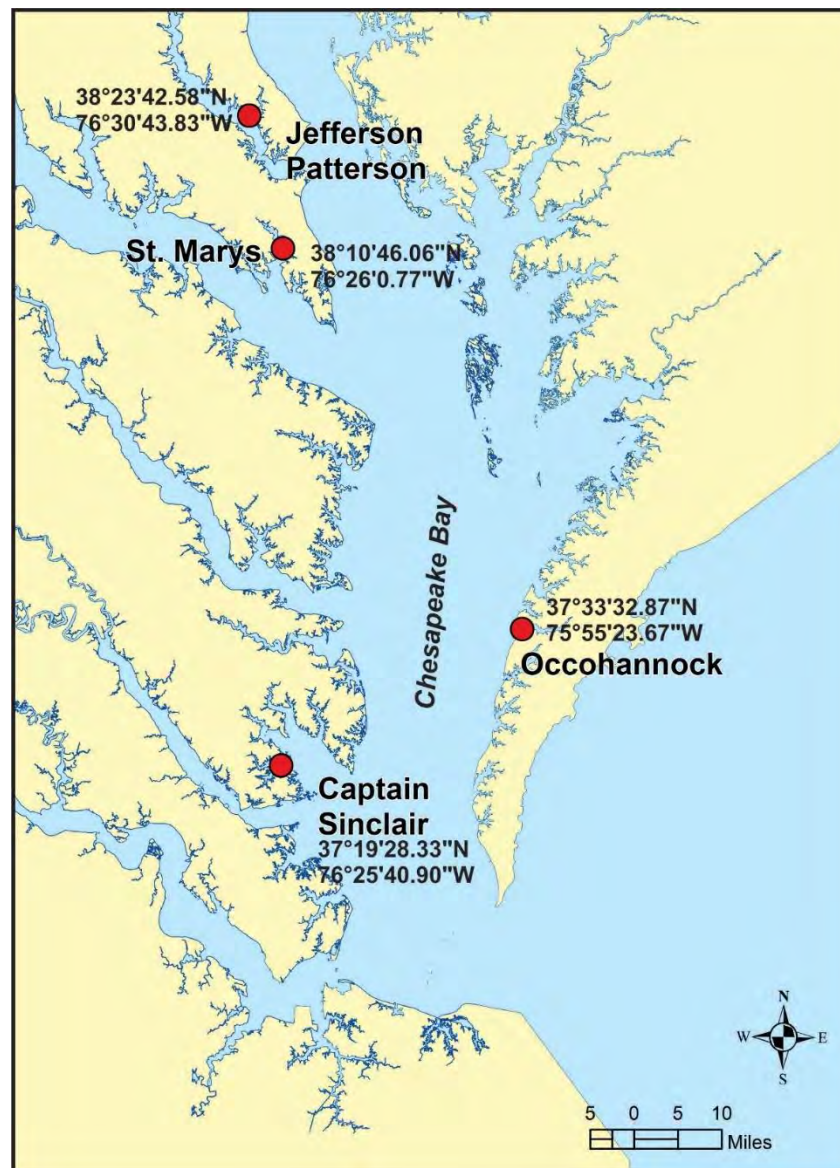


**Living Shoreline Sea-Level Resiliency:
Performance and Adaptive Management of
Existing Sites
Summary Report**

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Donna A. Milligan
Christine A. Wilcox**

Shoreline Studies Program
Virginia Institute of Marine Science
William & Mary





Location of the four sites within the Chesapeake Bay estuarine system

Sea Level Rise

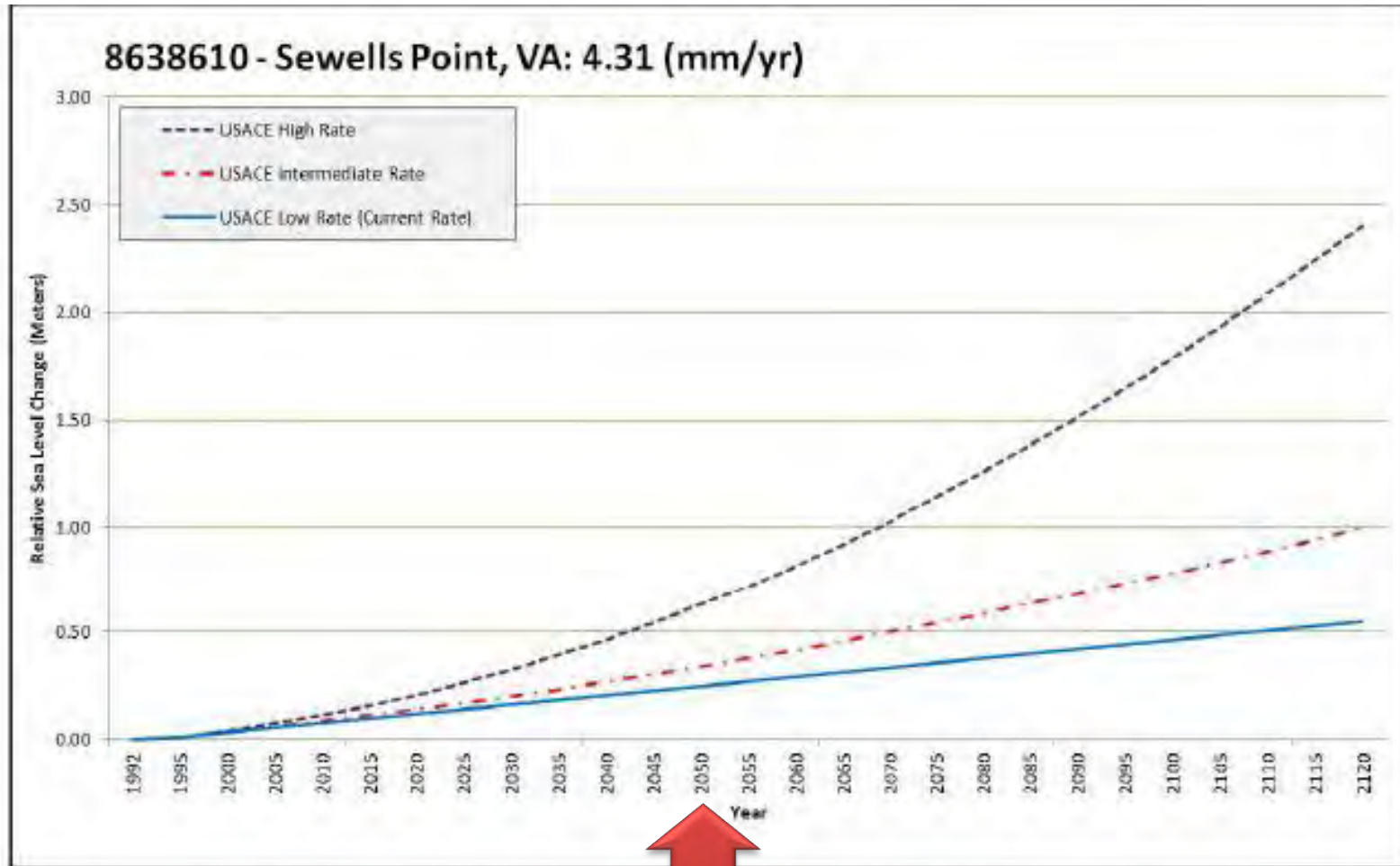


Figure 10: Projected Sea Level Rise at Sewell's Point Station (1992 - 2120)

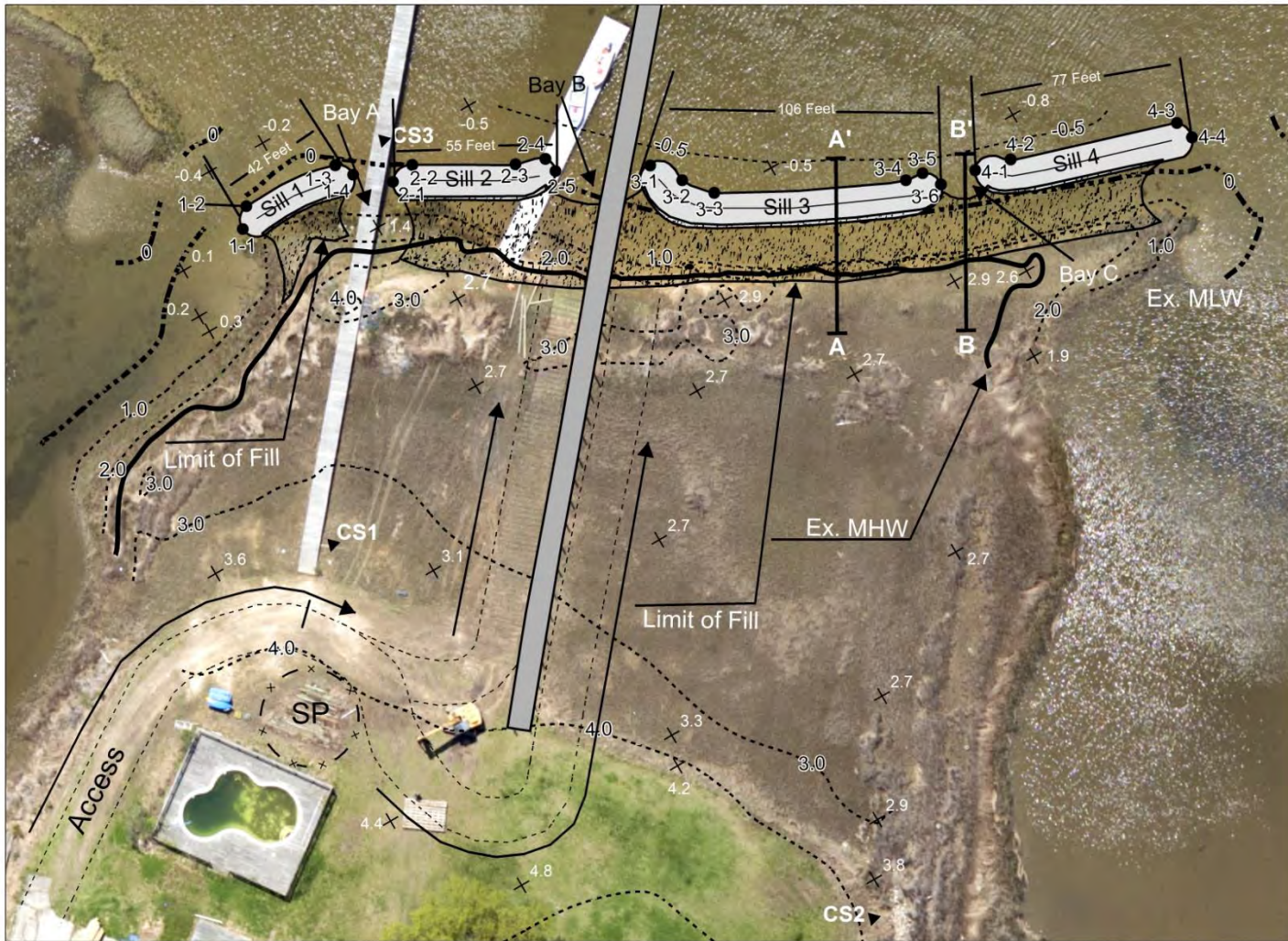
Sea-level rise predictions from the U.S. Army Corps of Engineers (2014).

Capt Sinclair Location



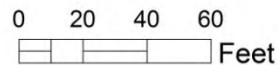


Conditions at Captain Sinclair before the project. Photo: Shoreline Studies Program, 1 April 2015.

