
AquaShield Engineering
GUARDING TOMORROW, TODAY

Proposed Modifications to Reduce Spring Tide Flooding at Motts Channel Seafood

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Brickell, Miami
October 17, 2016

Spring Tide/King Tide Flooding

Occurs during a new or full moon is aligned with the sun and earth.		Twice per month
Perigee: when the moon is closest to the Earth.		~ 28 days
Perigean-spring tides: New or Full moon coincides with perigee.		6-8 Times per year

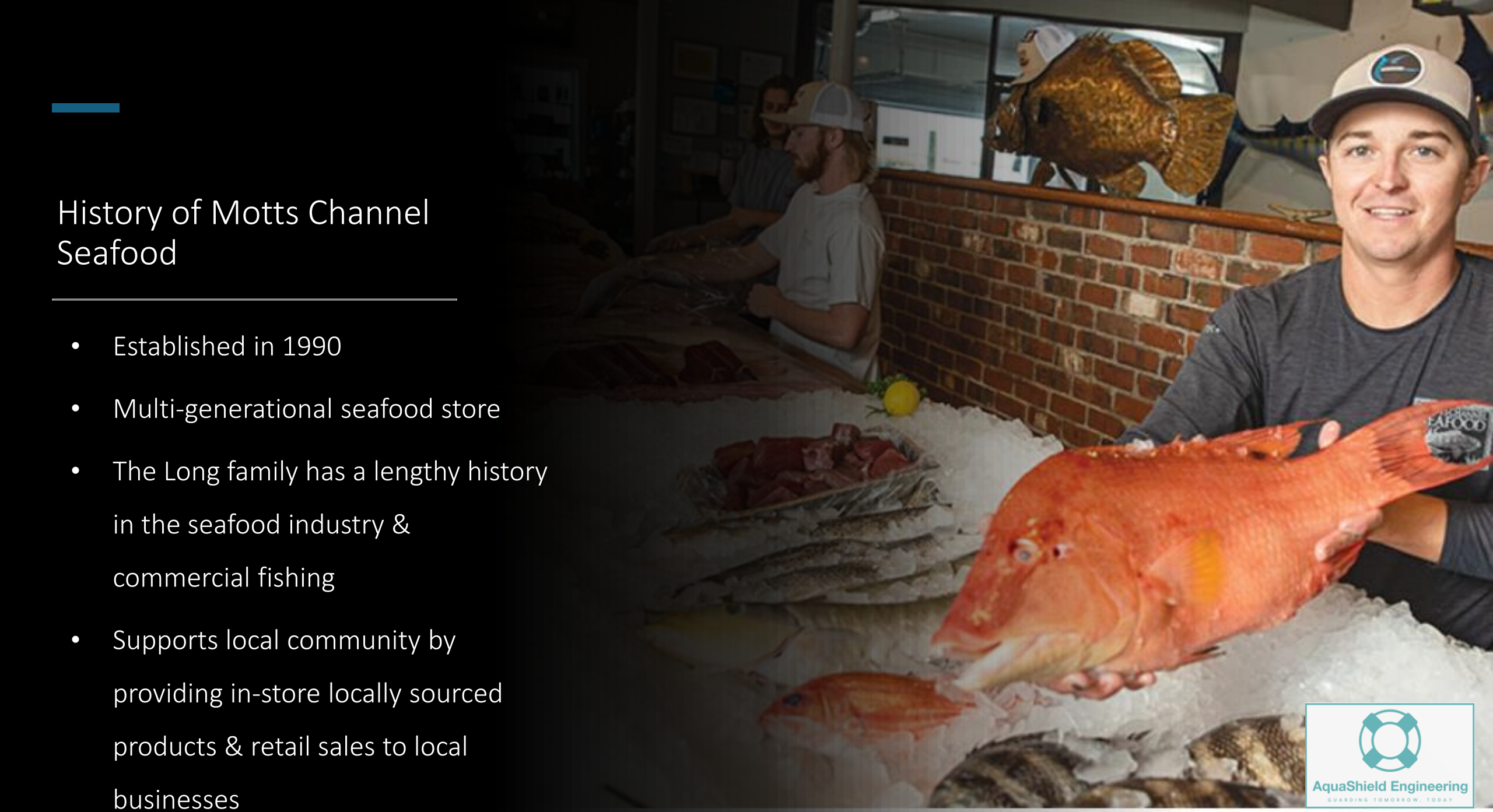
Image: B137, via Wikimedia Commons

Motts Channel Seafood

- On the southern side of Harbor Island
- Adjacent to Motts Channel
- Channel is a branch of the Intercoastal Waterway

History of Motts Channel Seafood

- Established in 1990
- Multi-generational seafood store
- The Long family has a lengthy history in the seafood industry & commercial fishing
- Supports local community by providing in-store locally sourced products & retail sales to local businesses



(Lambert Long, Son of Owners) Image: Michael Cline Spencer

Wilmington StarNews

January 24, 2011

Motts Channel Seafood Flooding

- Location
- Adjacent Properties
- History of flooding

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Phase 1

Analysis of Existing Conditions

Image: Natasha Alden

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Site Visits

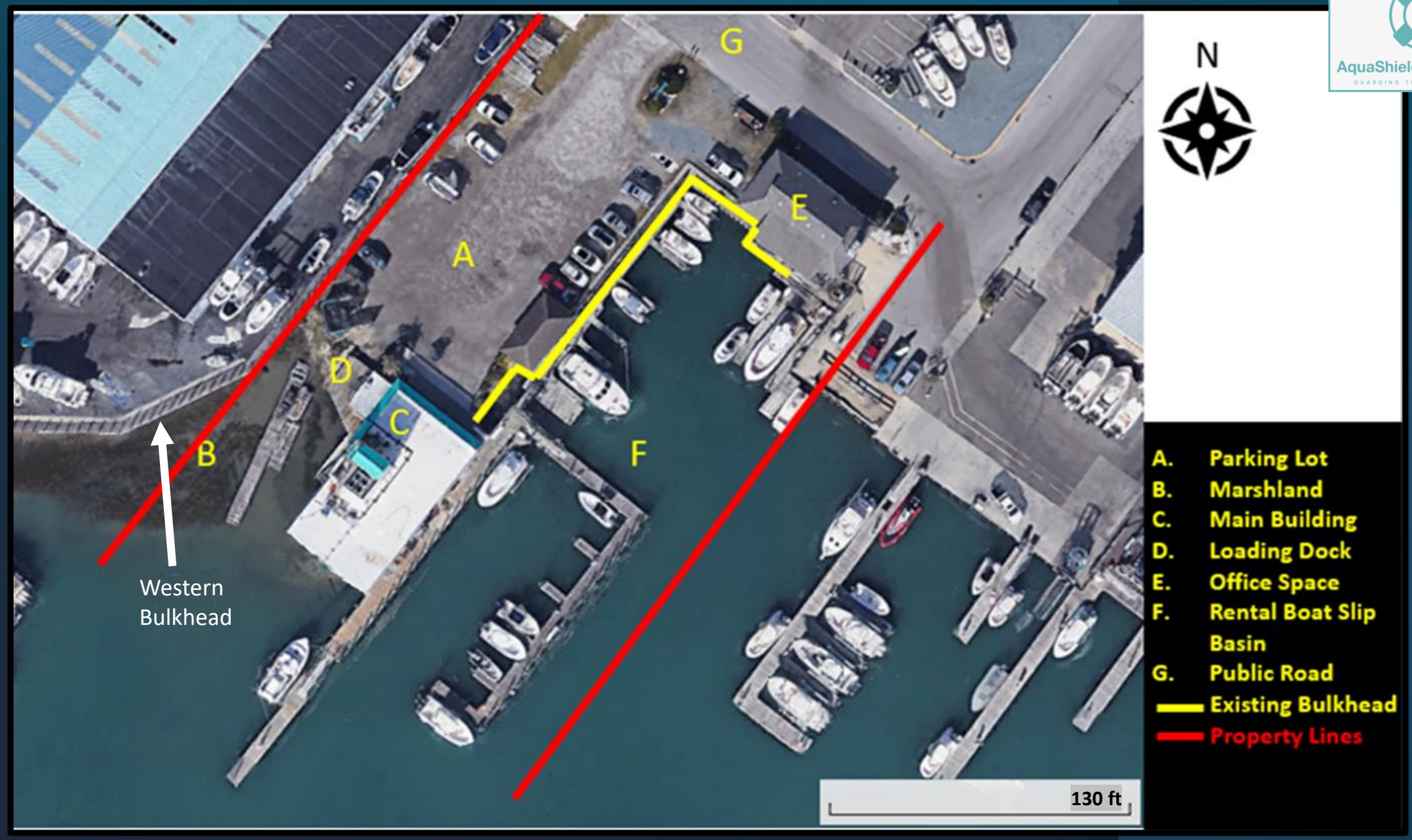
- Site visit 1 - February 12th, 2024
  - Employees at Motts Channel Seafood
- Site visit 2 - February 22nd, 2024
  - Owner of Motts Channel Seafood
- Site Visit 3 – March 14th, 2024
  - Surveying parking lot, dock, and surrounding bulkheads
  - Low-tide and clear weather during the visit

Analysis of Existing Conditions

EXISTING STRUCTURE CONDITIONS

EXISTING MARSH CONDITIONS

EXISTING PARKING LOT CONDITIONS



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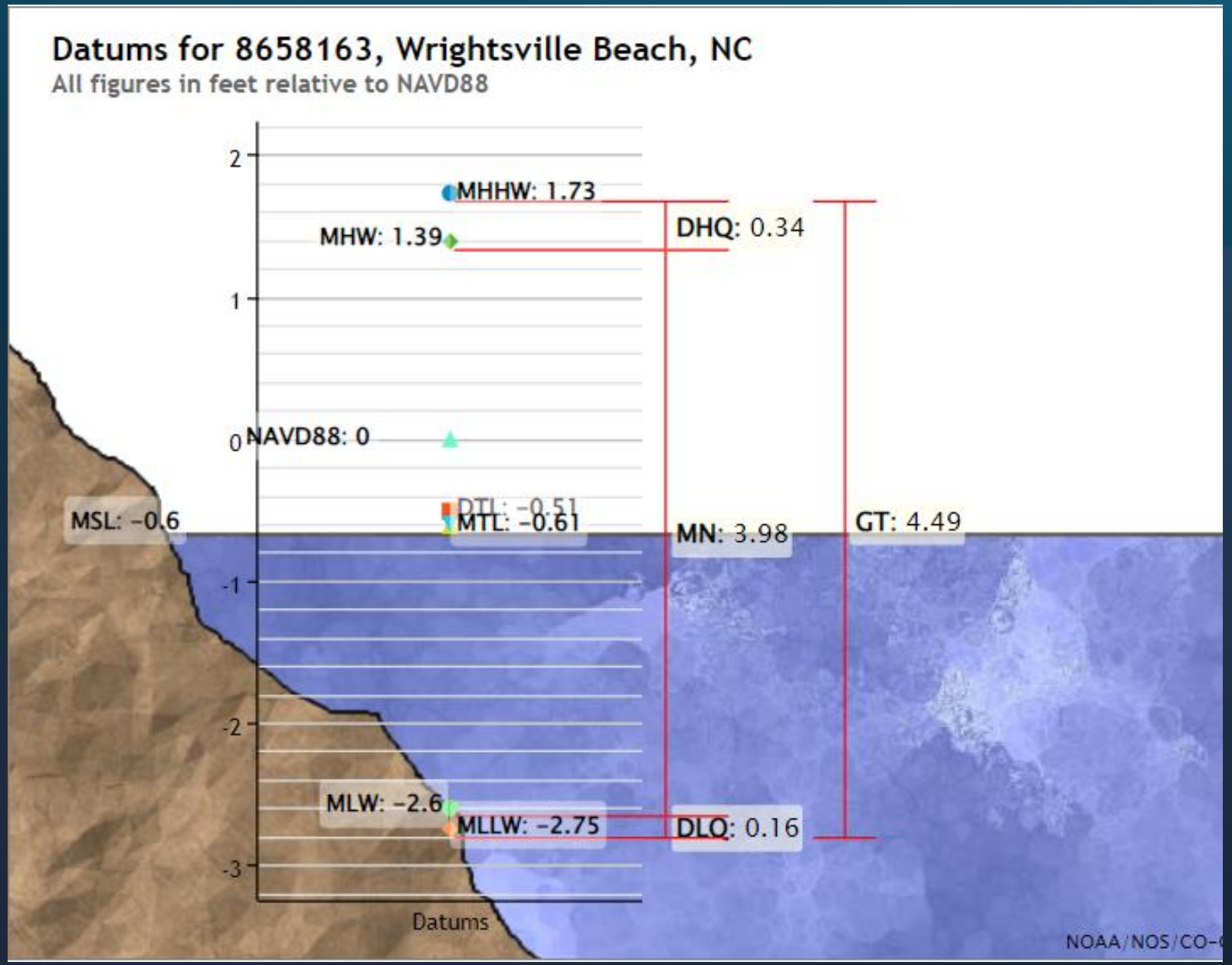
Existing Structures

