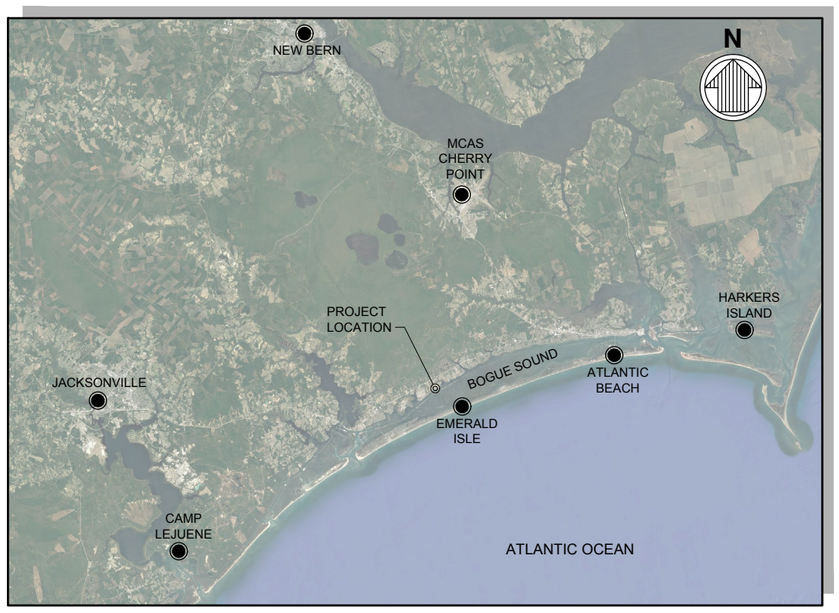
WESTERN CARTERET COUNTY BOAT LAUNCH FACILITY

241 MORADA BAY DRIVE, CARTERET COUNTY, NC



VICINITY MAP
SCALE: NTS

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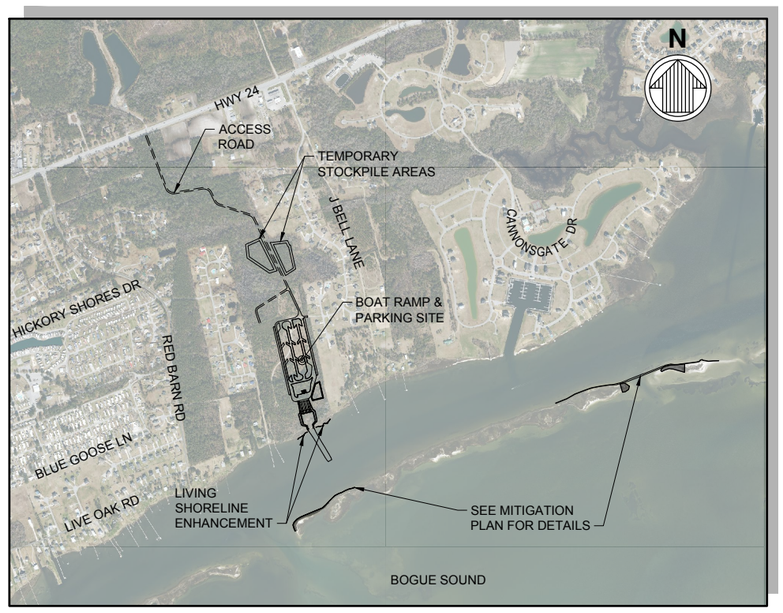


LOCATION PLAN
SCALE: NTS

ISSUED FOR PERMIT
ISSUED: 2023-04-##
NOT TO BE USED FOR CONSTRUCTION

DRAWING SCALES SHOWN BASED ON 22"x34" DRAWING

CARTERET COUNTY NORTH CAROLINA

Mark	Description	Date	Appr
0	ISSUED FOR PERMIT	2023-04-07	MAP

WESTERN CARTERET COUNTY BOAT LAUNCH FACILITY

COVER SHEET

Date: 2023-04-07 Rev. 0
M&N Project No. 210453
Drawing code:
Drawing Scale: AS SHOWN
Plot scale: 1:1 (D SHEET)
Dsd by: MAP
Drn by: VNM
Designed by: MEP/MAP
Reviewed by:
Submitted by: MARK P PIRRELLO MOFFATT & NICHOL

4700 FALLS OF NEUSE RD, SUITE 300
RALEIGH, NC 27609
PHONE: 919.781.4626
NC FIRM NO. P-0105
moffatt & nichol

SEAL

Sheet Reference No.
G-001
INDEX: 1 OF 16

File: Q:\RAL\210543\20 CADD_Active_210543\210453G-001 ; Plotted: 4/7/2023 4:28 PM by MORGAN, NEKOL ; Saved: 4/7/2023 3:44 PM by NMORGAN

GENERAL NOTES:

1. THE BATHYMETRIC SURVEY PRESENTED ON THE SITE PLAN IS BASED ON AN APRIL 2021 SURVEY CONDUCTED BY GEODYNAMICS AND CAN ONLY BE CONSIDERED AS REPRESENTATIVE OF CONDITIONS AT THAT TIME. THE TOPOGRAPHICAL SURVEY INFORMATION PRESENTED ON THE SITE PLAN IS BASED ON LIDAR DATA PRESENTED ON THE NC ONE MAP WEBSITE. AQUATIC RESOURCE SURVEY SHOWN ON DRAWINGS CONDUCTED IN SEPTEMBER 13-14, 2021 AND CAN ONLY BE CONSIDERED AS REPRESENTATIVE OF CONDITIONS AT THAT TIME. AN ADDITIONAL SURVEY WAS CONDUCTED AS PART OF THE MITIGATION PLAN, SEE MITIGATION PLAN REPORT FOR DETAILS.

2. ALL ELEVATIONS SHOWN ON DRAWINGS ARE REFERENCED TO NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88). THE TIDAL DATUM RELATIONSHIP IS ESTABLISHED BASED ON NOAA DATUM SOFTWARE.

   MHHW. . . . . .0.76 FEET
   MHW. . . . . 0.58 FEET
   MTL . . . . . 0.30 FEET
   NAVD88. . . . . .0.00 FEET
   MLW. . . . . -1.18 FEET
   MLLW. . . . . -1.31 FEET

3. PLAN COORDINATES AND WORK POINTS ARE BASED ON THE NORTH CAROLINA STATE PLANE COORDINATE SYSTEM, NORTH AMERICAN DATUM 83 (NAD83).

4. CONTRACTOR SHALL VERIFY ALL DIMENSIONS AND EXISTING CONDITIONS BEFORE STARTING WORK. DO NOT SCALE PROJECT DRAWINGS. REPORT ANY DISCREPANCIES IN THE DRAWINGS AND/OR SPECIFICATIONS TO THE OWNER'S REPRESENTATIVE FOR CLARIFICATION OR ADJUSTMENT PRIOR TO COMMENCING WORK. THE CONTRACTOR SHALL NOT BEGIN DEMOLITION/CONSTRUCTION IN ANY SUCH AFFECTED AREA UNTIL THE DISCREPANCY HAS BEEN RESOLVED.

5. THE CONTRACTOR SHALL PLACE THE PERMIT PLACARDS ON THE JOB SITE AND SHALL COMPLY WITH ALL TERMS OF THE PERMITS PERTAINING TO THE PERFORMANCE OF THE WORK.

6. ALL SAFETY REGULATIONS ARE TO BE STRICTLY FOLLOWED. METHODS OF CONSTRUCTION AND ERECTION OF STRUCTURAL MATERIAL ARE THE CONTRACTORS RESPONSIBILITY.

7. THESE PLANS ARE INCOMPLETE WITHOUT THE PROJECT TECHNICAL SPECIFICATIONS. IF THERE ARE CONFLICTS BETWEEN THE PLANS AND SPECIFICATIONS, THE CONTRACTOR SHALL ALERT THE OWNER AND ENGINEER. THE TECHNICAL SPECIFICATIONS SHALL TAKE PRECEDENCE.

8. THE CONTRACTOR SHALL ABIDE BY ALL APPLICABLE FEDERAL, STATE, AND LOCAL ENVIRONMENTAL PROTECTION STANDARDS, LAWS, AND REGULATIONS.

9. UNLESS OTHERWISE NOTED, THE CONTRACTOR SHALL, ON A DAILY BASIS, REMOVE FROM THE SITE ANY DEBRIS RESULTING FROM DEMOLITION/CONSTRUCTION. DISPOSAL OF MATERIALS IS THE RESPONSIBILITY OF THE CONTRACTOR. ALL MATERIALS TO BE REMOVED SHALL BECOME THE PROPERTY OF THE CONTRACTOR, UNLESS OTHERWISE NOTED, AND SHALL BE DISPOSED OF AS SPECIFIED. ALL DEBRIS SHALL BE PROPERLY DISPOSED OF IN A PERMITTED LANDFILL.

10. THE CONTRACTOR IS TO PROVIDE EROSION CONTROL/SEDIMENTATION BARRIERS (SILTATION CURTAINS AND FLOATING TURBIDITY SCREENS) TO PREVENT SILTATION OF ADJACENT PROPERTY, STREETS, STORM SEWERS, AND WATERWAYS, IF IN THE OPINION OF THE COUNTY, EXCESSIVE QUANTITIES OF EARTH ARE BEING TRANSPORTED OFF SITE EITHER BY NATURAL DRAINAGE OR VEHICULAR TRAFFIC, THE CONTRACTOR IS TO REMOVE AND CLEAN SAID EARTH FROM TRAVEL WAYS TO THE SATISFACTION OF THE CITY.

11. ALL SITE IMPROVEMENTS SHALL BE INSTALLED PER CARTERET COUNTY AND STATE REGULATIONS.

PERMITS:

1. IT IS THE INTENT OF THESE PLANS TO BE IN ACCORDANCE WITH APPLICABLE CODES AND AUTHORITIES HAVING JURISDICTION. ANY DISCREPANCIES BETWEEN THESE PLANS AND APPLICABLE CODES SHALL BE IMMEDIATELY BROUGHT TO THE ATTENTION OF THE OWNER.

2. IT IS THE INTENT OF THESE PLANS AND THE RESPONSIBILITY OF THE CONTRACTOR TO COMPLY WITH THE ENVIRONMENTAL PERMITS ISSUED FOR THIS PROJECT, IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO FAMILIARIZE AND GOVERN THEM SELF BY ALL PROVISIONS OF THESE PERMITS.

STAGING:

1. STAGING AREAS SHALL BE MAINTAINED BY THE CONTRACTOR. STAGING AREAS SHALL BE CLEARED OF DEBRIS AND CONTRACTOR INSTALLED AMENITIES AT THE COMPLETION AND ACCEPTANCE OF WORK IN THE AREA. THE CONTRACTOR SHALL RESTORE THE ACCESS AREAS TO THEIR ORIGINAL CONDITION AFTER WORK IN THE AREA IS COMPLETE. THIS WORK INCLUDES REPLACEMENT OF FENCING, SIGNS, VEGETATION, WALKWAYS, PARKING FACILITIES, PAVED AREAS AND OTHER MISCELLANEOUS ITEMS. ALL REPLACEMENT MATERIALS SHALL BE APPROVED BY THE OWNER BEFORE INSTALLATION.

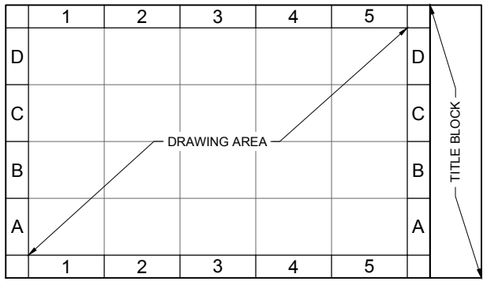
ESTIMATE OF QUANTITIES

SITE DATA

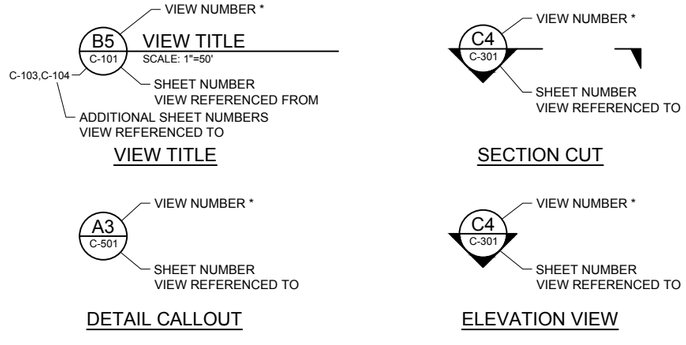
PROJECT OVERVIEW	
NON-ADA PARKING SPACES	159 EA
ADA PARKING SPACES	4 EA
TOTAL PARKING SPACES	163 EA
WET BASIN AREA	0.62 +/- AC
TOTAL BASIN AREA	1.54 +/- AC
REVETMENT AREA	0.39 +/- AC
LAUNCH RAMPS (152.5' LONG x 17' WIDE)	6 EA
ENTRANCE CHANNEL	450' LONG x 50' WIDE
IN-WATER IMPACTS	
EXCAVATION OF EXISTING COASTAL WETLAND	2,212 SF (0.05 +/- AC)
DREDGE AREA FOOTPRINT	33,833 SF (0.78 +/- AC)
DESIGN DREDGE QUANTITY @ EL -6.2' NAVD (-5.0' MLLW)	3,345 CY
ALLOWABLE +1' OVERDEPTH DREDGE QUANTITY (EL -7.2' NAVD)	1,280 CY
UPLAND IMPACTS	
DISTURBANCE AREA (PARKING LOT & BASIN)	17.20 +/- AC
% IMPERVIOUS SURFACE CREATED IN ORW AREA	21.8% (1.37+/-AC)
PARKING LOT EXCAVATION QUANTITY	28,200 CY
BASIN & BOAT RAMP EXCAVATION QUANTITY	28,575 CY
LIVING SHORELINE ENHANCEMENT	
ON-SITE ENHANCED MARSH PROTECTION (QUICKREEF SILLS)	464 LF (0.05 +/-AC)

ABBREVIATIONS:

AC	ACREAGE	NAD 83	NORTH AMERICAN DATUM OF 1983
AIWW	ATLANTIC INTRACOASTAL WATERWAY	NAVD88	NORTH AMERICAN VERTICAL DATUM OF 1988
APPROX	APPROXIMATE	NCCF	NORTH CAROLINA COASTAL FEDERATION
AVE	AVENUE	ORW	OUTSTANDING WATER RESOURCE
CIR	CIRCLE	PROP	PROPOSED
CONC	CONCRETE	REINF	REINFORCING
CL	CENTERLINE	S	SOUTH
CY	CUBIC YARDS	SAV	SUBMERGED AQUATIC VEGETATION
DR	DRIVE	SF	SQUARE FOOT
E	EAST OR EASTING	ST	STREET
EL/ELEV	ELEVATION	STA	STATION
EOP	EDGE OF PAVEMENT	SY	SQUARE YARDS
EXIST.	EXISTING	TYP	TYPICAL
FT	FEET	UON	UNLESS OTHERWISE NOTED
LF	LINEAR FEET	USACE	UNITED STATES ARMY CORPS OF ENGINEERS
MHW	MEAN HIGH WATER	"	SECONDS OR INCH
MHHW	MEAN HIGHER HIGH WATER	'	MINUTES OR FEET
MILS	ONE THOUSANDTH OF AN INCH	&	AND
MLW	MEAN LOW WATER	Ø	DIAMETER
MLLW	MEAN LOWER LOW WATER	@	AT
MTL	MEAN TIDE LEVEL	%	PERCENT
N	NORTH OR NORTHING		



DRAWING AREA COORDINATE SYSTEM (DACS)



* VIEW NUMBER IS BASED ON THE DACS LOCATION OF THE LOWER-LEFT EXTENTS OF THE VIEW ON THE REFERENCED SHEET. WHEN REFERENCING DRAWING INFORMATION BETWEEN SHEETS, BOTH THE VIEW AND SHEET NUMBERS MUST BE QUOTED TOGETHER - EITHER IN A CALLOUT FORMAT AS SHOWN ABOVE OR IN THE FORM; "VIEW NO./SHEET NO." (C1/C-301)

North Carolina 811 www.nc811.org

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CARTERET COUNTY NORTH CAROLINA

Mark	Description	Date	Appr
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WESTERN CARTERET COUNTY BOAT LAUNCH FACILITY

GENERAL NOTES & ABBREVIATIONS

moffatt & nichol
4700 FALLS OF NEUSE RD, SUITE 300
RALEIGH, NC 27609
PHONE: 919.781.4626
NC FIRM NO. F-0105

Designed by: MEP/MAP
Drawn by: VNM
Checked by: MAP
Reviewed by:
Submitted by: MARK P.RIRELLO, MOFFATT & NICHOL
Date: 2023-04-07
M&N Project No. 210453
Drawing code:
Rev. 0
Drawing Scale: AS SHOWN
Plot scale: 1:1 (0 SHEET)

SEAL

Sheet Reference No.
G-002
INDEX: 2 OF 16

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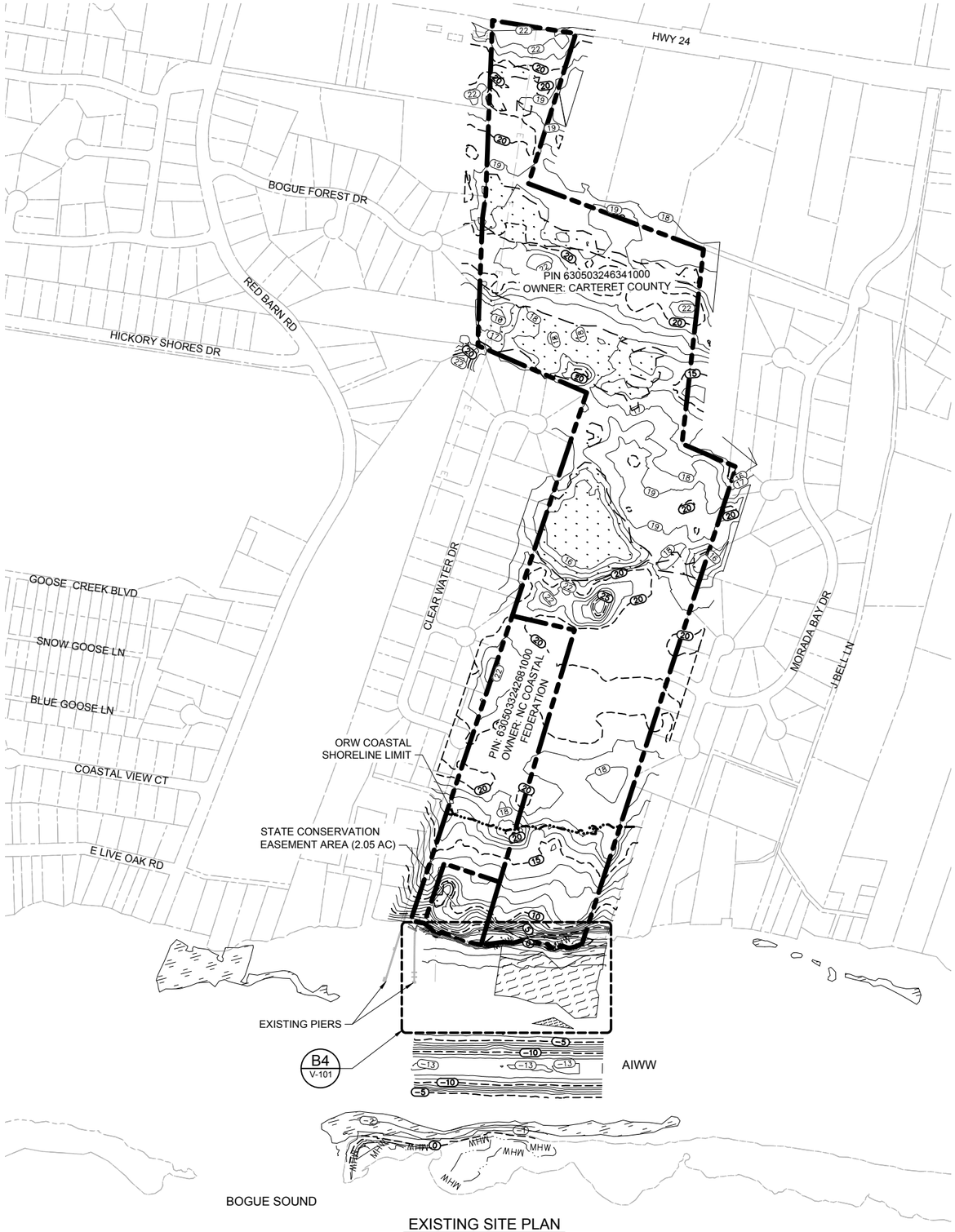
DRAWING SCALES SHOWN BASED ON 22"x34" DRAWING



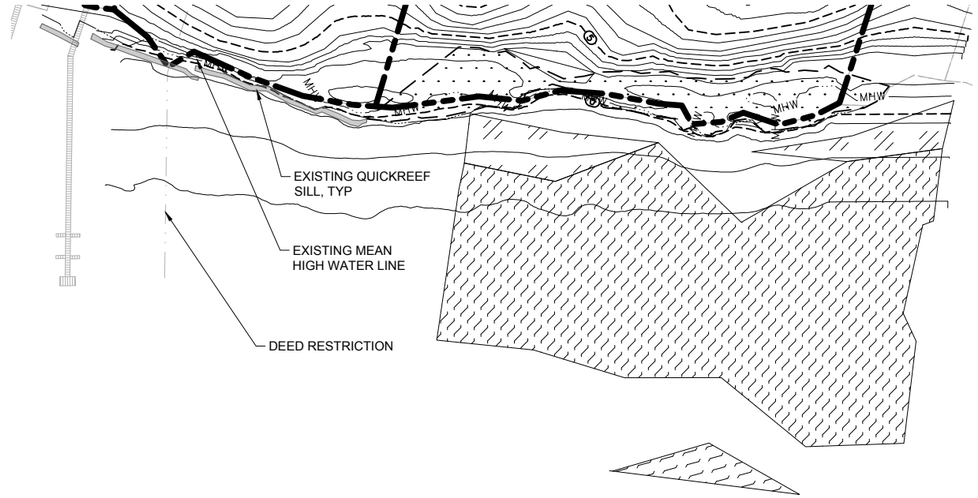
EXISTING SITE PLAN
SCALE: 1" = 300'

NOTE

SUBMERGED AQUATIC VEGETATION (SAV) SURVEY CONDUCTED SEPTEMBER 13-14, 2021 BY NORTH CAROLINA COASTAL FEDERATION.

