THE GREAT BAY
LIVING SHORELINE PROJECT

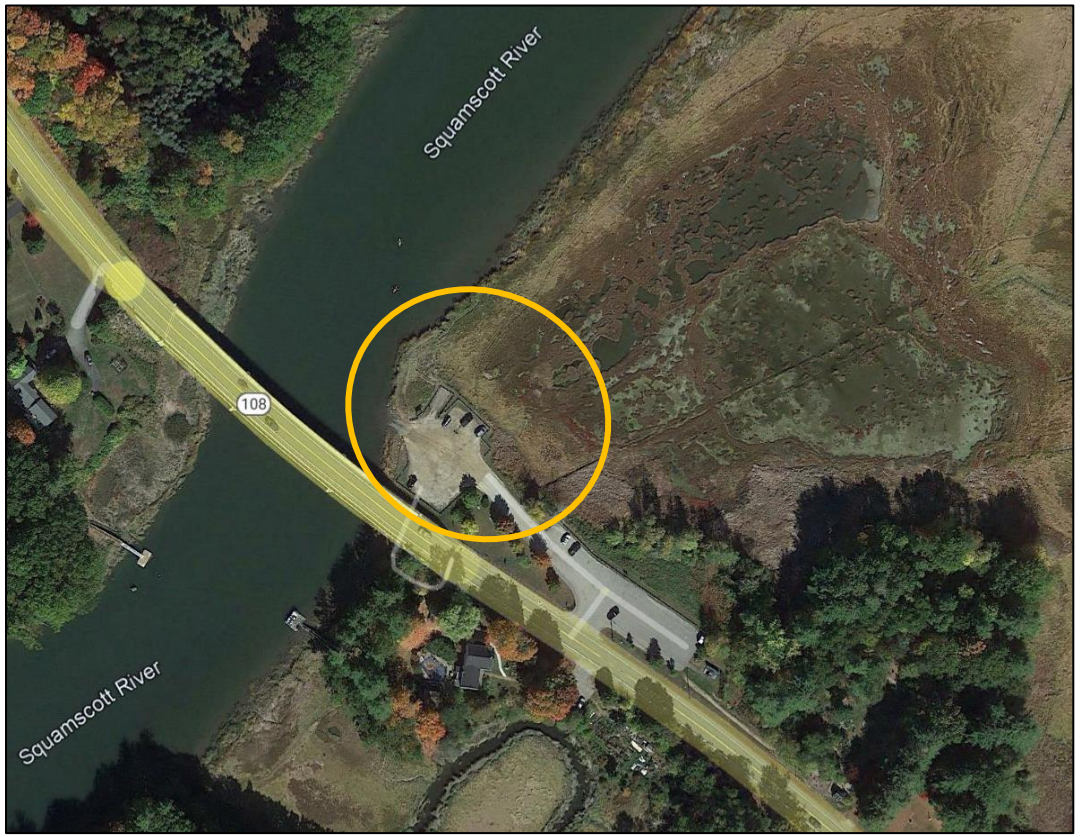
Chapman's Landing

Stratham, NH

Designing Living Shorelines for Great Bay Workshop
April 8, 2022

Existing Conditions

- Owned by NH Fish and Game
- Public boat ramp
- Extensive salt marsh



Landowner Goals

- Maintain boat access and general public use
- Preserve saltmarsh sparrow habitat
- Erosion – causes and mitigation measures

Site Impairments & Design Constraints

- Impairments
  - Erosion at edge of boat ramp
  - Trampling of salt marsh vegetation
  - Marsh edge erosion
- Design Constraints
  - Bedrock
  - Maintain boat ramp and parking lots
  - Need to avoid impacts to high marsh habitat

Tidal Datums:

Datums by Monthly Means Simultaneous Comparison (MMSC):