- Floating Docks
- Eastern Bulkhead – 5.25 ft, NAVD88
- Western Bulkhead – 6.90 ft, NAVD88
- MarineMax Boat Dealership



Tidal Range ~4.0 ft

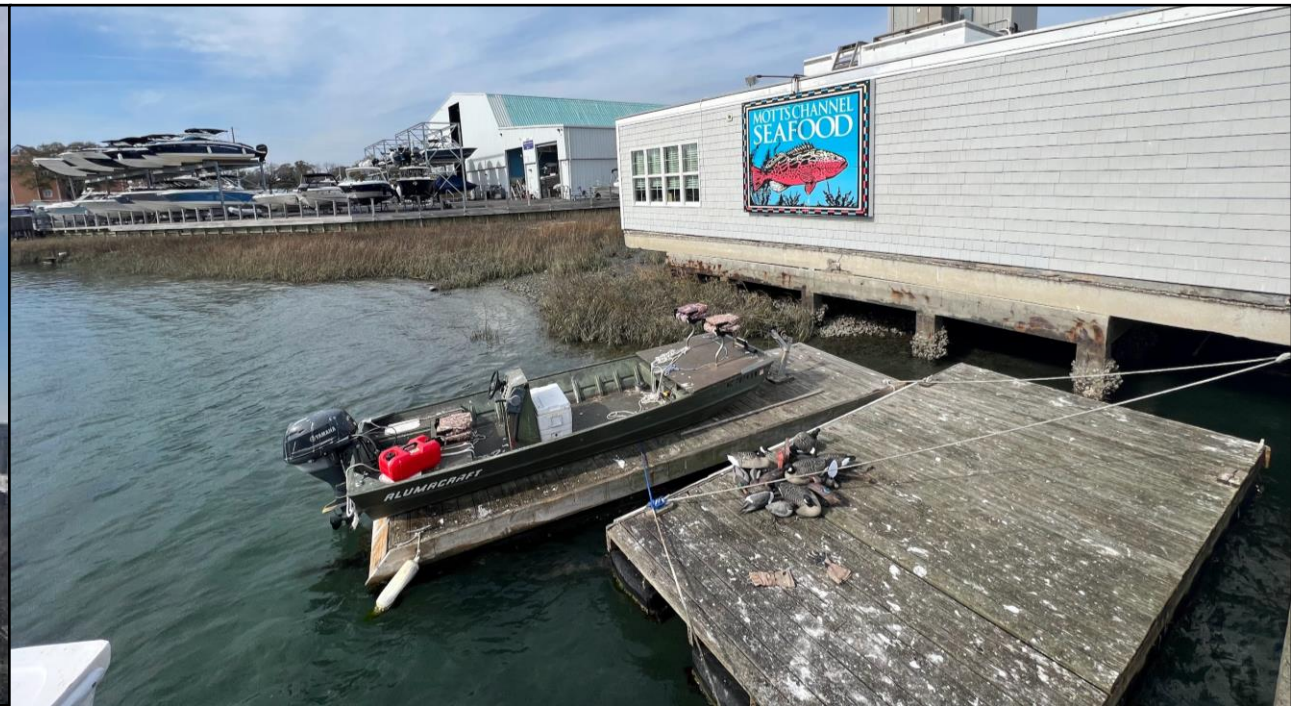
Existing Marsh

Low-lying elevation

Picture taken at mid tide

Exposed concrete foundation

Loading Dock and Marsh
Flooding point of entry



Parking Lot

- ~20,000 sq ft
- Parking capacity ~30 cars
- Essential for everyday activities
- Floods 25-50% of parking lot during king tide events
- Main area of vulnerability

RTK Survey of Motts Channel Seafood

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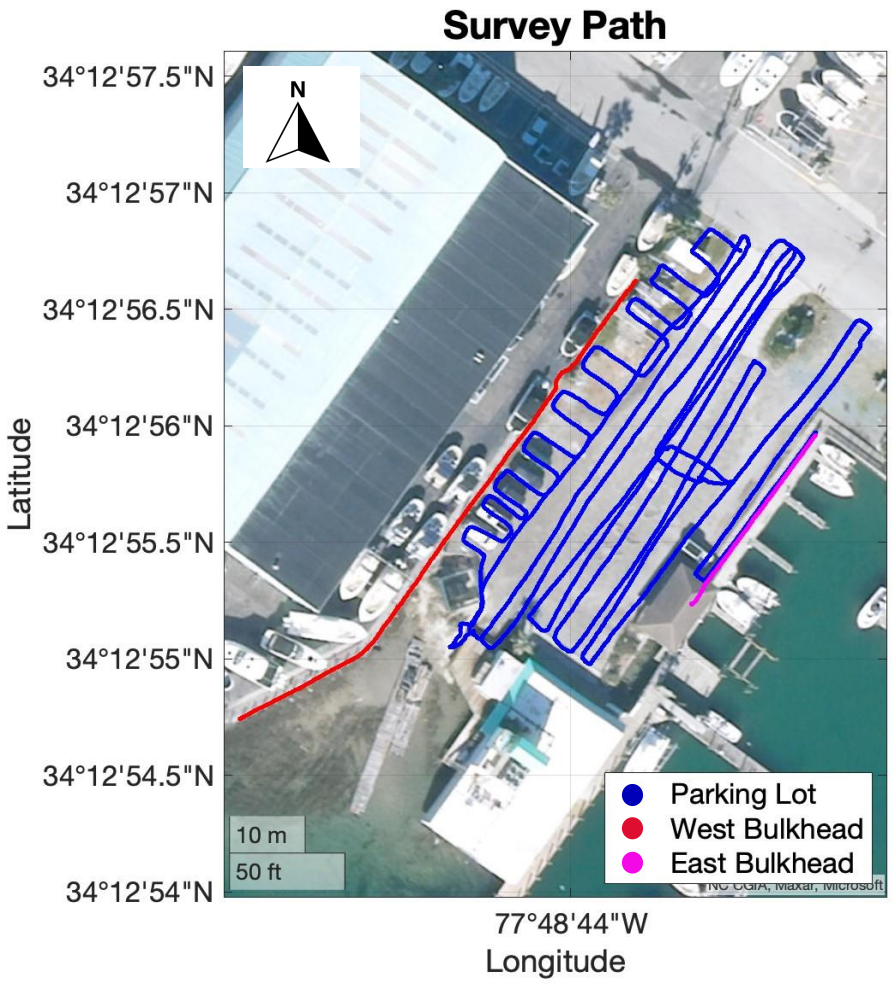
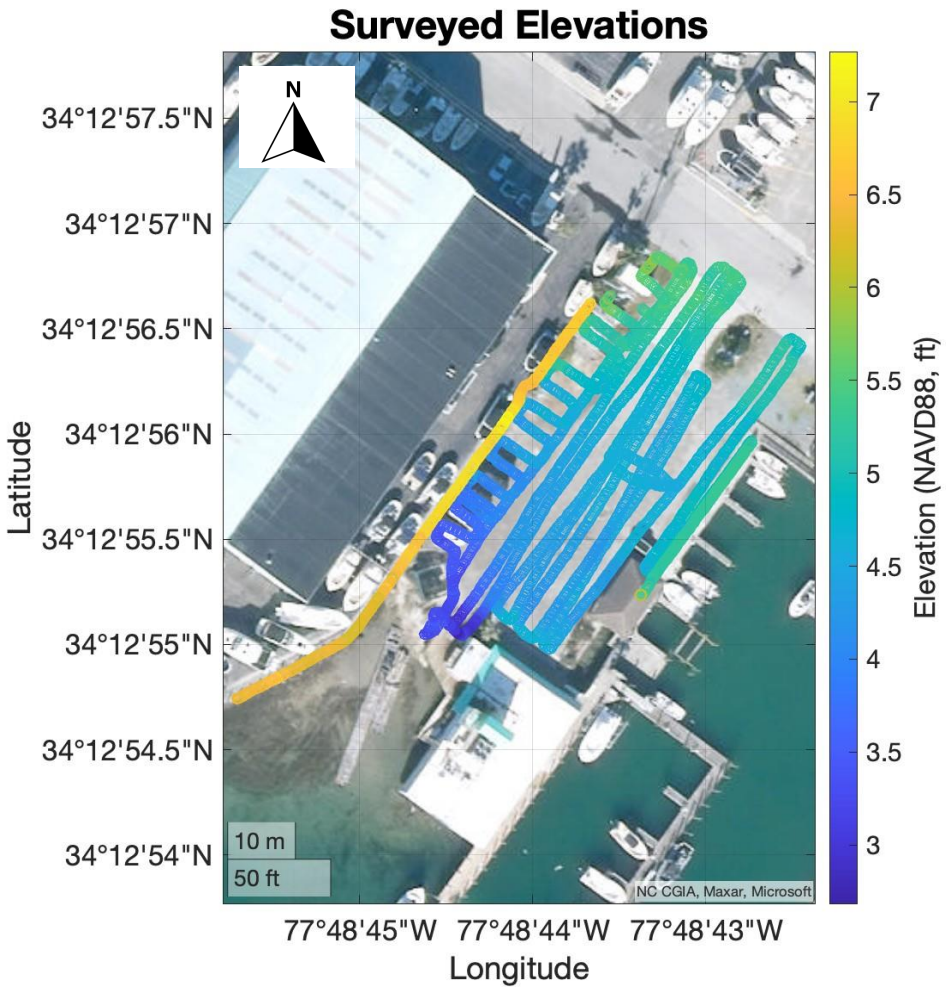
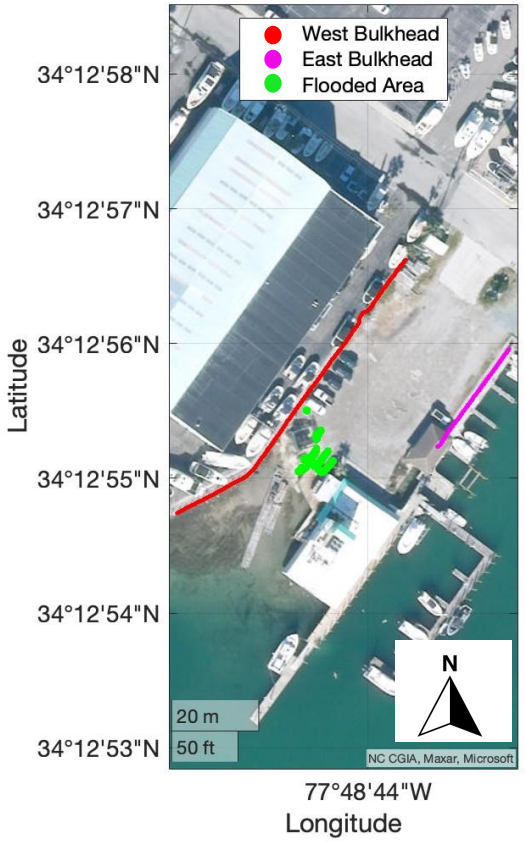
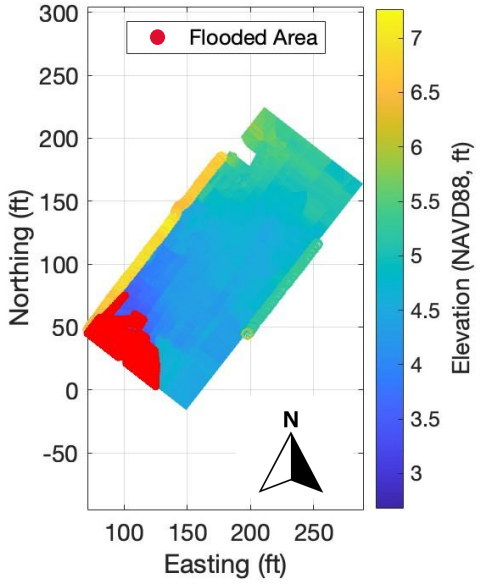