LEGEND

- EXISTING MINOR CONTOUR
- EXISTING MAJOR CONTOUR
- PARCEL BOUNDARY
- SITE PARCEL BOUNDARY
- ORW COASTAL SHORELINE LIMIT
- WETLAND DELINEATION
- SAV DELINEATION (SEE NOTE)
- COASTAL WETLAND DELINEATION
- MEAN HIGH WATER



B4 V-101 INSET - EXISTING SHORELINE
SCALE: 1" = 80'

80' 0' 80' 160'
SCALE: 1"=80'

400' 0' 300' 600'
SCALE: 1"=300'

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CARTERET COUNTY NORTH CAROLINA

No.	Description	Date	
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WESTERN CARTERET COUNTY BOAT LAUNCH FACILITY

EXISTING CONDITION

Rev. 0
Date: 2023-04-07
M&N Project No. 210453
Drawing code:
Designed by: MEP/MAP
Drawn by: VNM
Cad by: MAP
Reviewed by:
Submitted by: MARK PIRRELLO MOFFATT & NICHOL
Drawing Scale: AS SHOWN
Plot scale: 1:1 (D SHEET)

4700 FALLS OF NEUSE RD, SUITE 300
RALEIGH, NC 27609
PHONE: 984.466.7286
NC FIRM NO. P-0105
moffatt & nichol

SEAL

Sheet Reference No.
V-101
INDEX: 3 OF 16

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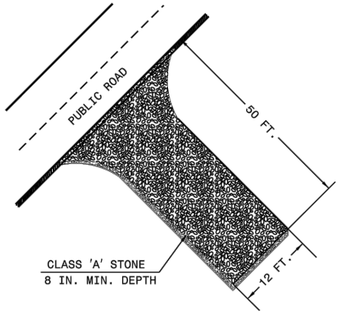
DRAWING SCALES SHOWN BASED ON 22"x34" DRAWING

EROSION CONTROL NOTES

1. ALL INLET/OUTLET PROTECTION WILL BE CHECKED FOR MAINTENANCE AND FAILURE EACH ACTIVE DAY ON SITE. SEDIMENT WILL BE REMOVED FROM THE SEDIMENT TRAP AND INLET PROTECTION DEVICES WHEN THE STORAGE CAPACITY HAS BEEN APPROXIMATELY 50% FILLED. GRAVEL WILL BE CLEANED OR REPLACED WHEN THE SEDIMENT POOL NO LONGER DRAINS PROPERLY. SEDIMENT WILL BE REMOVED FROM BEHIND THE SEDIMENT FENCE WHEN IT BECOMES ABOUT 0.5' DEEP AT THE FENCE. THE SEDIMENT FENCE WILL BE REPAIRED AS NEEDED TO MAINTAIN A PROPER BARRIER.
2. TEMPORARY EROSION CONTROL FACILITIES AND/OR PERMANENT FACILITIES INTENDED TO CONTROL EROSION OF THE EARTH DISTURBANCE OPERATION SHALL BE INSTALLED BEFORE ANY EARTH DISTURBANCE OPERATIONS TAKE PLACE OR AT THE EARLIEST POSSIBLE POINT DURING CONSTRUCTION.
3. TEMPORARY AND PERMANENT EROSION CONTROL MEASURES SHALL BE CONSTRUCTED PER THE DETAILS HEREIN, OR SHALL BE CONSTRUCTED IN ACCORDANCE WITH THE NORTH CAROLINA EROSION AND SEDIMENT CONTROL PLANNING AND DESIGN MANUAL.
4. THE CONTRACTOR MUST NOTIFY THE APPROPRIATE NCDEQ OFFICE A MINIMUM OF 48 HOURS PRIOR TO BEGINNING ANY LAND DISTURBING ACTIVITIES. 910-433-3300
5. REMOVE ALL SOILS AND SEDIMENTS TRACKED OR OTHERWISE DEPOSITED ONTO PUBLIC AND PRIVATE PAVEMENT AREAS. REMOVAL SHALL BE ON A DAILY BASIS WHEN TRACKING OCCURS.
6. LOCATE SOIL STOCKPILES NO LESS THAN FIFTY (50) FEET FROM ANY PUBLIC OR PRIVATE ROADWAY OR DRAINAGE CHANNEL. IF REMAINING FOR MORE THAN SEVEN DAYS, STABILIZE THE STOCKPILES BY VEGETATIVE COVER, TARPS, OR OTHER MEANS. CONTROL EROSION FROM ALL STOCKPILES BY PLACING SILT BARRIERS AROUND THE PILES. TEMPORARY STOCKPILES LOCATED ON PAVED SURFACES MUST BE NO LESS THAN FIVE FEET FROM THE DRAINAGE/GUTTER LINE AND SHALL BE COVERED IF LEFT MORE THAN 24 HOURS.
7. MAINTAIN ALL TEMPORARY EROSION AND SEDIMENT CONTROL DEVICES IN PLACE UNTIL THE CONTRIBUTING DRAINAGE AREA HAS BEEN STABILIZED. INSPECT TEMPORARY EROSION AND SEDIMENT CONTROL DEVICES ON A DAILY BASIS AND REPLACE DETERIORATED, DAMAGED, OR ROTTED EROSION CONTROL DEVICES IMMEDIATELY.
8. TEMPORARILY OR PERMANENTLY STABILIZE ALL DENUDED AREAS WHICH HAVE BEEN FINISH GRADED, AND ALL DENUDED AREAS IN WHICH GRADING OR SITE BUILDING CONSTRUCTION OPERATIONS ARE NOT ACTIVELY UNDERWAY AGAINST EROSION DUE TO RAIN, WIND AND RUNNING WATER WITHIN 14 DAYS. USE SEEDING AND MULCHING, EROSION CONTROL MATTING, AND/OR SODDING AND STAKING IN GREEN SPACE AREAS AND OTHERWISE APPROPRIATE MEASURES. USE EARLY APPLICATION OF GRAVEL BASE ON AREAS TO BE PAVED.
9. DO NOT REMOVE ANY EROSION AND SEDIMENT CONTROL DEVICES UNTIL AFTER THE PROTECTED AREA HAS UNDERGONE FINAL STABILIZATION AND PERMANENT VEGETATION HAS BEEN ESTABLISHED. IT IS RECOMMENDED THAT NCDEQ APPROVE THE ACTION PRIOR TO REMOVAL.
10. THE CONSTRUCTION ENTRANCE SHALL BE INSTALLED CONCURRENTLY WITH THE INITIATION OF CONSTRUCTION ACTIVITY.
11. THE INSTALLATION OF EROSION CONTROL MEASURES SHALL TAKE PRECEDENCE OVER ALL OTHER CONSTRUCTION ACTIVITIES.
12. THE PERMITTEE SHALL BE HELD RESPONSIBLE FOR THE ACTIONS AND PERFORMANCE OF ANY OTHER PARTIES PERFORMING WORK ON THIS PROJECT.
13. ALL EROSION AND SEDIMENT CONTROL PRACTICES WILL BE CHECKED FOR STABILITY AND OPERATION FOLLOWING EVERY RUN-OFF PRODUCING RAINFALL BUT IN NO CASE LESS THAN ONCE EVERY WEEK. ANY NEEDED REPAIRS WILL BE MADE IMMEDIATELY TO MAINTAIN ALL PRACTICES AS DESIGNED.
14. PURSUANT TO G.S 113A-57(2), THE ANGLE FOR GRADED SLOPES AND FILLS SHALL BE NO GREATER THAN THE ANGLE THAT CAN BE RETAINED BY VEGETATIVE COVER OR OTHER ADEQUATE EROSION CONTROL DEVICES OR STRUCTURES. IN ANY EVENT, SLOPES LEFT EXPOSED WILL, WITHIN 7 OR 14 CALENDAR DAYS OF COMPLETION OF ANY PHASE OF GRADING, BE PLANTED OR OTHERWISE PROVIDED WITH TEMPORARY OR PERMANENT GROUND COVER, DEVICES OR STRUCTURES SUFFICIENT TO RESTRAIN EROSION. PURSUANT TO G.S. 113A-57(3), PROVISIONS FOR PERMANENT GROUND COVER SUFFICIENT TO RETAIN EROSION MUST BE ACCOMPLISHED FOR ALL DISTURBED AREAS WITHIN 14 WORKING DAYS OR 90 CALENDAR DAYS (WHICHEVER IS SHORTER) FOLLOWING COMPLETION OF CONSTRUCTION DEVELOPMENT.



NOTES

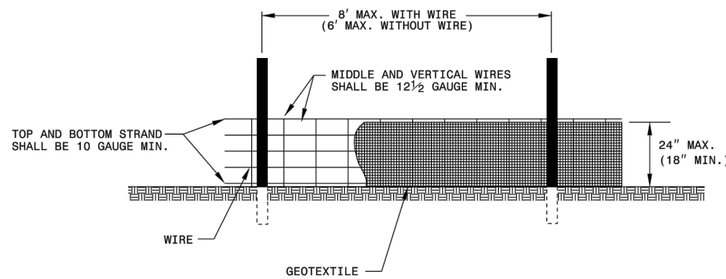
1. PROVIDE TURNING RADIUS SUFFICIENT TO ACCOMMODATE LARGE TRUCKS.
2. LOCATE ENTRANCES TO PROVIDE FOR UTILIZATION BY ALL CONSTRUCTION VEHICLES.
3. MUST BE MAINTAINED IN A CONDITION WHICH WILL PREVENT TRACKING OR DIRECT FLOW OF MUD ONTO STREETS. PERIODIC TOPDRESSING WITH STONE WILL BE NECESSARY.
4. ANY MATERIAL TRACKED ONTO THE ROADWAY MUST BE CLEANED UP IMMEDIATELY.
5. LOCATE GRAVEL CONSTRUCTION ENTRANCE AT ALL POINTS OF INGRESS AND EGRESS UNTIL SITE IS STABILIZED. PROVIDE FREQUENT CHECKS OF THE DEVICE AND TIMELY MAINTENANCE.
6. NUMBER AND LOCATION OF CONSTRUCTION ENTRANCES TO BE DETERMINED BY THE ENGINEER.
7. USE CLASS 'A' STONE OR OTHER COARSE AGGREGATE APPROVED BY THE ENGINEER.
8. INSTALL CONSTRUCTION ENTRANCES IN A WAY TO PREVENT VEHICLES FROM BYPASSING CONSTRUCTION ENTRANCE LEAVING PROJECT SITE.

NOTE: PLACE GEOTEXTILE FOR DRAINAGE BENEATH STONE

STATE OF NORTH CAROLINA
DEPT. OF TRANSPORTATION
DIVISION OF HIGHWAYS
RALEIGH, N.C.
1-18

ROADWAY STANDARD DRAWING FOR
GRAVEL CONSTRUCTION ENTRANCE

SHEET 1 OF 1
1607.01



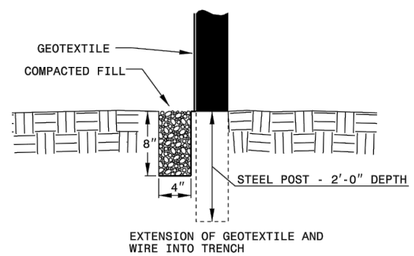
NOTES

USE GEOTEXTILE A MINIMUM OF 36" IN WIDTH AND FASTEN ADEQUATELY TO THE POSTS AND WIRE AS DIRECTED.

USE WIRE A MINIMUM OF 32" IN WIDTH AND WITH A MINIMUM OF 5 LINE WIRES WITH 12" VERTICAL SPACING.

PROVIDE 5'-0" STEEL POST OF THE SELF-FASTENER ANGLE STEEL TYPE.

FOR MECHANICAL SLICING METHOD INSTALLATION, GEOTEXTILE SHALL BE A MAXIMUM OF 18" ABOVE GROUND SURFACE.



EXTENSION OF GEOTEXTILE AND WIRE INTO TRENCH

STATE OF NORTH CAROLINA
DEPT. OF TRANSPORTATION
DIVISION OF HIGHWAYS
RALEIGH, N.C.
1-18

ROADWAY STANDARD DRAWING FOR
TEMPORARY SILT FENCE

SHEET 1 OF 1
1605.01

ISSUED FOR PERMIT
ISSUED: 2023-04-##
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CARTERET COUNTY
NORTH CAROLINA

No.	Mark	Description	Date	Appr
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WESTERN CARTERET COUNTY BOAT LAUNCH FACILITY

EROSION & SEDIMENT CONTROL NOTES

4700 FALLS OF NEUSE RD, SUITE 300
RALEIGH, NC 27609
(919) 781-4550
NC FIRM NO. F-0105
moffatt & nichol

Designed by: MEF/MAP
Drawn by: VNM
Cad by: MAP
Reviewed by:
Submitted by: MARK PRIRELLO MOFFATT & NICHOL
Date: 2023-04-07
M&N Project No. 210453
Drawing code:
Drawing Scale: AS SHOWN
Plot scale: 1:1 (D SHEET)
Rev: 0

SEAL

Sheet Reference No.
CE001
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File: Q:\RA\210543\20 CADD_Active_210543210543-CE001 ; Plotted: 4/7/2023 4:29 PM by MORGAN, NEKOL ; Saved: 3/28/2023 12:12 PM by MMORGAN

DRAWING SCALES SHOWN BASED ON 22"x34" DRAWING

MATERIALS:

1. TURBIDITY CURTAIN BARRIERS SHALL BE ORANGE IN COLOR IN ORDER TO ATTRACT THE ATTENTION OF NEARBY BOATERS.
2. THE TURBIDITY CURTAIN FABRIC SHALL MEET THE MINIMUM REQUIREMENTS NOTED IN TABLE 1 ON THIS DRAWING.
3. SEAMS IN THE TURBIDITY CURTAIN FABRIC SHALL BE EITHER VULCANIZE WELDED OR SEWN, AND SHALL DEVELOP THE FULL STRENGTH OF THE FABRIC.
4. FLOATATION DEVICES SHALL BE FLEXIBLE, BUOYANT UNITS CONTAINED IN AN INDIVIDUAL FLOTATION SLEEVE OR COLLAR ATTACHED TO THE CURTAIN. BUOYANCY PROVIDED BY THE FLOATATION UNITS SHALL BE SUFFICIENT TO SUPPORT THE WEIGHT OF THE CURRENT AND MAINTAIN A FREEBOARD OF AT LEAST 3 INCHES ABOVE THE WATER SURFACE LEVEL AS INDICATED IN THE TURBIDITY CURTAIN DETAIL ON THIS DRAWING.
5. LOAD LINES MUST BE FABRICATED INTO THE TOP AND BOTTOM OF ALL FLOATING TURBIDITY CURTAINS. THE TOP LOAD LINE SHALL CONSIST OF WOVEN WEBBING OR VINYL-SHEATHED STEEL CABLE AND SHALL HAVE A BREAK STRENGTH IN EXCESS OF 10,000 POUNDS. THE SUPPLEMENTAL (BOTTOM) LOAD LINE SHALL CONSIST OF A CHAIN INCORPORATED INTO THE BOTTOM HEM OF THE CURTAIN OF SUFFICIENT WEIGHT TO SERVE AS BALLAST TO HOLD THE CURTAIN IN A VERTICAL POSITION. ADDITIONAL ANCHORAGE SHALL BE PROVIDED AS NECESSARY. THE LOAD LINES SHALL HAVE SUITABLE CONNECTING DEVICES WHICH DEVELOP THE FULL BREAKING STRENGTH FOR CONNECTING TO LOAD LINES IN ADJACENT SECTIONS (SEE TURBIDITY CURTAIN DETAIL ON THIS DRAWING).
6. BOTTOM ANCHORS ARE REQUIRED. BOTTOM ANCHORS MUST BE SUFFICIENT TO HOLD THE CURTAIN IN THE SAME POSITION RELATIVE TO THE BOTTOM OF THE WATERCOURSE WITHOUT INTERFERING WITH THE ACTION OF THE CURTAIN. THE ANCHOR MAY DIG INTO THE BOTTOM (GRAPPLING HOOK, PLOW, OR FLUKE TYPE) OR MAY BE WEIGHTED (MUSHROOM TYPE), AND SHOULD BE ATTACHED TO A FLOATING ANCHOR BUOY VIA AN ANCHOR LINE. THE ANCHOR LINE WOULD THEN RUN FROM THE BUOY TO THE TOP LOAD LINE OF THE CURTAIN. THESE LINES MUST CONTAIN ENOUGH SLACK TO ALLOW THE BUOY AND CURTAIN TO FLOAT FREELY WITH A WATER SURFACE ELEVATION INCREASE FROM THE MEAN LOWER LOW WATER (MLLW) ELEVATION TO THE MEAN HIGHER HIGH WATER (MHHW) ELEVATION WITHOUT PULLING THE BUOY OR CURTAIN DOWN. THESE LINES MUST BE CHECKED REGULARLY TO MAKE SURE THEY DO NOT BECOME ENTANGLED WITH DEBRIS. ANCHOR SPACING WILL VARY WITH CURRENT VELOCITY AND POTENTIAL WIND AND WAVE ACTION, THEREFORE THE MANUFACTURER'S RECOMMENDATIONS SHOULD BE FOLLOWED. SEE ORIENTATION OF EXTERNAL ANCHORS AND ANCHOR BUOYS AS SHOWN IN FIGURE 1 ON THIS DRAWING FOR INSTALLATION.