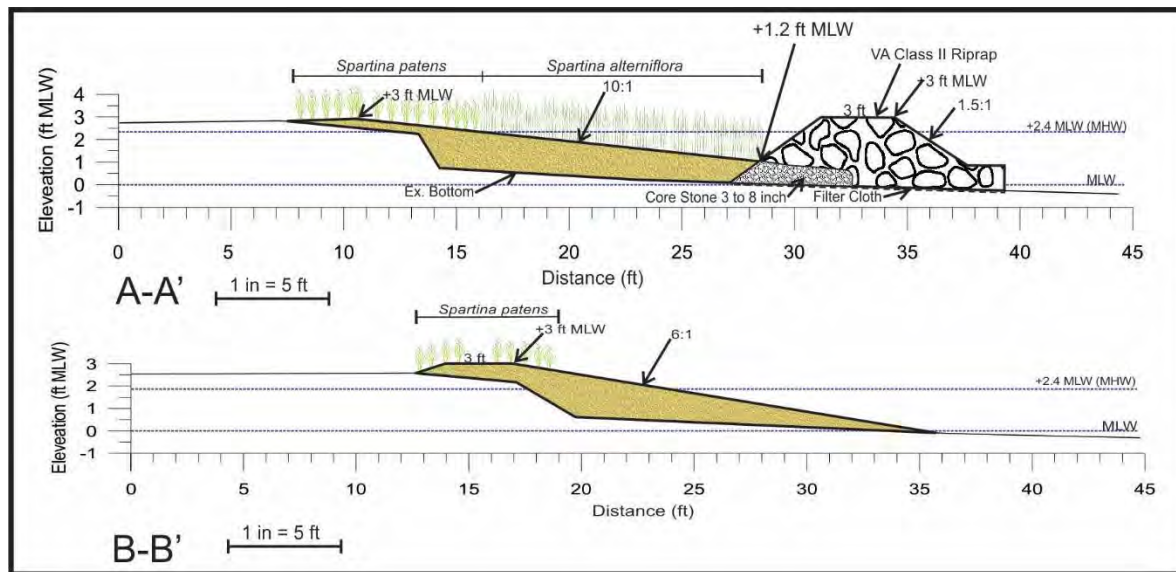


- Sills
- New Pier
- Sand Fill
- Benchmarks
- Spot Elevations
- SP = StockPile
- Contours
- Profiles
- Ex. MLW
- Ex. MHW
- Limit of Fill
- Stakeout Points

Survey Date: 1 April 2015
 Photo Date: April 2015



Living shoreline project design at Captain Sinclair by Shoreline Studies Program, VIMS

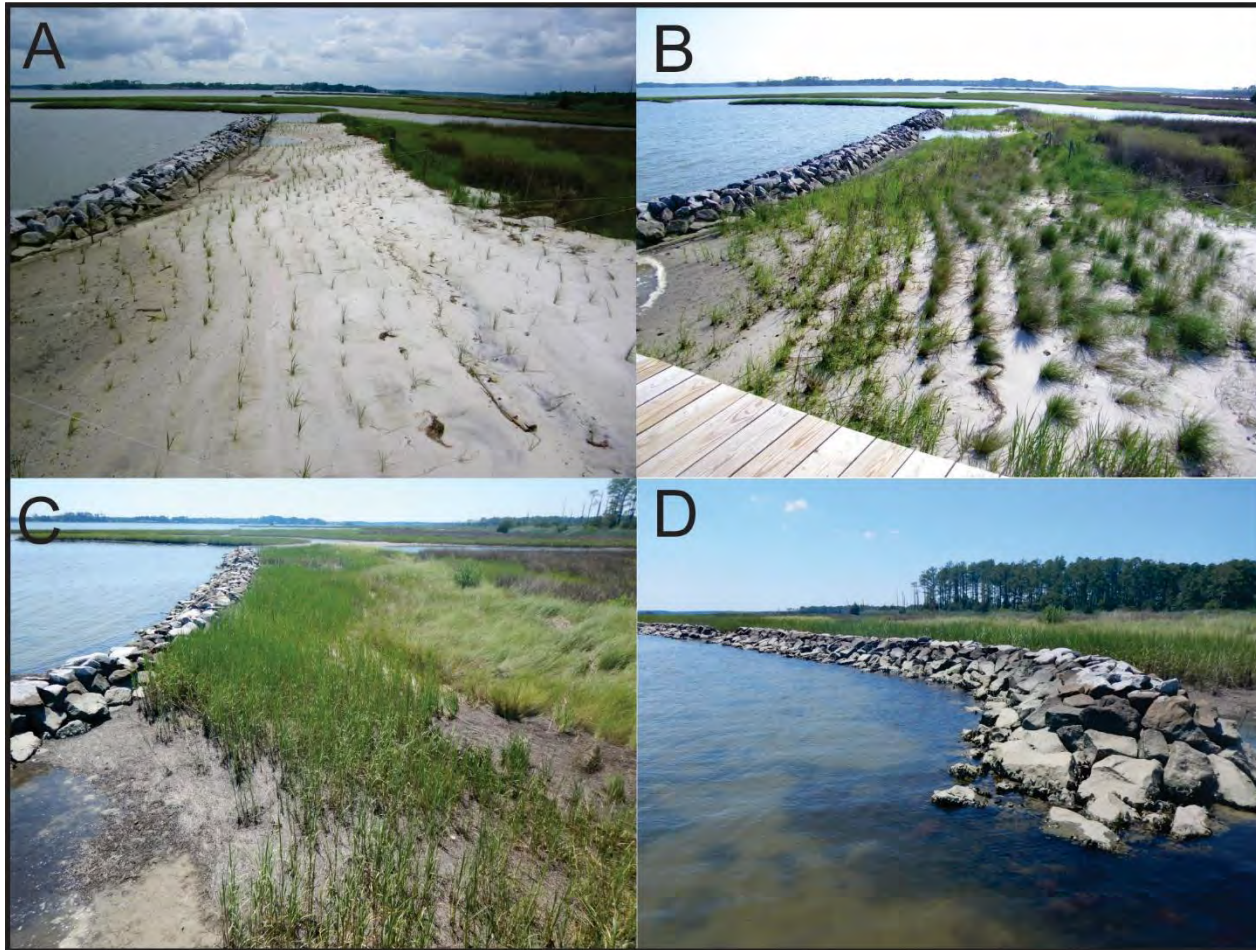


Typical cross-sections for the Captain Sinclair living shoreline project by Shoreline Studies Program, VIMS.

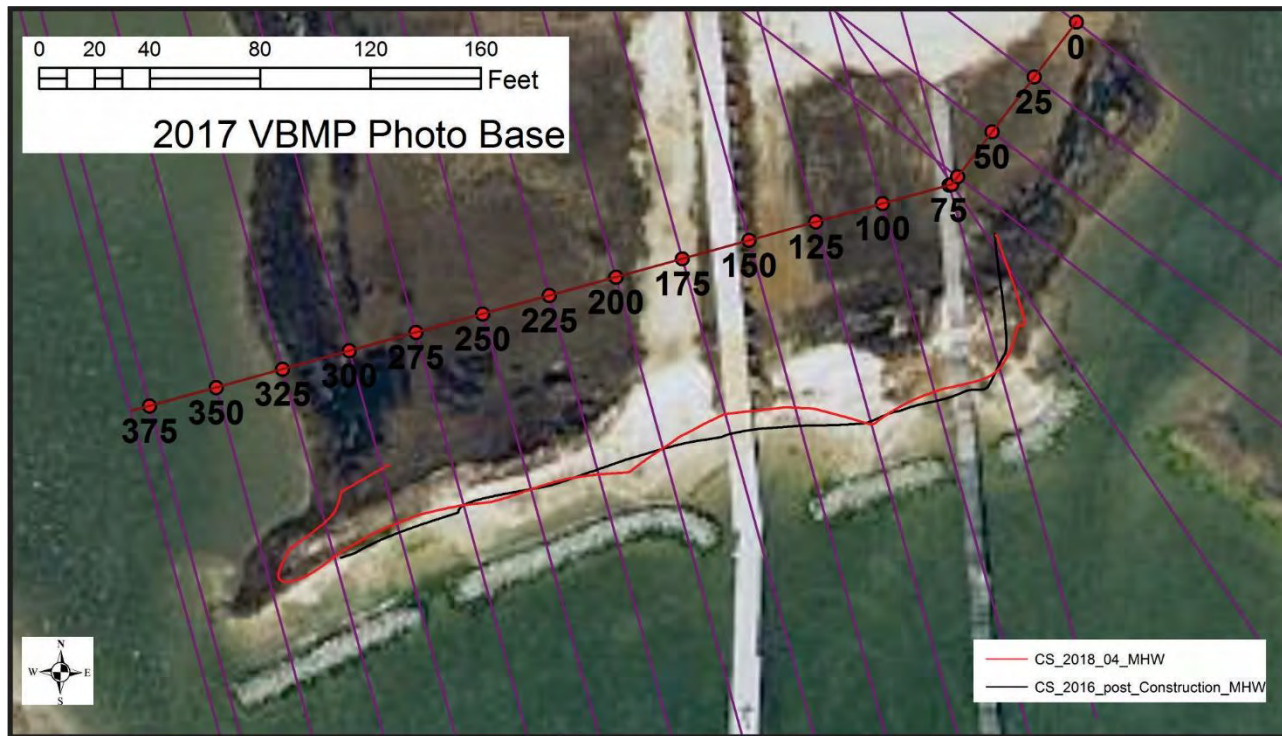
5.5.16



Gloucester High School Crew team planting Capt. Sinclair under the supervision Of Walter Priest and Cool Daddy

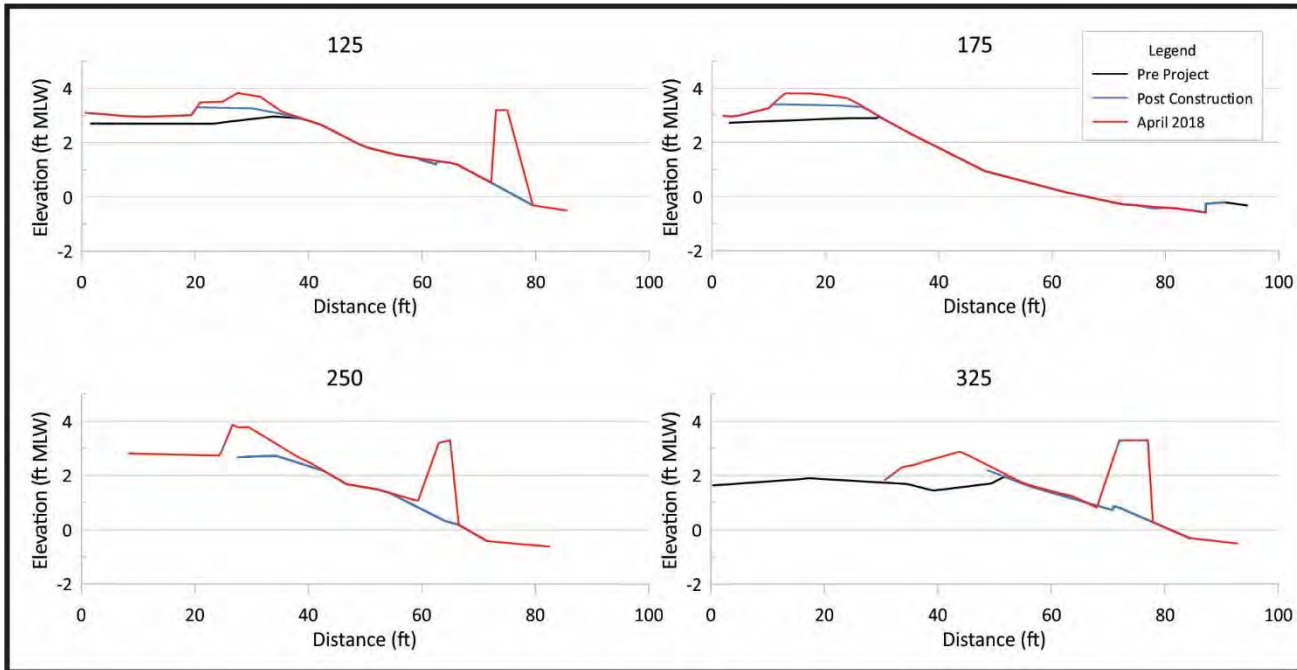


Photos of Captain Sinclair A) Just planted, 2 June 2016; B) One year post planting, 10 May 2017; C) Two years post-planting, 10 July 2018; D) Oysters line the rock sill shown at low water, 10 July 2018. Photo credit: Shoreline Studies Program.



Basemap for Captain Sinclair showing the profile baseline and the position of mean high water in 2016 and in 2018.