April 8th, 2024
King Tide: 3.29 ft, NAVD88

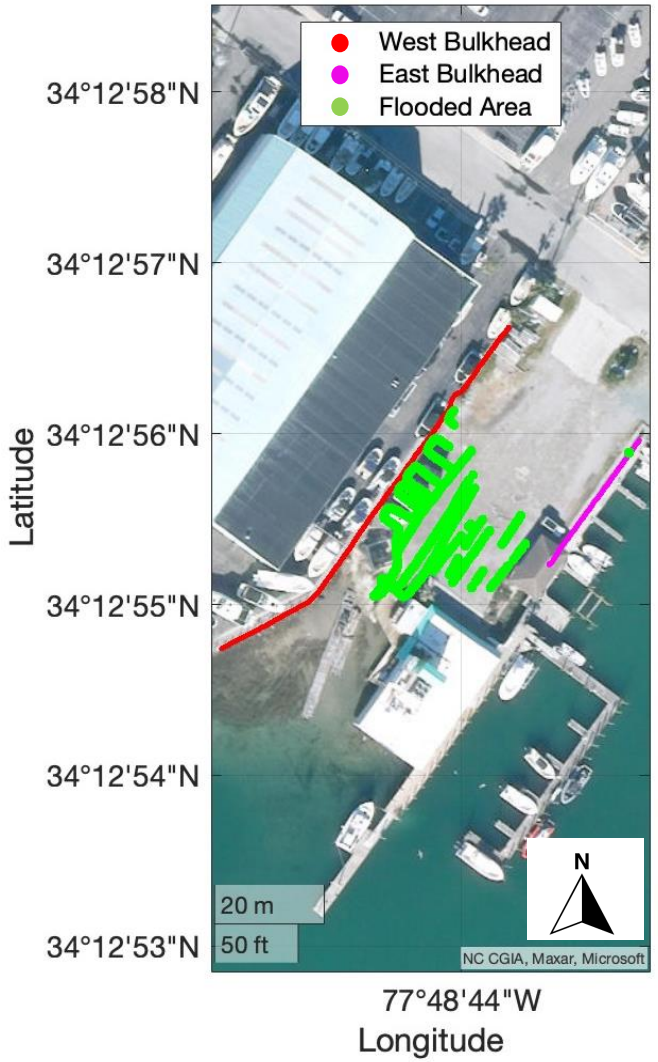
- 1.9 ft above MHW

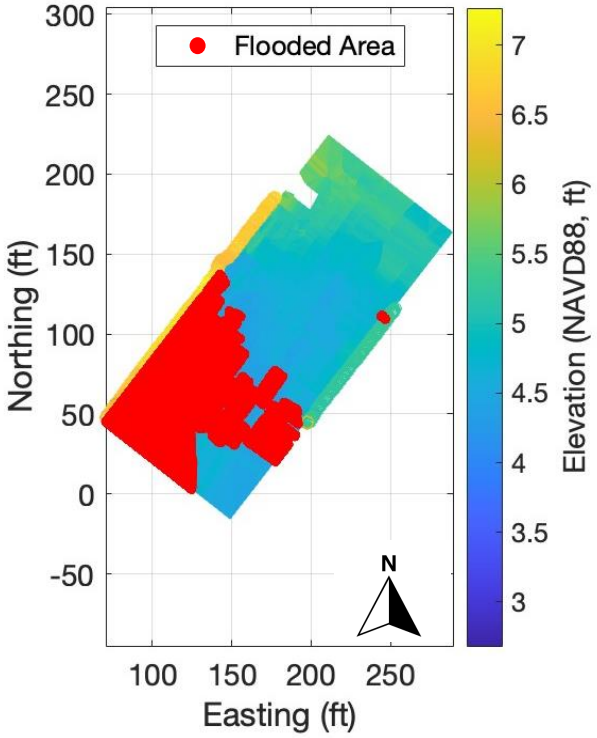




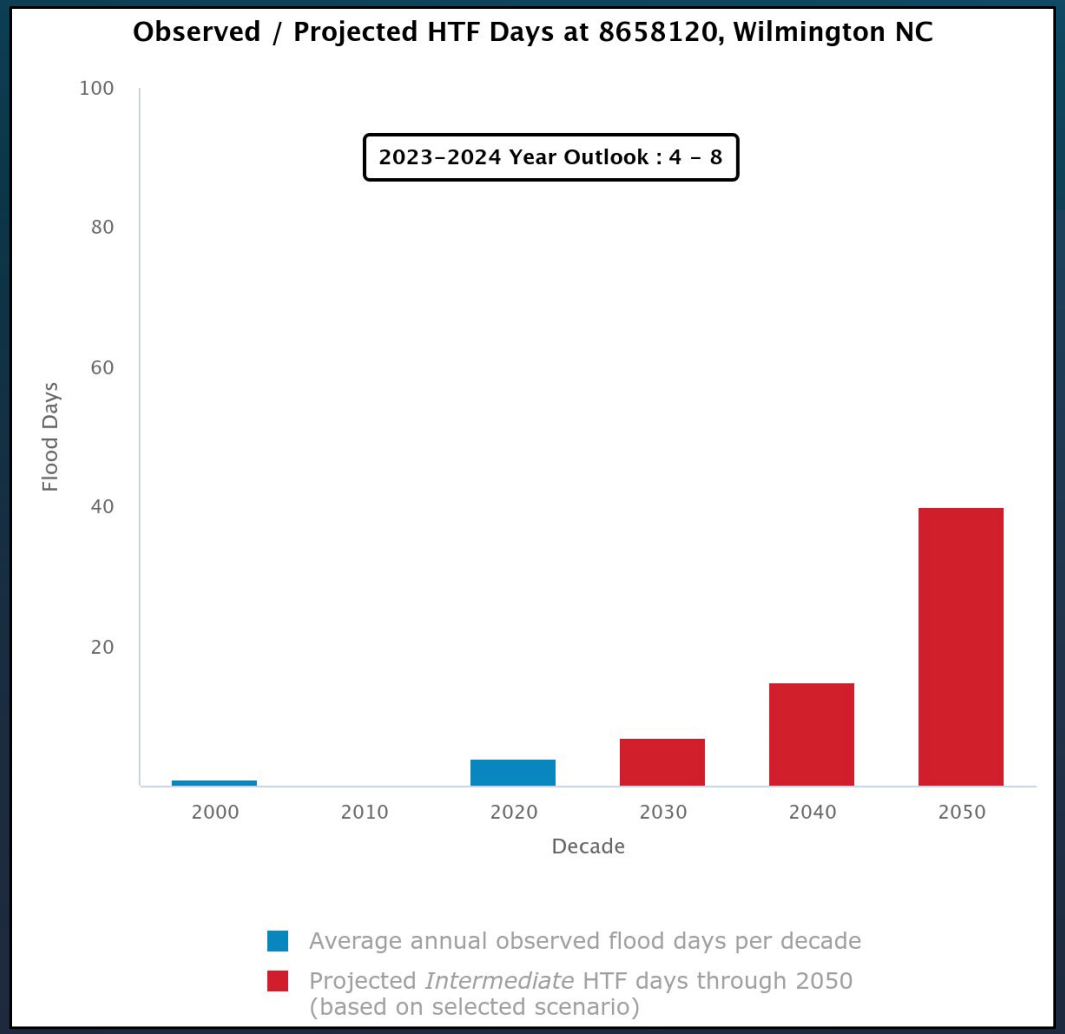
August 31st, 2023
King Tide: 4.32 ft, NAVD88