INSTALLATION:

1. THE CURTAIN SHOULD NEVER TOUCH THE BOTTOM. A MINIMUM 1 FOOT "GAP" SHOULD EXIST BETWEEN THE WEIGHTED LOWER END OF THE SKIRT AND THE BOTTOM AT MLLW. MOVEMENT OF THE LOWER SKIRT OVER THE BOTTOM DUE TO CURRENT OR ELEVATION FLUCTUATION ON THE FLOTATION SYSTEM MAY FAN AND STIR SEDIMENTS ALREADY SETTLED OUT.
2. TURBIDITY CURTAINS SHOULD BE LOCATED PARALLEL TO THE DIRECTION OF FLOW OF A MOVING BODY OF WATER. TURBIDITY CURTAIN SHOULD NOT BE PLACED ACROSS THE MAIN FLOW OF A SIGNIFICANT BODY OF MOVING WATER.
3. WHEN SIZING THE LENGTH OF A FLOATING CURTAIN, ALLOW AN ADDITIONAL 10 TO 20 PERCENT VARIANCE TO STRAIGHT LINE MEASUREMENTS. THIS WILL ALLOW FOR MEASURING ERRORS, MAKE INSTALLING EASIER AND REDUCE STRESS FROM POTENTIAL WAVE ACTION DURING HIGH WINDS.
4. AN ATTEMPT SHOULD BE MADE TO AVOID AN EXCESSIVE AMOUNT OF JOINTS IN THE CURTAIN. A MINIMUM CONTINUOUS SPAN OF 50 FEET BETWEEN JOINTS IS REQUIRED.
5. FOR STABILITY REASONS, A MAXIMUM SPAN OF 100 FEET BETWEEN JOINTS (ANCHOR OR STAKE LOCATIONS) IS REQUIRED. IF SPACINGS EXCEEDING THIS ARE ALLOWED BY THE MANUFACTURER, DATA SHALL BE SUBMITTED FOR REVIEW.
6. THE ENDS OF THE CURTAIN (BOTH FLOATING UPPER AND WEIGHTED LOWER) SHOULD EXTEND WELL UNDER THE EXISTING STRUCTURE TO BE REMOVED. THE ENDS SHOULD BE SECURED FIRMLY TO FULLY ENCLOSE THE AREA WHERE SEDIMENT MAY ENTER THE WATER.
7. TYPICAL ALIGNMENTS OF TURBIDITY CURTAINS CAN BE SEEN IN FIGURE 2 ON THIS DRAWING. THE NUMBER AND SPACING OF EXTERNAL ANCHORS MAY VARY DEPENDING ON CURRENT VELOCITIES AND POTENTIAL WIND AND WAKE ACTION. THE MANUFACTURER'S RECOMMENDATIONS SHOULD BE FOLLOWED.
8. IN RIVERS OR IN OTHER MOVING WATER, IT IS IMPORTANT TO SET ALL THE CURTAIN ANCHOR POINTS. CARE MUST BE TAKEN TO ENSURE THAT ANCHOR POINTS ARE OF SUFFICIENT HOLDING POWER TO RETAIN THE CURTAIN UNDER THE EXISTING CURRENT CONDITIONS, PRIOR TO PUTTING THE FURLED CURTAIN INTO THE WATER. AGAIN, ANCHOR BUOYS SHOULD BE EMPLOYED ON ALL ANCHORS TO PREVENT THE CURRENT FROM SUBMERGING THE FLOTATION AT THE ANCHOR POINTS.
9. WHEN THE ANCHORS ARE SECURE, THE FURLED CURTAIN SHOULD BE SECURED TO THE UPSTREAM ANCHOR POINT AND THEN SEQUENTIALLY ATTACHED TO EACH NEXT DOWNSTREAM ANCHOR POINT UNTIL THE ENTIRE CURTAIN IS IN POSITION. AT THIS POINT, AND BEFORE UNFURLING, THE "LAY" OF THE CURTAIN SHOULD BE ASSESSED AND ANY NECESSARY ADJUSTMENTS MADE TO THE ANCHORS. FINALLY, WHEN THE LOCATION IS ASCERTAINED TO BE AS DESIRED, THE FURLING LINES SHOULD BE CUT TO ALLOW THE SKIRT TO DROP.
10. ALWAYS ATTACH ANCHOR LINES TO THE FLOATATION DEVICE, NOT TO THE BOTTOM OF THE CURTAIN. THE ANCHORING LINE ATTACHED TO THE FLOATATION DEVICE ON THE DOWNSTREAM SIDE WILL PROVIDE SUPPORT FOR THE CURTAIN. ATTACHING THE ANCHORS TO THE BOTTOM OF THE CURTAIN COULD CAUSE PREMATURE FAILURE OF THE CURTAIN DUE TO THE STRESSES IMPARTED ON THE MIDDLE SECTION OF THE CURTAIN.

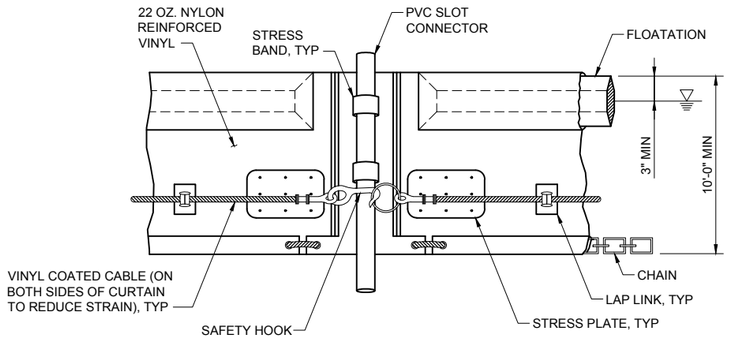
REMOVAL:

1. CARE SHOULD BE TAKEN TO PROTECT THE SKIRT FROM DAMAGE AS THE TURBIDITY CURTAIN IS DRAGGED FROM THE WATER.
2. IF THE CURTAIN IS TO BE REUSED AT THE SITE, THE AREA SELECTED TO BRING THE CURTAIN ASHORE SHOULD BE FREE OF SHARP ROCKS, BROKEN CEMENT, DEBRIS, ETC SO AS TO MINIMIZE DAMAGE WHEN HAULING THE CURTAIN. ANY DAMAGE TO THE CURTAIN SHALL BE REPAIRED AS SPECIFIED.
3. IF THE CURTAIN HAS A DEEP SKIRT, IT CAN BE FURTHER PROTECTED BY RUNNING A SMALL BOAT ALONG ITS LENGTH WITH A CREW INSTALLING FURLING LINES BEFORE ATTEMPTING TO REMOVE THE CURTAIN FROM THE WATER.

MAINTENANCE:

1. THE CONTRACTOR SHALL BE RESPONSIBLE FOR MAINTENANCE OF THE TURBIDITY CURTAIN FOR THE DURATION OF THE PROJECT IN ORDER TO ENSURE THE CONTINUOUS PROTECTION OF THE WATERWAY.
2. SHOULD REPAIRS TO THE GEOTEXTILE FABRIC BECOME NECESSARY, REPAIR KITS AVAILABLE FROM THE ORIGINAL MANUFACTURER SHALL BE USED. MANUFACTURER'S INSTRUCTIONS MUST BE FOLLOWED TO ENSURE THE ADEQUACY OF THE REPAIR.
3. WHEN THE CURTAIN IS NO LONGER REQUIRED, THE CURTAIN AND RELATED COMPONENTS SHALL BE REMOVED IN SUCH A MANNER AS TO MINIMIZE TURBIDITY. REMAINING SEDIMENT SHALL BE SUFFICIENTLY SETTLED BEFORE REMOVING THE CURTAIN.

TABLE 1 - FABRIC PROPERTIES	
PHYSICAL PROPERTY	REQUIREMENT
THICKNESS (MILS)	45
WEIGHT (OZ./SY)	22
TENSILE STRENGTH (LB)	300
UV INHIBITOR	REQUIRED



TURBIDITY CURTAIN DETAIL

NOTE:
ANCHORING WITH BUOYS, AS SHOWN, REMOVES ALL VERTICAL FORCES FROM THE CURTAIN. HENCE, THE CURTAIN WILL NOT SINK FROM WIND OR CURRENT LOADS. FINAL CONFIGURATION AND DETAILS AS RECOMMENDED BY MANUFACTURER.

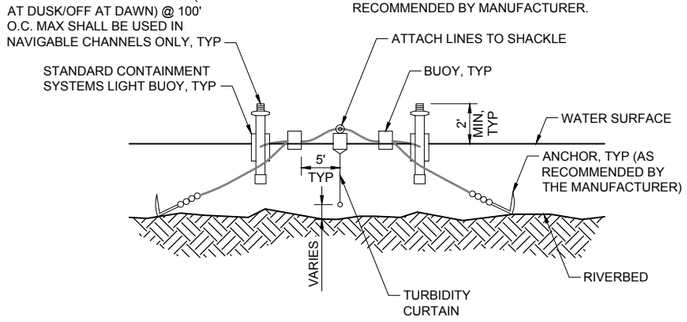
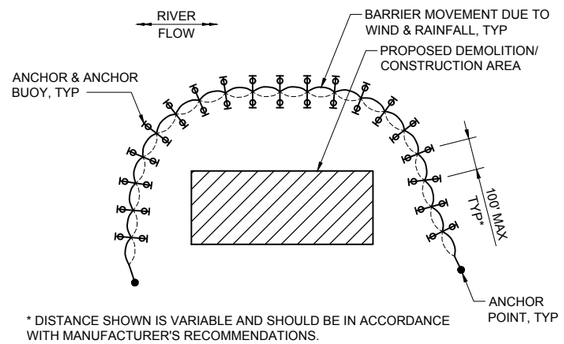


FIGURE 1 - SECTION



* DISTANCE SHOWN IS VARIABLE AND SHOULD BE IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS.

FIGURE 2 - PLAN

ISSUED FOR PERMIT
ISSUED: 2023-04-##
NOT TO BE USED FOR CONSTRUCTION
DRAFT

CARTERET COUNTY NORTH CAROLINA

No.	Mark	Description	Date	Appr
0		ISSUED FOR PERMIT	2023-04-07	MAP

WESTERN CARTERET COUNTY BOAT LAUNCH FACILITY

TURBIDITY CURTAIN NOTES & DETAILS

moffatt & nichol
4700 FALLS OF NEUSE RD, SUITE 300
RALEIGH, NC 27609
(919) 781-4626
NC FIRM NO. F-0105

Designed by:	MEF/MAP
Drawn by:	VNM
Cad by:	MAP
Reviewed by:	
Submitted by:	MARK PRIRELLO MOFFATT & NICHOL
Drawing Scale:	AS SHOWN
Plot scale:	1:1 (D SHEET)
Date:	2023-04-07
Rev:	0
M&N Project No.	210453
Drawing code:	

SEAL

Sheet Reference No.
CE002
INDEX: 5 OF 16

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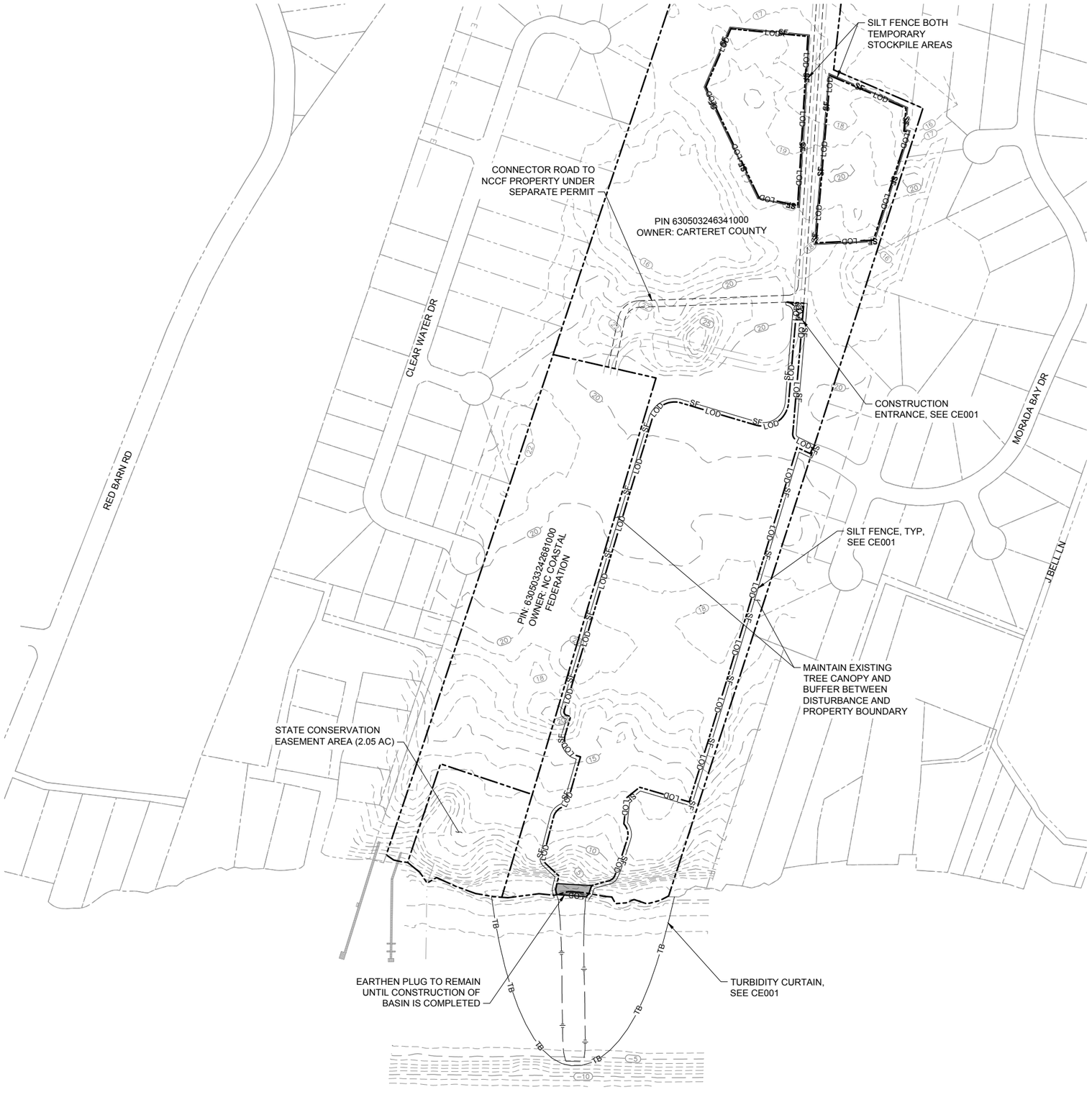
DRAWING SCALES SHOWN BASED ON 22"x34" DRAWING



CONSTRUCTION SEQUENCE

1. OBTAIN ALL NECESSARY PERMITS AND APPROVALS AND HOLD PRE CONSTRUCTION CONFERENCE.
2. INSTALL STONE CONSTRUCTION ENTRANCE, TEMPORARY SILT FENCE, AND TURBIDITY CURTAIN WHERE SPECIFIED.
3. CLEAR AND GRUB THE SITE AS NEEDED.
4. ROUGH GRADE THE SITE AND APPLY TEMPORARY SEEDING TO AREAS TO REMAIN GRASSED.
5. INSTALL UTILITIES.
6. INSTALL INLET PROTECTION ON ALL NEW STORM WATER INLETS.
7. PERFORM FINE GRADING.
8. INSTALL ASPHALT PAVING AND/OR PERVIOUS STONE AREAS.
9. FERTILIZE, SEED AND MULCH ALL REMAINING DISTURBED AREAS.
10. UPON SITE STABILIZATION, SEEK NCDEQ APPROVAL TO REMOVE ALL TEMPORARY MEASURES.
11. ALL EROSION CONTROL MEASURES SHALL BE MAINTAINED AS OUTLINED IN THE DETAILS WITHIN THE PLANS AND ACCORDING TO THE NCDEQ EROSION CONTROL MANUAL.

LEGEND

- EXISTING MINOR CONTOUR
- EXISTING MAJOR CONTOUR
- PARCEL BOUNDARY
- SITE PARCEL BOUNDARY
- SF — SILT FENCE
- TB — TURBIDITY CURTAIN
- LOD — LIMITS OF EXCAVATION
- LIMITS OF DREDGE
- EARTHEN PLUG

N

160' 0' 160' 320'

SCALE: 1"=160'

ISSUED FOR PERMIT
ISSUED: 2023-04-##
NOT TO BE USED FOR CONSTRUCTION

DRAFT

CARTERET COUNTY NORTH CAROLINA

Mark	Description	Date	Appr
0	ISSUED FOR PERMIT	2023-04-07	MAP

WESTERN CARTERET COUNTY BOAT LAUNCH FACILITY

EROSION AND SEDIMENT CONTROL PLAN

4700 FALLS OF NEUSE RD, SUITE 300
RALEIGH, NC 27609
PHONE: 919.781.4626
NC FIRM NO. P-0105
moffatt & nichol

Designed by: MEP/MAP
Drawn by: VNM
Checked by: MAP
Reviewed by:
Submitted by: MARK P PIRRELLO MOFFATT & NICHOL
Date: 2023-04-07
M&N Project No. 210453
Drawing code:
Drawing Scale: AS SHOWN
Plot scale: 1:1 (0 SHEET)
Rev. 0

SEAL

Sheet Reference No.
CE101
INDEX: 6 OF 16

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DRAWING SCALES SHOWN BASED ON 22"x34" DRAWING

NOTE

WETLAND IMPACTS ASSOCIATED WITH ENTRANCE ROAD ARE PERMITTED UNDER PERMIT # SAW-2019-02188.

LEGEND

- MINOR CONTOUR
- MAJOR CONTOUR
- PARCEL BOUNDARY
- SITE PARCEL BOUNDARY
- ORW COASTAL SHORELINE LIMIT
- LIMITS OF EXCAVATION
- WETLAND DELINEATION
- SAV DELINEATION
- COASTAL WETLAND DELINEATION

160' 0' 160' 320'

SCALE: 1"=160'

ISSUED FOR PERMIT
ISSUED: 2023-04-##
NOT TO BE USED FOR CONSTRUCTION

DRAFT

CARTERET COUNTY NORTH CAROLINA

Rev.	Description	Date	Appr
0	ISSUED FOR PERMIT	2023-04-07	MAP

WESTERN CARTERET COUNTY BOAT LAUNCH FACILITY

DEMOLITION PLAN

4700 FALLS OF NEUSE RD, SUITE 300
RALEIGH, NC 27609
PHONE: 919.781.4626
NC FIRM NO. P-0105

moffatt & nichol

Designed by:	MEP/MAP
Drawn by:	VNM
Checked by:	MAP
Reviewed by:	
Submitted by:	MARK P.RRELLO MOFFATT & NICHOL
Date:	2023-04-07
M&N Project No.	210453
Drawing code:	
Drawing Scale:	AS SHOWN
Plot scale:	1:1 (D SHEET)

SEAL

Sheet Reference No.