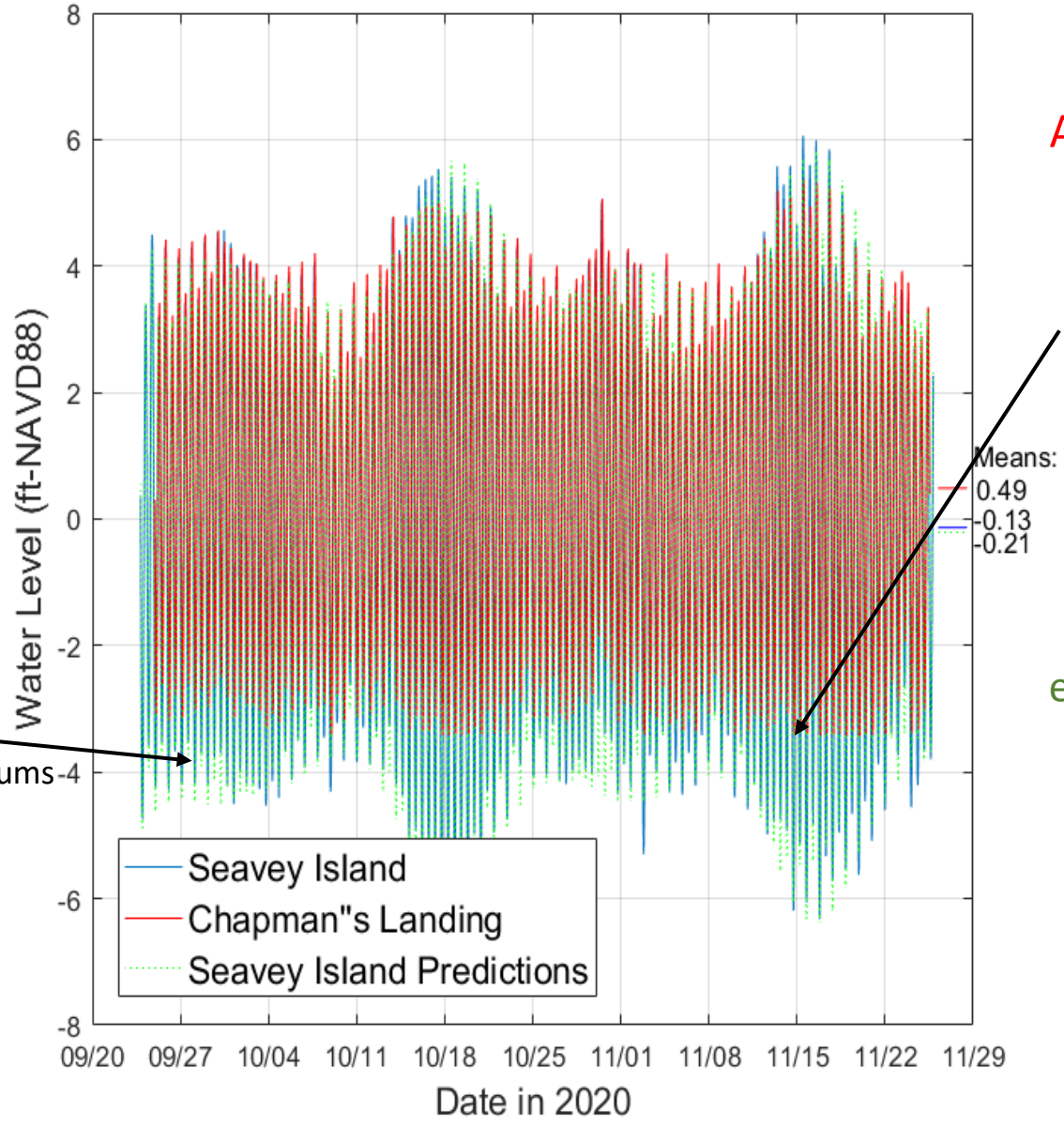
Tidal Datum Analysis Period: 2021-09-24 - 2021-11-29

Data Unit: Feet

MHHW	=	3.74	DHQ	=	0.33	HV	
MHW	=	3.41	DLQ	=	0.19	LW	
MTL	=	-0.16	MN	=	7.14		
DTL	=	-0.09	GT	=	7.65		
MSL	=	-0.13					
MLW	=	-3.73					
MLLW	=	-3.91					