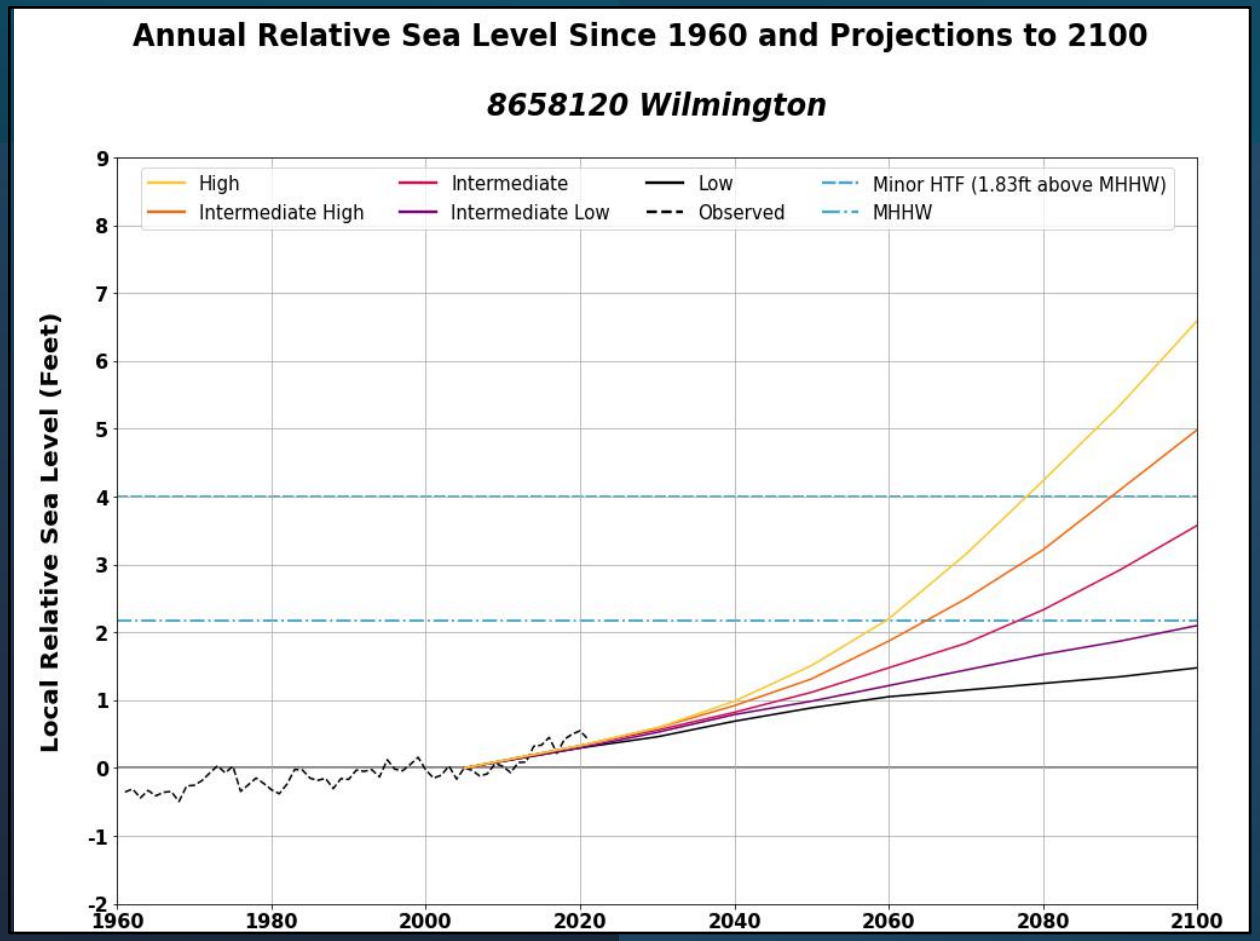
- 2.93 ft above MHW





NOAA Predictions

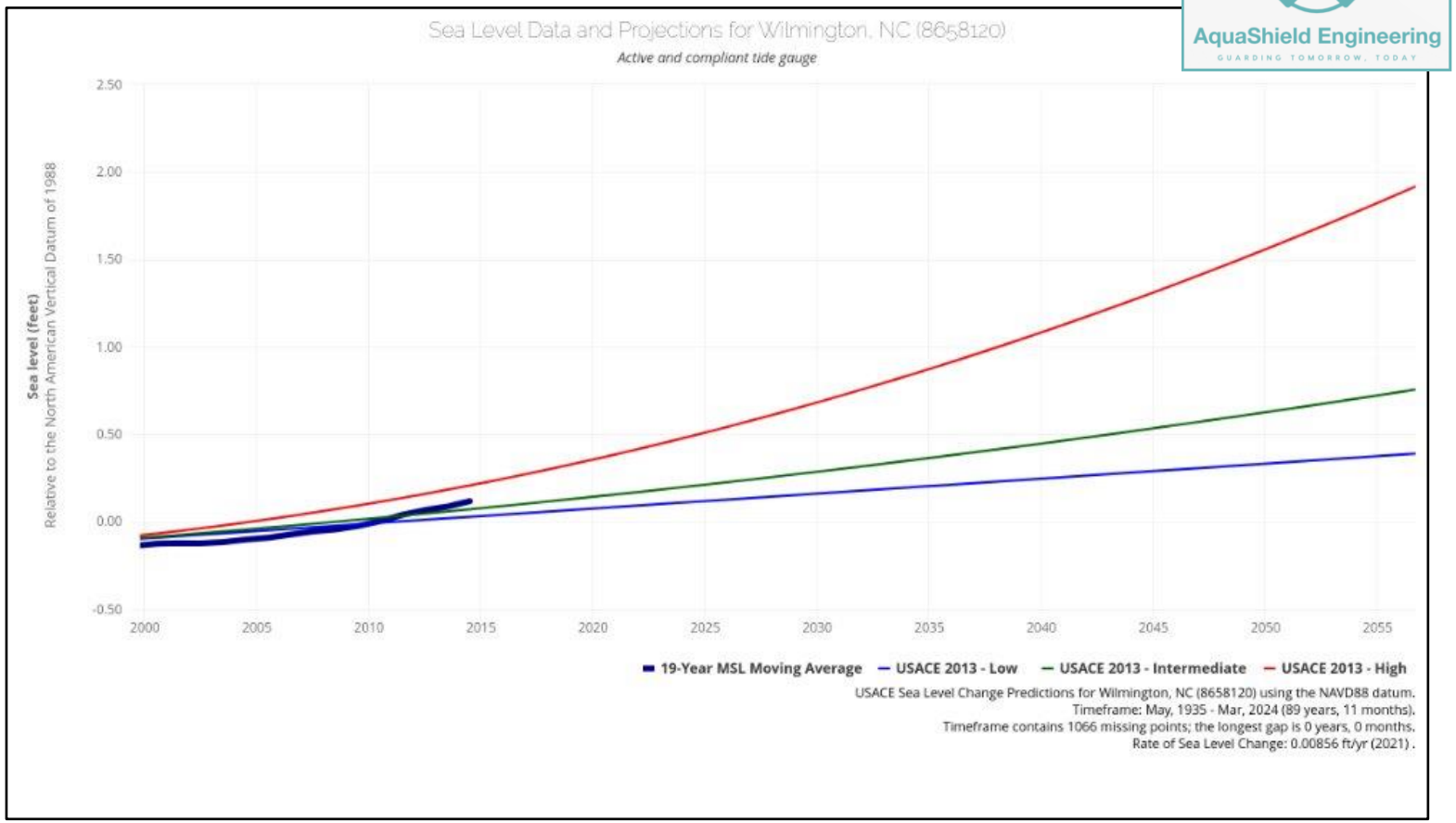




- # of tides exceeding 1.75 ft above MHW
- Based on intermediate SLR prediction

- Highest projection: 6.5 ft SLR by 2100
- Lowest projection: 1.5 ft SLR by 2100

25-Year SLR Prediction



- Low ~ 0.5 ft
- Intermediate ~ 0.8 ft
- High ~ 1.8 ft

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Phase 2

Design Alternatives

Design Alternatives

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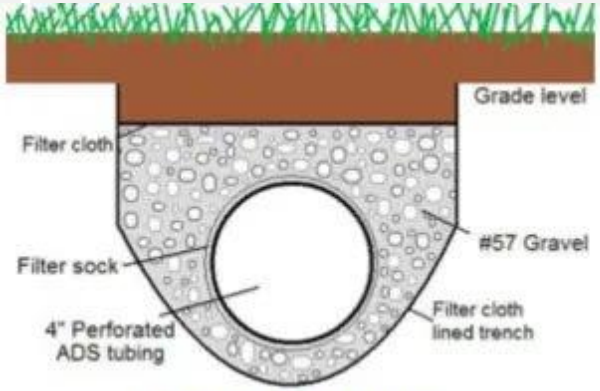
- Do Nothing
- Parking Lot Fill & Grade
- Pervious Pavement
- Infiltration System
- Vinyl Sheet Pile Bulkhead
- Marsh Sill

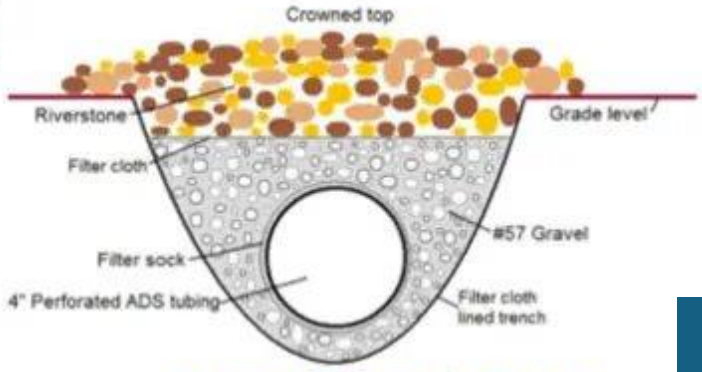
Design Alternatives

- Parking Lot Fill & Grade
- Pervious Pavement
- Parking Lot Infiltration System

- Constraints
  - Soil Composition
  - Infiltration Rate
  - Ground Water Table
  - Regular Maintenance
  - Limited Load-Bearing Capacity
  - Not Budget Friendly



French Drain



Open French Drain

Design Alternatives

- **Vinyl Sheet Pile Bulkhead**
  - Resilience against Spring Tides
  - Property Aesthetics
  - Long-term Protections

- **Constraints**
  - Outdated Topobathy Data
  - Adjacent Property’s Existing Bulkhead
  - Building's Concrete Foundation
  - Sourcing Materials

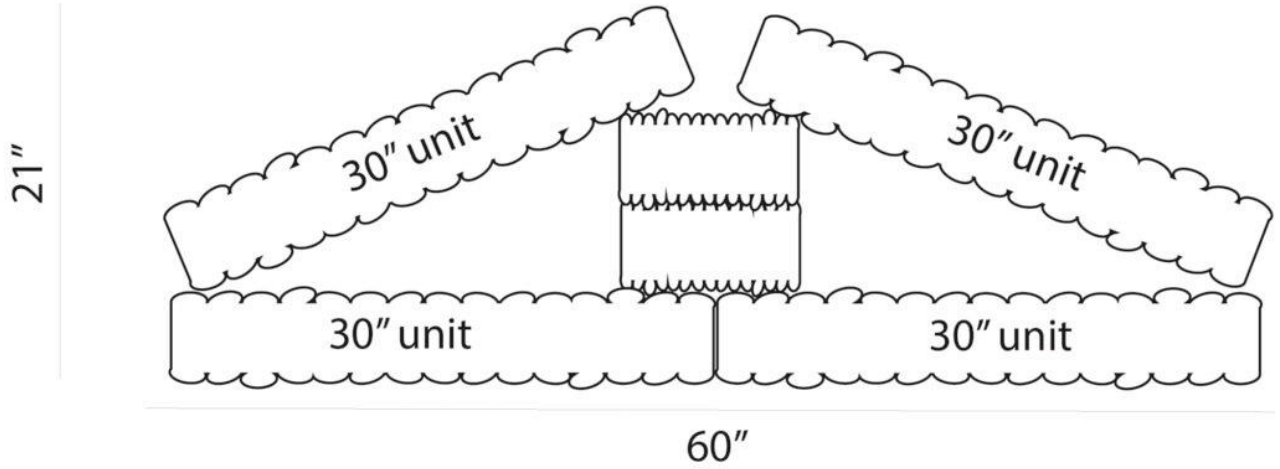
American Pole & Timber: Navy-style vinyl bulkhead

NC Coastal Federation Meeting – April 2nd, 2024

- Coastal Specialist – Georgia Busch
- Topic: Living Shoreline Project & Motives
- Sill Designs for Marsh Stabilization
  - QuickReef
  - Riprap
  - Oyster Bags
- Cost-Share Funding
  - 50-75% of Living Shoreline Projects covered by grants

Design Alternatives

- Living Shoreline Marsh Sill
  - Saltmarshes- vital coastal habitats
  - Erosion control measure
  - Dampen Wave Energy
  - Increases Natural Stormwater Infiltration
  - Combination of non-structural & structural elements
- Constraints:
  - Tidal Range (MLW → MHW = 4’)
  - Exposed Structure Toe at MLW
  - Foundation: Marsh Silt
  - General CAMA Permit
  - Sea Level Rise



HOW GREEN OR GRAY SHOULD YOUR SHORELINE SOLUTION BE?

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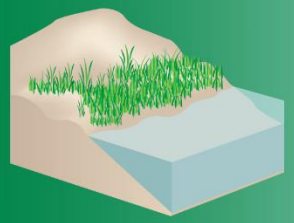
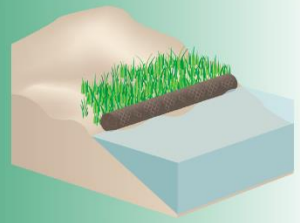
GREEN - SOFTER TECHNIQUES **GRAY - HARDER TECHNIQUES**

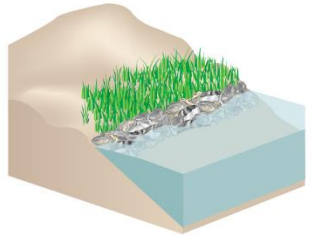
Living Shorelines



VEGETATION ONLY - Provides a buffer to upland areas and breaks small waves. Suitable for low wave energy environments.

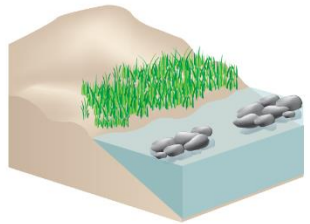


EDGING - Added structure holds the toe of existing or vegetated slope in place. Suitable for most areas except high wave energy environments.

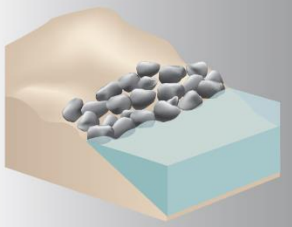


SILLS - Parallel to vegetated shoreline, reduces wave energy, and prevents erosion. Suitable for most areas except high wave energy environments.

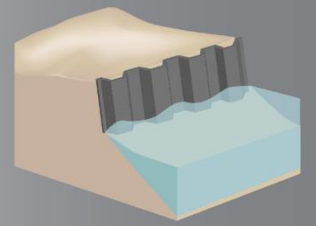
Coastal Structures



BREAKWATER - (vegetation optional) - Offshore structures intended to break waves, reducing the force of wave action, and encourage sediment accretion. Suitable for most areas.