D-101

INDEX: 7 OF 16

DRAWING SCALES SHOWN BASED ON 22"x34" DRAWING

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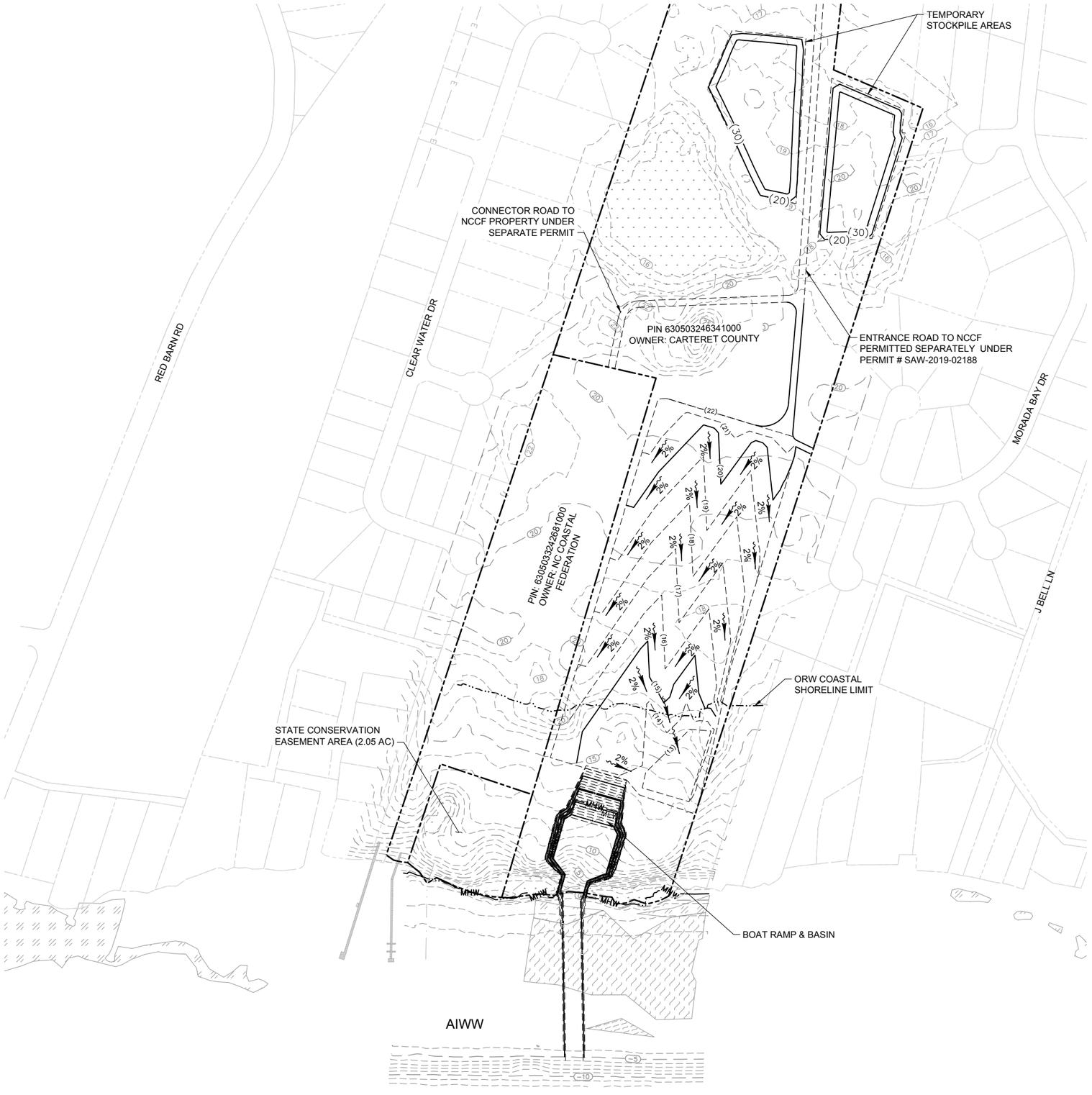

LEGEND

- EXISTING MINOR CONTOUR
- EXISTING MAJOR CONTOUR
- PROPOSED MINOR CONTOUR
- PROPOSED MAJOR CONTOUR
- PARCEL BOUNDARY
- SITE PARCEL BOUNDARY
- ORW COASTAL SHORELINE LIMIT
- WETLAND DELINEATION
- SAV DELINEATION
- COASTAL WETLAND DELINEATION
- MEAN HIGH WATER LINE
- MEAN LOW WATER LINE
- FLOW INDICATOR

160' 0' 160' 320'

SCALE: 1"=160'

ISSUED FOR PERMIT
ISSUED: 2023-04-##
NOT TO BE USED FOR CONSTRUCTION

DRAFT

CARTERET COUNTY
NORTH CAROLINA

No.	Mark	Description	Date	Appr.
0		ISSUED FOR PERMIT	2023-04-07	MAP

WESTERN CARTERET COUNTY BOAT LAUNCH FACILITY

GRADING & DRAINAGE PLAN

moffatt & nichol
4700 FALLS OF NEUSE RD, SUITE 300
RALEIGH, NC 27609
PHONE: 919.781.4626
NC FIRM NO. F-0105

Designed by:	MEP/MAP
Dwn by:	VNM
Ckd by:	MAP
Reviewed by:	
Submitted by:	MARK P.RRELLO MOFFATT & NICHOL
Date:	2023-04-07
Rev.	0
M&N Project No.	210453
Drawing code:	
Drawing Scale:	AS SHOWN
Plot scale:	1:1 (D SHEET)

SEAL

Sheet Reference No.

CG101

INDEX: 8 OF 16

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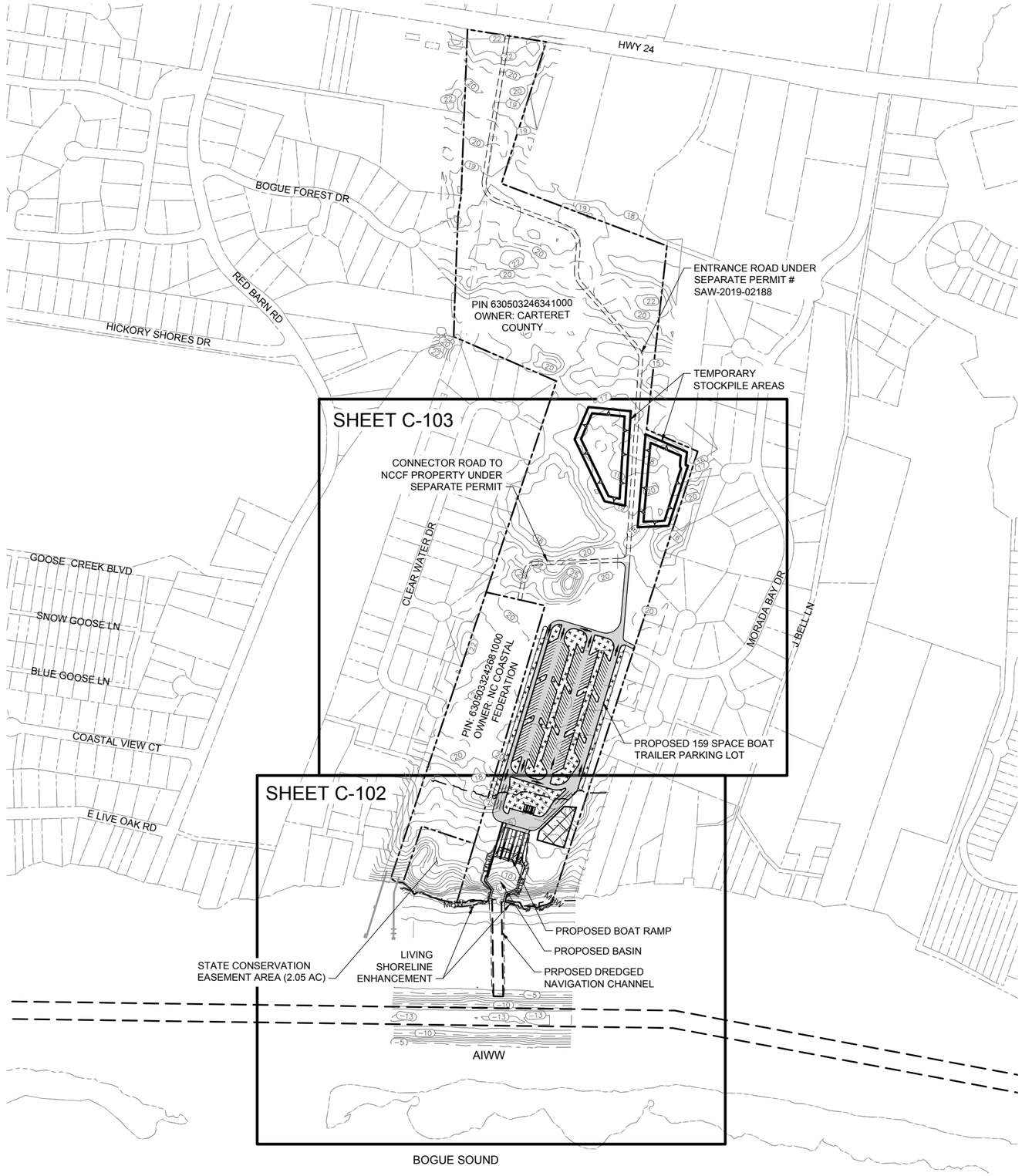

ISSUED FOR PERMIT
ISSUED: 2023-04-##
NOT TO BE USED FOR CONSTRUCTION

DRAFT

DRAWING SCALES SHOWN BASED ON 22"x34" DRAWING

CARTERET COUNTY NORTH CAROLINA

No.	Mark	Description	Date	Appr.
0		ISSUED FOR PERMIT	2023-04-07	MAP

WESTERN CARTERET COUNTY BOAT LAUNCH FACILITY

SITE & KEY PLAN

moffatt & nichol
4700 FALLS OF NEUSE RD, SUITE 300
RALEIGH, NC 27609
PHONE: 919.781.4626
NC FIRM NO. F-0105

Designed by: MEF/MAP	Cad by: MAP	Date: 2023-04-07	Rev. 0
Dwn by: VNM		M&N Project No. 210453	
Reviewed by:		Drawing code:	
Submitted by: MARK PIRRELLO MOFFATT & NICHOL		Drawing Scale: AS SHOWN	
		Plot scale: 1:1 (D SHEET)	

SEAL

Sheet Reference No.
C-101
INDEX: 9 OF 16

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MATCH LINE - SEE SHEET C-103

ORW COASTAL SHORELINE LIMIT

PIN: 6305033242681000
OWNER: NC COASTAL FEDERATION

SEE NOTE 3

ASPHALT ROADWAY

E4 C-300

INFILTRATION AREA (.55 AC)

STATE CONSERVATION EASEMENT AREA (2.05 AC)

D4 C-300

MHW

EXISTING QUICKREEF SILL, TYP

EXISTING COASTAL WETLAND, TYP

LIVING SHORELINE ENHANCEMENTS, SEE A1 C-102

SAV DELINEATION

EXISTING PIERS

ENLARGED BOAT RAMP, SEE NOTE 3 & C-400

D2 C-300

450' X 50' PROPOSED DREDGE CHANNEL

AIWW CHANNEL

PLAN VIEW
SCALE: 1" = 300'

94 LF QUICKREEF SILL

92 LF QUICKREEF SILL

100 LF QUICKREEF SILL

99 LF QUICKREEF SILL

79 LF QUICKREEF SILL

A1 C-102 INSET - LIVING SHORELINE ENHANCEMENTS
SCALE: 1" = 30'

NOTES

1. FOR SITE GRADING PLAN SEE SHEET CG101.
2. PROPOSED MINOR CONTOURS NOT SHOWN IN BASIN AREA FOR CLARITY.
3. CONTRACTOR SHALL MAINTAIN A MINIMUM 20.0' BUFFER OF THE EXISTING VEGETATED AREA AND TREE CANOPY BETWEEN PROJECT LIMITS AND ADJOINING PROPERTY BOUNDARIES.

LEGEND

- EXISTING MINOR CONTOUR
- EXISTING MAJOR CONTOUR
- PROPOSED MINOR CONTOUR
- PROPOSED MAJOR CONTOUR
- ORW COASTAL SHORELINE LIMIT
- WETLAND DELINEATION
- SAV DELINEATION
- COASTAL WETLAND DELINEATION
- INFILTRATION AREA
- QUICKREEF SILL
- GRASS
- RIPRAP
- ASPHALT
- MEAN HIGH WATER LINE
- MEAN LOW WATER LINE
- PARCEL BOUNDARY

N

30' 0' 30' 60'
SCALE: 1"=30'

50' 0' 100' 200'
SCALE: 1"=100'

ISSUED FOR PERMIT
ISSUED: 2023-04-##
NOT TO BE USED FOR CONSTRUCTION

DRAFT

DRAWING SCALES SHOWN BASED ON 22"x34" DRAWING

CARTERET COUNTY NORTH CAROLINA

No.	Description	Date	Appr
0	ISSUED FOR PERMIT	2023-04-07	MAP

WESTERN CARTERET COUNTY BOAT LAUNCH FACILITY

SITE PLAN 1 OF 2

4700 FALLS OF NEUSE RD, SUITE 300
RALEIGH, NC 27609
PH: 919.781.9595
NC FIRM NO. F-0105

moffatt & nichol

Rev: 0
Date: 2023-04-07
M&N Project No: 210453
Drawing code:
Drawing Scale: AS SHOWN
Plot scale: 1:1 (0 SHEET)
Designed by: MEF/MAP
Cad by: MAP
Drawn by: VNM
Reviewed by:
Submitted by: MARK PIRRELLO MOFFATT & NICHOL

SEAL

Sheet Reference No.
C-102
INDEX: 10 OF 16

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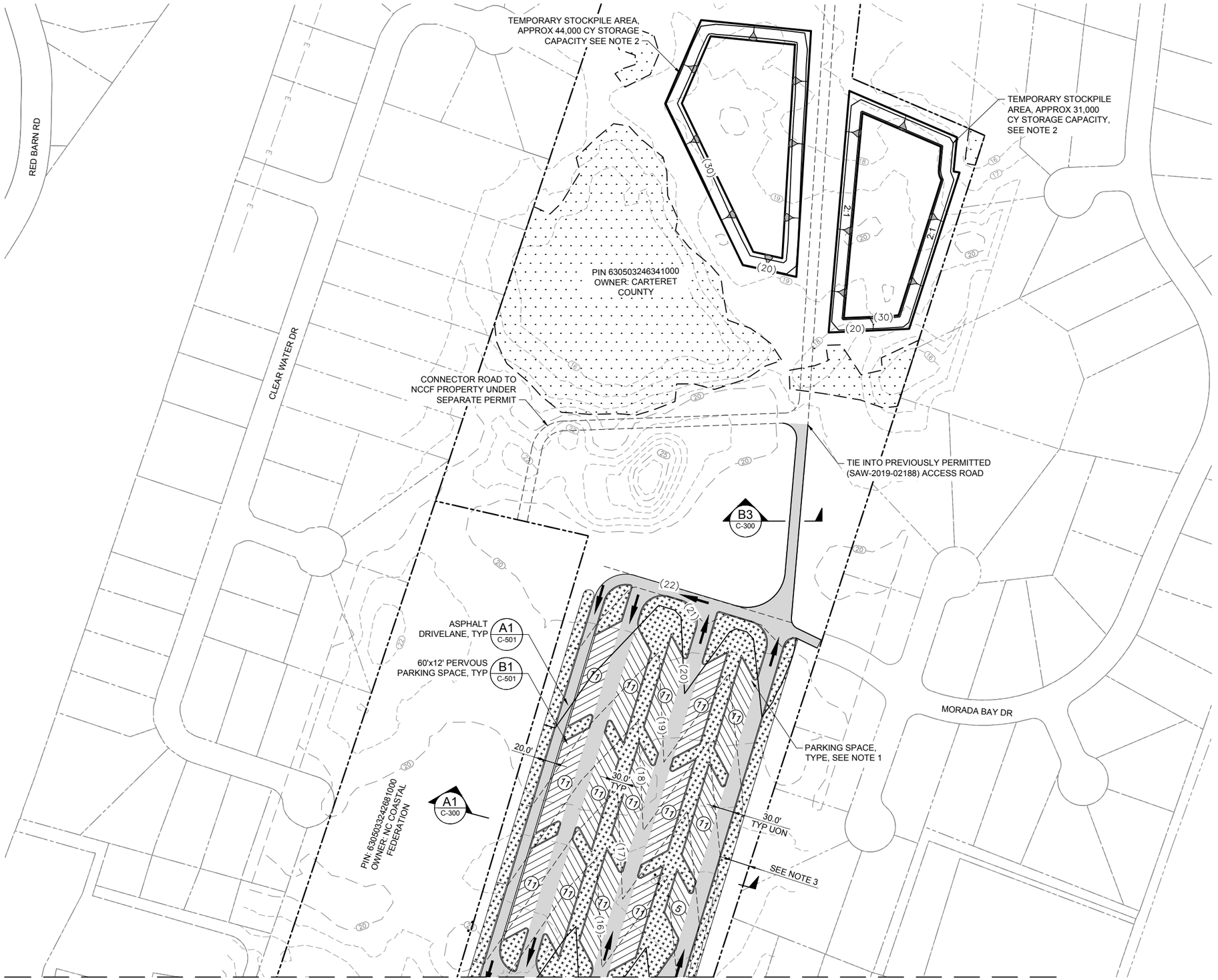

NOTES

1. PARKING SPACE MARKINGS SHOWN FOR ILLUSTRATIVE PURPOSES ONLY.
2. TEMPORARY STOCKPILE AREAS SHALL NOT BE HIGHER THAN 15-FEET ABOVE EXISTING GRADE AT A 2:1 SLOPE.
3. CONTRACTOR SHALL MAINTAIN A MINIMUM 20.0' BUFFER OF THE EXISTING VEGETATED AREA AND TREE CANOPY BETWEEN PROJECT LIMITS AND ADJOINING PROPERTY BOUNDARIES.

LEGEND

- EXISTING MINOR CONTOUR
- EXISTING MAJOR CONTOUR
- PROPOSED MINOR CONTOUR
- PROPOSED MAJOR CONTOUR
- PARCEL BOUNDARY
- WETLAND DELINEATION
- GRASS
- ASPHALT
- PERVIOUS PARKING SPACES
- PARKING NUMBER INDICATOR
- SLOPE INDICATOR

N

50' 0' 100' 200'

SCALE: 1"=100'

ISSUED FOR PERMIT
ISSUED: 2023-04-##
NOT TO BE USED FOR CONSTRUCTION

DRAFT

CARTERET COUNTY NORTH CAROLINA

No.	Mark	Description	Date	Appr
0		ISSUED FOR PERMIT	2023-04-07	MAP

WESTERN CARTERET COUNTY BOAT LAUNCH FACILITY

SITE PLAN 2 OF 2

4700 FALLS OF NEUSE RD, SUITE 300
RALEIGH, NC 27609
PHONE: (919) 781-4626
NC FIRM NO. F-0105

Designed by: MEF/MAP	Date: 2023-04-07	Rev: 0	
Dwn by: VNM	Ckd by: MAP	M&M Project No: 210453	
Reviewed by:		Drawing code:	
Submitted by: MARK PIERELLO MOFFATT & NICHOL		Drawing Scale: AS SHOWN	Plot scale: 1:1 (0 SHEET)

SEAL

Sheet Reference No.