https://access.co-ops.nos.noaa.gov/datumcalc/CalculateDatums

Seavey Island Reference Station
MMSC method doesn't give reasonable MLW or MLLW

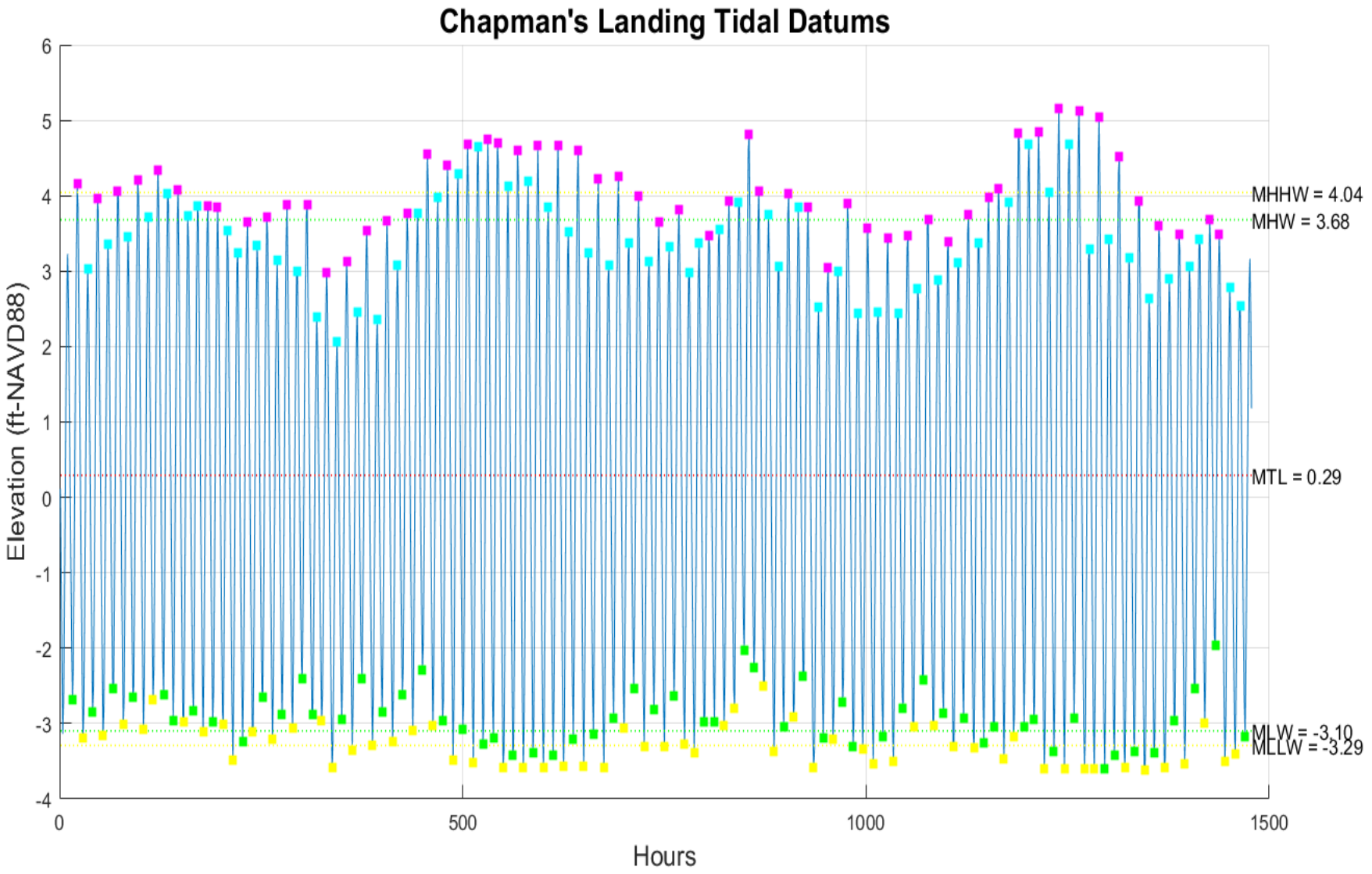


Low Water Appears Limited by local Ebb Flow Hydraulics

Limiting Suggests Potential non-linearity with SLR Should be investigated

e.g. MLW/MLLW may increase less than MSL increases with SLR

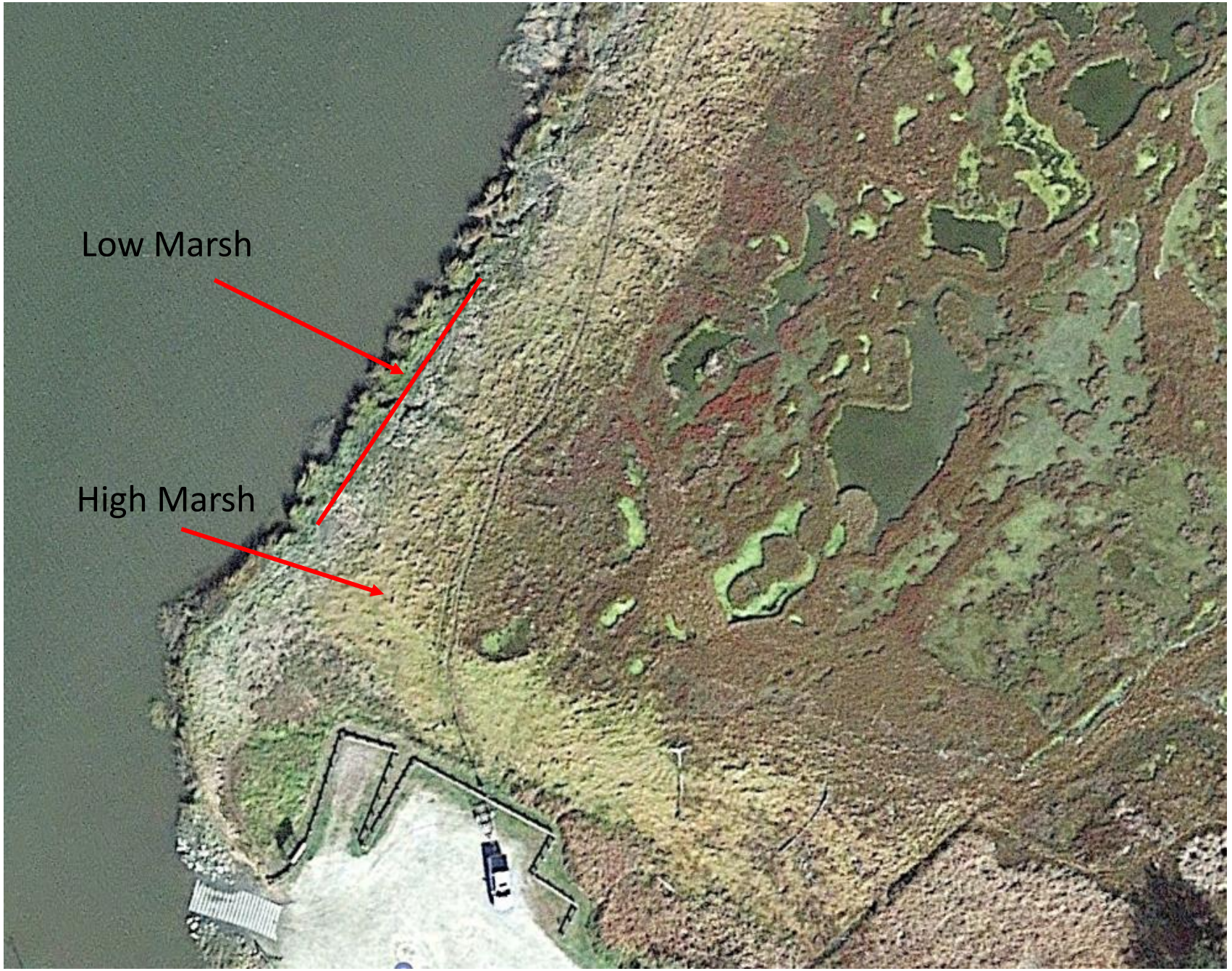
Tidal Datums:



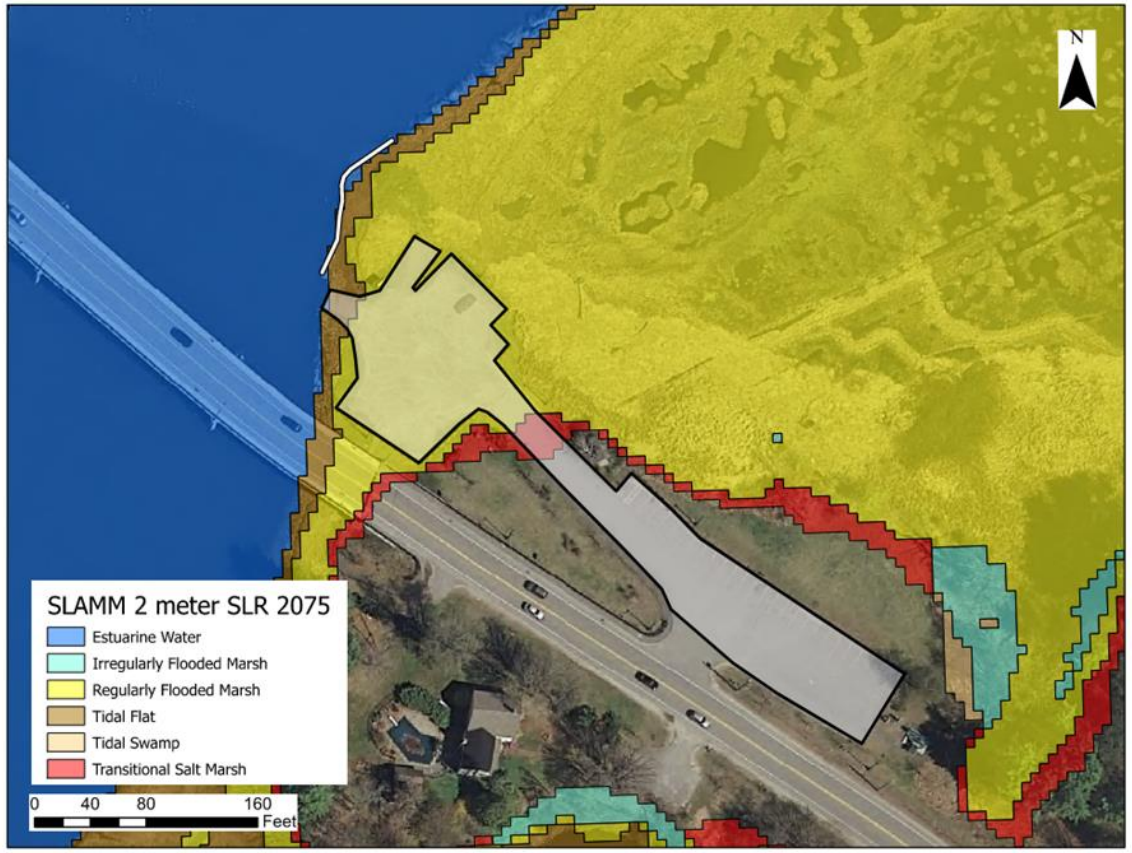
- Calculated directly from locally observed record
- Adjusted to NTDE by subtracting the difference between simultaneous MSL at Seavey Island and NTDE MSL at Seavey Island.
- For Preliminary Design Assume SLR is Linear