REVETMENT - Lays over the slope of the shoreline and protects it from erosion and waves. Suitable for sites with existing hardened shoreline structures.



BULKHEAD - Vertical wall parallel to the shoreline intended to hold soil in place. Suitable for high energy settings and sites with existing hard shoreline structures.

Guidance for Considering the Use of Living Shorelines (2015)

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Phase 3

Proposed Solution

Vinyl Bulkhead

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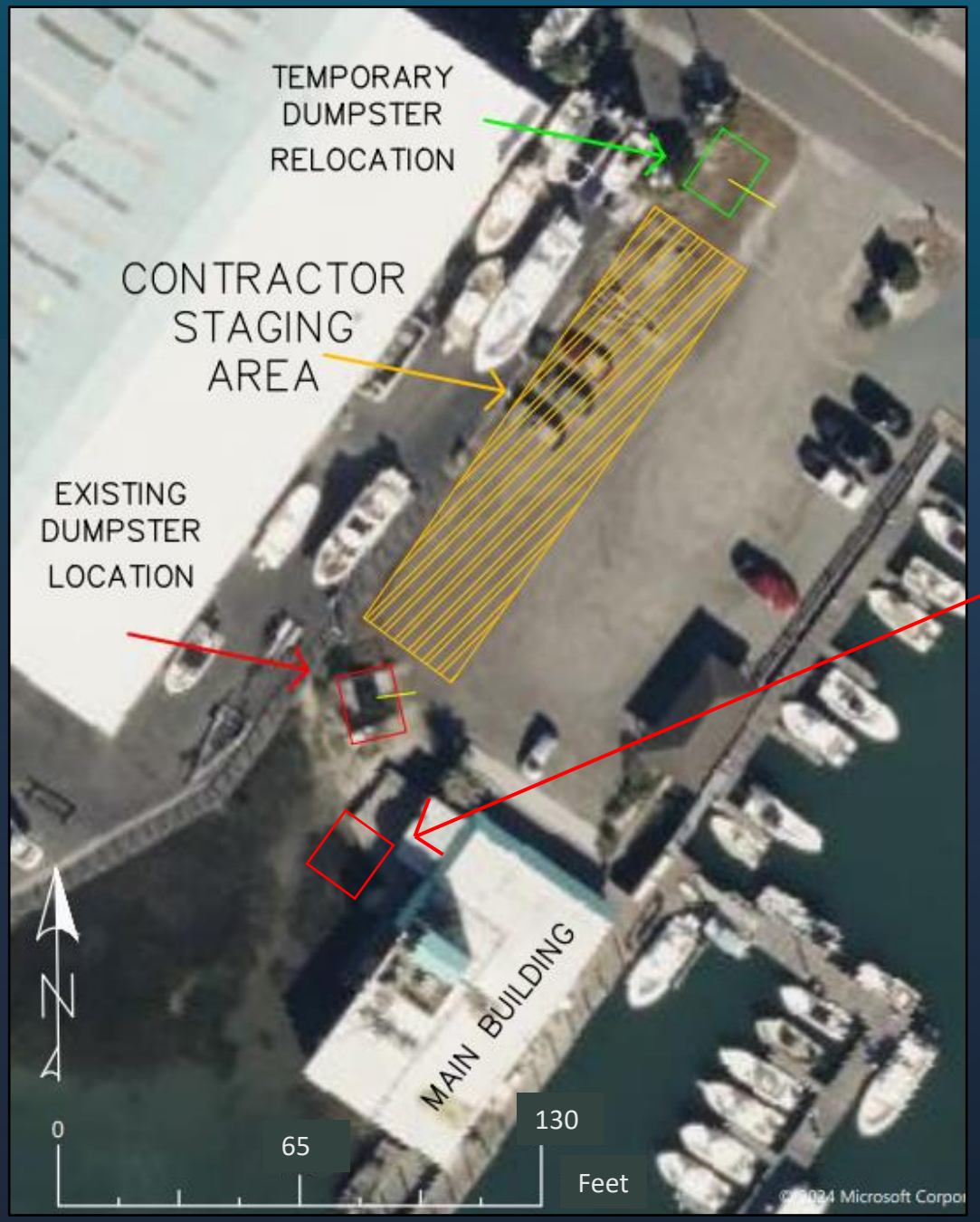

TEMPORARY LOADING DOCK REMOVAL

RECONSTRUCTION WILL BE SUBCONTRACTED

CAMA Permits

- General vs. Major CAMA Permit Guidelines
- Kelsey Beachman- CAMA Rep for WB
  - Construction of Bulkheads and Riprap Revetments for Shoreline Protection (15A NCAC 07H .1100)
- Guidelines followed for Design of Bulkhead
  - Positions shall not exceed 5 ft offshore of MHW or NWL
  - Along shorelines with wetland vegetation, construction shall be completed landward of the vegetation
  - Use of bulkhead materials approved by the Division of Coastal Management
  - Backfill material shall be sourced from upland source
  - Construction limited to a maximum length of 500 linear ft

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N.C. DIVISION OF COASTAL MANAGEMENT

Bulkhead: Plan View

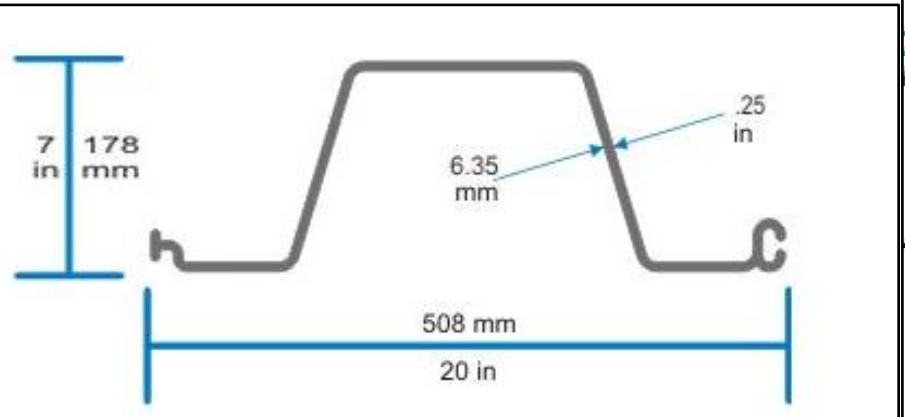
Existing:

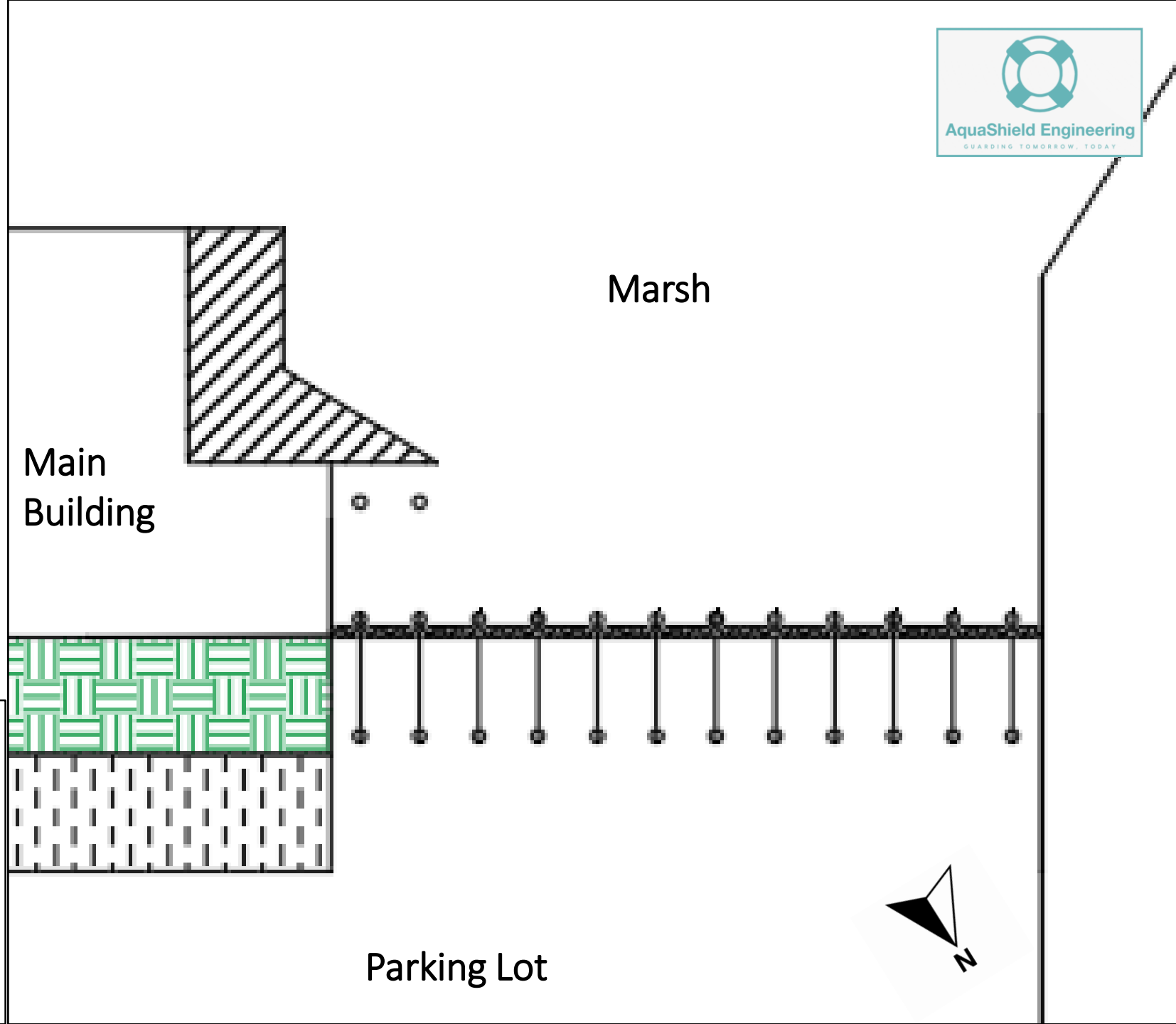
- Adjacent Bulkhead
- Loading Dock Piles
- Vegetation and Walkway

Proposed:

- Bulkhead Piles
- Deadman Anchors
- Tiebacks
- Vinyl Sheet Piles
- Walers

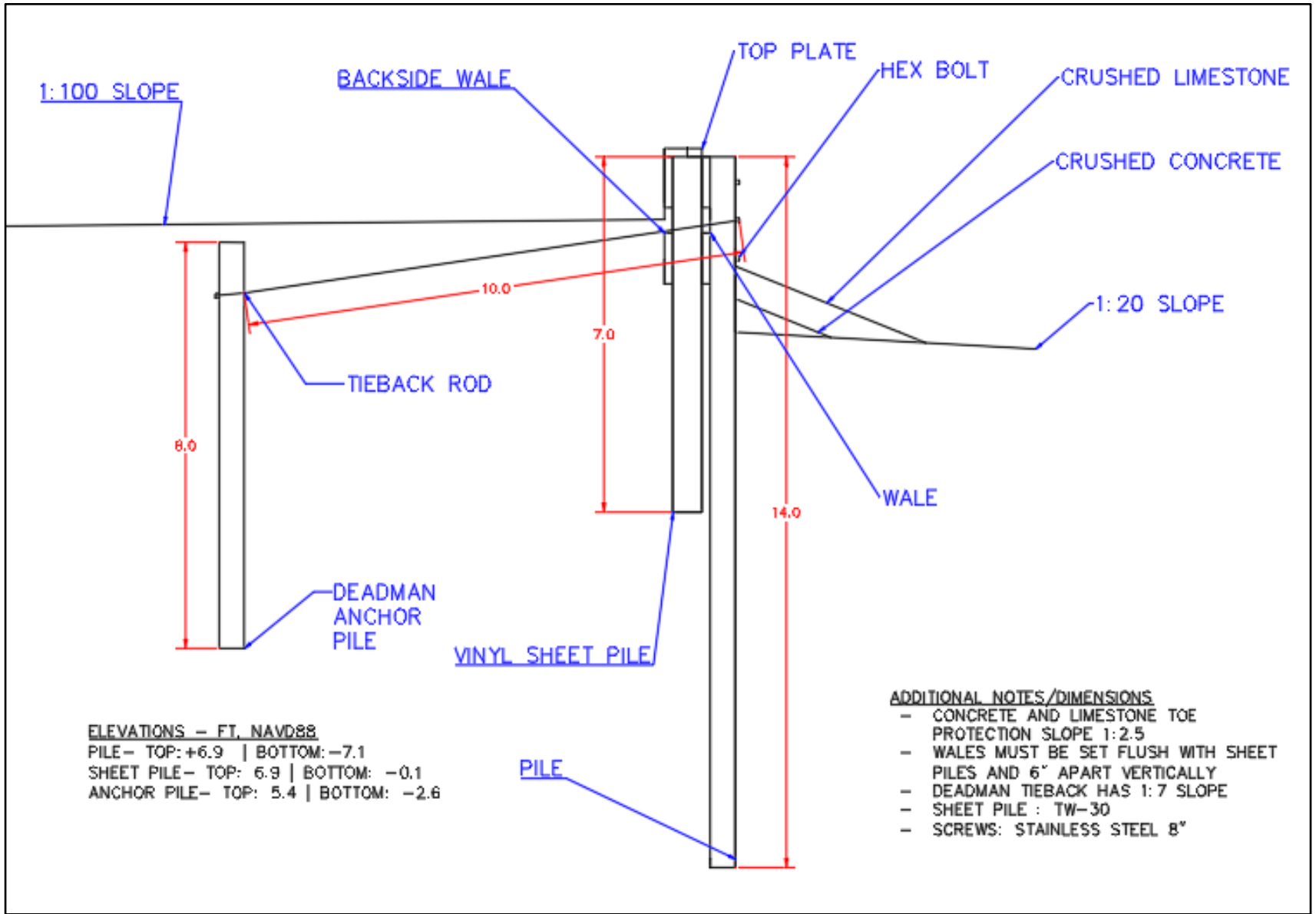
Bulkhead Standard - TW30





Bulkhead: Cross-sectional View

Bulkhead Elevation :
6.9 ft, NAVD88



Parking Lot Fill and Grading

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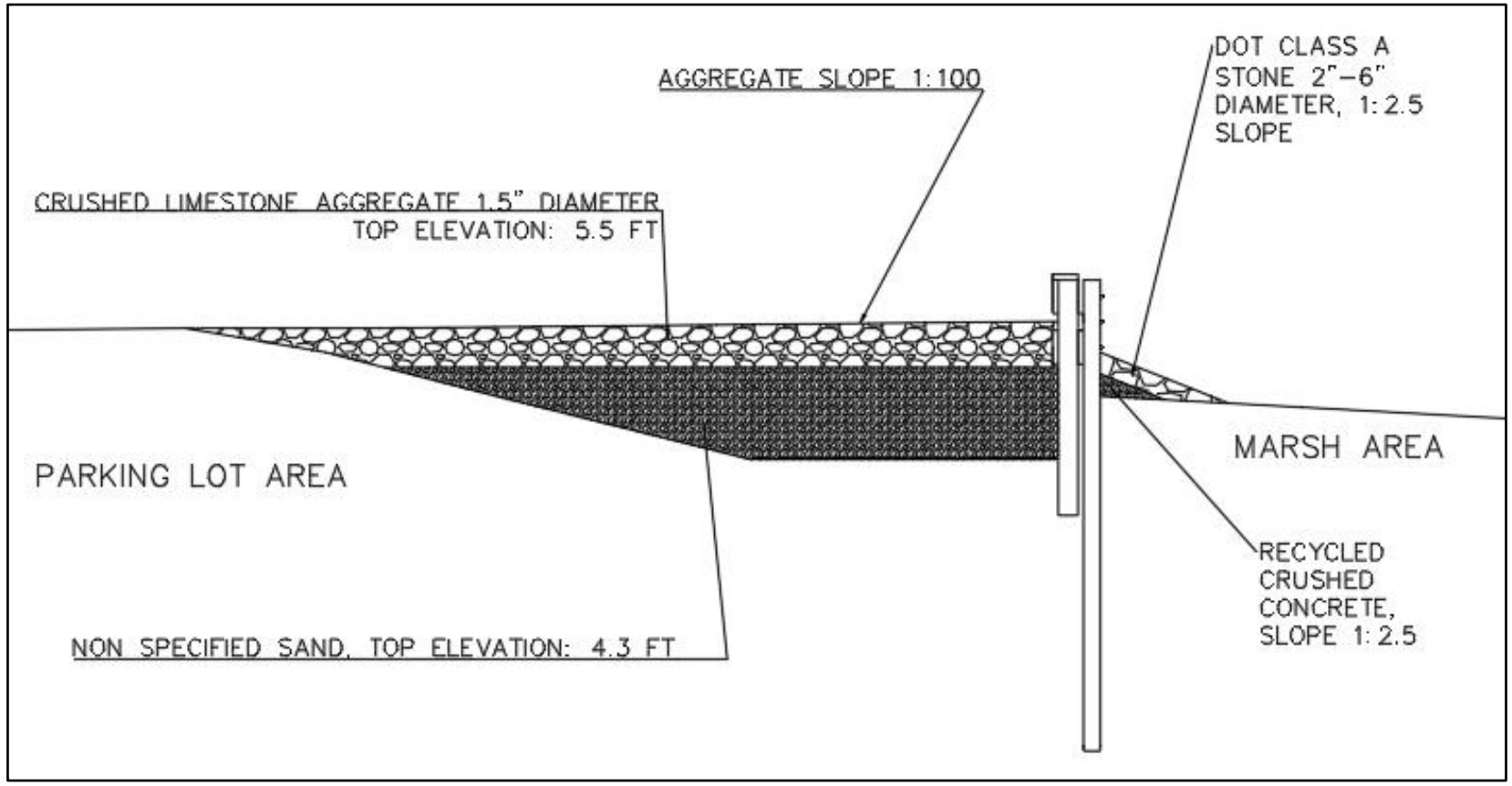
Bulkhead Elevation :
6.9 ft, NAVD88

- Total Fill Material Needed
  - 301 Tons
- Non-Specified Fill Sand
  - 113 Tons
- AB-3 Crushed Limestone Aggregate
  - 188 Tons
- Grade of 1:100’ (1%)
  - From elevation of 5.5’ to 4.5’



Project Cost Analysis

#	Item	Unit	Quantity	Cost/Unit	Total Unit
1	Mobilization	ls	1	15000	15000
				subtotal	15000
	Bulkhead				
2	Vinyl Sheet Pile TW 30	lnf	60	$9.40	$564.00
3	6"x 6" 14' Wooden Piles	ea	12	$75	$900
4	12" x 2" x 20' Wooden Whalers	ea	15	$97	$1,455.00
5	1" - 8 x 18" Stainless Hex Bolts	ea	24	$13	$312
6	1" Stainless Washers	ea	48	$2	$100.80
7	1" Stainless Nuts	ea	24	$4	$96
8	Stainless Steel Wood Construction Screws	18 ct	4	$27	$108
9	Fill sand	ton	113	$15	$1,695
10	Geotextile Material (20' x 60')	ea	1	$190	$190
				subtotal	$5,420.80
	Deadman				
11	5/8" by 10' Stainless Tie Back Anchor Rod	ea	12	$96	$1,152
12	5/8" Stainless Washers	ea	24	$0.2	$5
13	5/8" Stainless Nuts	ea	12	$0.6	$7
14	6"x 6" 8' Wooden Piles	ea	12	$25	$300
				subtotal	$1,464
	Bulkhead Toe Protection				
15	Recycled Crsuhed Concrete	ton	1	$20	$20
16	DOT Class A Stone (2"- 6")	ton	3	$30	$90
				subtotal	$110
	Parking Lot Fill				
17	AB-3 Crsuhed Limestone Aggregate (1.5")	ton	188	$55	$10,340
				subtotal	$10,340
				Construction Subtotal	$32,334.56
				Contingency (%15)	$4,850.18
				CONSTRUCTION TOTAL	**$37,184.74**

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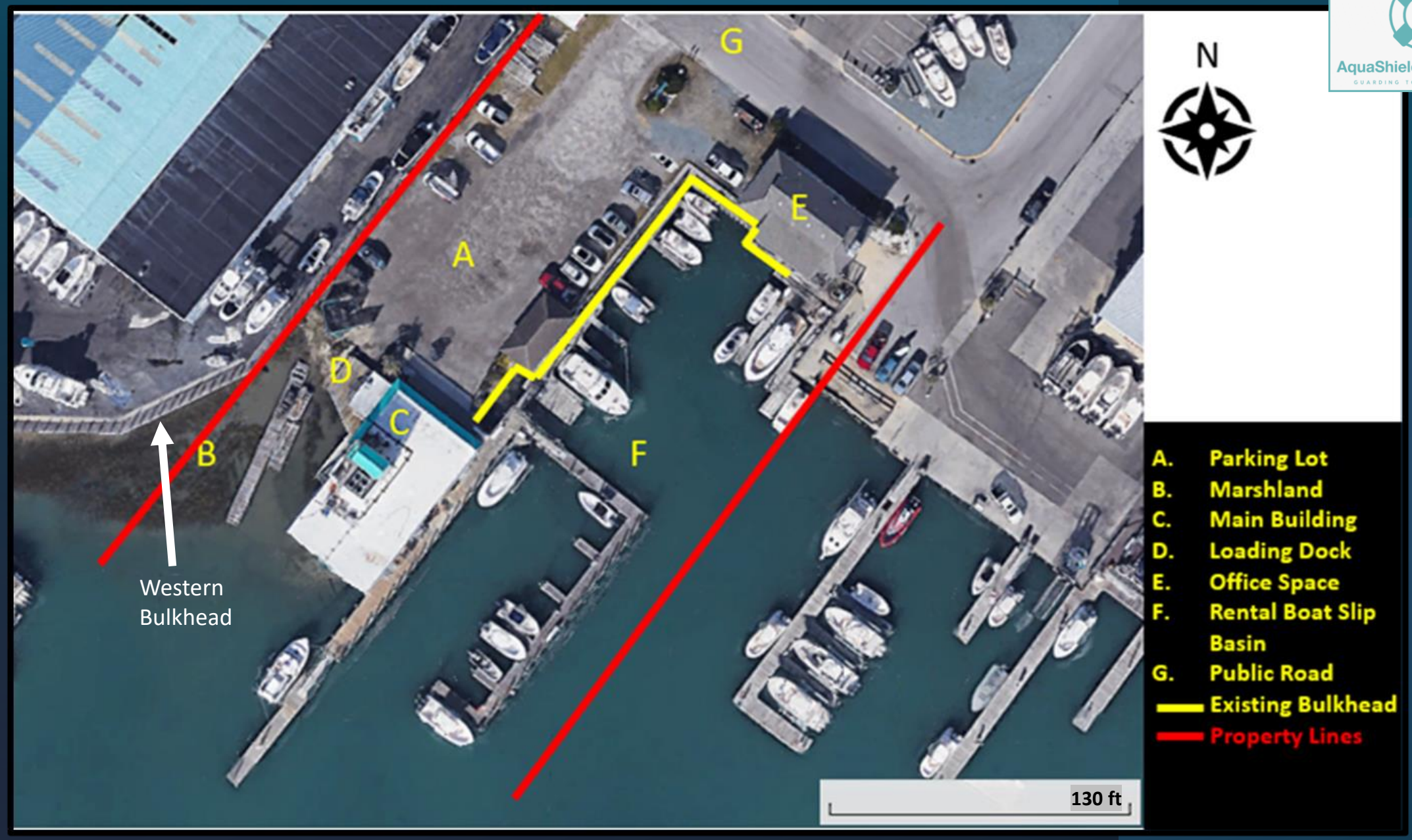
Conclusion



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Questions?