C-103

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DRAWING SCALES SHOWN BASED ON 22"x34" DRAWING

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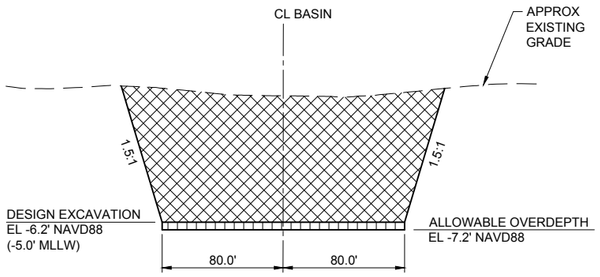

D1 D-101 SECTION- BASIN
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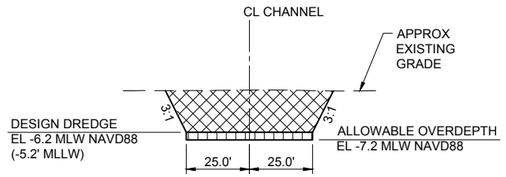

D2 C-102 SECTION- DREDGE
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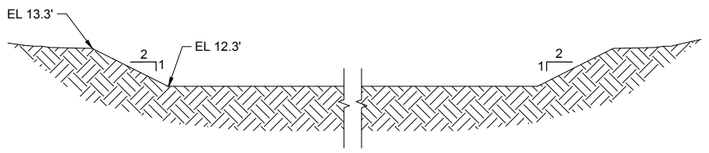

E4 C-102 SECTION - INFILTRATION AREA
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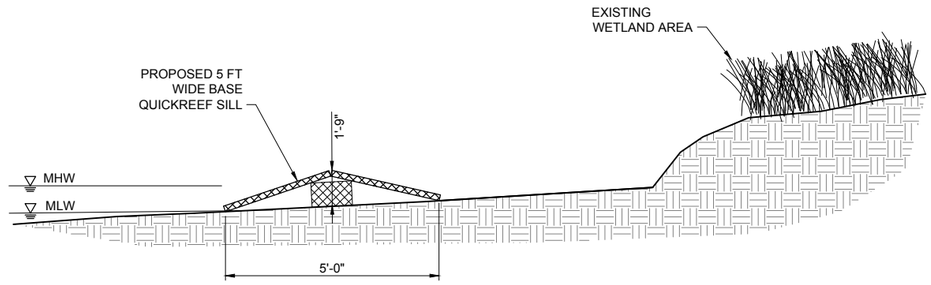
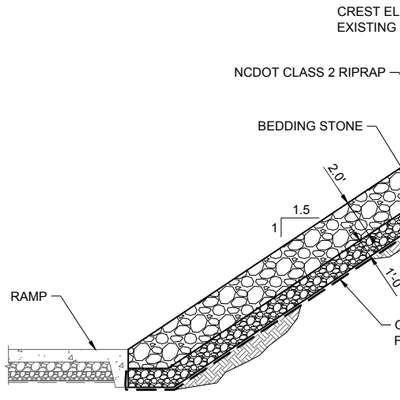


D4 C-102 SECTION - LIVING SHORELINE
SCALE: NTS



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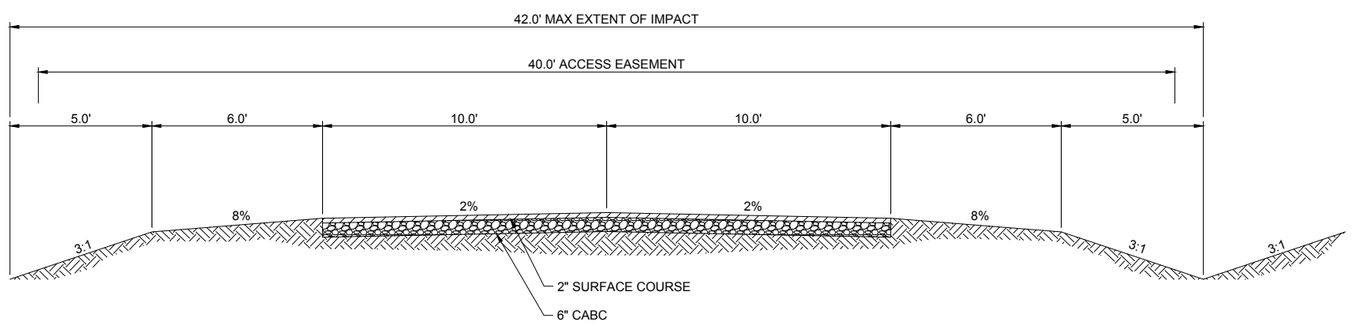

B3 C-103 SECTION- ROADWAY
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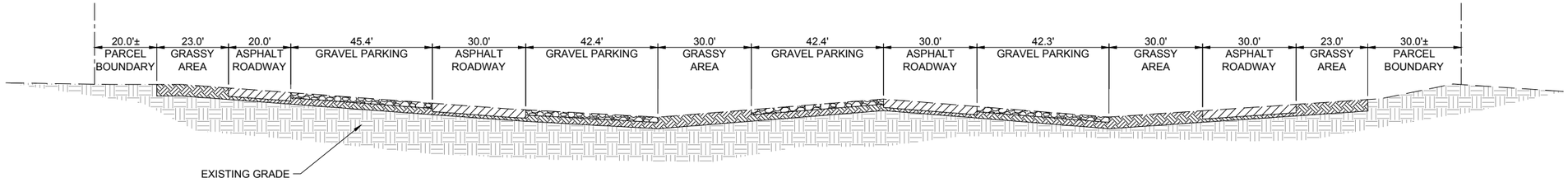

A1 C-103 SECTION - PARKING LOT
SCALE: NTS

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CARTERET COUNTY NORTH CAROLINA

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WESTERN CARTERET COUNTY BOAT LAUNCH FACILITY

TYPICAL SECTIONS

Designed by: MEP/MAP	Dwn by: VNM	Ckd by: MAP	Date: 2023-04-07
Reviewed by:	Submitted by: MARK PIRRELLO MOFFATT & NICHOL	Drawing code:	M&N Project No. 210453
		Drawing Scale: AS SHOWN	Rev. 0
		Plot scale: 1:1 (D SHEET)	

4700 FALLS OF NEUSE RD, SUITE 300
RALEIGH, NC 27609
PHONE: 919.781.4626
NC FIRM NO. F-0105

moffatt & nichol

SEAL

Sheet Reference No.
C-300
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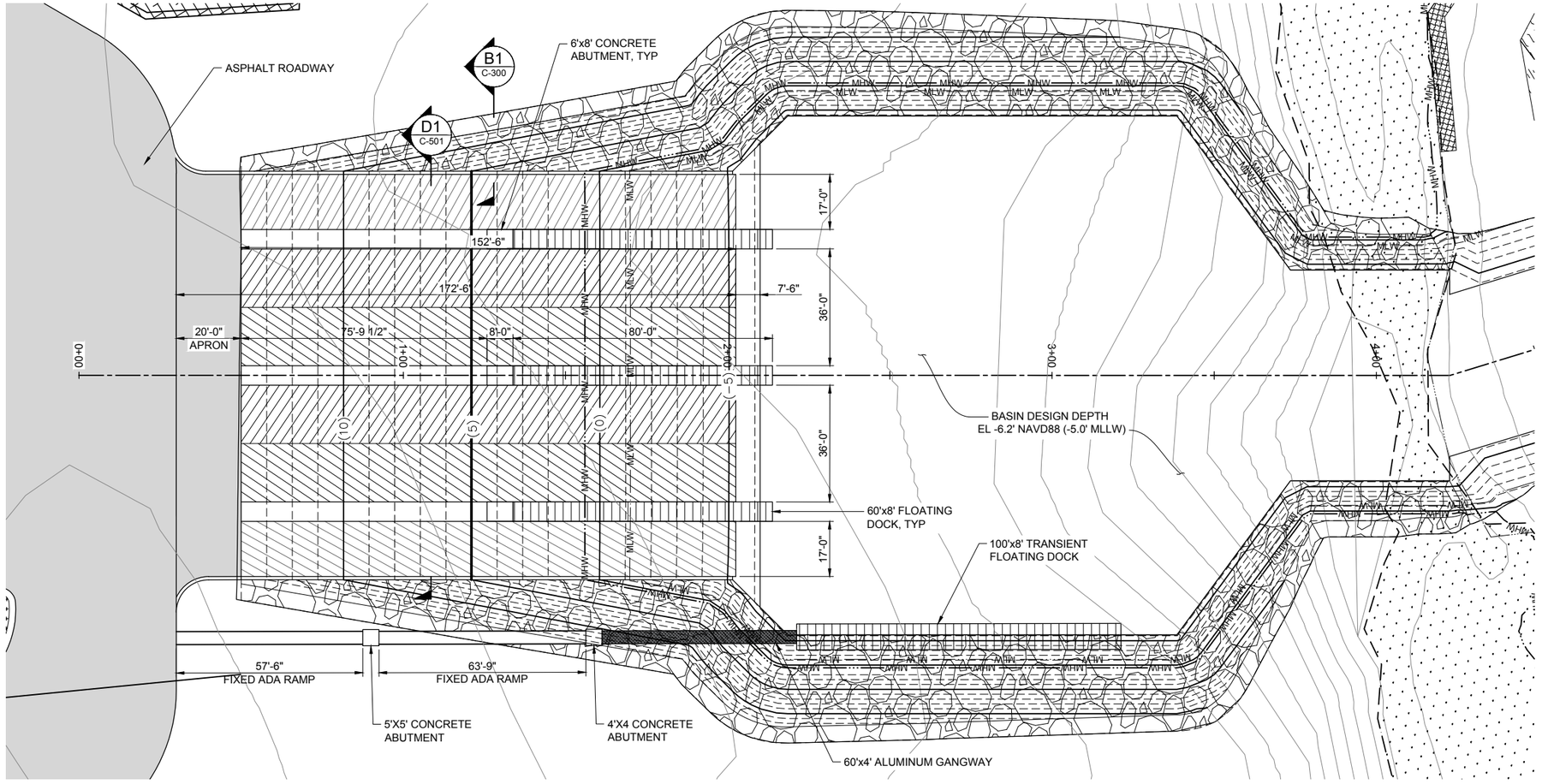

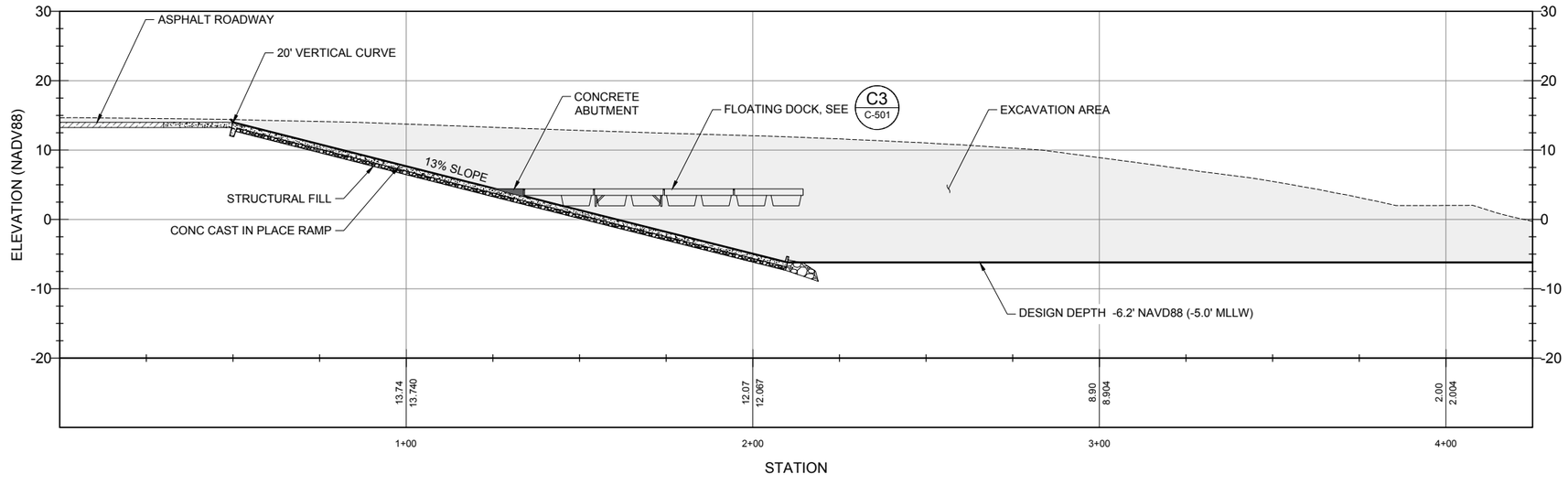

LEGEND

- EXISTING MINOR CONTOUR
- EXISTING MAJOR CONTOUR
- PROPOSED MAJOR CONTOUR
- WETLAND DELINEATION
- SAV DELINEATION
- COASTAL WETLAND DELINEATION
- INFILTRATION POND
- QUICKREEF
- MARSHLAND
- RIPRAP
- ASPHALT
- MEAN HIGH WATER LINE
- MEAN LOW WATER LINE
- EXCAVATION AREA

SCALE: 1"=30'

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CARTERET COUNTY
NORTH CAROLINA

No.	Description	Date	Appr
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WESTERN CARTERET COUNTY BOAT LAUNCH FACILITY

ENLARGED BOAT RAMP PLAN & PROFILE

moffatt & nichol
4700 FALLS OF NEUSE RD, SUITE 300
RALEIGH, NC 27609
PHONE: 919.781.4626
NC FIRM NO. F-0105

Designed by: MEF/MAP
Drawn by: VNM
Checked by: MAP
Reviewed by:
Submitted by: MARK PIRRELLO MOFFATT & NICHOL

Date: 2023-04-07
M&N Project No: 210453
Drawing code:
Drawing Scale: AS SHOWN
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Rev: 0

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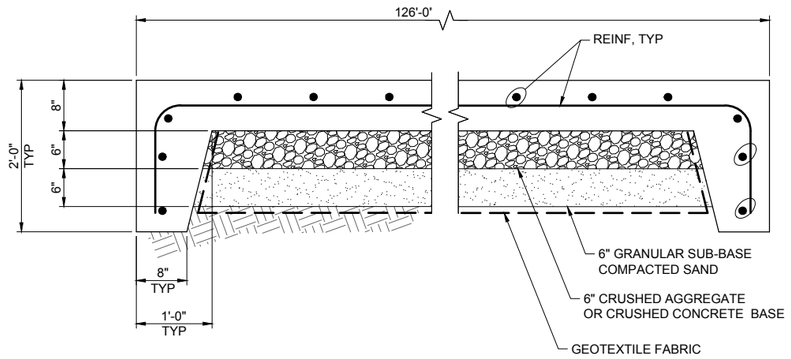

D1 C-400 SECTION - TYPICAL BOAT RAMP
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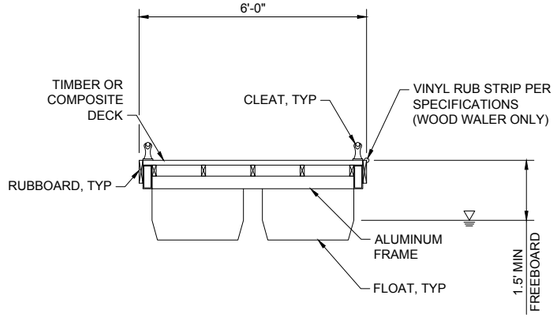

C3 C-400 SECTION - TYPICAL FLOATNG DOCK
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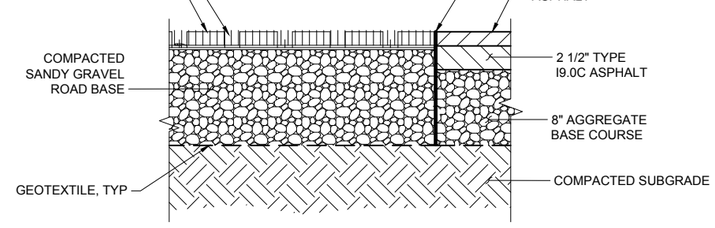

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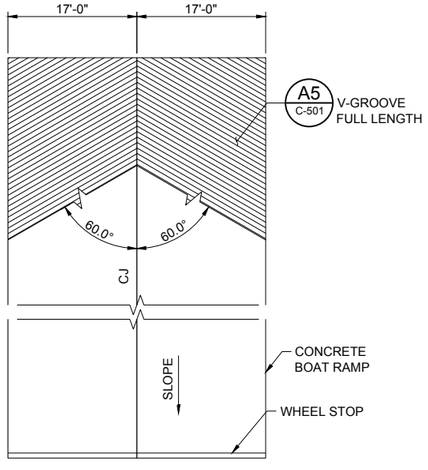

A3 C-501 PLAN - V-GROOVE
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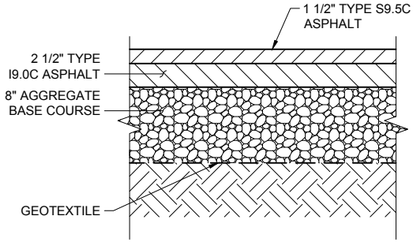

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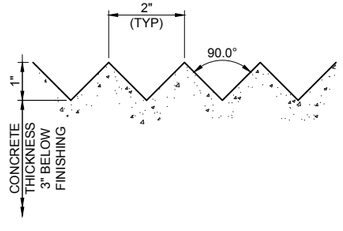

A5 C-501 DETAIL - V-GROOVE
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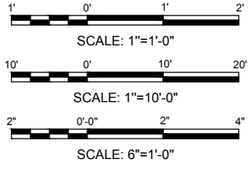

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ISSUED: 2023-04-##
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DRAWING SCALES SHOWN BASED ON 22"x34" DRAWING

CARTERET COUNTY NORTH CAROLINA

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WESTERN CARTERET COUNTY
BOAT LAUNCH FACILITY

CIVIL DETAILS

4700 FALLS OF NEUSE RD, SUITE 300
RALEIGH, NC 27609
PHONE: 919.781.4626
NC FIRM NO. P-0105
moffatt & nichol

Designed by: MEP/MAP	Drawn by: VNM	Checked by: MAP	Reviewed by:
Submitted by: MARK P.RIRELLO MOFFATT & NICHOL	Drawing code:	Date: 2023-04-07	Rev. 0
Drawing Scale: AS SHOWN	Plot scale: 1:1 (D SHEET)	M&N Project No. 210453	

SEAL

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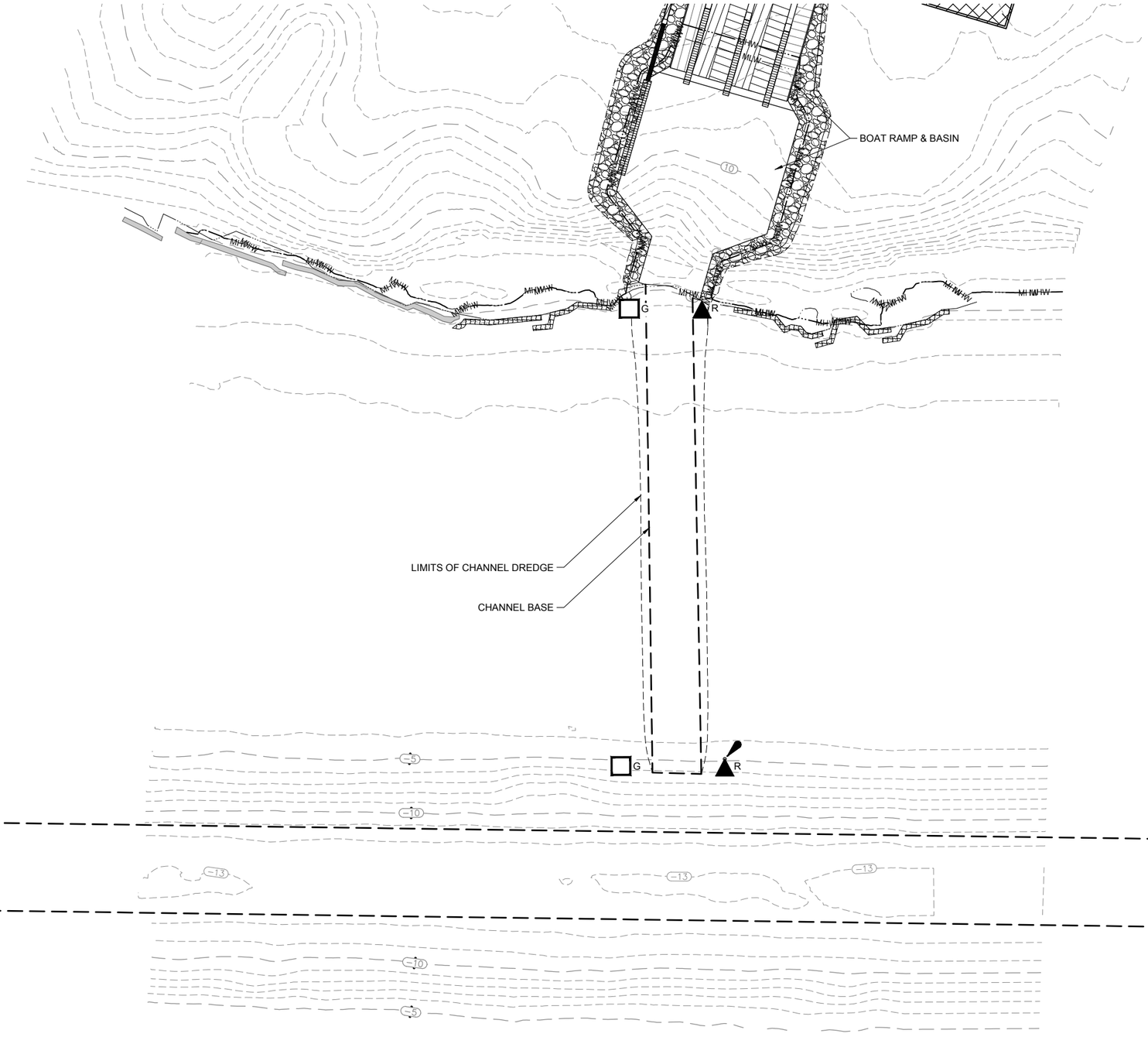

NOTE

FOR NAVIGATION AID DETAILS, SEE SHEET N-501.