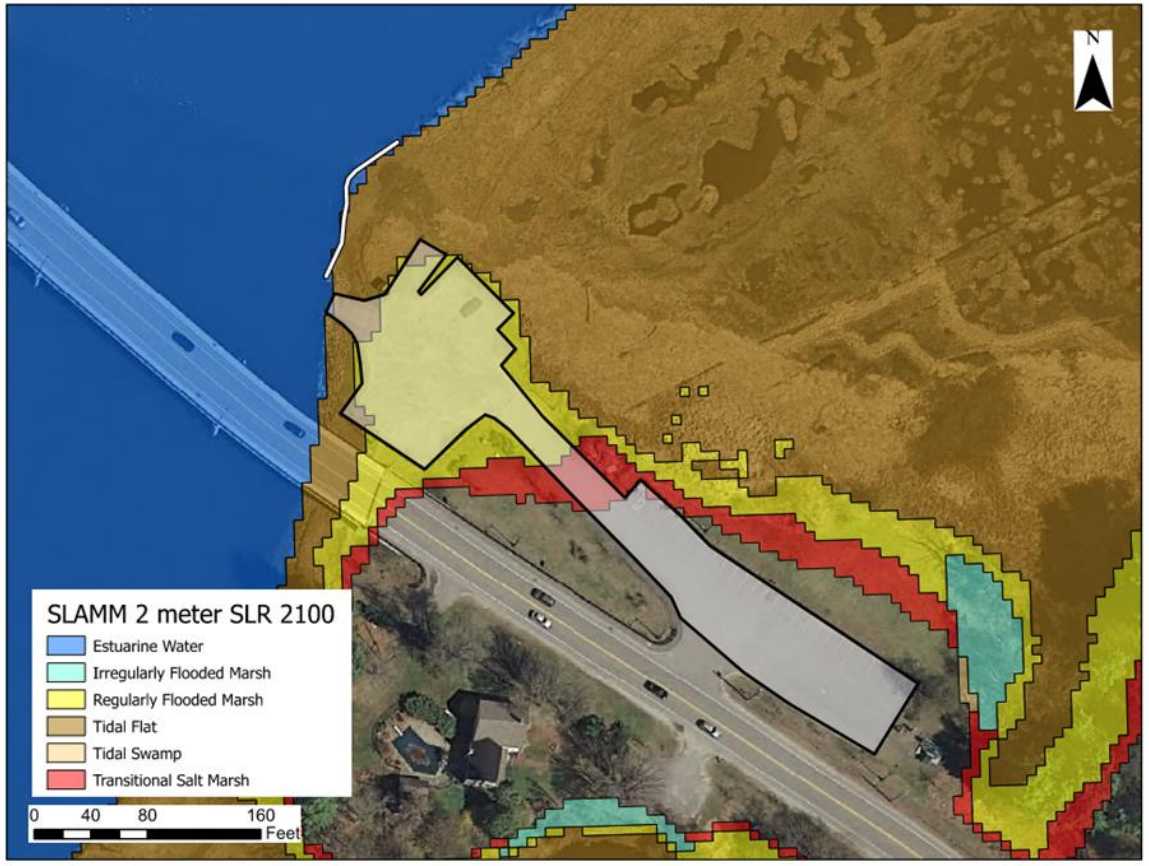
Existing Vegetation Zones

Datum	Elevation (ft, NAVD88)		Zone	Description	Typical Vegetation
	Existing	*2070 SLR Scenario (+2')*			
HTL	5.33	7.33	Tidal Buffer	Begins at or above HTL and extends up to 2ft higher	Transition from high marsh plants to *Phragmites*, sweetgrass, cattails, and oak-dominated upland
MHHW	4.04	6.04	High Marsh	Begins at MHW and extends up to HTL	*S. patens, J. gerardii, D. spicata, L. carolinianum*
MHW	3.68	5.68			
MTL	.29	2.29	Low Marsh	Begins above, but near, MTL and extends up to MHW	*S. alterniflora* at bank; megapools with short-form *S. alterniflora* and *Salicornia*
MLW	-3.10	-1.10	Subtidal	Below MTL	Mudflat, cobbles, bedrock
MLLW	-3.29	-1.29			