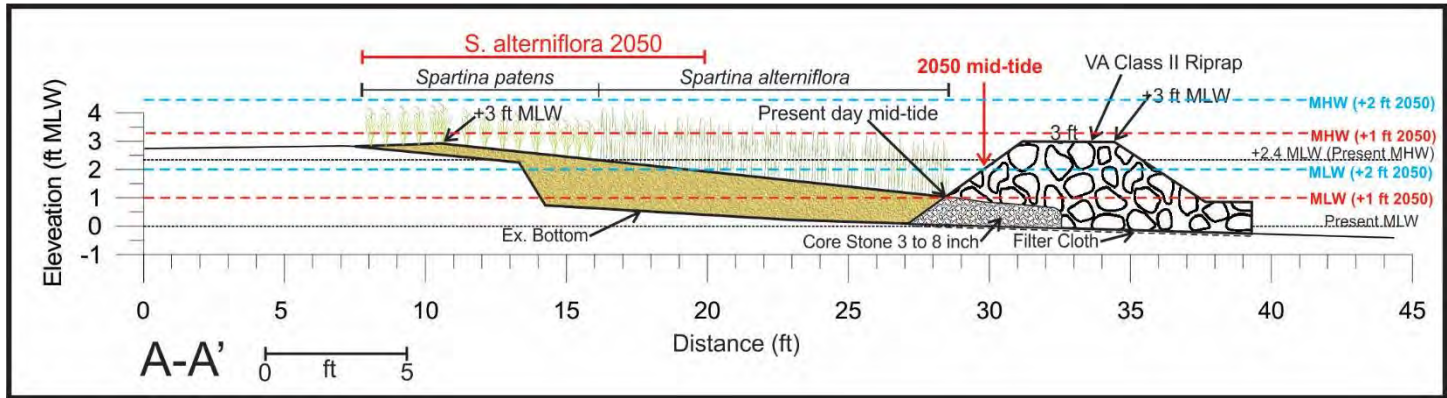
Figure



Cross-sections of survey data for Captain Sinclair.

Capt. Sinclair: May 20, 2020





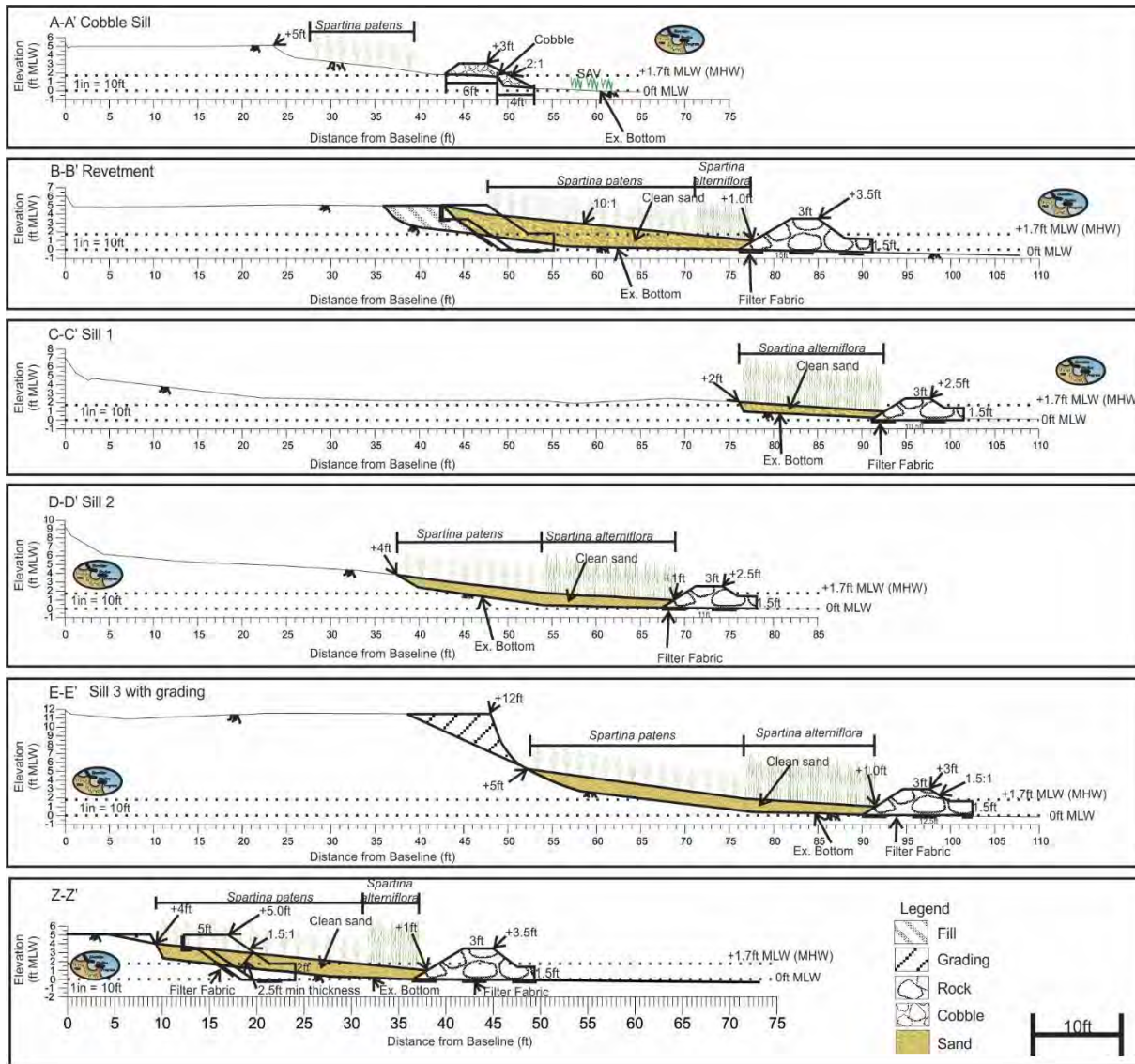
Sea-level rise scenarios modeled at Captain Sinclair and depicted on a typical cross-section.



Location of Occohannock on the Bay



Camp Occohannock living shoreline plan. Reaches 1, 2 and 3



Typical cross-sections for Camp Occohannock living shoreline



Photos of reach 1 at
Occohannock on the Bay A) before
installation (April 2013),

B) after 5years (July 2018),

C) after 5 years, the
backshore is being colonized by trees.



Photos of reach 2 at Occohannock on the Bay A) after planting (May 2013),

B) after 5 years(July 2018),

C) after 5 years there is abundant oyster growth around the end and outside of the rock sills.

Oyster growth and small fish utilization along sill structures at high water



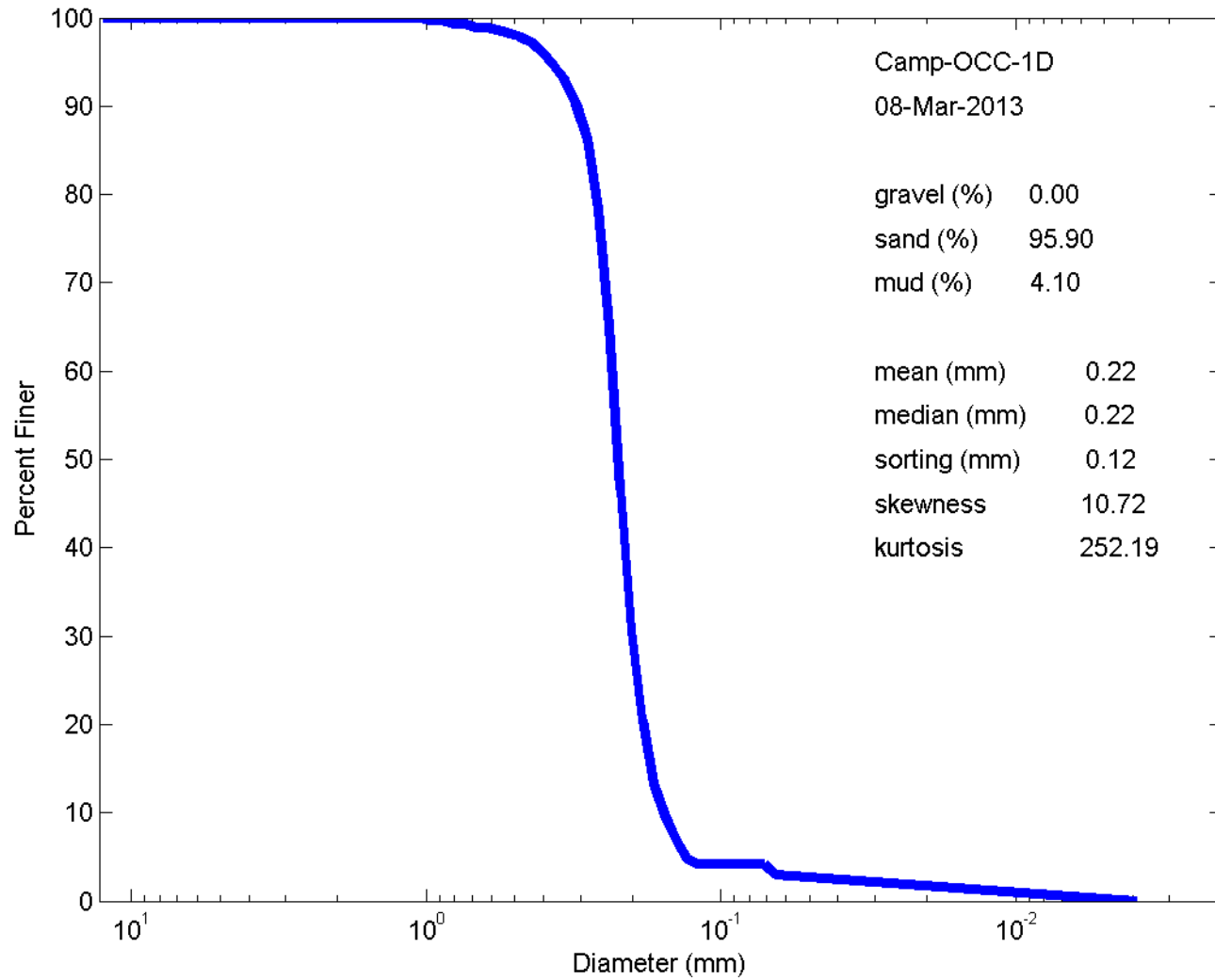


Photos of reach 3 at Occohannock on the Bay A), before construction (March 2013),

B) After planting (May 2013),

C) after 5 years.

Camp Occohannock: Bank Sample

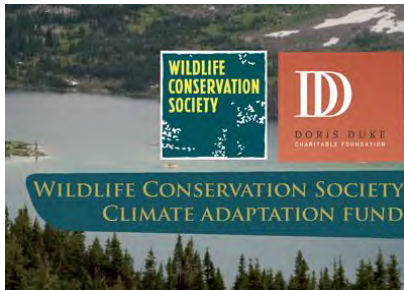


Camp Occ. Living Shoreline Project



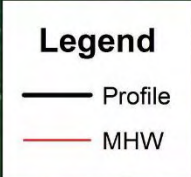
Project Purpose:

Demonstrate living shorelines as cost-effective, hybrid green-gray infrastructure approach for protecting local communities from coastal hazards while enhancing coastal resilience and ecosystem health.

