposed Structures

Structure Name	Structure Type	Length (ft)
Oyster Castle Headland BW 1	Oyster Castle	100
Oyster Castle Headland BW 2	Oyster Castle	100
Oyster Castle Headland BW 3A	Oyster Castle	140
Oyster Castle Headland BW 3B	Oyster Castle	140
Oyster Castle Headland BW 4	Oyster Castle	100
Oyster Castle Headland BW 5A	Oyster Castle	150
Oyster Castle Headland BW 5B	Oyster Castle	150
Oyster Castle Headland BW 6A	Oyster Castle	80
Oyster Castle Headland BW 6B	Oyster Castle	80
Oyster Castle Headland BW 7A	Oyster Castle	80
Oyster Castle Headland BW 7B	Oyster Castle	80
Oyster Castle Headland BW 8	Oyster Castle	100
Oyster Bag Sill 1	Sill	100
Oyster Bag Sill 2	Sill	100
Oyster Bag Sill 3	Sill	100
Oyster Bag Sill 4	Sill	100
Oyster Bag Sill 5	Sill	100
Oyster Bag Sill 6	Sill	100
Oyster Bag Sill 7	Sill	100
Oyster Bag Sill 8	Sill	100
Oyster Bag Sill 9	Sill	100
Total		1,400



Hog Island Living Shoreline Project

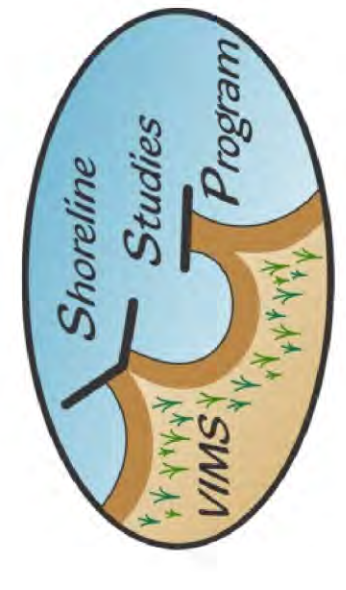
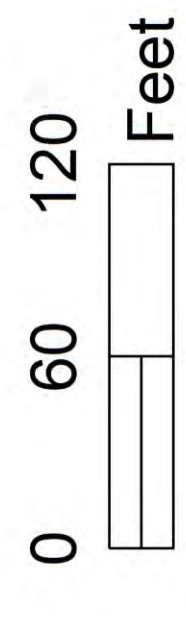
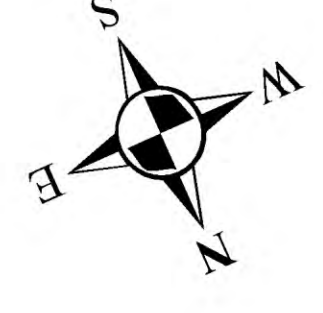
Existing Conditions

- ▲ Benchmarks
- × Spot Elevation October 2020
- Profile
- Existing MHW*
- - - - - Existing MLW*

* Digitized from survey and drone imagery

Proposed Conditions

- Oyster Castle End Points
- ▬ Oyster Bag Sill
- ▬ Oyster Castle Headland BW



Project Title	Hog Island Living Shoreline Project
Issued for	Final Plan
Drawing Title	Proposed Plan
Date	December 11, 2020
Scale	1" = 60'

Appendix B
Joint Permit Application

- ❖ VMRC: An application fee of \$300 may be required for projects impacting tidal wetlands, beaches and/or dunes when VMRC acts as the LWB. VMRC will notify the applicant in writing if the fee is required. Permit fees involving subaqueous lands are \$25.00 for projects costing \$10,000 or less and \$100 for projects costing more than \$10,000. Royalties may also be required for some projects. The proper permit fee and any required royalty is paid at the time of permit issuance by VMRC. VMRC staff will send the permittee a letter notifying him/her of the proper permit fees and submittal requirements.
- ❖ LWB: Permit fees vary by locality. Contact the LWB for your project area or their website for fee information and submittal requirements. Contact information for LWBs may be found at http://ccrm.vims.edu/permits_web/guidance/local_wetlands_boards.html.

FOR AGENCY USE ONLY	
	Notes:
	JPA #

APPLICANTS

Part 1 – General Information

PLEASE PRINT OR TYPE ALL ANSWERS: If a question does not apply to your project, please print N/A (not applicable) in the space provided. If additional space is needed, attach 8-1/2 x 11 inch sheets of paper.