Low Marsh
High Marsh

Predicted Sea Level Rise at Chapman's Landing

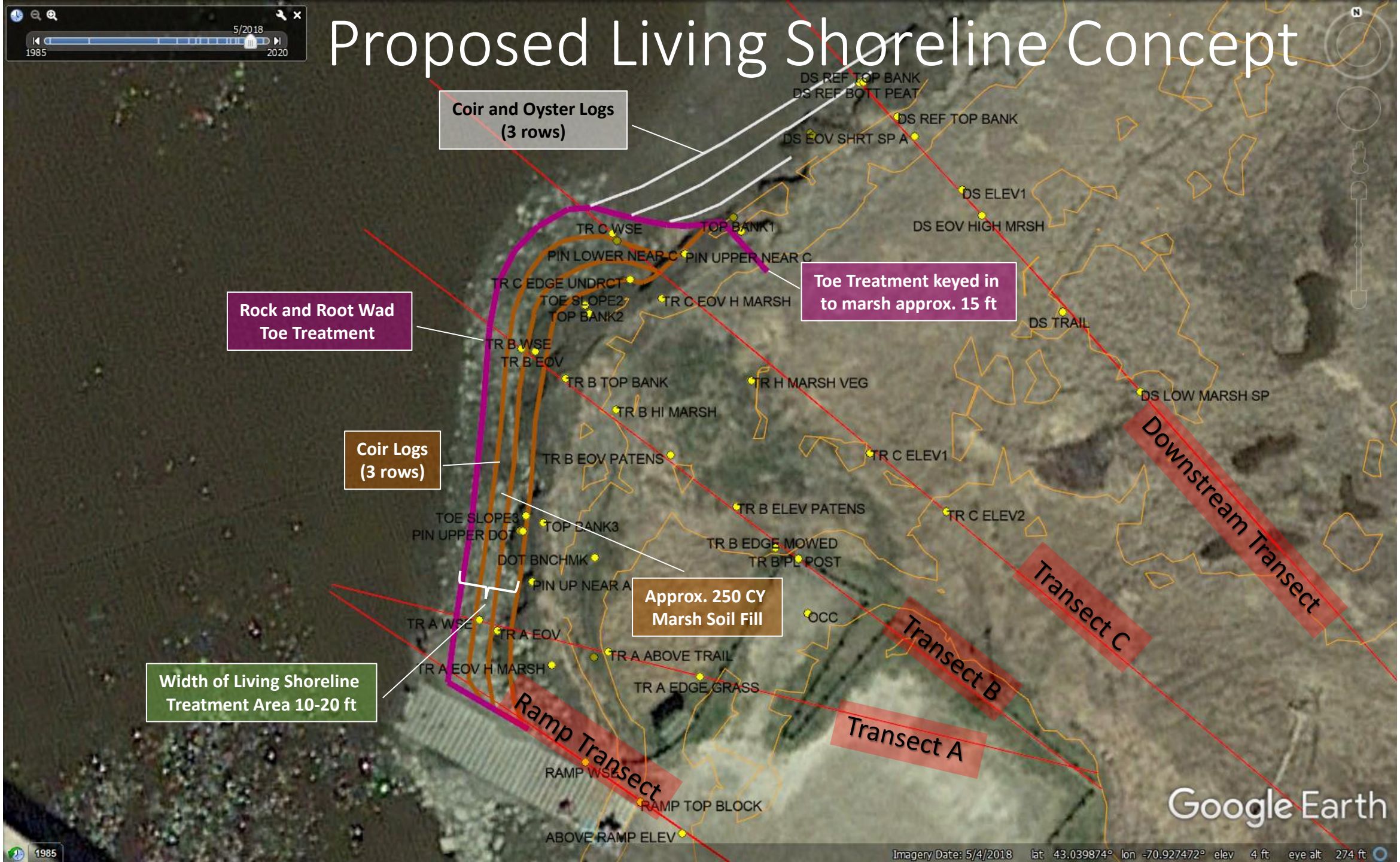




Site Challenges & Suggested Design

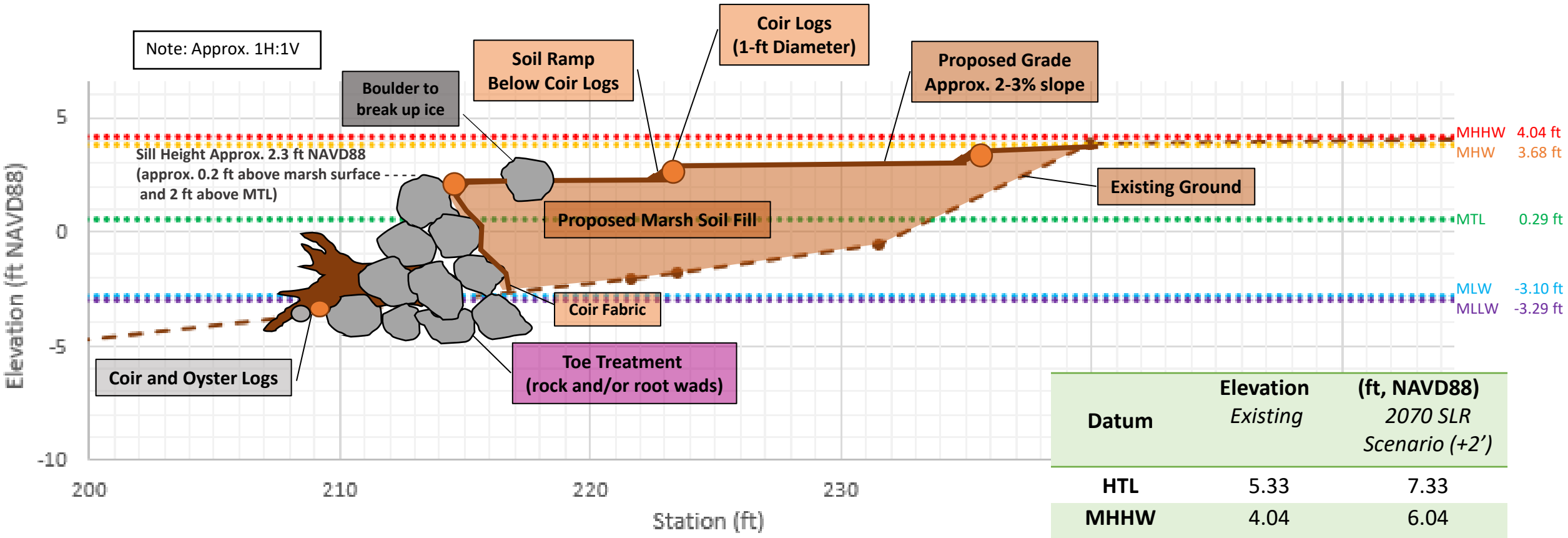
- When to intervene?
  - “No Action” is currently recommended
- Living Shoreline design
  - Protect boat ramp area and hold marsh edge
- Other site improvements
  - Stormwater runoff, pedestrian access
- Adaptation Pathway approach
  - Taking SLR into account, planning for retreat

Proposed Living Shoreline Concept



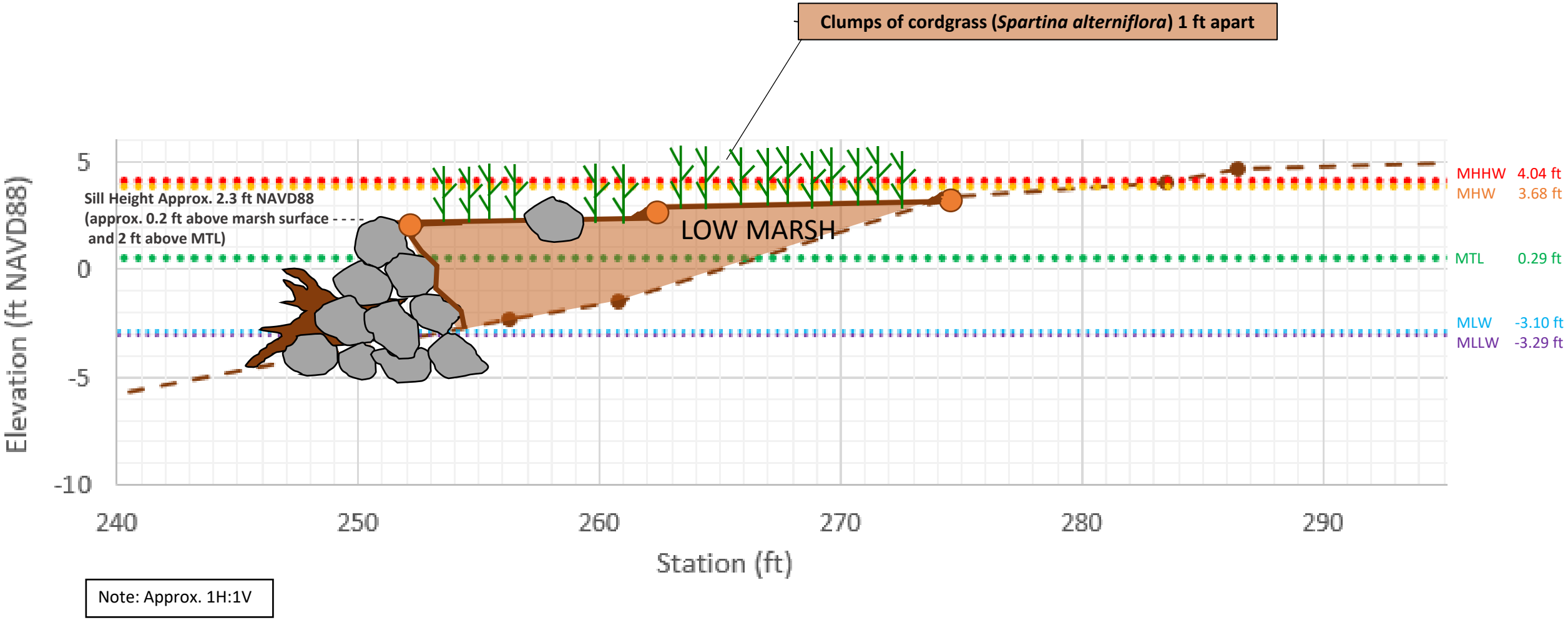
Proposed Transect C

(approx. 100 ft downstream of boat ramp)