LEGEND

- 19 — EXISTING MINOR CONTOUR
- 20 — EXISTING MAJOR CONTOUR
- QUICKREEF SILL
- MHW — MEAN HIGH WATER LINE
- MLW — MEAN LOW WATER LINE
- G — PORT LATERAL DAY BEACON
- R — STARBOARD LATERAL DAY BEACON
- FLASHING LIGHT

N

60' 0' 60' 120'

SCALE: 1"=60'

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CARTERET COUNTY NORTH CAROLINA

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WESTERN CARTERET COUNTY BOAT LAUNCH FACILITY

NAVIGATION AID PLAN

4700 FALLS OF NEUSE RD, SUITE 300
RALEIGH, NC 27609
PHONE: 919-781-4626
NC FIRM NO. F-0105
moffatt & nichol

Designed by:	MEF/MAP
Drawn by:	VNM
Cad by:	MAP
Reviewed by:	
Submitted by:	MARK PRIRELLO MOFFATT & NICHOL
Date:	2023-04-07
M&N Project No.	210453
Drawing code:	
Drawing Scale:	AS SHOWN
Plot scale:	1:1 (0 SHEET)

SEAL

Sheet Reference No.

N-101

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DRAWING SCALES SHOWN BASED ON 22"x34" DRAWING

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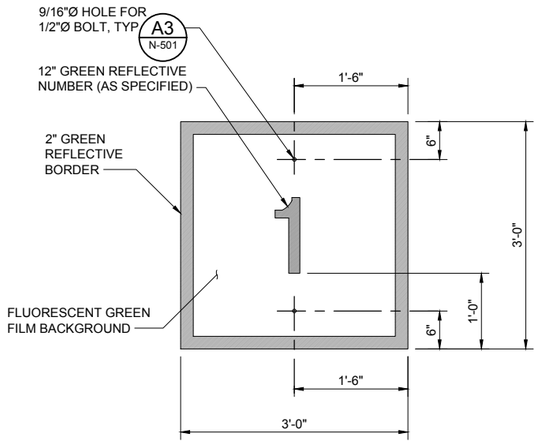

D1 N-501 DETAIL- PORT LATERAL DAYBOARD
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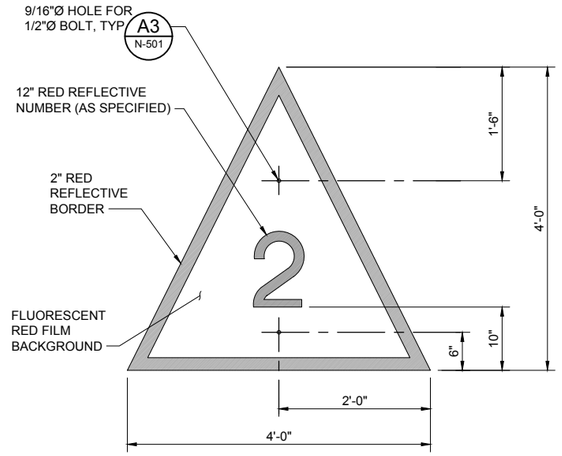
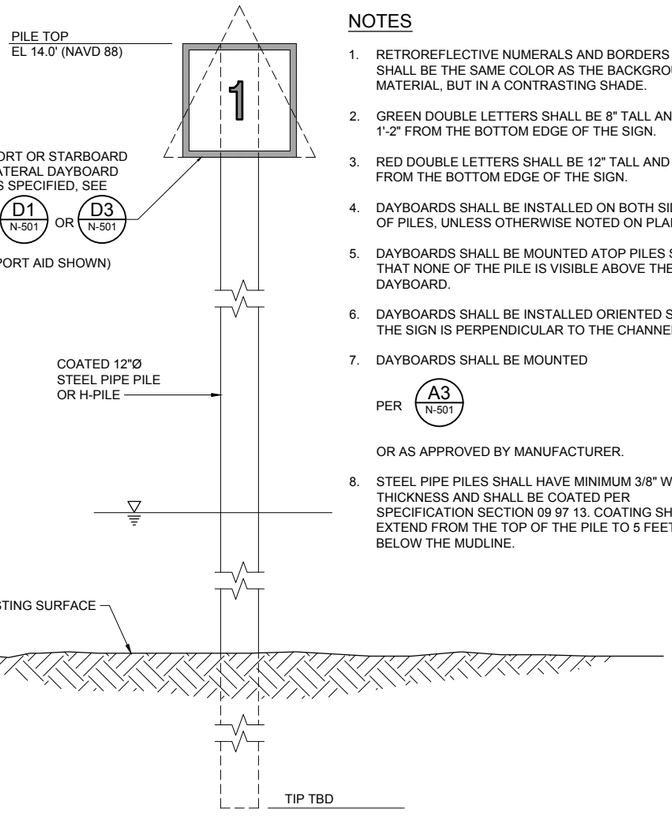


D3 N-501 DETAIL- STARBOARD LATERAL DAYBOARD
SCALE: 1"=1'-0"

NOTES

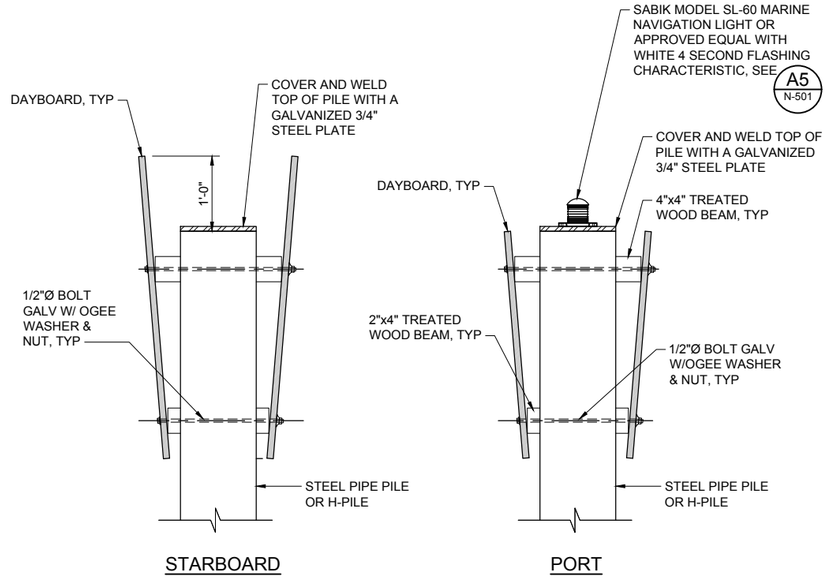
1. ALL PILINGS MUST BE PRESSURE TREATED LUMBER (2.50 CCA FOR SALTWATER APPLICATIONS). WRAP WITH HDPE OR PVC BLACK PILE WRAP WITH A MIN 6 INCH OVERLAP. EXTEND WRAP FROM 1 FOOT ABOVE MHW TO 2 FEET BELOW MUDLINE. INSTALL USING 1/2 INCH STAINLESS STEEL SPIRAL-SHANK ROOFING NAILS SPACED AT 2 INCHES ON CENTER ALONG SEAM.
2. ALL FRAMING FOR SIGN BOARD MUST BE PRESSURE TREATED LUMBER (0.60 CCA, 0.60 ACQ, OR 0.60 ACZA FOR SALTWATER APPLICATIONS.
3. BOLT HOLES BORED 1/8" LARGER THAN DIAMETER OF BOLT. ALL FASTENERS MUST BE VANDAL PROOF.
4. THE CONTRACTOR SHALL NOT IMPACT THE MESSAGE AREA OR REFLECTIVE SURFACES OF THE SIGN WHEN DRILLING HOLES IN THE SIGNS, OR SPLIT THE ENDS OF THE CROSSING TIMBERS.
5. SIGN(S) MUST BE MOUNTED ON SINGLE PILE.



NOTES

1. RETROREFLECTIVE NUMERALS AND BORDERS SHALL BE THE SAME COLOR AS THE BACKGROUND MATERIAL, BUT IN A CONTRASTING SHADE.
2. GREEN DOUBLE LETTERS SHALL BE 8" TALL AND 1'-2" FROM THE BOTTOM EDGE OF THE SIGN.
3. RED DOUBLE LETTERS SHALL BE 12" TALL AND 7" FROM THE BOTTOM EDGE OF THE SIGN.
4. DAYBOARDS SHALL BE INSTALLED ON BOTH SIDES OF PILES, UNLESS OTHERWISE NOTED ON PLANS.
5. DAYBOARDS SHALL BE MOUNTED ATOP PILES SO THAT NONE OF THE PILE IS VISIBLE ABOVE THE DAYBOARD.
6. DAYBOARDS SHALL BE INSTALLED ORIENTED SO THE SIGN IS PERPENDICULAR TO THE CHANNEL.
7. DAYBOARDS SHALL BE MOUNTED PER A3 N-501 OR AS APPROVED BY MANUFACTURER.
8. STEEL PIPE PILES SHALL HAVE MINIMUM 3/8" WALL THICKNESS AND SHALL BE COATED PER SPECIFICATION SECTION 09 97 13. COATING SHALL EXTEND FROM THE TOP OF THE PILE TO 5 FEET BELOW THE MUDLINE.

A1 N-501 DETAIL- ATON DAYBEACON
SCALE: 1"=1'-0"



A3 N-501 DETAIL- DAYBOARD MOUNTING
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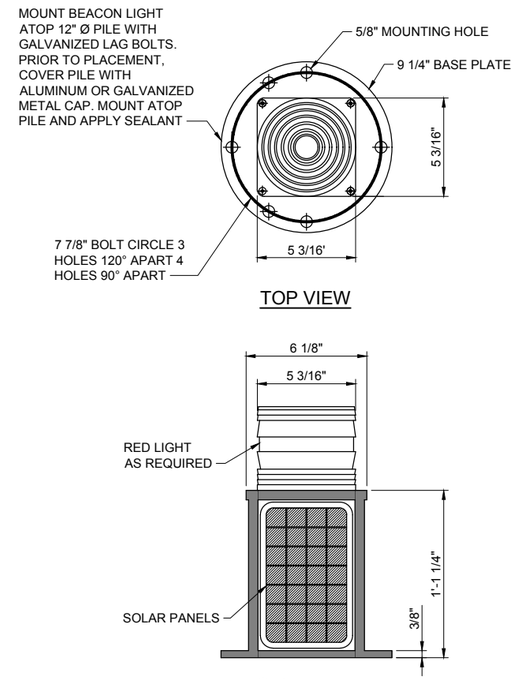

A5 N-501 DETAIL- BEACON LIGHT
SCALE: NTS

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CARTERET COUNTY NORTH CAROLINA

Mark	Description	Date	Appr
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WESTERN CARTERET COUNTY BOAT LAUNCH FACILITY

AIDS TO NAVIGATION DETAILS

4700 FALLS OF NEUSE RD, SUITE 300
RALEIGH, NC 27609
PHONE: 919.781.4626
NC FIRM NO. F-0105
moffatt & nichol

Designed by:	MEF/MAP
Drawn by:	VNM
Cad by:	MAP
Reviewed by:	
Submitted by:	MARK PIRRELLO MOFFATT & NICHOL
Drawing Scale:	AS SHOWN
Plot scale:	1:1 (D SHEET)
Drawing code:	
M&N Project No.	210453
Date:	2023-04-07
Rev:	0

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Sheet Reference No.
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DRAWING SCALES SHOWN BASED ON 22"x34" DRAWING

moffatt & nichol

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Raleigh, NC 27609

(919) 781-4626 Fax: (919) 781-4626
www.moffattnichol.com

MEMORANDUM

To: Eugene Foxworth, Assistant County Manager, Carteret County

Cc: Douglas Huggett, Moffatt & Nichol

From: Mark Pirrello

Date: June 7, 2022

Subject: Flushing Analysis – Western Carteret County Boat Launch Project

Project Overview

The Western Carteret County Boat Ramp Facility (Project) is located on the north coast of Bogue Sound, approximately 4.5 miles east of Cape Carteret. The project site is accessed through an entrance road on State Highway 24, approximately 2,000 feet east of the intersection with J. Bell Lane. Carteret County received a permit from the US Army Corps of Engineers (USACE) to construct an entrance road that provides access to the boat launch facility and the adjoining North Carolina Coastal Federation (NCCF) property. Figure 1 shows the project location.

Figure 1: Project Site

The proposed boat launch facility consists of excavating 1.5-acre launch basin to a minimum 5-foot water depth @ Mean Lower Low Water (MLLW), a 450-foot-long x 50-foot entrance channel, six (6) concrete boat ramps, 4 queuing launch docks, and a 159-space trailer parking lot. The perimeter of the launch basin is stabilized with riprap.

The geometry of the interior basin was guided by several considerations including safe and efficient launch operations, existing site topography, minimization of impacts to coastal wetlands, the Outstanding Resource Water (ORW) coastal line requirements, the Shellfish Sanitation water quality buffer setback, and water exchange/flushing guidelines from North Carolina Department of Environmental Quality (NCDEQ). This

memorandum discusses the evaluation of flushing for the interior launch basin and the selection of final geometry to meet the state's guidelines.

The County in conjunction with the North Carolina Department of Wildlife Resource (WRC) had developed several interior basin configurations that considered the ORW coastal line requirements whereas the interior basin was placed farther north with the overall geometry was more rectangular in the north-south orientation as shown in Figure 2. Refinements to the site plan were performed to minimize impacts to coastal wetlands

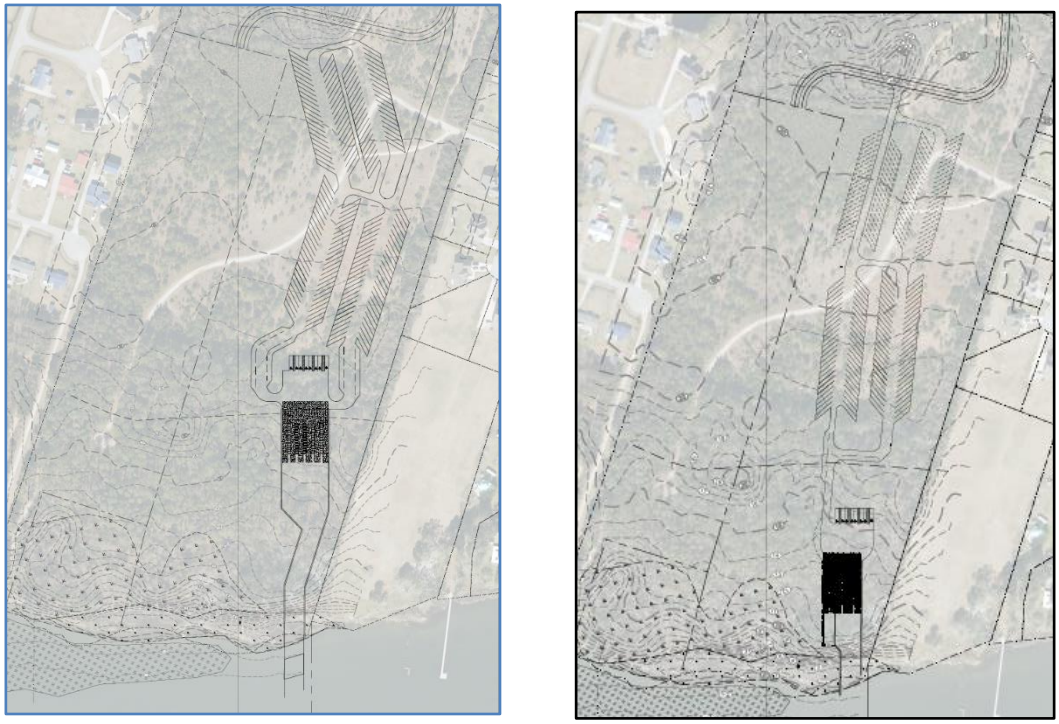


Figure 2: Initial Site Plans with Basin Geometry

and take advantage of the lower topographic relief in the central portion of the property. Figure 3 shows the refined geometry that was selected for evaluation of basin water exchange in flushing. The basin in Figure 3 consists of a 1.5-acre basin with water depth of -5 feet relative to Mean Lower Low Water (MLLW) or elevation -6.2 feet NAVD (land based vertical datum). The basin is approximately 470 feet long (measured from Mean High Water (MHW) line and approximately 125 feet at center point. The dredge channel is 450 feet long and approximately 50 feet wide and connects the basin to Bogue Sound.

The purpose of this study is to analyze the flushing within the proposed launch basin. As stated in North Carolina Department of Environmental Quality's Water Quality Guidelines for Planning of Upland Marina Development, an inland basin with good flushing characteristics will reduce the concentration of a non-decaying conservative pollutant to less than 10 to 15% of its initial concentration within a 24-hour period. This memorandum summarizes the hydrodynamic modeling that was developed by Moffatt & Nichol (M&N) to evaluate flushing characteristics of the project..

Hydrodynamic and Flushing Modeling

Approach

The relative rate in water volume exchanged in the canal will be evaluated numerically by placing a non-decaying conservative pollutant in the basin and evaluating the percent residual concentration of the pollutant at the

Figure 3: Preferred Basin Configuration for Initial Evaluation

most north point in the basin over time. This situation is representative of a boat spill that would occur during a launching or retrieval operation. The rate of concentration reduction within a 24 hour to 168-hour window was calculated to assess how well the basin exchanges water with Bogue Sound.

M&N developed a depth-averaged two-dimensional hydrodynamic numerical model of Bogue Sound, Bogue Inlet, and the project site as shown in Figure 4. The model was forced with the hydrodynamic conditions extracted from TOPEX/POSEIDON global tidal model. The model mesh was reduced in size at the project site to allow for a more thorough definition of the local topographic and bathymetric features and optimization of the model runtimes. The MIKE21 models were used, which are a part of the MIKE by DHI suite of models. The models are suitable for evaluation of changes in water levels and tidal currents for existing (baseline) and proposed conditions (upland basin addition) at the project site. The MIKE21 Hydrodynamic (HD) model simulates unsteady free-surface water levels and flows in water bodies where vertical stratification is negligible (representative of hydrodynamic conditions at the project site). The model is designed to simulate tidal flows at the project site, with water levels and depth-averaged flow velocities extracted at locations of interest. The hydrodynamic model was then coupled to the MIKE21 Advection-Diffusion (AD) model to evaluate the transport and mixing of the conservative pollutant in the basin. The AD model simulates the transport and

dispersion of the conservative pollutant in water, with hydrodynamic forcing provided by the flow conditions generated by the HD model.