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REVISION RECORD

NO.	DATE	DESCRIPTION	BY

PROJECT NAME:
MODIFICATIONS TO REDUCE SPRING TIDE FLOODING AT MOTTS CHANNEL SEAFOOD

DRAWING TITLE:
PROPOSED RELOCATIONS OF DUMPSTER AND CONTRACTOR STAGING AREA

GENERAL NOTES:
- DUMPSTER HAS FENCING THAT NEEDS TO BE REMOVED AND REPLACED POST CONSTRUCTION OF BULKHEAD.
- CONCRETE FOUNDATION WILL STAY IN PLACE AND NOT BE MOVED.

GROUP MEMBERS:
JERRY GARCIA
NOAH CLARK
COLBY LYON
ANDREW MCLAWHORN

PROG MGR:	ASE
DESIGN BY:	ASE
DRAWN BY:	ASE
PROG DATE:	APRIL 2024
DRAWING NUMBER:	
ASE PROJ. NO.:	1.00.A

AquaShield Engineering

REVISION RECORD

NO.	DATE	DESCRIPTION	BY

PROJECT NAME:
MODIFACATIONS TO REDUCE SPRING TIDE FLOODING AT MOTTS CHANNEL SEAFOOD

DRAWING TITLE:
REMOVAL OF LOADING DOCK

GENERAL NOTES:
REMOVAL OF LOADING DOCK: THIS SECTION OF THE LOADING DOCK WILL BE REMOVED FOR CONSTRUCTION OF BULKHEAD. TWO PILINGS ADJACENT TO BULKHEAD LOCATION (SHOWN ON PAGE) WILL BE REMOVED FOR TOE PROTECTION. PILINGS ON MARSH SIDE WILL BE LEFT FOR THE RECONSTRUCTION OF LOADING DOCK (SUB CONTRACTED AFTER CONSTRUCTION).

PROG MGR:	ASE
DESIGN BY:	ASE
DRAWN BY:	ASE
PROG DATE:	APRIL 2024
DRAWING NUMBER:	

GROUP MEMBERS: JERRY GARCIA | COLBY LYON | NOAH CLARK | ANDREW MCLAWHORN

ASE PROJ. NO.:
1.00.A

CONNECTION WITH BUILDING:
–CONCRETE FOUNDATION UP TO 5.38 FT (NAVD88)
–METAL SIDING ON BUILDING ABOVE FOUNDATION

ADJACENT MARINEMAX BULKHEAD:
–VINYL SHEET PILING
–ELEVATION: 6.9 FT (NAVD88)
–WOODEN CAP

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REVISION RECORD	NO.	DATE	DESCRIPTION	BY

PROJECT NAME: MODIFACATIONS TO REDUCE SPRING TIDE FLOODING AT MOTTS CHANNEL SEAFOOD

DRAWING TITLE: BULKHEAD LOCATION

GENERAL NOTES:
LOCATION OF BULKHEAD CONSTRUCTION: BULKHEAD WITH BE BUILT FLUSH WITH ADJACENT MARINEMAX BULKHEAD AND MAIN BUILDING (CONNECTION SHOWN IN PAGE).

GROUP MEMBERS: JERRY GARCIA | COLBY LYON | NOAH CLARK | ANDREW MCLAWHORN

PROG MGR:	ASE
DESIGN BY:	ASE
DRAWN BY:	ASE
PROG DATE:	APRIL 2024
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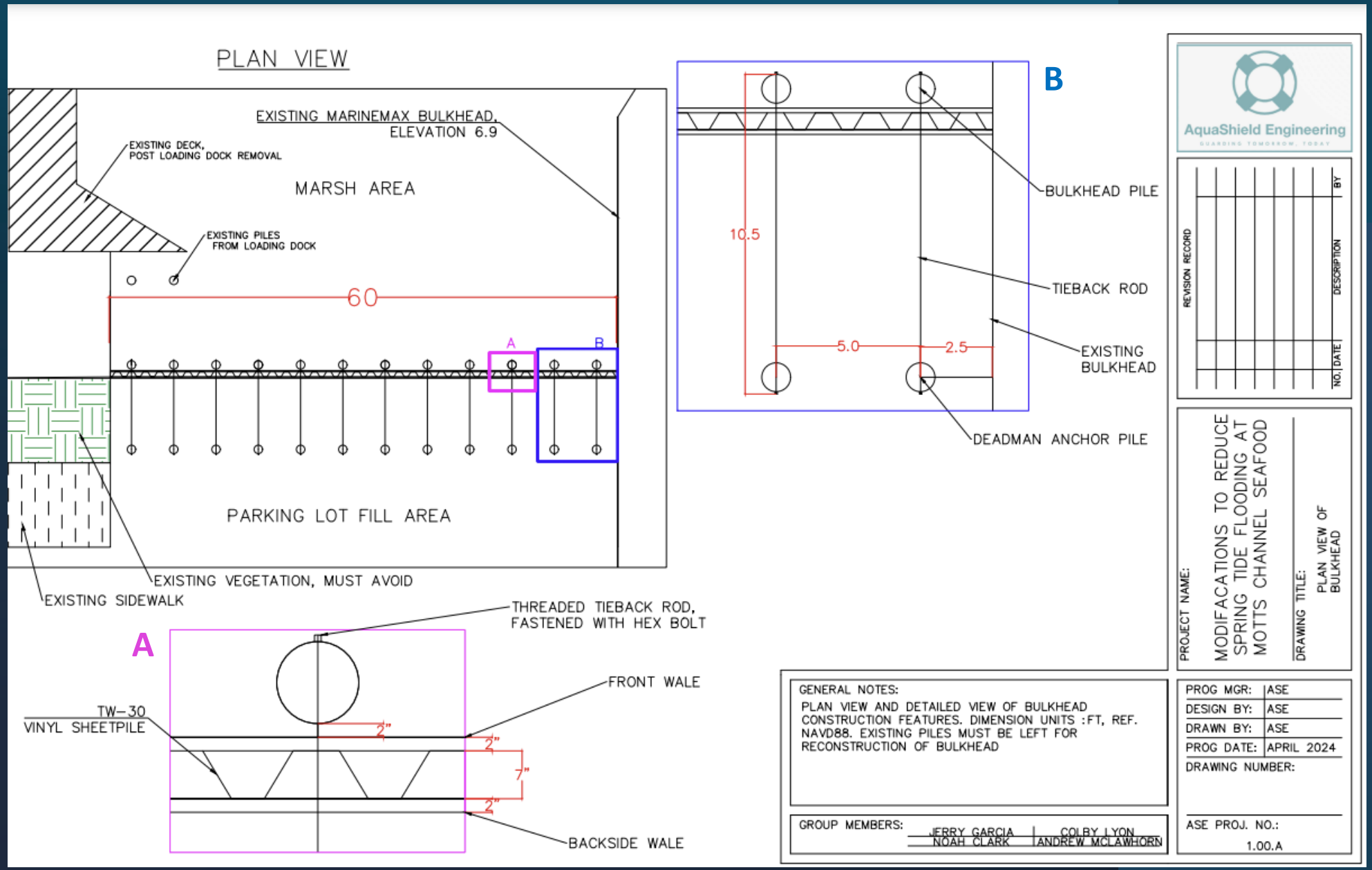
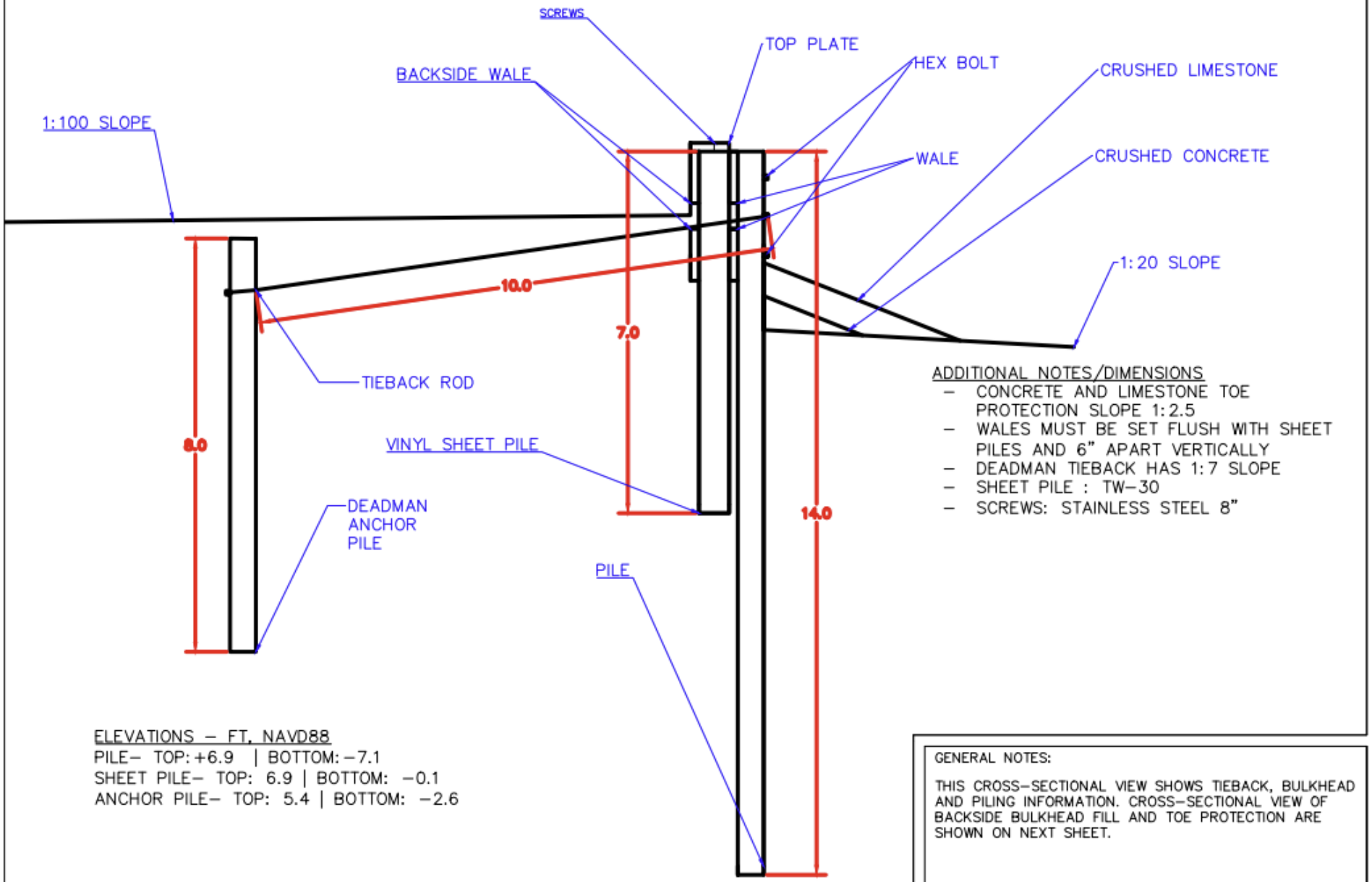

PLAN VIEW
EXISTING MARINEMAX BULKHEAD, ELEVATION 6.9
EXISTING DECK, POST LOADING DOCK REMOVAL
MARSH AREA
EXISTING PILES FROM LOADING DOCK
60
A
B
PARKING LOT FILL AREA
EXISTING VEGETATION, MUST AVOID
EXISTING SIDEWALK
B
10.5
BULKHEAD PILE
TIEBACK ROD
5.0
2.5
EXISTING BULKHEAD
DEADMAN ANCHOR PILE
A
THREADED TIEBACK ROD, FASTENED WITH HEX BOLT
FRONT WALE
TW-30 VINYL SHEETPILE
2"
2"
7"
2"
BACKSIDE WALE
AquaShield Engineering
REVISION RECORD
NO. DATE DESCRIPTION BY
PROJECT NAME:
MODIFACATIONS TO REDUCE SPRING TIDE FLOODING AT MOTTS CHANNEL SEAFOOD
DRAWING TITLE:
PLAN VIEW OF BULKHEAD
GENERAL NOTES:
PLAN VIEW AND DETAILED VIEW OF BULKHEAD CONSTRUCTION FEATURES. DIMENSION UNITS :FT, REF. NAVD88. EXISTING PILES MUST BE LEFT FOR RECONSTRUCTION OF BULKHEAD
GROUP MEMBERS:
JERRY GARCIA
NOAH CLARK
COLBY LYON
ANDREW MCLAWHORN
PROG MGR: ASE
DESIGN BY: ASE
DRAWN BY: ASE
PROG DATE: APRIL 2024
DRAWING NUMBER:
ASE PROJ. NO.:
1.00.A



ADDITIONAL NOTES/DIMENSIONS

- CONCRETE AND LIMESTONE TOE PROTECTION SLOPE 1:2.5
- WALES MUST BE SET FLUSH WITH SHEET PILES AND 6" APART VERTICALLY
- DEADMAN TIEBACK HAS 1:7 SLOPE
- SHEET PILE : TW-30
- SCREWS: STAINLESS STEEL 8"

ELEVATIONS – FT. NAVD88

PILE– TOP: +6.9 | BOTTOM: –7.1

SHEET PILE– TOP: 6.9 | BOTTOM: –0.1

ANCHOR PILE– TOP: 5.4 | BOTTOM: –2.6

GENERAL NOTES:

THIS CROSS-SECTIONAL VIEW SHOWS TIEBACK, BULKHEAD AND PILING INFORMATION. CROSS-SECTIONAL VIEW OF BACKSIDE BULKHEAD FILL AND TOE PROTECTION ARE SHOWN ON NEXT SHEET.