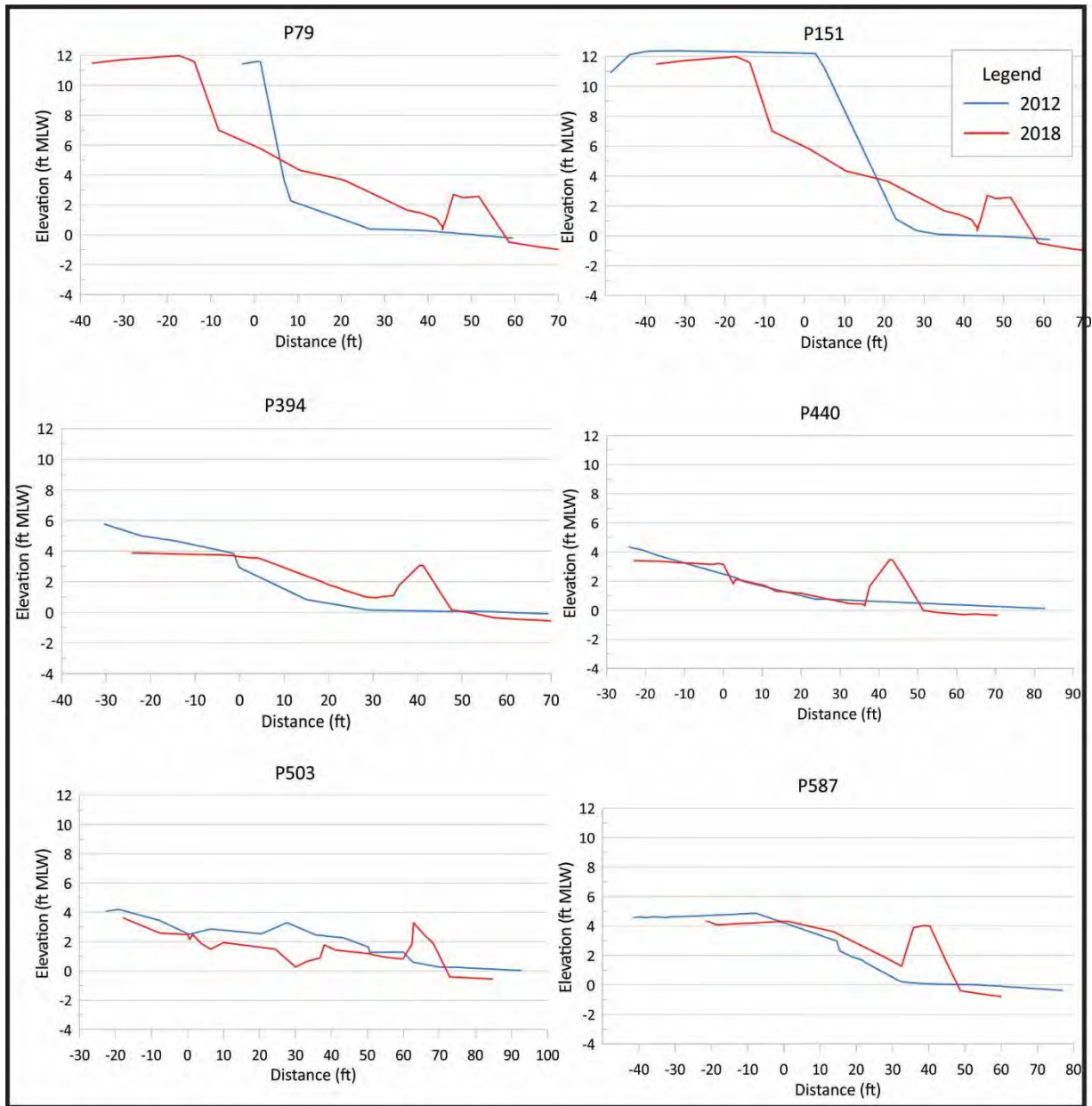




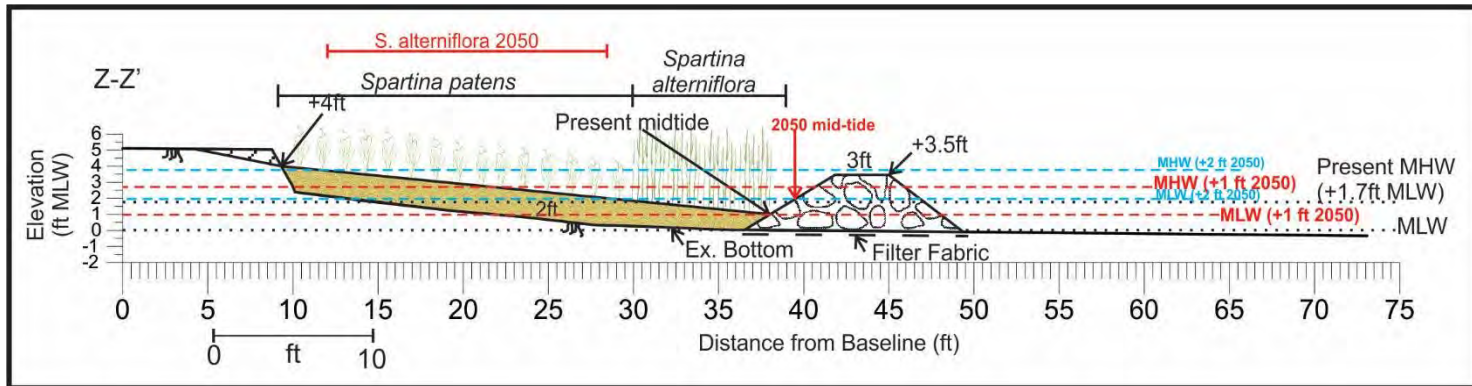




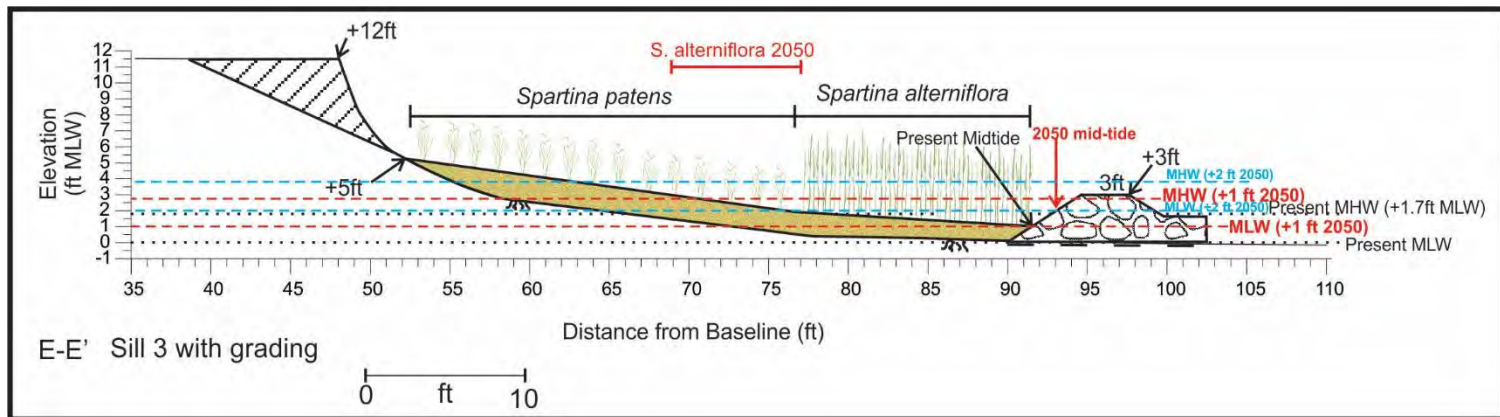
Location of cross-sectional profiles
At Occohannock and the 2018
surveyed position of mean high
water.



Cross-sectional profiles at Occohannock taken before the living shoreline project was installed and in 2018.



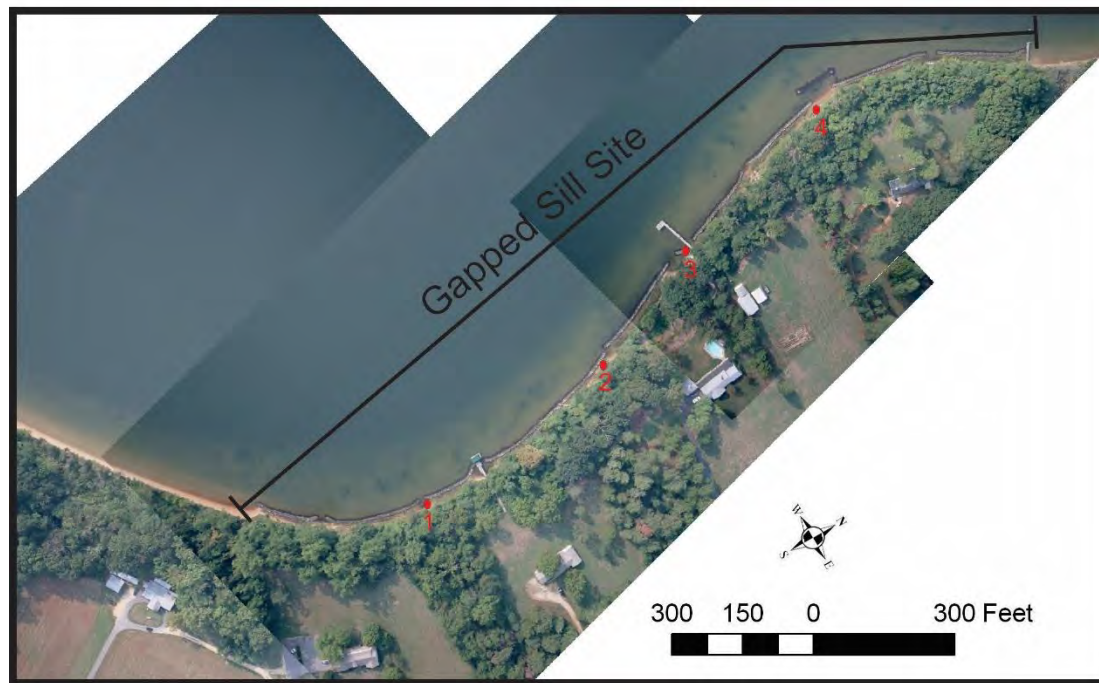
Sea-level rise scenarios modeled at St. Mary's and depicted on a typical cross-section.



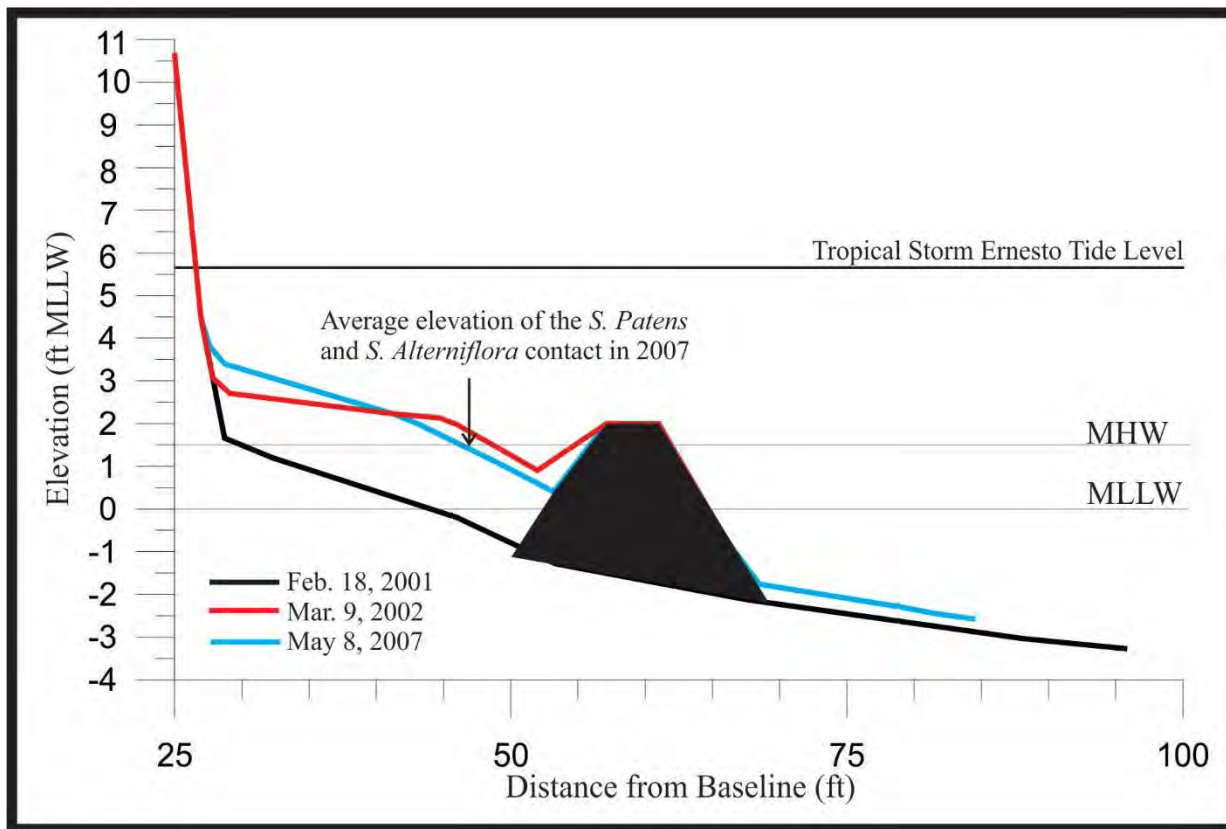
Sea-level rise scenarios modeled at Occhohannock. Also shown is the adaptive management strategy coastal resiliency of the living shoreline. Rock and sand could be added to the system to “reset” it thereby protecting the base of the bank.