County or City in which the project is located: _____				
Waterway at project site: _____				
<i>PREVIOUS ACTIONS RELATED TO THE PROPOSED WORK (Include all federal, state, and local pre-application coordination, site visits, previous permits, or applications whether issued, withdrawn, or denied)</i>				
Historical information for past permit submittals can be found online with VMRC - https://webapps.mrc.virginia.gov/public/habitat/ - or VIMS - http://ccrm.vims.edu/perms/newpermits.html				
Agency	Action / Activity	Permit/Project number, including any non-reporting Nationwide permits previously used (e.g., NWP 13)	Date of Action	If denied, give reason for denial

1. Applicant's legal name* and complete mailing address: Contact Information:
 - Home (____) _____
 - Work (____) _____
 - Fax (____) _____
 - Cell (____) _____
 - e-mail _____
 State Corporation Commission Name and ID Number (if applicable) _____

2. Property owner(s) legal name* and complete address, if different from applicant: Contact Information:
 - Home (____) _____
 - Work (____) _____
 - Fax (____) _____
 - Cell (____) _____
 - e-mail _____
 State Corporation Commission Name and ID Number (if applicable) _____

Part 1 - General Information (continued)

3. Authorized agent name* and complete mailing address (if applicable):

Contact Information:

Home (____) _____

Work (____) _____

Fax (____) _____

Cell (____) _____

e-mail _____

State Corporation Commission Name and ID Number (if applicable) _____

*** If multiple applicants, property owners, and/or agents, each must be listed and each must sign the applicant signature page.**

4. Provide a detailed description of the project in the space below, including the type of project, its dimensions, materials, and method of construction. Be sure to include how the construction site will be accessed and whether tree clearing and/or grading will be required, including the total acreage. If the project requires pilings, please be sure to include the total number, type (e.g. wood, steel, etc), diameter, and method of installation (e.g. hammer, vibratory, jetted, etc). If additional space is needed, provide a separate sheet of paper with the project description.

5. Have you obtained a contractor for the project? ___ Yes* ___ No. *If your answer is "Yes" complete the remainder of this question and submit the Applicant's and Contractor's Acknowledgment Form (enclosed)

Contractor's name* and complete mailing address:

Contact Information:

Home (____) _____

Work (____) _____

Fax (____) _____

Cell (____) _____

email _____

State Corporation Commission Name and ID Number (if applicable) _____

*** If multiple contractors, each must be listed and each must sign the applicant signature page.**

6. List the name, address and telephone number of the newspaper having general circulation in the area of the project. Failure to complete this question may delay local and State processing.

Name and complete mailing address:

Telephone number

(____) _____

Part 1 - General Information (continued)

7. Give the following project location information:

Street Address (911 address if available) _____

Lot/Block/Parcel# _____

Subdivision _____

City / County _____ ZIP Code _____

Latitude and Longitude at Center Point of Project Site (Decimal Degrees):

_____ / - _____ (Example: 36.41600/-76.30733)

If the project is located in a rural area, please provide driving directions giving distances from the best and nearest visible landmarks or major intersections. *Note: if the project is in an undeveloped subdivision or property, clearly stake and identify property lines and location of the proposed project. A supplemental map showing how the property is to be subdivided should also be provided.*

8. What are the *primary and secondary purposes of and the need for* the project? For example, the primary purpose may be “to protect property from erosion due to boat wakes” and the secondary purpose may be “to provide safer access to a pier.”

9. Proposed use (check one):

Single user (private, non-commercial, residential)

Multi-user (community, commercial, industrial, government)

10. Describe alternatives considered and the measures that will be taken to avoid and minimize impacts, to the maximum extent practicable, to wetlands, surface waters, submerged lands, and buffer areas associated with any disturbance (clearing, grading, excavating) during and after project construction. *Please be advised that unavoidable losses of tidal wetlands and/or aquatic resources may require compensatory mitigation.*

Part 1 - General Information (continued)

11. Is this application being submitted for after-the-fact authorization for work which has already begun or been completed? ___Yes ___No. If yes, be sure to clearly depict the portions of the project which are already complete in the project drawings.

12. Approximate cost of the entire project (materials, labor, etc.): \$ _____
Approximate cost of that portion of the project that is channelward of mean low water:
\$ _____

13. Completion date of the proposed work: _____ - _____

14. Adjacent Property Owner Information: List the name and complete **mailing address**, including zip code, of each adjacent property owner to the project. (NOTE: If you own the adjacent lot, provide the requested information for the first adjacent parcel beyond your property line.) Failure to provide this information may result in a delay in the processing of your application by VMRC.

Part 2 - Signatures

1. Applicants and property owners (if different from applicant).

NOTE: REQUIRED FOR ALL PROJECTS

PRIVACY ACT STATEMENT: The Department of the Army permit program is authorized by Section 10 of the Rivers and Harbors Act of 1899, Section 404 of the Clean Water Act, and Section 103 of the Marine Protection Research and Sanctuaries Act of 1972. These laws require that individuals obtain permits that authorize structures and work in or affecting navigable waters of the United States, the discharge of dredged or fill material into waters of the United States, and the transportation of dredged material for the purpose of dumping it into ocean waters prior to undertaking the activity. Information provided in the Joint Permit Application will be used in the permit review process and is a matter of public record once the application is filed. Disclosure of the requested information is voluntary, but it may not be possible to evaluate the permit application or to issue a permit if the information requested is not provided.