The model includes all of Bogue Sound, Bogue Inlet and nearshore Atlantic Ocean area and the White Oak River. The model is composed of triangulated mesh which have varying resolutions with cell sizes from 1000 ft within the offshore-most areas of the Atlantic Ocean to 300 ft within Bogue Sound and 15 feet inside the upland basin. The shoreline in the vicinity of the project site corresponds to the Mean High-Water Line (MHWL) and was obtained from local bathymetry. The model bathymetry in the offshore areas of the Bogue Sound was derived from the USACE data and data from C-MAP provided by Jeppesen and NAVIONICS.

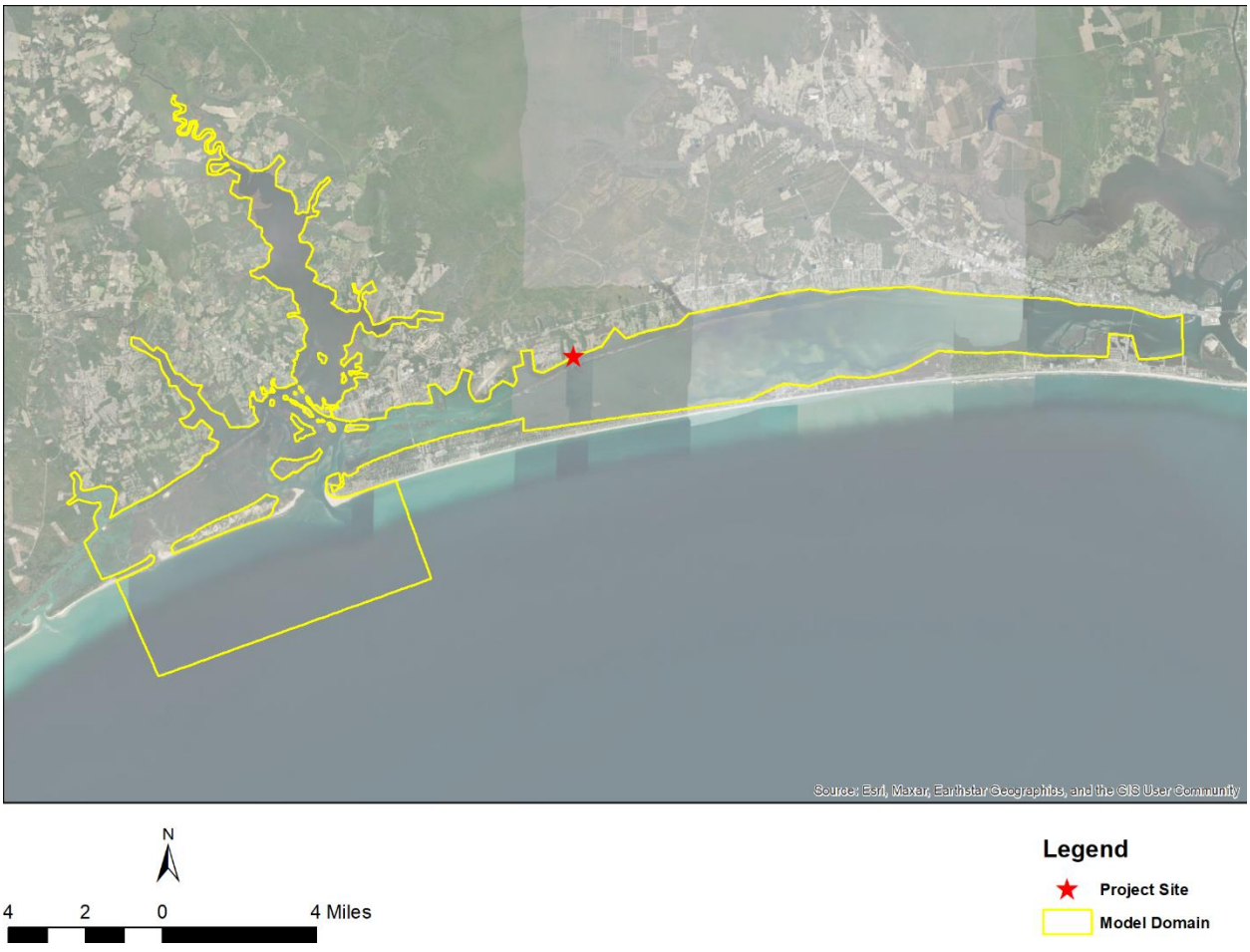


Figure 4: Model Domain

Boundary Conditions

For calibration analysis, only tidal variations in water levels were applied in the model. Wind, waves, and other freshwater inflows were not considered to evaluate the flushing characteristics of the project site under a more conservative condition. The boundary conditions for the HD model consisted of a tidal signal along at the boundaries of the MIKE 21 model (using Tidal Constituent data provided by TOPEX/POSEIDON).

For the flushing analysis, an average tide was considered for the hydrodynamic analysis as it is reflective of current velocities through the neap and spring ranges and, therefore, yields a representative assessment of flushing performance of the basin. A Flather condition was used to capture tidal forcing and water currents to drive the model and, therefore, were not included separately in the model. Further, a constant bed friction of 55 m1/3/s (M = 1/n), a Smagorinsky eddy formulation with a constant value of 0.28, and a Coriolis forcing varying in the model domain were also specified for calibration. Horizontal dispersion was defined by a scale eddy viscosity formulation. To capture the proposed upland basin, the topography and bathymetry were adjusted to incorporate the basin and entrance channel.

The AD module specified an initial condition of a non-dimensional non-decaying conservative pollutant concentration of 100 released over a period of 20 minutes at the northmost point in the basin (Point P01 in Figure 5). The 20-minute period would be representative of a fuel tank spill as vessels are launched or hauled out of the basin. This tracer concentration is a value that is relative to the remainder of the model domain. At all other locations within the model, and at the boundaries, the initial concentration is specified to be zero.

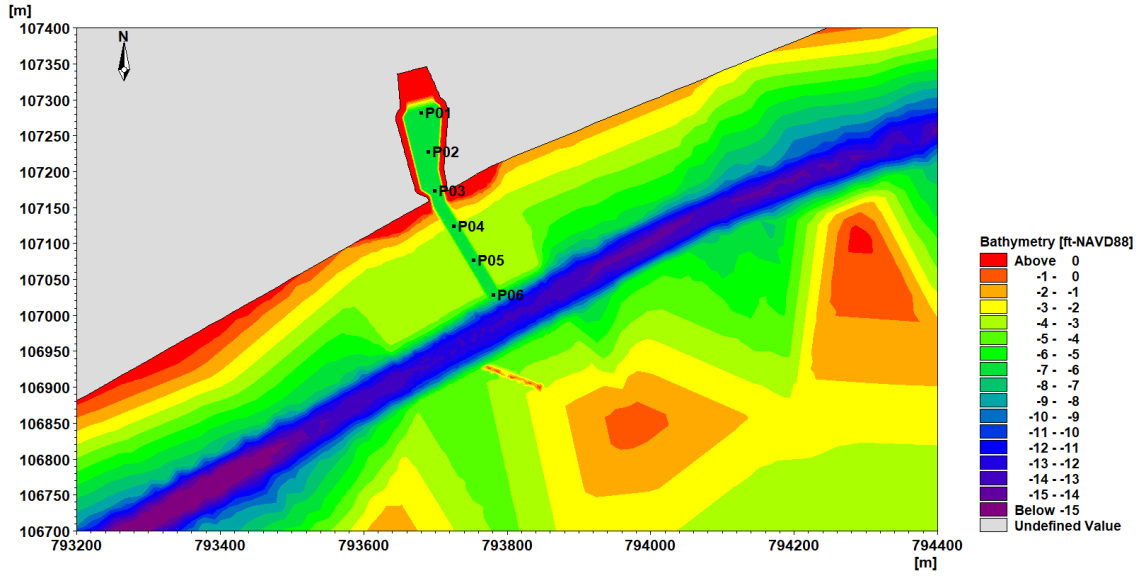


Figure 5:Basin Bathymetry and Observation Points

Calibration

Data to calibrate the model with historical recorded data was limited and the tide gauges within the model domain were based on predicted tidal data and current and water level data collected during a three-day field collection program in October 2020. Current and water level data was collected at several locations along the south shore of Cape Carteret and the NC24 bridge at Swansboro as shown in Figure 6. For model calibration, the high and low tidal predictions were downloaded and then interpolated to create an hourly time series and compared to the field collected data. A total of five tidal constituents were used to generate Flather boundary conditions. The Flather boundary conditions generate numerically stable offshore boundaries and are efficient at downscaling models from coarse to finely resolved areas. Each of these constituents were used and then the amplitude of each constituent was altered by the percentages shown to allow for calibration of specific tidal

constituents. These data were then used to calculate tidal constituents which were then compared to model output at each gauge location.

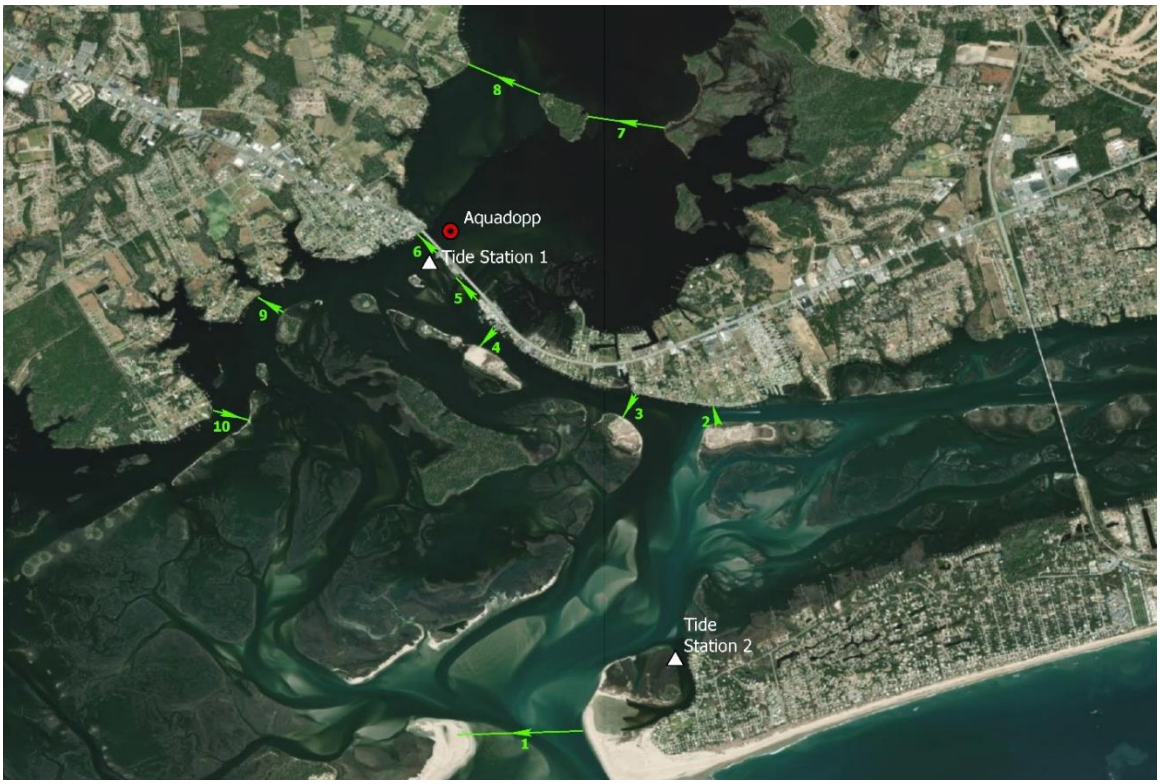


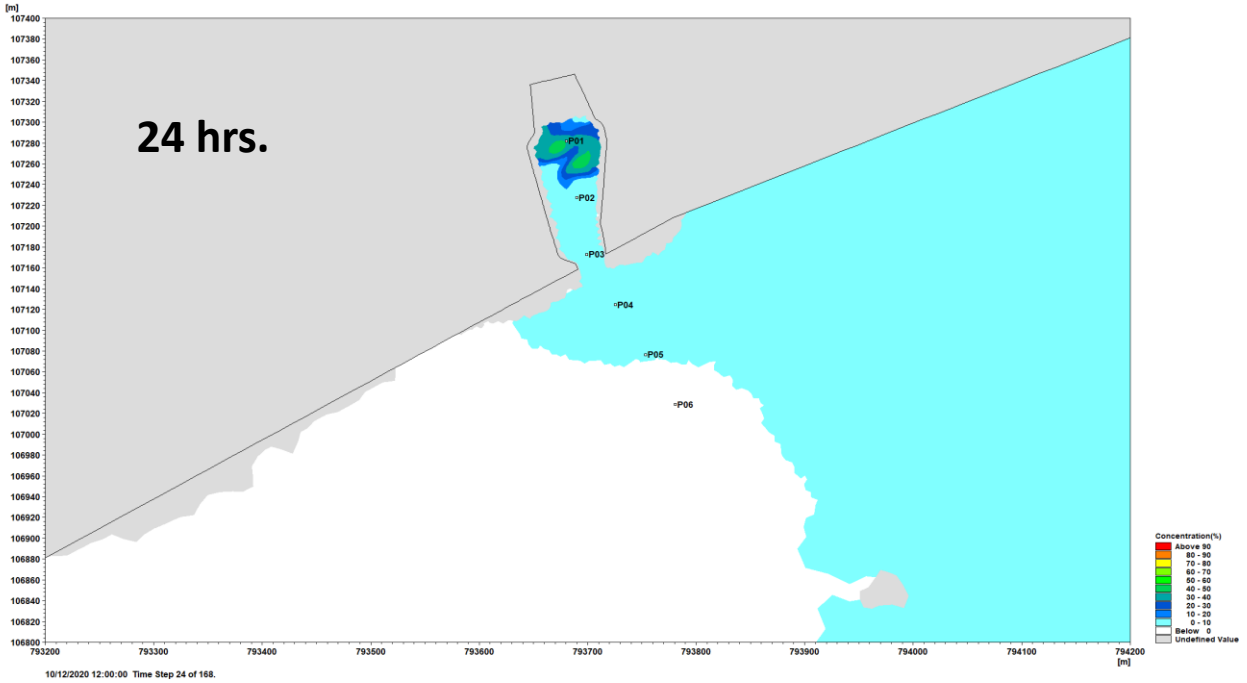
Figure 6: Location of Current and Water Level Measurements

A quantitative model calibration was performed, and it was determined the model adequately reproduces the water level phases and amplitudes.

Model Results

The initial concentration of a non-dimensional conservative tracer was specified as 100 and dispersed over a 20-minute period in the proposed basin. The local hydrodynamic model forced with an average tidal signal for a period of 7 days (Figure 7). The guidelines for upland basin indicate the residual concentration value after 24-hours should be less than 10 to 15%, which would be indicative of the overall water exchange and quality for a body of water. Model results were analyzed within a polygon over the entire basin area to analyze how the tracer evolution behaves throughout the basin shown in Figure 7.

The results indicate that the residual concentration at the inner basin was greater than 20 percent after 24 hours and did not effectively change after the 7-day period. The velocities were very low in this area and that mixing was minimal with the change in the tidal prism. As noted in the state guidelines and discussed in the ASCE Manual No 50 Planning and Design of Small Craft Harbors, the geometry of the basin heavily influences water exchange in the basin. Upland basins that extend further inland and are narrower in width will not exchange water as effectively as the basins that are wider and closer to the entrance.