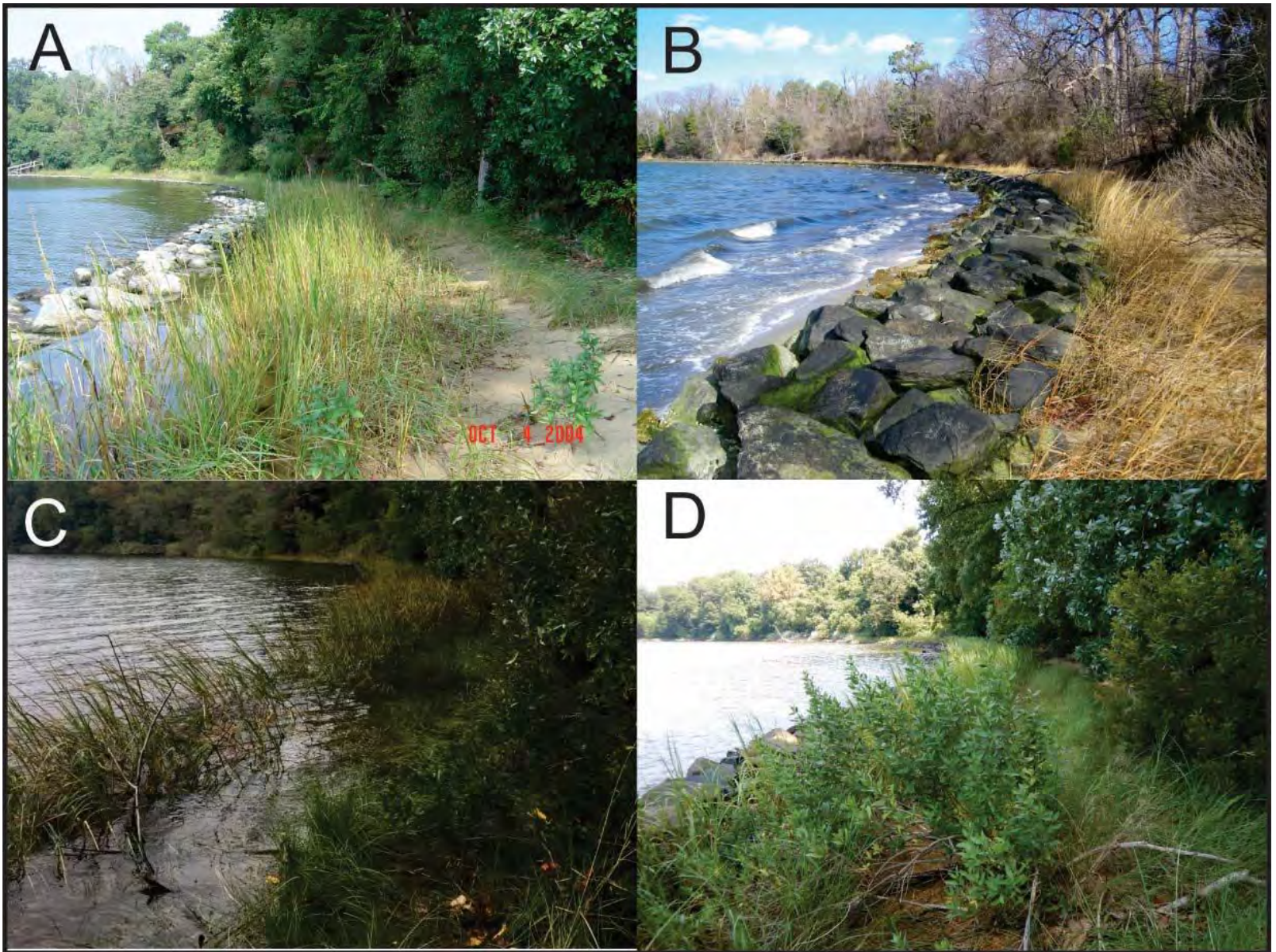
Location of St. Mary's sills.



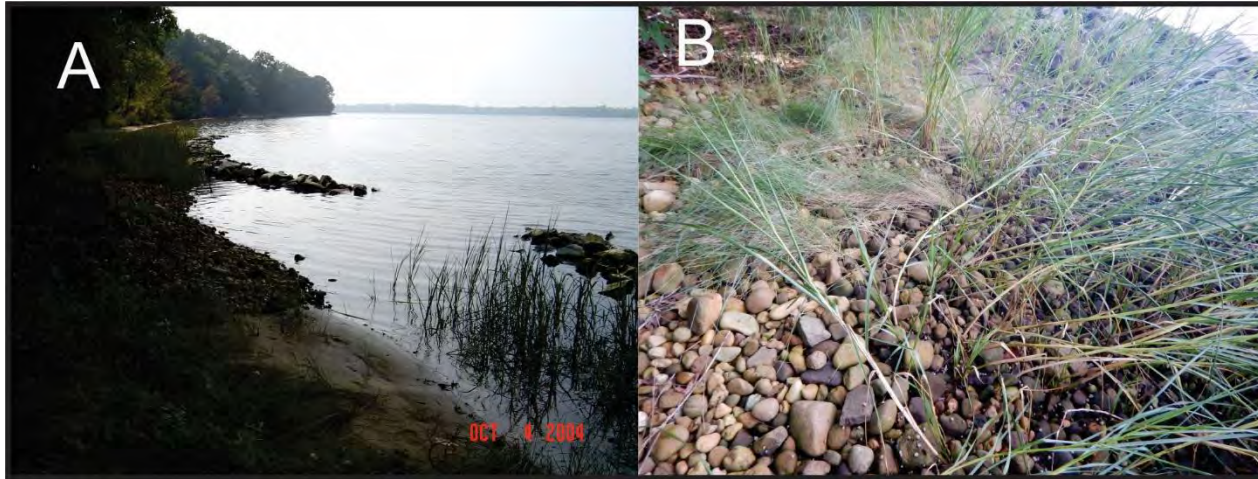
A photo mosaic of the St. Mary's City, Maryland shoreline on August 24, 2007 indicating the four sites of gapped fill projects and ground photographs of each site.



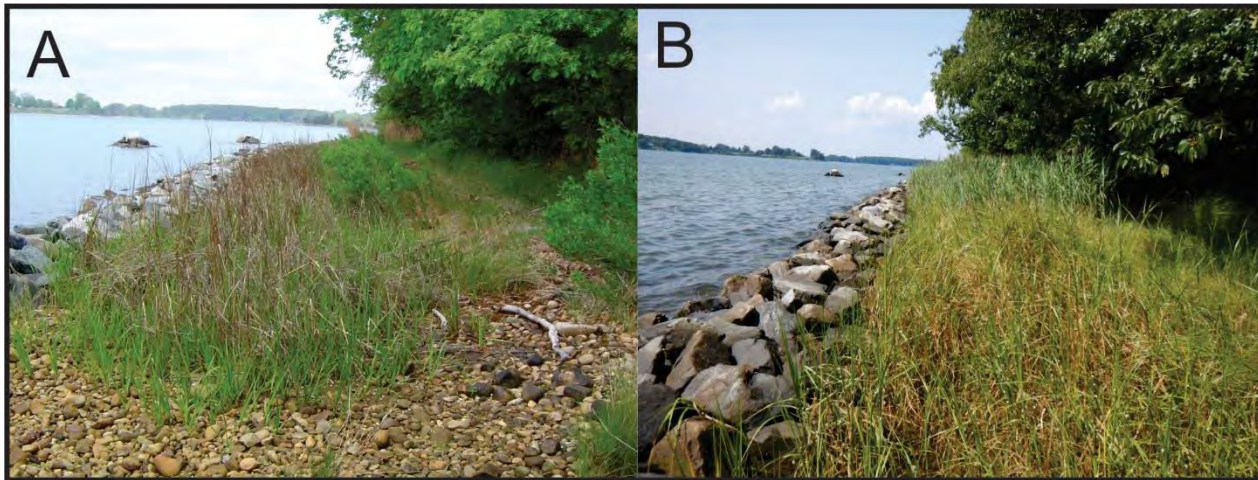
Typical St. Mary's City sill profile from survey data.



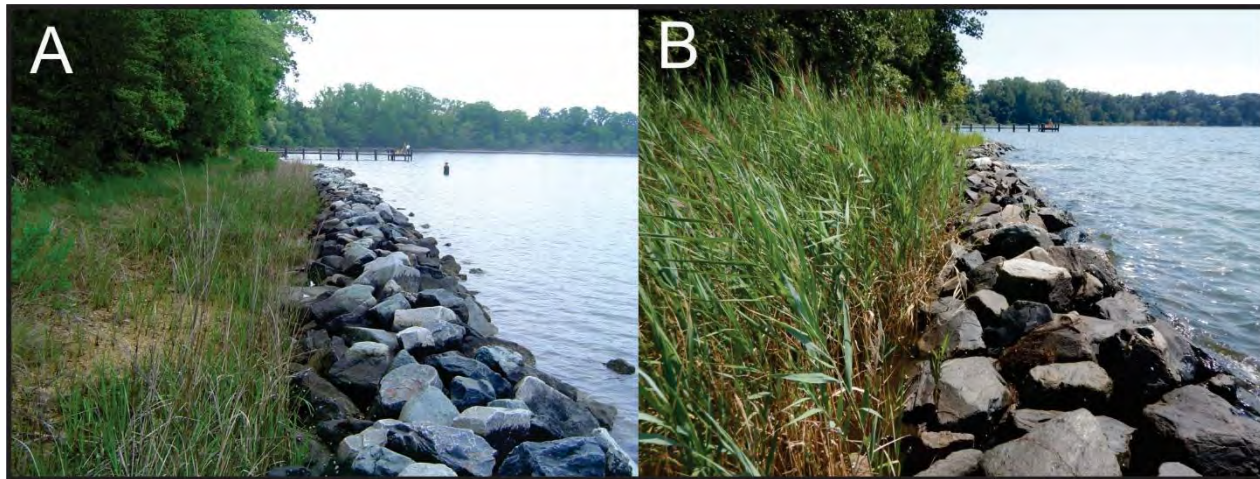
Photos of St. Mary's, South end: **A**) two years after construction (4 Oct 2004), **B**) 11 years after construction (1 Feb 2013), **C**) 15 years after construction (13 Oct 2017), **D**) 16 years after construction (15 Aug 2018).