CERTIFICATION: I am hereby applying for all permits typically issued by the DEQ, VMRC, USACE, and/or Local Wetlands Boards for the activities I have described herein. I agree to allow the duly authorized representatives of any regulatory or advisory agency to enter upon the premises of the project site at reasonable times to inspect and photograph site conditions, both in reviewing a proposal to issue a permit and after permit issuance to determine compliance with the permit.

In addition, I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Applicant's Legal Name (printed/typed)

(Use if more than one applicant)

Applicant's Signature

(Use if more than one applicant)

Date

Property Owner's Legal Name (printed/typed)
(If different from Applicant)

(Use if more than one owner)

Property Owner's Signature

(Use if more than one owner)

Date

Part 2 – Signatures (continued)

2. Applicants having agents (if applicable)

CERTIFICATION OF AUTHORIZATION

I (we), _____, hereby certify that I (we) have authorized _____
(Applicant's legal name(s)) (Agent's name(s))

to act on my behalf and take all actions necessary to the processing, issuance and acceptance of this permit and any and all standard and special conditions attached.

We hereby certify that the information submitted in this application is true and accurate to the best of our knowledge.

(Agent's Signature)

(Use if more than one agent)

(Date)

(Applicant's Signature)

(Use if more than one applicant)

(Date)

3. Applicant's having contractors (if applicable)

CONTRACTOR ACKNOWLEDGEMENT

I (we), _____, have contracted _____
(Applicant's legal name(s)) (Contractor's name(s))
to perform the work described in this Joint Permit Application, signed and dated _____.

We will read and abide by all conditions set forth in all Federal, State and Local permits as required for this project. We understand that failure to follow the conditions of the permits may constitute a violation of applicable Federal, state and local statutes and that we will be liable for any civil and/or criminal penalties imposed by these statutes. In addition, we agree to make available a copy of any permit to any regulatory representative visiting the project to ensure permit compliance. If we fail to provide the applicable permit upon request, we understand that the representative will have the option of stopping our operation until it has been determined that we have a properly signed and executed permit and are in full compliance with all terms and conditions.

Contractor's name or name of firm

Contractor's or firms address

Contractor's signature and title

Contractor's License Number

Applicant's signature

(use if more than one applicant)

Date

Part 2 – Signatures (continued)

ADJACENT PROPERTY OWNER'S ACKNOWLEDGEMENT FORM

I (we), _____, own land next to (across the water
(Print adjacent/nearby property owner's name)

from/on the same cove as) the land of _____.
(Print applicant's name(s))

I have reviewed the applicant's project drawings dated _____
(Date)

to be submitted for all necessary federal, state and local permits.

I HAVE NO COMMENT _____ ABOUT THE PROJECT.

I DO NOT OBJECT _____ TO THE PROJECT.

I OBJECT _____ TO THE PROJECT.

The applicant has agreed to contact me for additional comments if the proposal changes prior to construction of the project.

(Before signing this form be sure you have checked the appropriate option above).

Adjacent/nearby property owner's signature(s)

Date

Note: If you object to the proposal, the reason(s) you oppose the project must be submitted in writing to VMRC. An objection will not necessarily result in denial of the project; however, valid complaints will be given full consideration during the permit review process.

Part 2 – Signatures (continued)

ADJACENT PROPERTY OWNER'S ACKNOWLEDGEMENT FORM

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(Print adjacent/nearby property owner's name)

from/on the same cove as) the land of _____.
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Date

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Part 3 – Appendices (continued)

Appendix B: Projects for Shoreline Stabilization in tidal wetlands, tidal waters and dunes/beaches including riprap revetments and associated backfill, marsh toe stabilization, bulkheads and associated backfill, breakwaters, beach nourishment, groins, jetties, and living shoreline projects. Answer all questions that apply. Please provide any reports provided from the Shoreline Erosion Advisory Service or VIMS.

NOTE: It is the policy of the Commonwealth that living shorelines are the preferred alternative for stabilizing tidal shorelines (Va. Code § 28.2-104.1). **Information on non-structural, vegetative alternatives (i.e., Living Shoreline) for shoreline stabilization is available at http://ccrm.vims.edu/coastal_zone/living_shorelines/index.html.**

1. Describe each **revetment, bulkhead, marsh toe, breakwater, groin, jetty, other structure, or living shoreline project** separately in the space below. Include the overall length in linear feet, the amount of impacts in acres, and volume of associated backfill below mean high water and/or ordinary high water in cubic yards, as applicable:
 2. What is the maximum encroachment channelward of mean high water? _____ feet.
Channelward of mean low water? _____ feet.
Channelward of the back edge of the dune or beach? _____ feet.
3. Please calculate the square footage of encroachment over:
 - Vegetated wetlands _____ square feet
 - Non-vegetated wetlands _____ square feet
 - Subaqueous bottom _____ square feet
 - Dune and/or beach _____ square feet
4. For bulkheads, is any part of the project maintenance or replacement of a previously authorized, currently serviceable, existing structure? ____ Yes ____ No.

If yes, will the construction of the new bulkhead be no further than two (2) feet channelward of the existing bulkhead? ____ Yes ____ No.