Datum	Elevation (ft, NAVD88) *Existing*	*2070 SLR Scenario (+2')*
HTL	5.33	7.33
MHHW	4.04	6.04
MHW	3.68	5.68
MTL	0.29	2.29
MLW	-3.10	-1.10
MLLW	-3.29	-1.29

Proposed Transect A Plantings



Note: Approx. 1H:1V

Permitting Pathway

- Section 404 Permit – USACE
- Wetlands Permit – NHDES
  - Section Env-Wt 609.10 - Minimum Impact Tidal Shoreline Stabilization Projects:
    - A living shoreline project that is fully exposed at low tide
    - 200 LF or less
    - Minimize impacts to existing marsh

Conceptual Site Plan

Boardwalk

Trench Grate

Beach Plum

Bayberry

Boardwalk
Interpretive Signs

Rain Garden

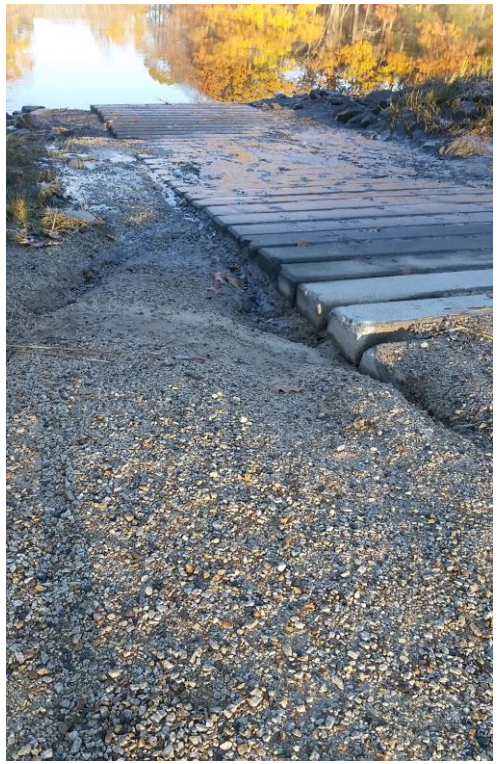
Stormwater Management, Erosion & Marsh Protection

Existing Conditions

Parking, Guard Rail & Marsh Interface

Kiosk

Parking Lot and Access Drive



Boat Ramp Erosion

Adaptive Pathways & Monitoring Metrics

- Key question:
  IF/WHEN to intervene?

- **Adapt decision-making based on monitoring metrics** and observed conditions over the next few years/decades
  - Rate of erosion observed
  - Rate of sea level rise observed
  - Rate of marsh vegetation rate observed
  - Salt marsh sparrow nesting success

Adaptation Pathways for Chapman's Landing **(Option 3)**

> 1 ft. of additional SLR since 2021

OBSERVE and MONITOR

TIER 1:
Stand by (no shoreline intervention recommended)

Pre-emptively abandon lower lot;
skip shoreline stabilization toe/sill,
install new boat ramp to upper lot

TIER 3
Retreat from lower lot … extend new ramp to upper lot, and add:
- new boat turnaround in upper lot
- living shoreline in eroded marsh area
- bioretention stormwater BMPs
- boardwalk/overlook amenity?

Stormwater BMPs and Living Shoreline may be inundated regularly w/tide (reduced effectiveness)

Metric #1 >>

Observed sea level rise (depth above 2021 baseline)

Legend

- Design choice/transition opportunity
- End/abandon action
- Action taken
- Transition to new action or adapt current action

Adaptation Pathways for Chapman's Landing **(Option 4)**

OBSERVE and MONITOR

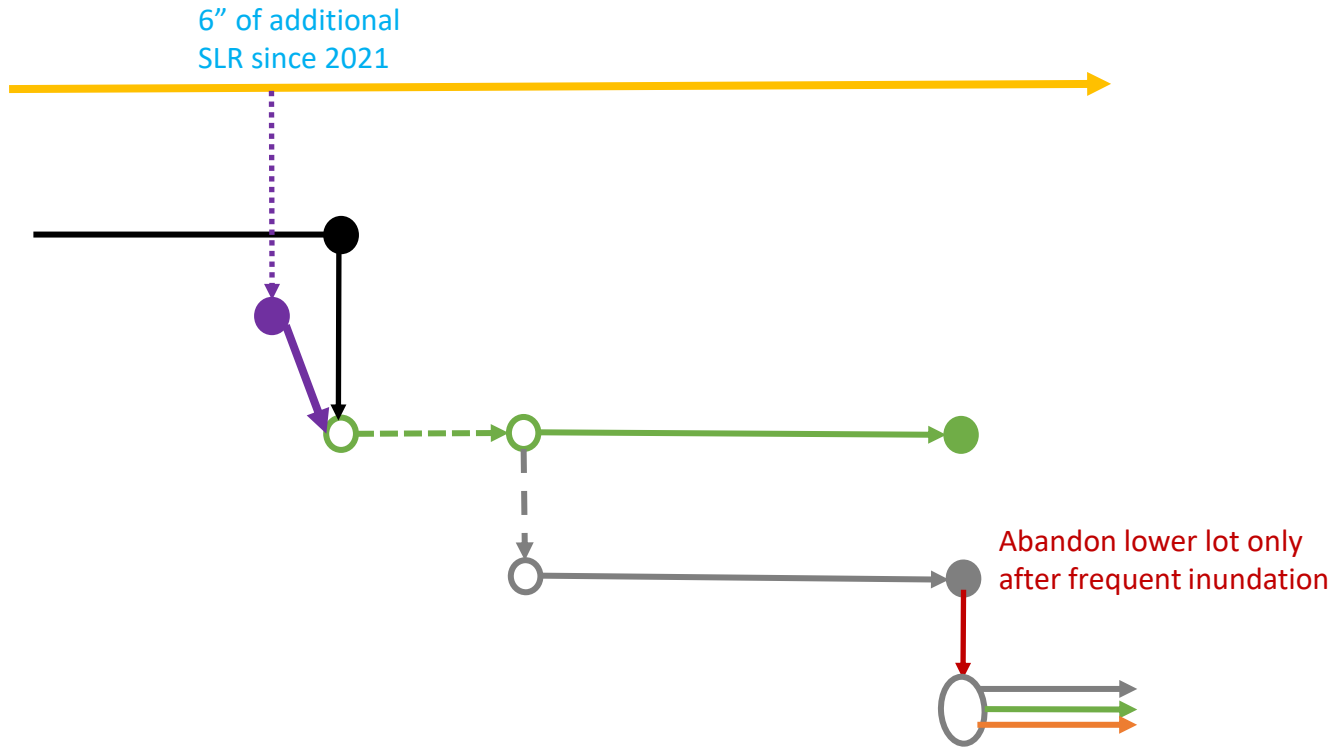
TIER 1:
Stand by (no shoreline intervention recommended)