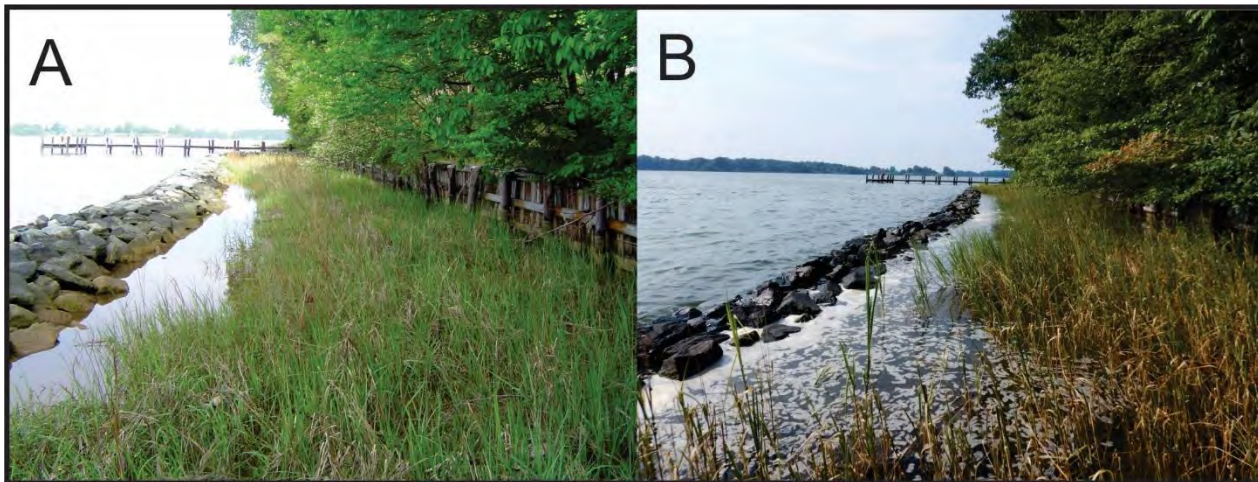
Gap at St. Mary's with Cobble pavement A) two years after construction, B) 16 years after construction (15 Aug 2018)



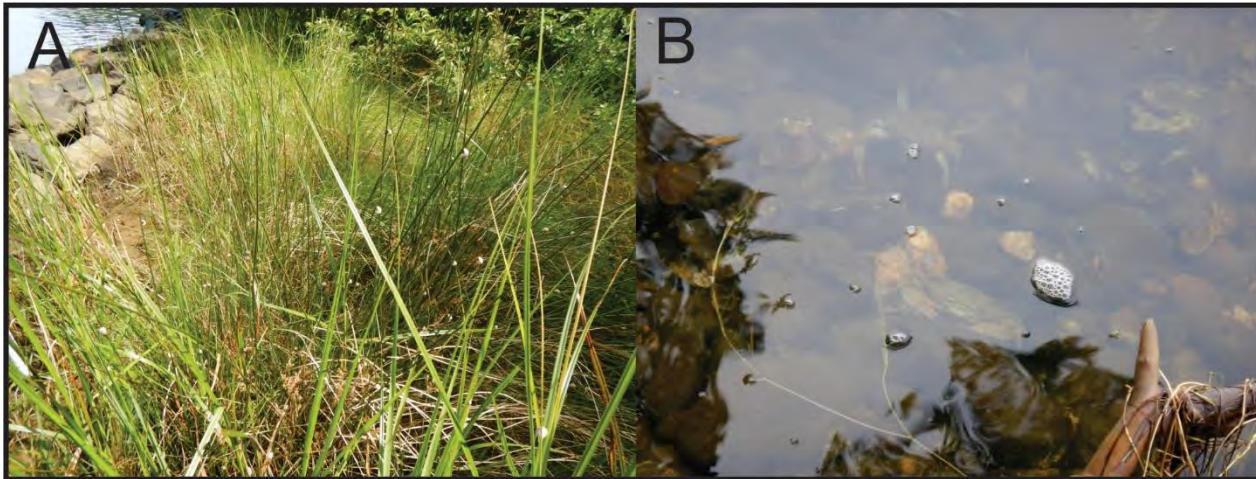
Gap and sill at St. Mary's A) five years after construction (9 May 2007), B) 16 years after construction (15 Aug 2018).



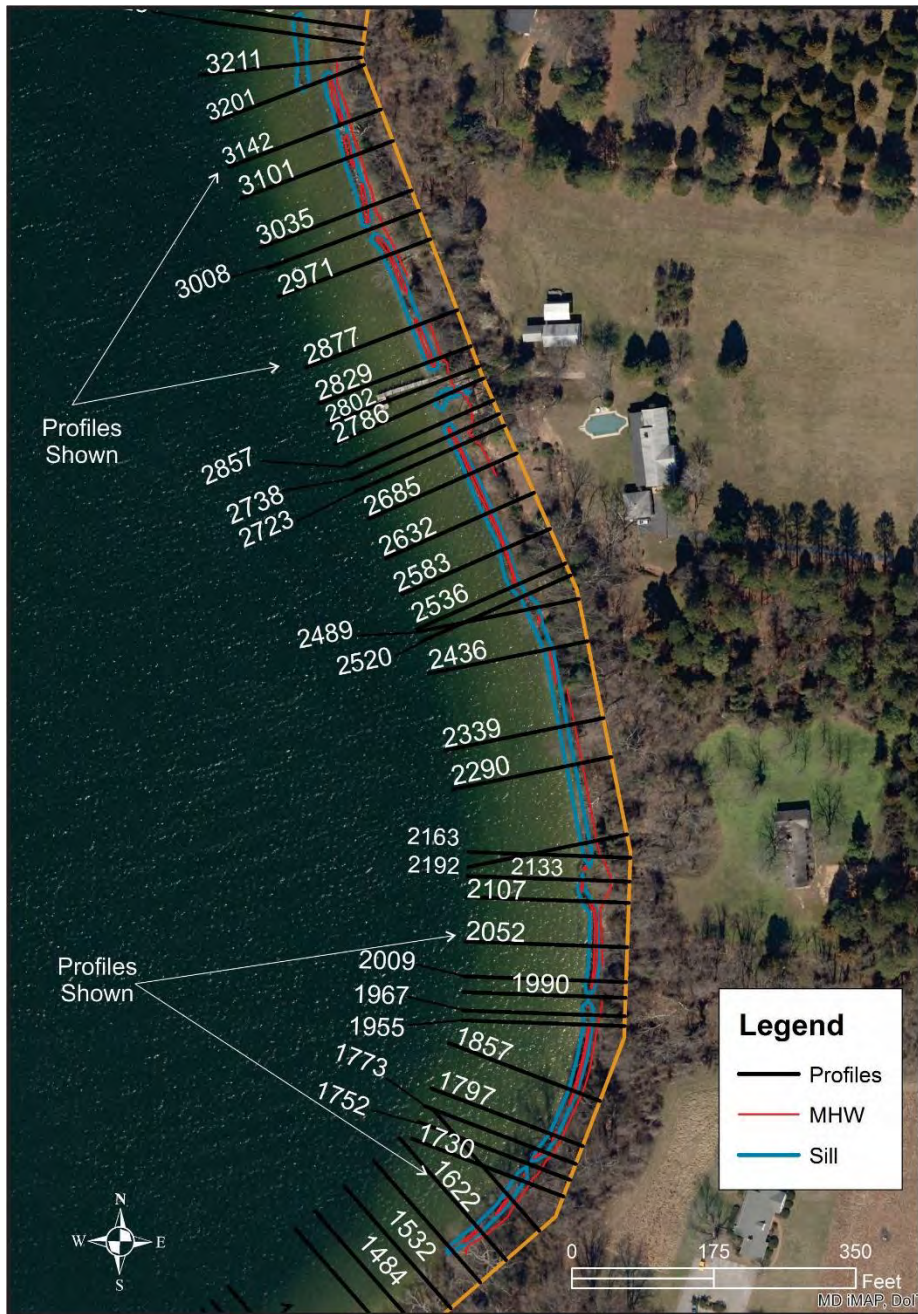
Sill at St. Mary's A) five years after construction (9 May 2007), B) 16 years after construction (15 Aug 2018). Phragmites has colonized behind the structures.



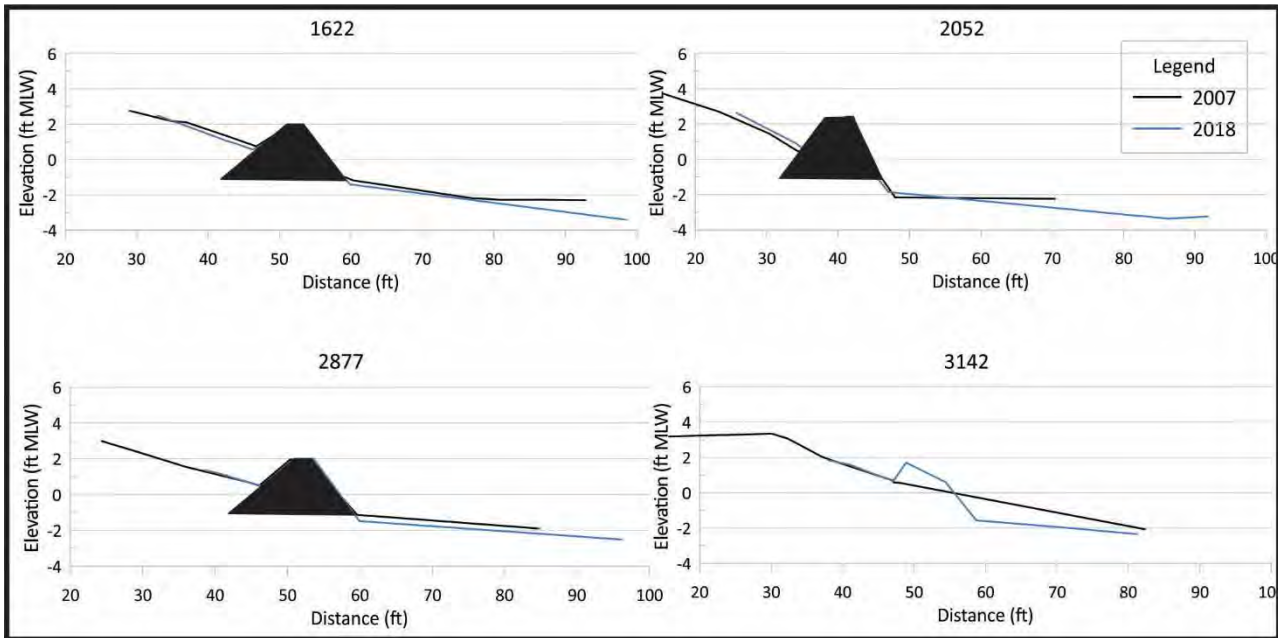
Sill backed by bulkhead at St. Mary's A) five years after construction (9 May 2007), B) 16 years after construction (15 Aug 2018). No change in the plants occurred



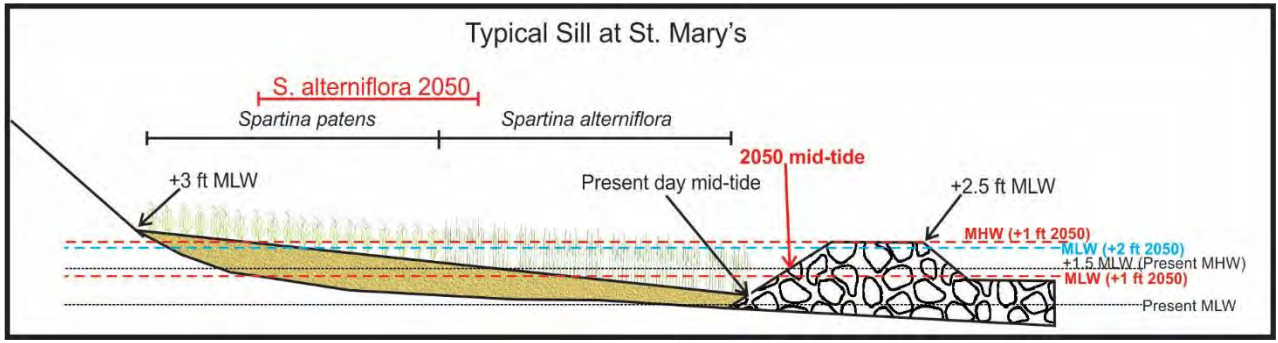
Sill at St. Mary's (15 Aug 2018) A) Needlerush has colonized some sections, B) blue crabs are prevalent along the shore.