If no, please provide an explanation for the purpose and need for the additional encroachment.

Part 3 – Appendices (continued)

5. Describe the type of construction and **all** materials to be used, including source of backfill material, if applicable (e.g., vinyl sheet-pile bulkhead, timber stringers and butt piles, 100% sand backfill from upland source; broken concrete core material with Class II quarry stone armor over filter cloth).

NOTE: Drawings must include construction details, including dimensions, design and all materials, including fittings if used.

6. If using stone, broken concrete, etc. for your structure(s), what is the average weight of the:

Core (inner layer) material _____ pounds per stone Class size _____

Armor (outer layer) material _____ pounds per stone Class size _____

7. For **beach nourishment**, including that associated with breakwaters, groins or other structures, provide the following:

- Volume of material _____ cubic yards channelward of mean low water
 _____ cubic yards landward of mean low water
 _____ cubic yards channelward of mean high water
 _____ cubic yards landward of mean high water

- Area to be covered _____ square feet channelward of mean low water
 _____ square feet landward of mean low water
 _____ cubic yards channelward of mean high water
 _____ cubic yards landward of mean high water

- Source of material, composition (e.g. 90% sand, 10% clay): _____

- Method of transportation and placement:

- Describe any proposed vegetative stabilization measures to be used, including planting schedule, spacing, monitoring, etc. Additional guidance is available at

<http://www.vims.edu/about/search/index.php?q=planting+guidelines>:



Adjacent Property Owners

Hog Island Living Shoreline

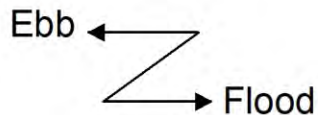
Application By:

Datum: MLW

At:
In:

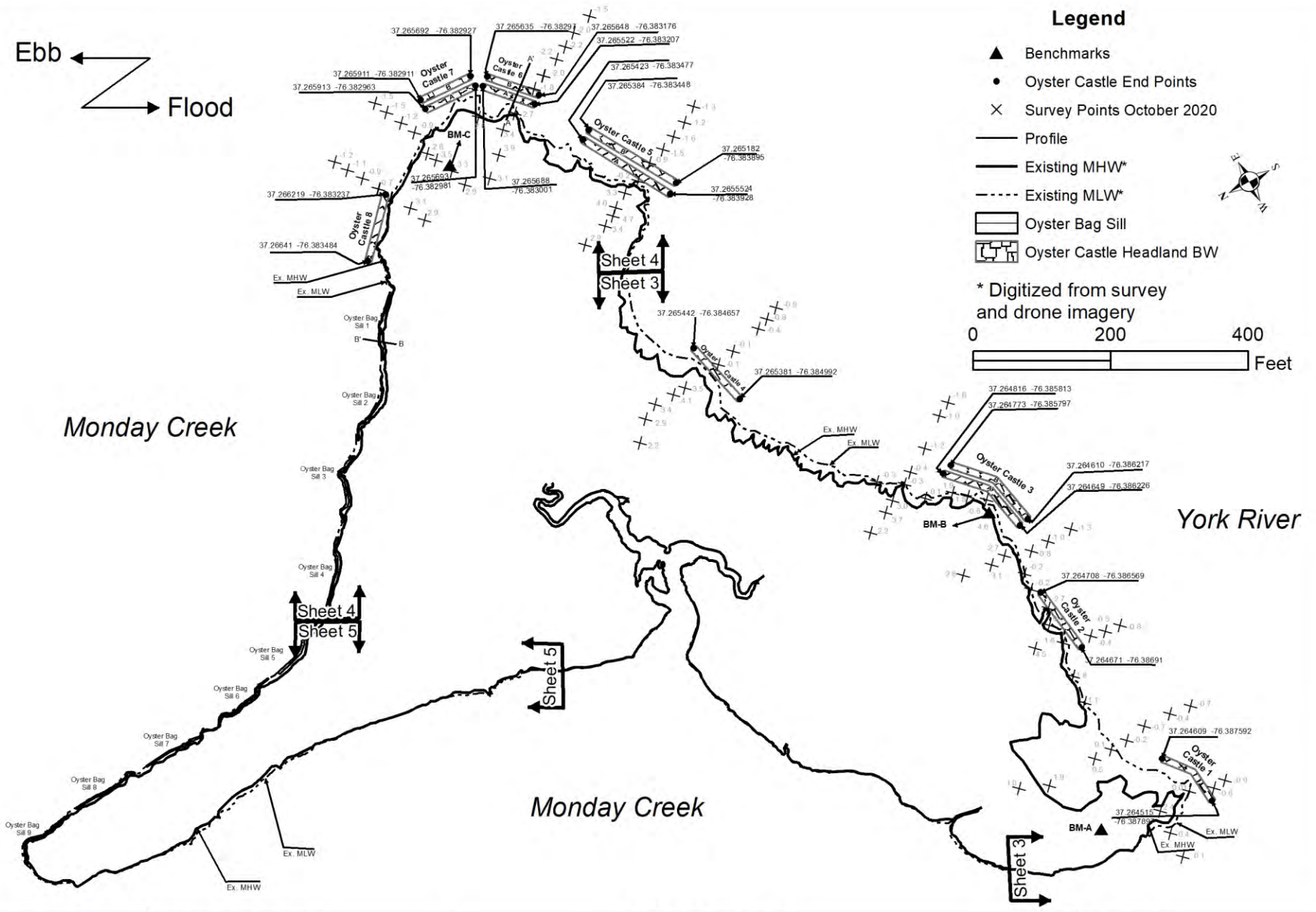
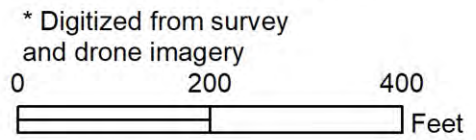
Purpose: Shore Protection