As observed SLR/erosion increases, apply for grant funding (for toe sill/signage)

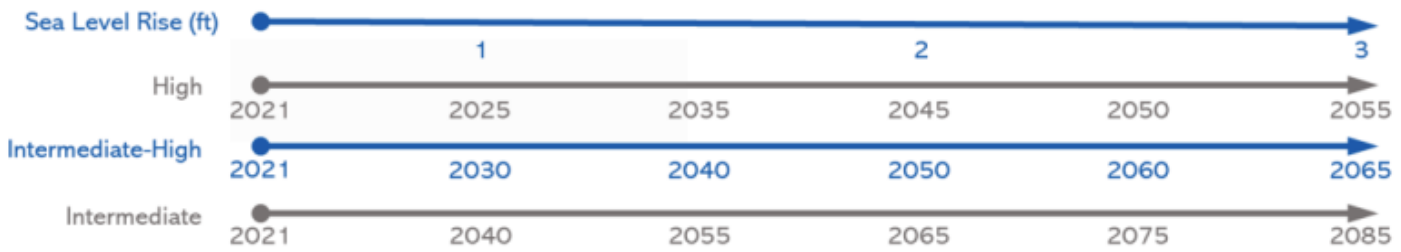
Implement shoreline stabilization;
rock/oyster "toe" edge protection
w/educational signage

WAIT…. then regrade/upgrade boat ramp (TIER 2)

WAIT…. then retreat from lower lot and add (TIER 3):
- new ramp; new boat turnaround in upper lot
- living shoreline in eroded marsh area
- boardwalk/overlook amenity?



Metric #1 >>



Observed sea level rise (depth above 2021 baseline)

Legend

- Design choice/transition opportunity
- End/abandon action
- Action taken
- Transition to new action or adapt current action

STEP 3

STEP 3 TABLE A. RECOMMENDED DECADAL RSLR ESTIMATES (IN FEET ABOVE 2000 LEVELS) BASED ON RCP 4.5, PROJECT TIMEFRAME, AND TOLERANCE FOR FLOOD RISK.

TIMEFRAME	HIGH TOLERANCE FOR FLOOD RISK	MEDIUM TOLERANCE FOR FLOOD RISK	LOW TOLERANCE FOR FLOOD RISK	VERY LOW TOLERANCE FOR FLOOD RISK
	Plan for the following RSLR estimate (ft)* *compared to sea level in the year 2000*			
	Lower magnitude, Higher probability	←	→	Higher magnitude, Lower probability
2030	0.7	0.9	1.0	1.1
2040	1.0	1.2	1.5	1.6
2050	1.3	1.6	2.0	
2060	1.6	2.1	2.6	
2070	2.0	2.5	3.3	3.7
2080		3.0	3.9	4.5
2090		3.4	4.6	5.3
2100		3.8	5.3	6.2
2110	3.3	4.4	6.1	7.3
2120	3.6	4.9	7.0	8.3
2130	3.9	5.4	7.9	9.3
2140	4.3	5.9	8.9	10.5
2150	4.6	6.4	9.9	11.7

Low tolerance for marsh itself / salt marsh sparrow nesting

Higher tolerance and later timeframe for boat ramp upgrade and parking lot, site amenities

*The colors (blue, red, purple, green) in Step 3 Table A correspond with the colors of the graph depicted in Figure 2 (see also Figure 4.5 in *Part I: Science*[17]). The RSLR estimates for High tolerance for flood risk projects correspond with K14, upper end of "likely" estimates for RCP4.5 (83% chance RSLR will not exceed this value). The RSLR estimates for Medium tolerance for flood risk projects correspond with K14, 1-in-20 chance estimates for RCP 4.5. The RSLR estimates for Low tolerance for flood risk projects correspond with K14, 1-in-100 chance estimates for RCP 4.5. The RSLR estimates for Very Low tolerance for flood risk projects correspond with K14, 1-in-200 chance estimates for RCP4.5. For K14, 1-in-1000 chance estimates, see Table 4.2 in *Part I: Science*.[17] Note that while the Bayesian probabilities associated with RSLR projections are useful, they have some limitations as described in Box 4.3 in *Part I: Science*.[17]

Next Steps

- Design Team's recommendation is not to intervene at this time
  - Continuation of monitoring (SLR, marsh edge erosion rate, salt marsh sparrow habitat, vegetation change, site usage)

- Site affords innovation + research opportunity; viability of oyster survivability in Great Bay with SLR
  - Coir logs with oyster spat, culture
  - Oyster castles

Questions?

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