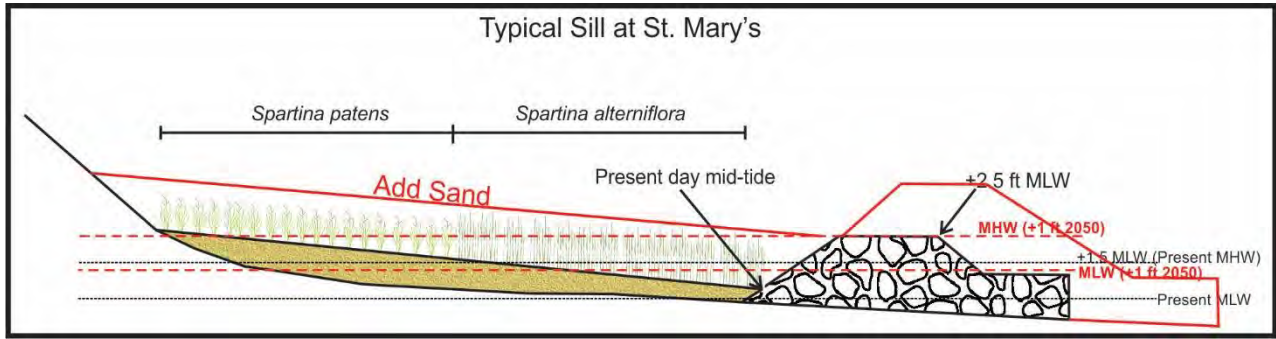
Cross-sectional profile baseline.
 Also shown are the outline of the sill structures (blue) and the 2018 mapped mean high water line.



Selected cross-sectional profiles showing the shoreline in 2007, 5 years after construction and in 2018.



Sea-level rise scenarios modeled at St. Mary's and depicted on a typical cross-section.



Sea-level rise scenarios modeled at Occohannock. Also shown is the adaptive management strategy coastal resiliency of the living shoreline. Rock and sand could be added to the system to “reset” it thereby protecting the base of the bank.



Location of living shoreline at Jefferson Patterson Park & Museum.



2



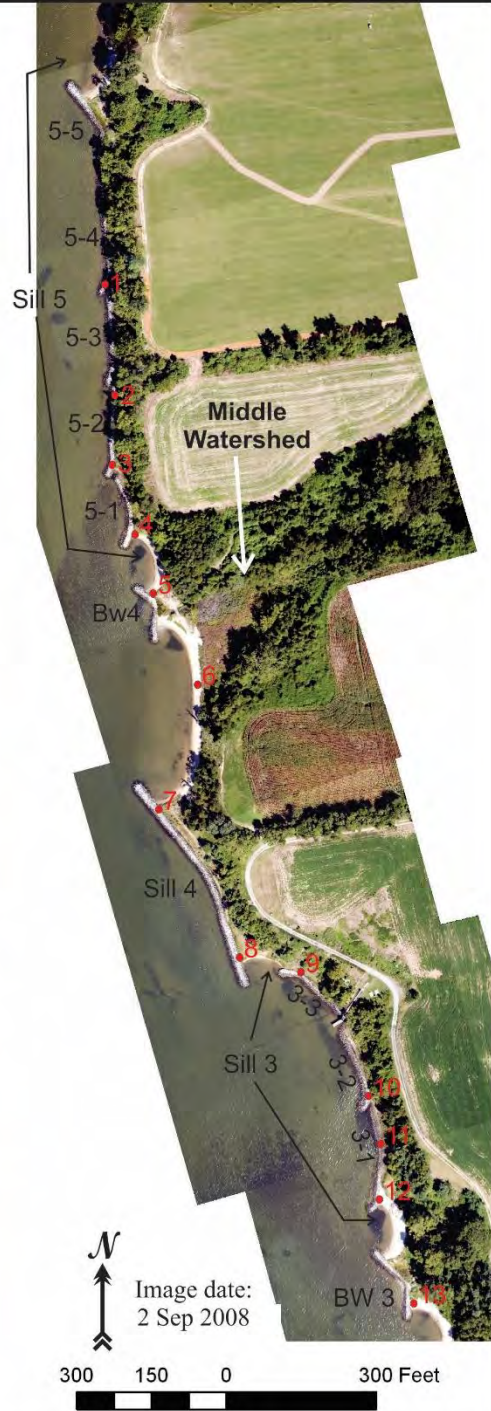
3



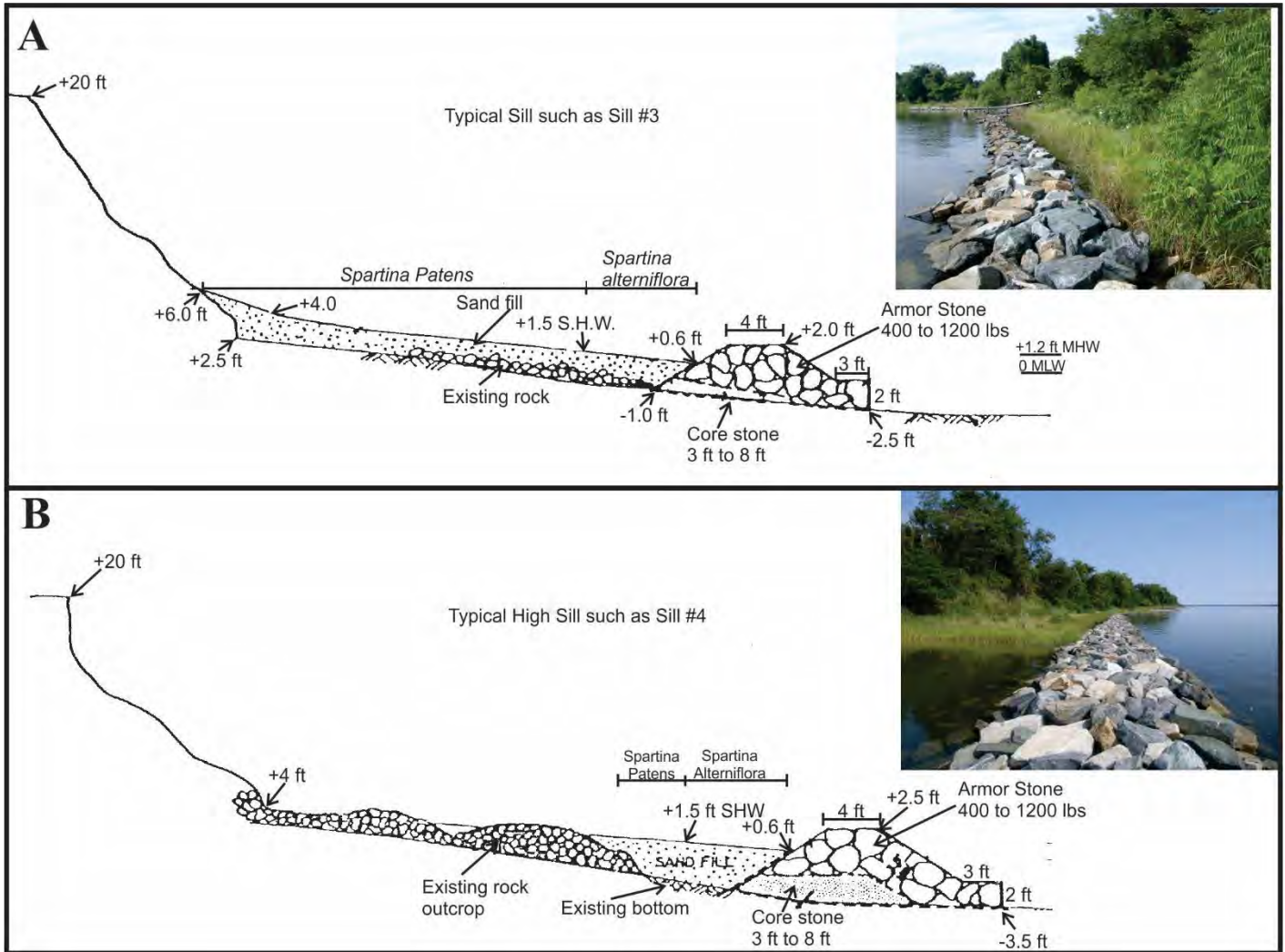
4



Ground photos taken on 20 Aug 2008



A photo mosaic of Jefferson Patterson Park & Museum shoreline on August 20, 2008 depicting the location of sills and breakwaters and indicating the locations of the ground photographs.



Design cross-sections of structures built at Jefferson Patterson Park & Museum in Phase 4 showing A) a typical sill such as Sill #3 (shown in the photo) and B) a typical high sill such as Sill #4 (shown in photo).



Photos of Sill #4 at Jefferson
Patterson on 20 Aug 2018 A) along the low
weir section,

B) higher section of sill,

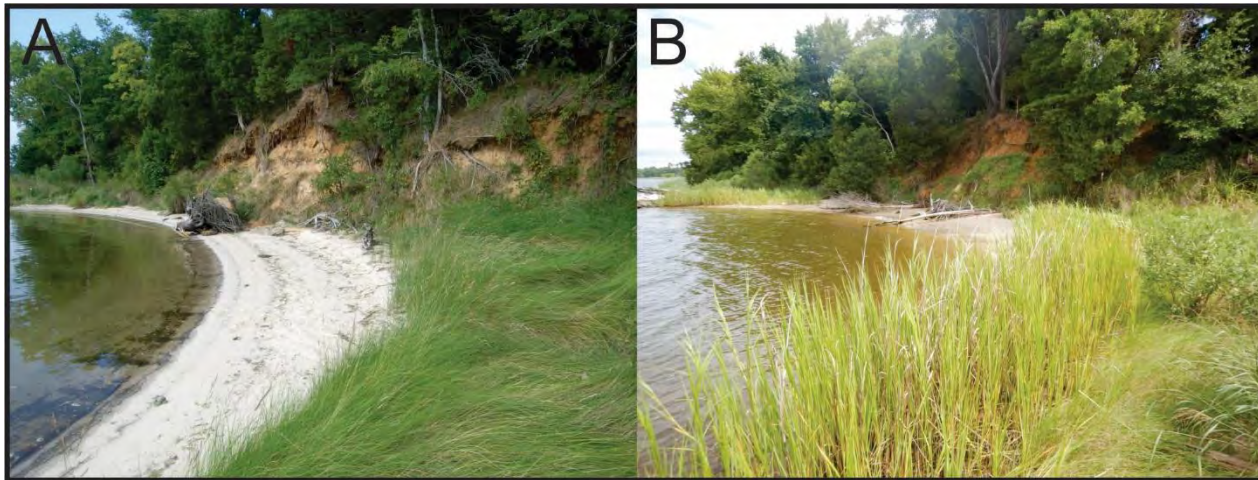
C) along
the backshore.



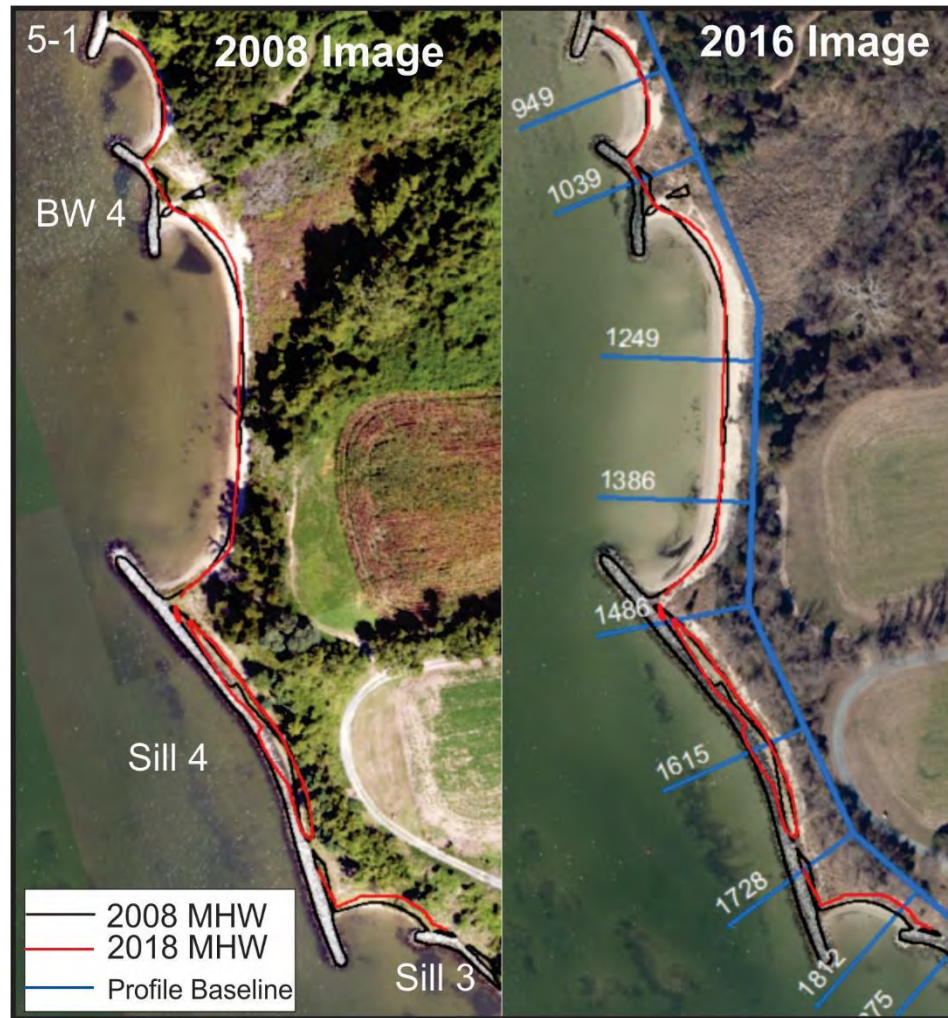
Photos at Jefferson Patterson looking from sill #4 downriver toward sill #3-3 in
A) 2008 and B) 2018 where extensive Phragmites is visible.