AquaShield Engineering

GUARDING TOMORROW, TODAY

REVISION RECORD

NO.	DATE	DESCRIPTION	BY

PROJECT NAME: MODIFACATIONS TO REDUCE SPRING TIDE FLOODING AT MOTTS CHANNEL SEAFOOD

DRAWING TITLE: DESIGN OF BULKHEAD, PILINGS AND TIEBACK ANCHORS

PROG MGR:	ASE
DESIGN BY:	ASE
DRAWN BY:	ASE
PROG DATE:	APRIL 2024

DRAWING NUMBER:

AquaShield Engineering

REVISION RECORD

NO.	DATE	DESCRIPTION	BY

PROJECT NAME:
MODIFICATIONS TO REDUCE SPRING TIDE FLOODING AT MOTTS CHANNEL SEAFOOD

DRAWING TITLE:
PARKING LOT FILL AND GRADING

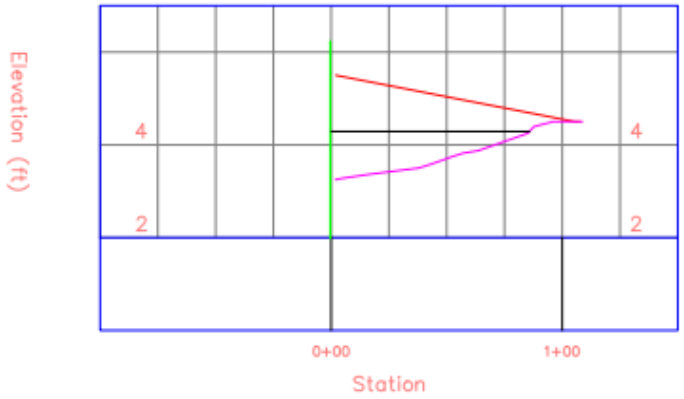
GENERAL NOTES:
- FILL BEHIND THE BULKHEAD TO MATCH WITH EXISTING PARKING LOT ELEVATION OF 4.5 FT

GROUP MEMBERS:
JERRY GARCIA | COLBY LYON
NOAH CLARK | ANDREW MCLAWHORN

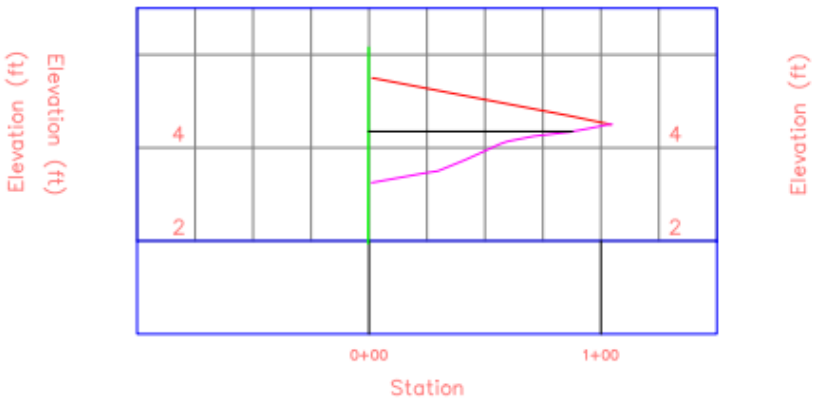
PROG MGR:	ASE
DESIGN BY:	ASE
DRAWN BY:	ASE
PROG DATE:	APRIL 2024
DRAWING NUMBER:	
ASE PROJ. NO.:	1.00.A

2d Area (Sq. Ft.)	Cut (Cu. Yd.)	Fill (Cu. Yd.)	Net (Cu. Yd.)
7011.45	0.00	214.48	214.48<Fill>

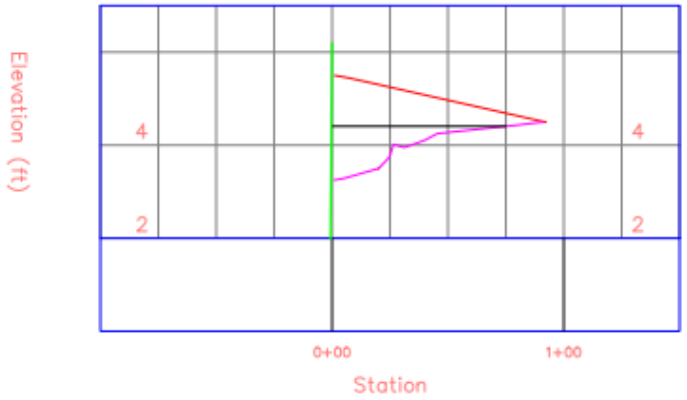
A–A'



B–B'



C–C'



FILL MATERIAL

- AB-3 CRUSHED LIMESTONE AGGREGATE: 1.5" DIAMETER
- NON SPECIFIED FILL SAND

GRADE

- 1:100' FROM LEEWARD SIDE OF BULKHEAD AT ELEVATION 5.5' TO PARKING LOT ELEVATION 4.5'

GENERAL NOTES:

- FILL WILL BE ADDED BEHIND BULKHEAD (GREEN COLOR) DURING CONSTRUCTION.
- THREE DIFFERENT TRANSECTS OF THE PARKING LOT BEFORE (MAGENTA COLOR) AND AFTER FILL (RED COLOR).
- NON SPECIFIED SAND (BLACK COLOR) WILL BE ADDED TO AN ELEVATION 4.3'AND FINISHED WITH CRUSHED LIMESTONE AGGREGATE.

GROUP MEMBERS: JERRY GARCIA | COLBY LYON
NOAH CLARK | ANDREW MCLAWHORN

AquaShield Engineering

GUARDING TOMORROW, TODAY

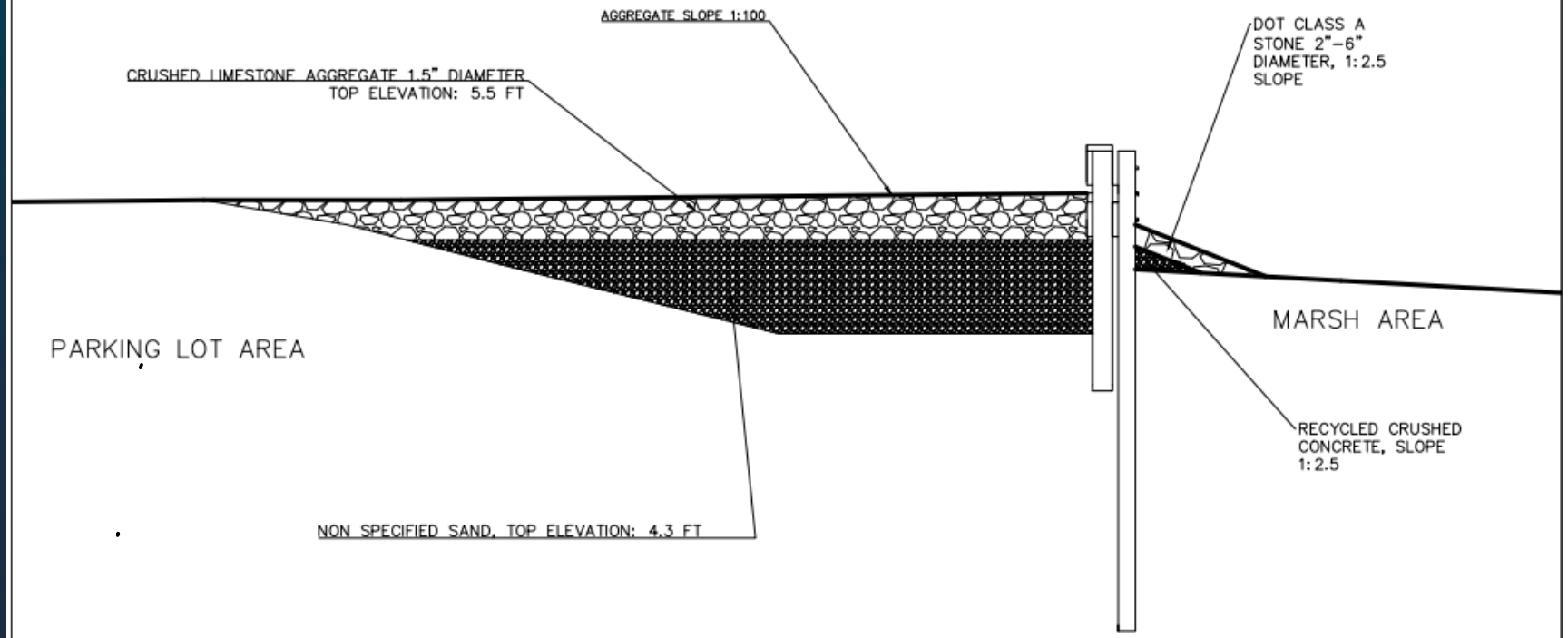
REVISION RECORD

NO.	DATE	DESCRIPTION	BY

PROJECT NAME: MODIFICATIONS TO REDUCE SPRING TIDE FLOODING AT MOTTS CHANNEL SEAFOOD

DRAWING TITLE: PARKING LOT FILL AND GRADING

PROG MGR:	ASE
DESIGN BY:	ASE
DRAWN BY:	ASE
PROG DATE:	APRIL 2024
DRAWING NUMBER:	
ASE PROJ. NO.:	1.00.A



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GUARDING TOMORROW, TODAY

REVISION RECORD

NO.	DATE	DESCRIPTION	BY

PROJECT NAME:
MODIFACATIONS TO REDUCE SPRING TIDE FLOODING AT MOTTS CHANNEL SEAFOOD

DRAWING TITLE:
DESIGN OF BULKHEAD FILL AND TOE PROTECTION

GENERAL NOTES:
ALL ELEVATIONS ARE IN REFERENCE TO NAVD88. ON THE BACKSIDE OF THE BULKHEAD THE FILL SAND MUST BE SET AT 3.28 FT. IF ABOVE, GROUND ADJACENT TO BULKHEAD WILL BE EXCAVATED TO MEET REQUIREMENTS.

PROG MGR:	ASE
DESIGN BY:	ASE
DRAWN BY:	ASE
PROG DATE:	APRIL 2024

DRAWING NUMBER:

GROUP MEMBERS: JERRY GARCIA | COLBY LYON | NOAH CLARK | ANDREW MCLAWHORN

ASE PROJ. NO.:
1.00.A