Date: 12/16/2020
Sheet: 1 of 6

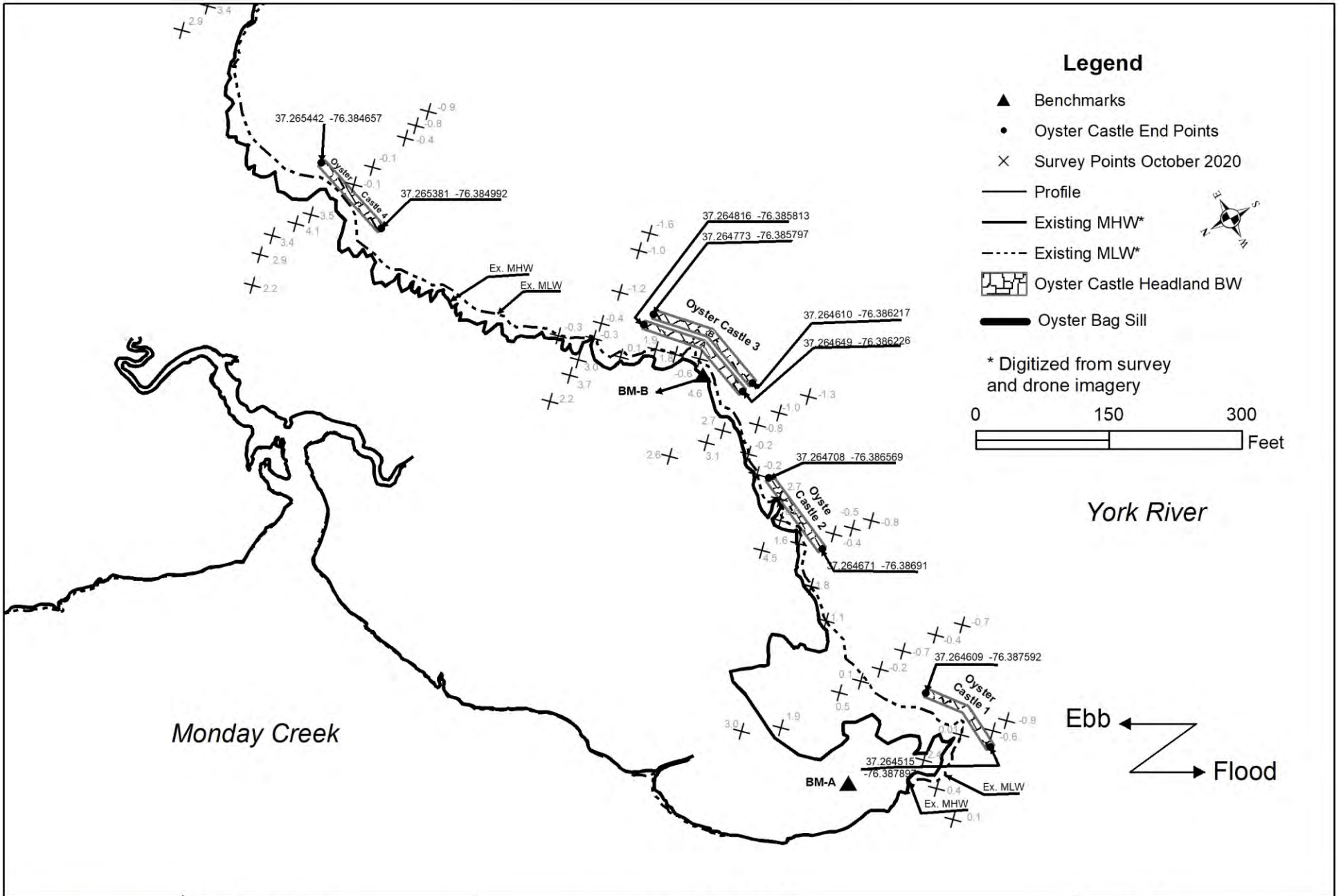


Legend

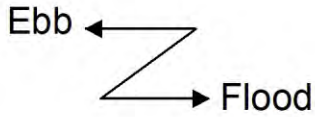
- ▲ Benchmarks
- Oyster Castle End Points
- × Survey Points October 2020
- Profile
- Existing MHW*
- - - Existing MLW*
- ▭ Oyster Bag Sill
- ▭ Oyster Castle Headland BW