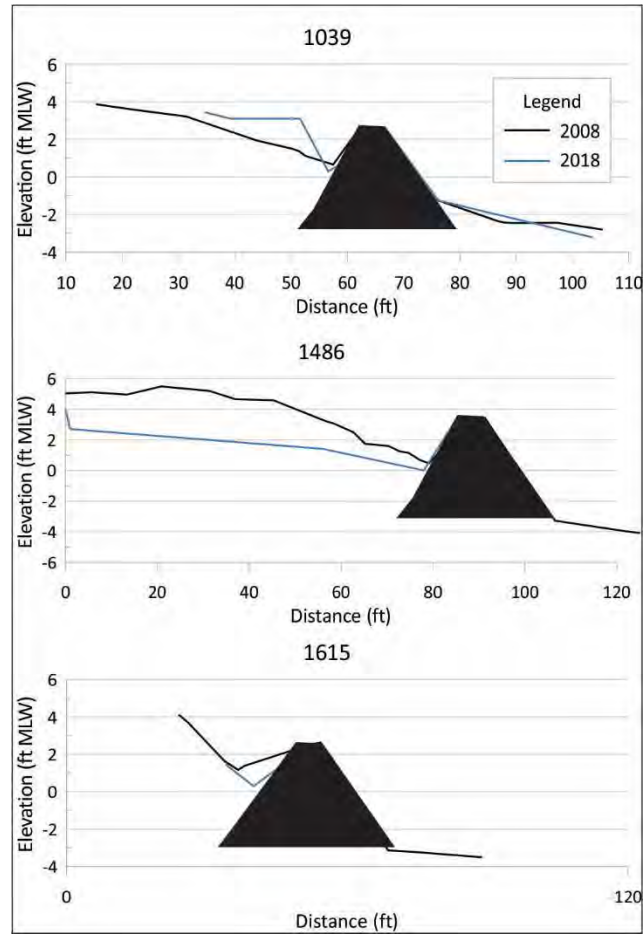
Photos at Jefferson Patterson looking from sill #5-1 and beyond in A) 2008 and B) 2018 where extensive Phragmites is visible.



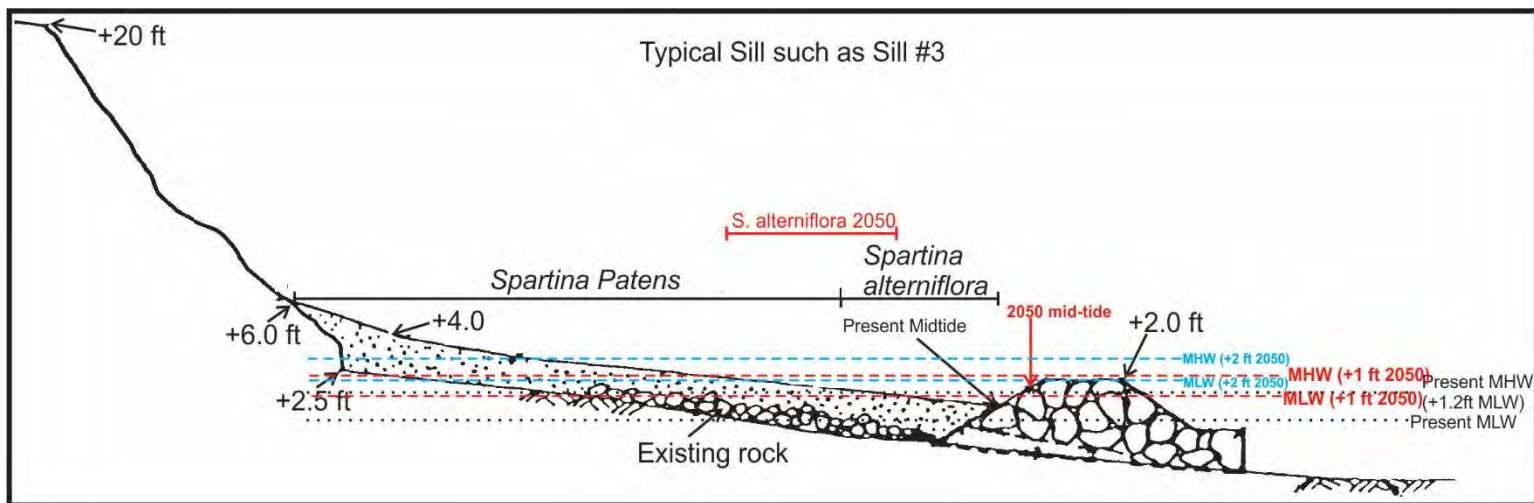
Photos at Jefferson Patterson of the embayment between BW4 and Sill 5-1 in A) 2008 and B) 2018 where Phragmites is visible and beach has narrowed with continued bank sloughing.

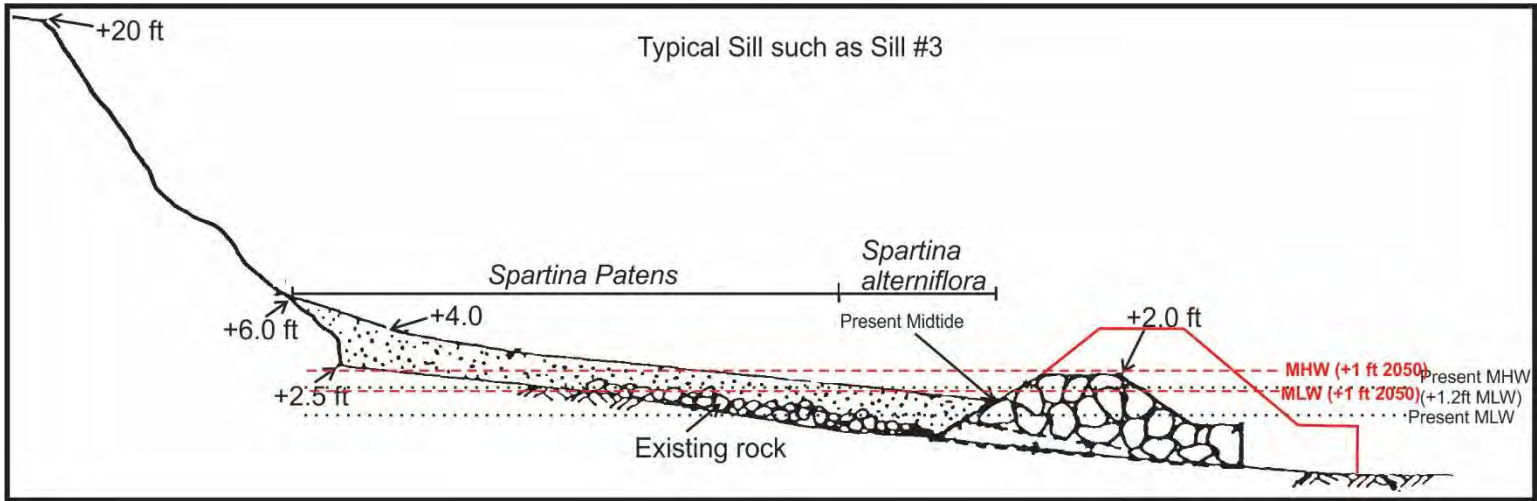


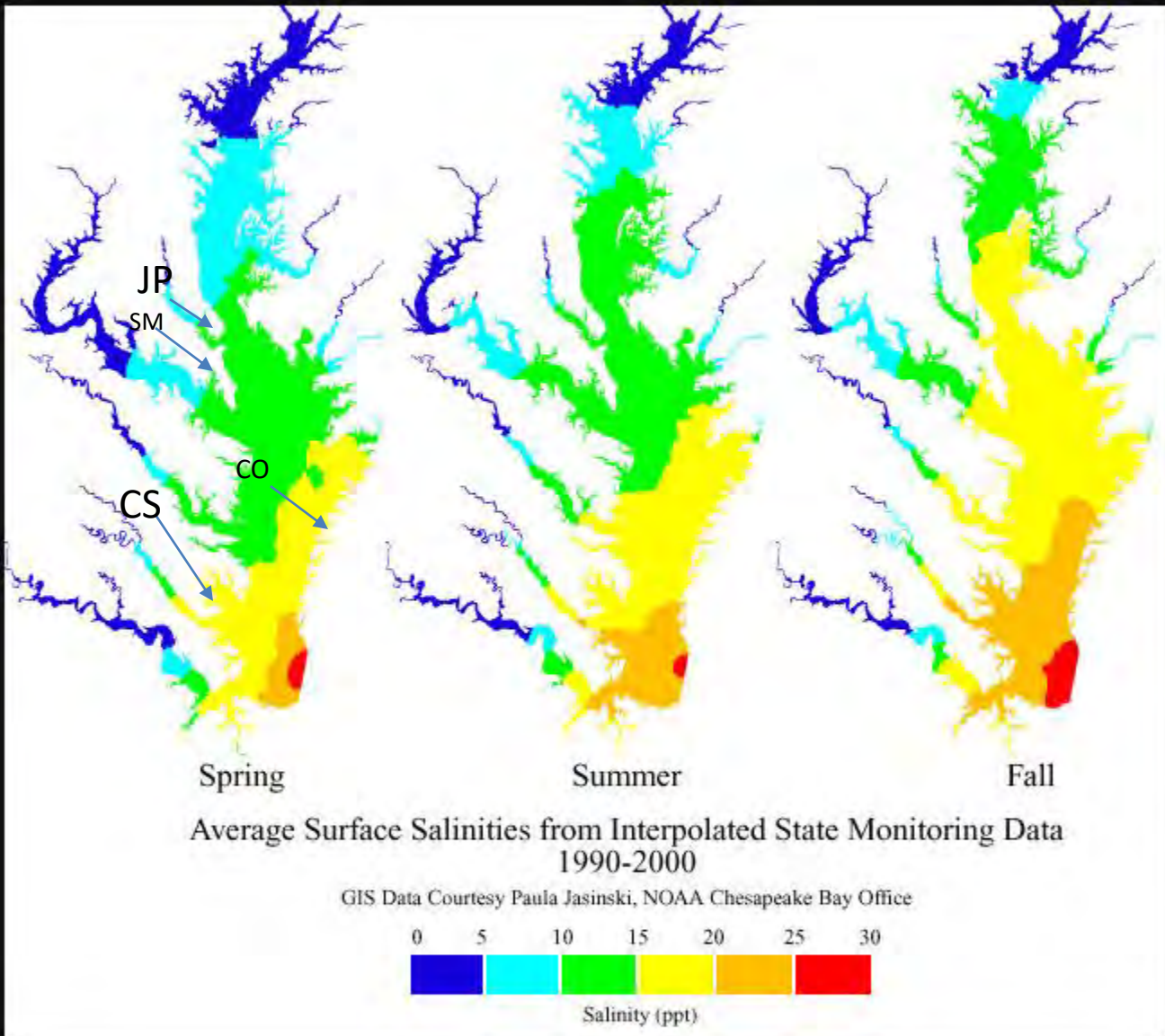
Aerial photos taken in 2008 and 2016 showing the cross-sectional profile locations and the surveyed position of mean high water in 2008 and 2018.



Cross-sectional profiles at Jefferson Patterson









Questions?