Adjacent Property Owners:		Hog Island Gloucester, Virginia	Application By:	
Datum: MLW	At In:		Date: December 16, 2020	Sheet No. 2 of 5
		Purpose: Shore Protection		



	Adjacent Property Owners:	Hog Island Gloucester, Virginia		Application By:
	Datum: MLW			At: In:
				Sheet No. 3 of 6

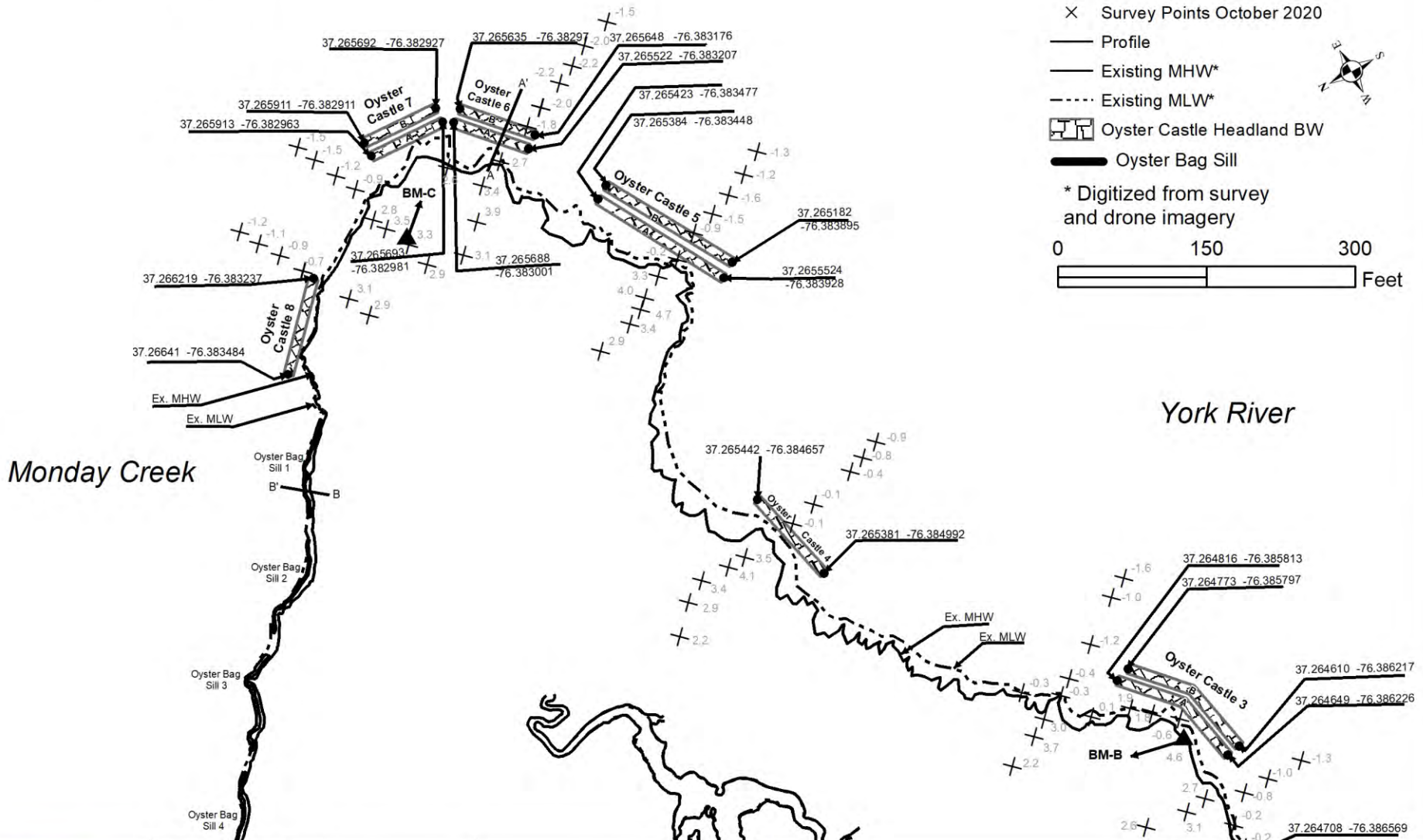
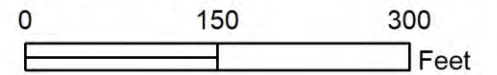


Legend

- ▲ Benchmarks
- Oyster Castle End Points
- × Survey Points October 2020
- Profile
- Existing MHW*
- - - Existing MLW*
- Oyster Castle Headland BW
- Oyster Bag Sill



* Digitized from survey and drone imagery





Adjacent Property Owners:
Datum: MLW

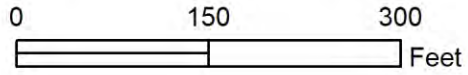
**Hog Island
Gloucester, Virginia**
At:
In:

Application By:
Date: December 16, 2020
Sheet No. 4 of 5

Purpose: Shore Protection

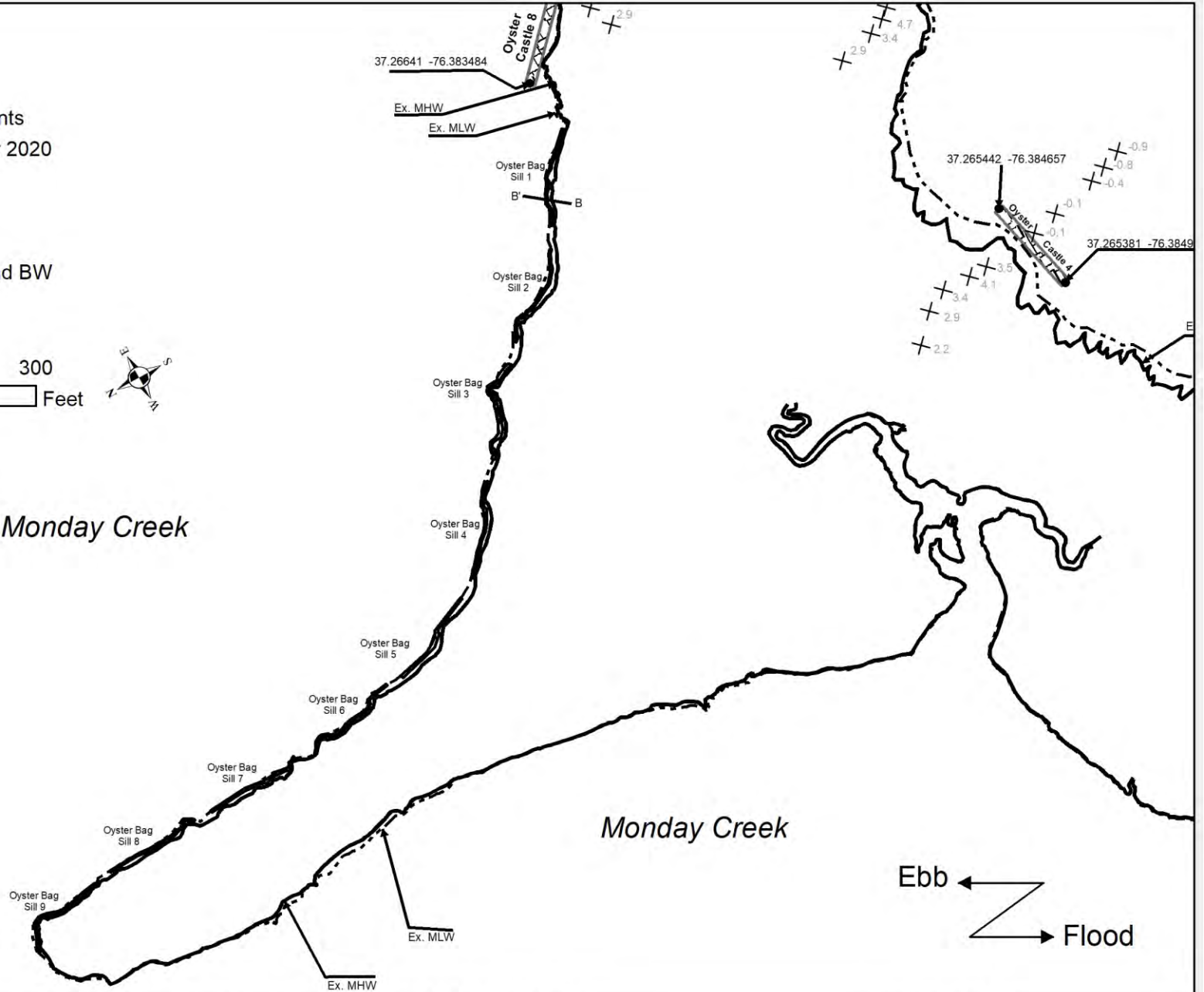
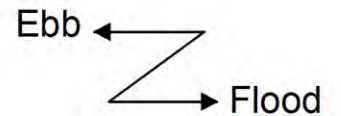
Legend

- ▲ Benchmarks
- Oyster Castle End Points
- × Survey Points October 2020
- Profile
- Existing MHW*
- - - Existing MLW*
-  Oyster Castle Headland BW
-  Oyster Bag Sill



Monday Creek

Monday Creek



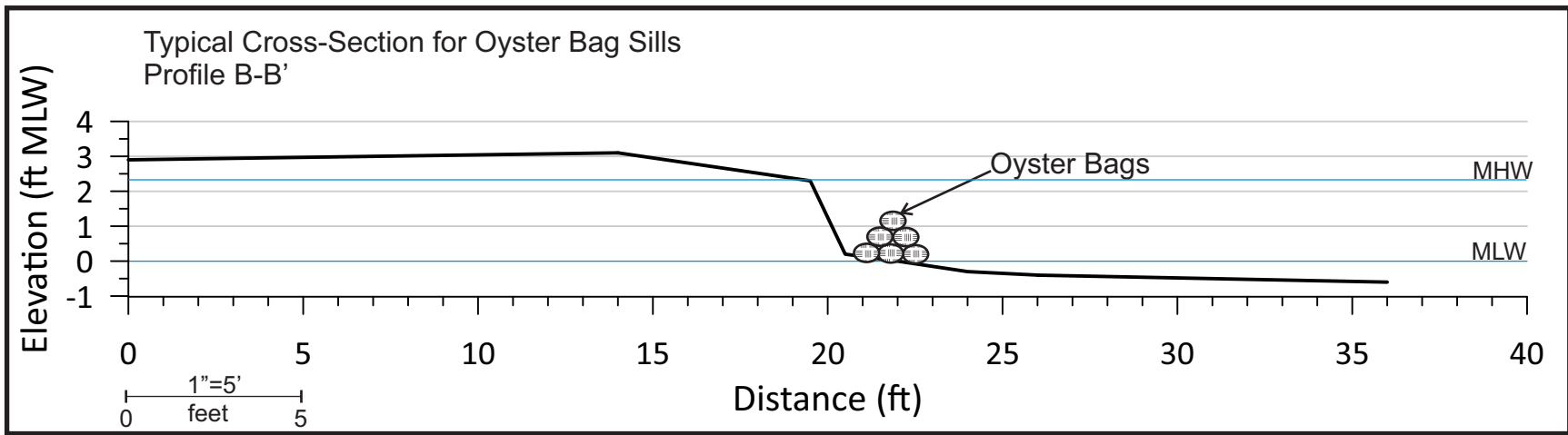
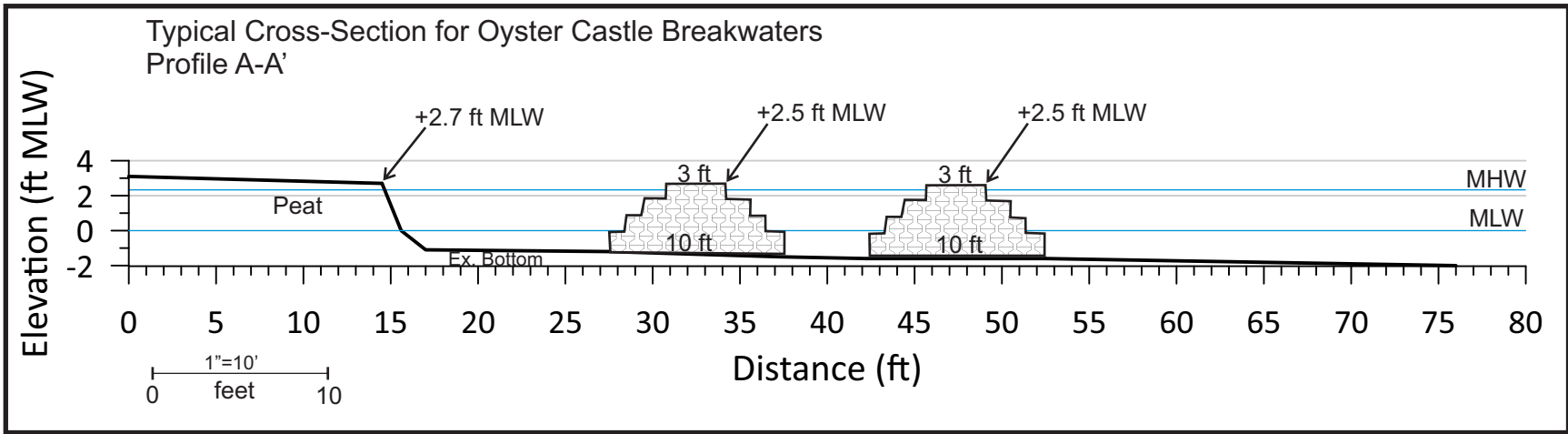
Adjacent Property Owners:

Datum: MLW

**Hog Island
Gloucester, Virginia**

At: In:
Purpose: Shore Protection

Application By:
Date: December 16, 2020
Sheet No. 5 of 5



Adjacent Property Owners

Hog Island Living Shoreline

Application By:

Datum: MLW

At:
In:

Purpose: Shore Protection

Date: 12/16/2020
Sheet: 6 of 6

Appendix C
Approximate 2020 Project Costs

Oyster Castles

10 ft wide, 3 ft crest

\$200 per foot x1.5 for delivery and installation

1,300 ft of structure \$260,000 \$390,000 \$650,000

Cost per foot and approximate installation costs supplied by Allied Concrete

6 Bag Oyster Sill

Construction requires 4 bags/ft

900 ft \$4/bag \$14,400

Note, this amount is for the bags only. It assumes volunteer transport to site and volunteer labor to install.

Grand Total \$664,400