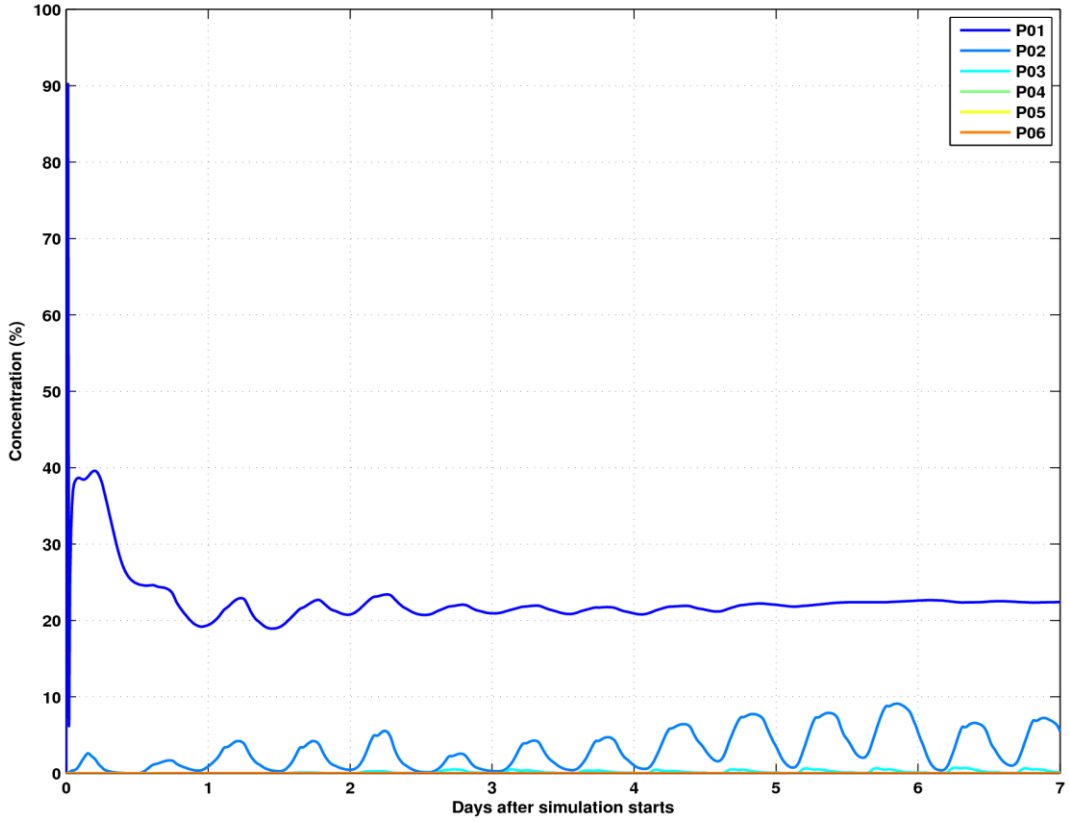


Figure 7: Results of Initial Basin Geometry

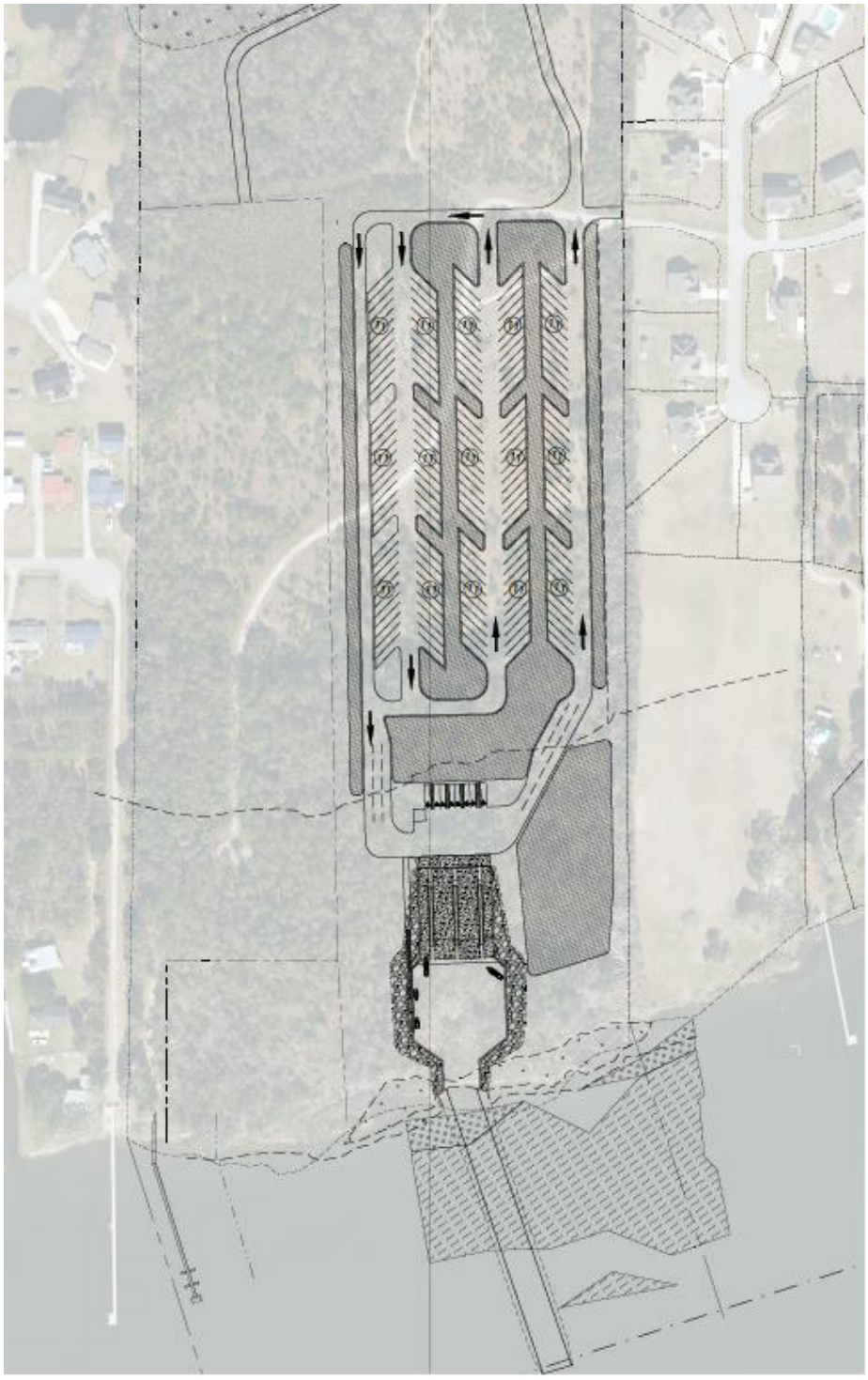


Figure 8: Revised Basin Geometry

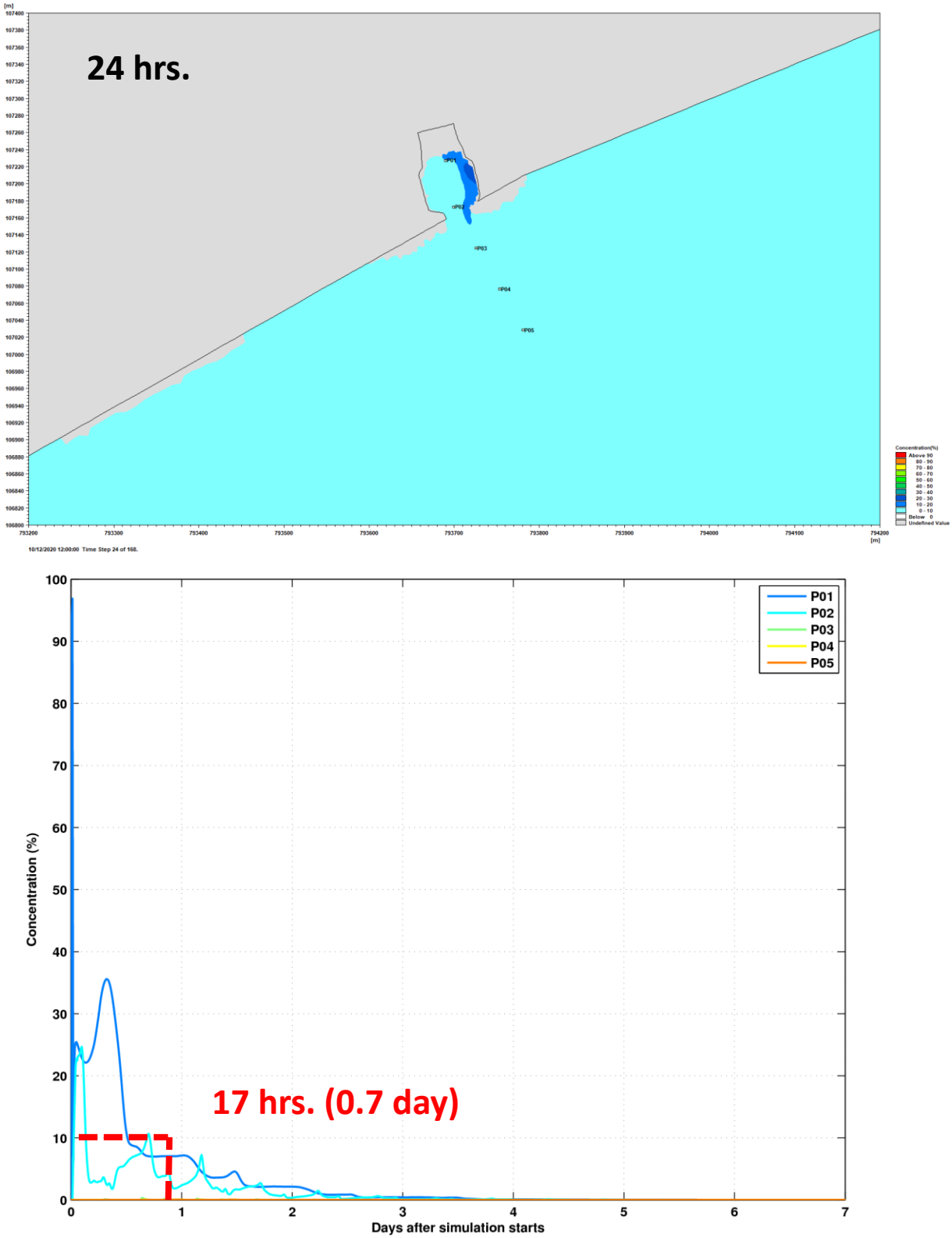


Figure 9: Results of Modified Basin Geometry

The basin geometry was significantly modified to improve water exchange. The basin was modified to a square shape, with the distance to the north extent of the basin reduced from 470 feet to approximately 250 feet and the basin width increased from 125 to 175 feet. The bottom width at the basin entrance with the navigation channel was also widened from 50 feet to 65 feet, consistent with recommendations from industry and state guidelines. Figure 8 shows the revised geometry of the basin.

The model was executed for the revised geometry. The results shown in Figu**Error! Reference source not found.**re 9 indicates that the residual concentration of the tracer was reduced to under 10 percent in a 17-hour period at the north extent of the basin P01). The residual concentration at the basin entrance occurred in the 14th hour.

Summary

The hydrodynamic model developed by M&N simulated tidal propagation in Bogue Sound and the proposed upland basin. The simulated water levels were compared to predicted data and acceptable agreement was observed as shown by the calculated statistics. The hydrodynamic characteristics within a polygon covering the area of the upland basin were analyzed using the model. The variation in the concentration of a tracer was modeled for a period of 168 hours, considering average tidal forcing only.

The tracer concentration for final basin plan conditions initially reaches the concentration of 10 percent in approximately 3 hours into the model simulation, increases above 10 percent then decreases and stays below 10 percent at 17 hours into the model run. The trendline computed from the time series of concentration shows that on average, the concentrations reduce below 10% after 17 hours.

CARTERET COUNTY

WESTERN BOAT RAMP PROJECT

CAMA MAJOR PERMIT APPLICATION

NARRATIVE

April 24, 2023

Prepared by:

Moffatt and Nichol
305 Commerce Ave.
Morehead City, NC 28557

Introduction

Carteret County proposes to construct public boat launch facility on the mainland shoreline of Bogue Sound (Figure 1). The North Carolina General Assembly has recognized the need for this facility, and has provided $7.5 million in direct appropriations to help purchase the land and build the facility. The proposed facility will be located on a 67-acre parcel that is permanently restricted for recreation, and 24 acres have already been placed under permanent conservation easements held by the N.C. Land and Water Fund. The boat ramp provides a much-needed public access facility to recreational and commercial boaters within Carteret County, as well as surrounding counties and vacationers from elsewhere in North Carolina and other states. The proposed location and design of the proposed public access facility will also help to reduce pressures on other boat ramps on the north shore of Bogue Sound in, most of which are frequently operating at or above capacity.

Figure 1 Western Carteret Boat Launch Facility Site

Purpose and Need

As was described above, there is a significant need for a public boat launch facility along the mainland shoreline of Bogue Sound. Carteret County has long desired a public boat launch facility on the mainland side of Bogue Sound. Currently the nearest existing public facilities are located in Emerald Isle, Cedar Point, Morehead City and Beaufort (See Figure 2).

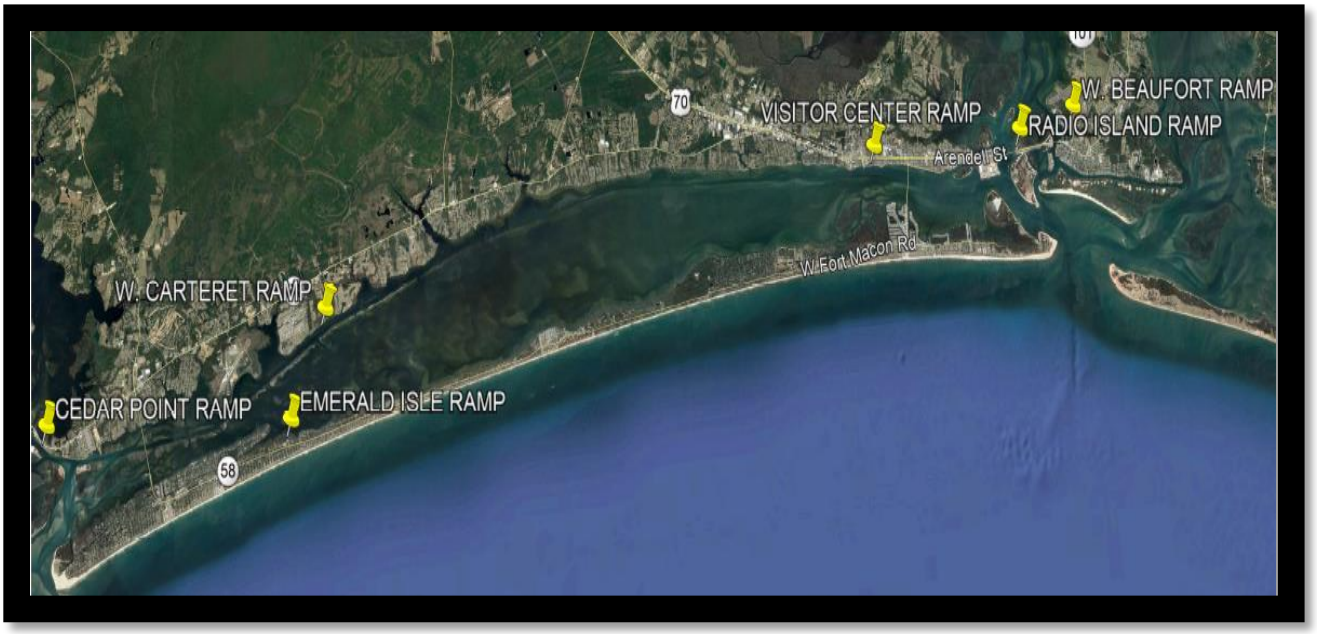


Figure 2 Location of Nearest Public Boat Launch Facilities

All of these existing facilities are subject to frequent heavy usage, with the number of users often exceeding the number of available parking spaces for trailers. To illustrate the usage of these existing launch facilities, a survey of usage was done on June 26, 2021. The results of this survey, which are shown in Table 1, indicate that several of these launch facilities operate at or above capacity, especially during busier times of the year.

Ramp	Number of Trailer Spaces	Total Number of Trailers	Amount over/under	Time of Survey (June 26, 2021)
Radio Island	56	96	+40	9:00am
West Beaufort	30	49	+19	10:00am
Visitor Center	33	33	0	11:00am
Cedar Point	38	38	0	9:30am

Emerald Isle	107	101	-6	2:15pm
Total	264	317	+53	---

Table 1. Survey of Nearby Public Boat Launch Facilities

As additional documentation of the significant need for a facility of this nature within Carteret County, an analysis of boater registrations with Carteret County and three adjacent counties (Craven, Jones, and Pitt) was performed. As Figure 3 shows, in 2020 over 17,000 boats between 16' long and 35' long were registered in this four-county area. This analysis does not include vessels that might be traveling from more distant locations for either day trips or vacation stays in the area.

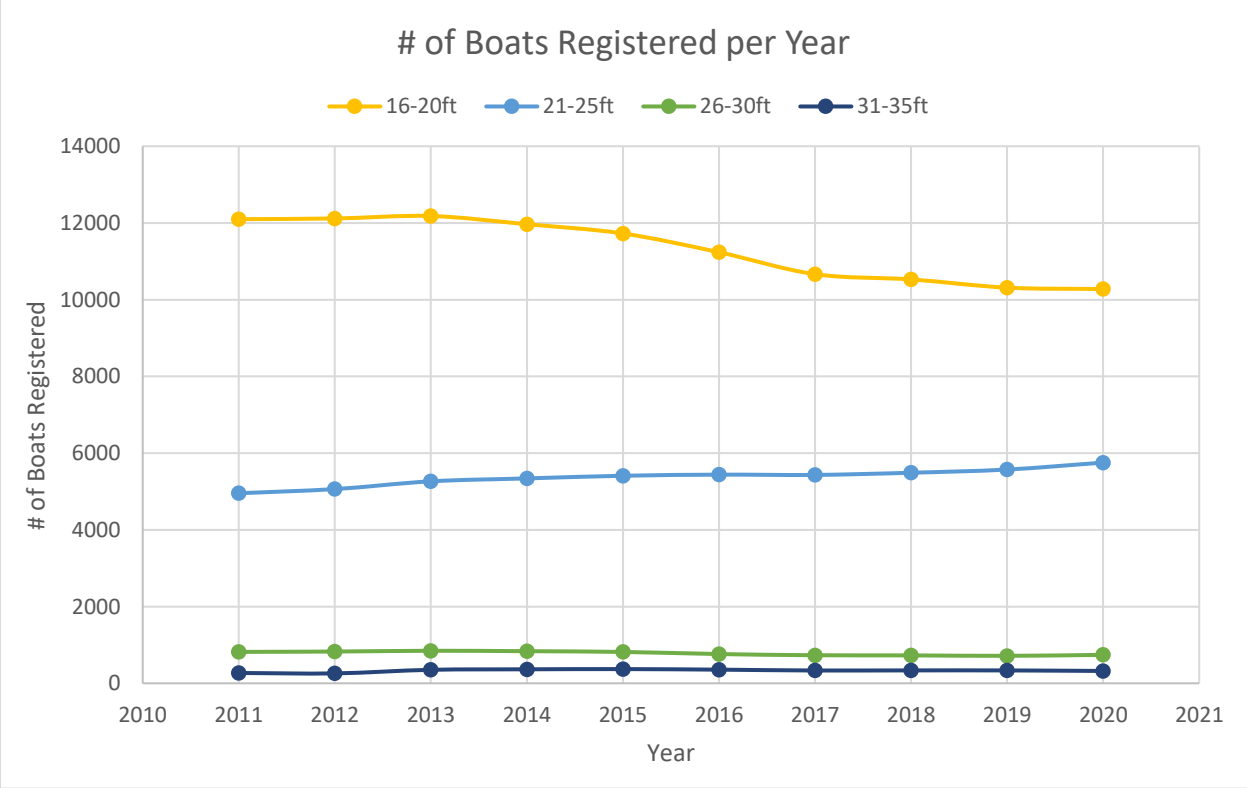


Figure 3 Boat Registrations per Year for Carteret, Craven, Jones, and Pitt Counties

With this data in mind, Carteret County has determined that there is a very significant public need for a facility of this type. The proposed facility would reduce pressures on nearby overcrowded public boat launch facilities, while also providing for greater recreational possibilities for the public. It is for these reasons that the County considered the proposed facility as providing a significant benefit to the public.

Site Selection Process

Carteret County conducted a search for a property along the mainland shoreline of Bogue Sound that could serve as the site of a large public boat launch facility. The following criteria were utilized in this search:

- Site of sufficient size to accommodate an upland basin, multi-ramp facility, and large parking area,
- Site with the capability of being purchased, and purchased for a reasonable price, and
- Site with limited submerged aquatic vegetation (SAV) coverage in adjacent waters (to accommodate dredging of new channel).

In searching for a site that met these criteria, the County looked at available SAV map layers available from the N.C. Department of Environmental Quality. The available SAV mapping data indicated that there was or had been SAV coverage along much of the Bogue Banks shoreline, with the main exception being a stretch of shoreline adjacent to what is now the proposed project location. Field inspections were conducted along this shoreline with limited SAV noted at the time of purchase.

After identifying a property that was devoid of SAV based on State-supplied SAV data, a site was located that was both large enough to accommodate the desired public boat launch facility, while also being available for purchase. This property was subsequently purchased by the County with the intention of placing the proposed facility at this location.

A detailed listing of development activities and their impacts are provided in the permit application narrative which is provided as a part of this application package.

Project Proposal

The proposed project involves the creation of a public boat launch facility along the mainland shoreline of Bogue Sound. The individual project components are as follows:

Upland Basin Excavation

An upland basin will be excavated. The upland basin, which will be 1.54 acres in size, will be dug to a depth of -7.2' NAVD88 (-6.2' target depth plus 1.0' foot of allowable overdredge allowance). The excavation of the boat basin will result in approximately 28,575 CY of material. The upland basin will be excavated "in the dry" by leaving an earthen plug between the area to be excavated and the waters of Bogue Sound. A 24-hour period (minimum) after completion of excavation of the basin will elapse prior to plug removal to prevent unnecessary siltation into the adjacent waters.

Boat Ramp Facility

The facility will include six launch ramps located within a high ground basin. Each of the six ramps will be 253.5' long. Three 60' by 8' floating piers are proposed between the ramps, and a 100' x 8' transient/queuing dock is proposed along the northwest side of the new upland basin. A 159-space boat trailer parking lot is also proposed. Site access to Highway 24 will be covered by way of an entrance road which was previously permitted by way of Permit No. SAW-2019-02188. The proposed development will result of 1.37 acres of impervious surface within the 575' Outstanding Resources Water (ORW) Coastal Shoreline. Stormwater management at the project site will be accomplished through infiltration.

Access Channel

A +/-450' x 50' (bottom width) access channel will be dredged excavated providing vessels access to deep water and the Atlantic Intracoastal Waterway (AIWW). The proposed dredging will be accomplished through the use of mechanical (bucket-to-barge) methodologies, with the resulting spoil material placed in two temporary disposal areas (see permit drawing sheet CE101). The proposed dredging will result in impacts to +/- 0.78 acres of bottom habitat and will produce approximately 4,625 CY of spoil material.

On-Site Living Shorelines

The proposed project also involves the placement of five Quickreef sills along the shoreline to either side of the proposed access channel (see permit drawing sheet C-102). The five sills range in length from 79' to 100 and will all have a width of 5'.

Mitigation

In excavating the basin and channel, there will be unavoidable impacts to coastal wetlands (2,212 sf) as the high ground basin transitions to the in-water access channel and submerged aquatic vegetation (SAV) habitat (0.78 acres) within the footprint of the access channel. The proposed project also includes a compensatory mitigation plan to offset these unavoidable impacts.

Environmental Impacts

Environmental impacts of the proposed project are summarized below:

Upland Impacts

- Total Disturbance Area (Parking Lot and Basin) +/-17.2 acres
- % Impervious within 575' ORW AEC 21.8%
- % Impervious for Entire Property 25.9%
- Parking Lot 28,200 CY
- Upland Basin Excavation 28,575 CY

In-Water Impacts

- Excavation of Coastal Wetlands 2,212 sf
- Excavation of SAV and SAV habitat 0.78 acres
- Dredge Area Impacts (access channel) 33,833 sf
- Dredge Volume (-6.2' NAVD88 w/ 1 foot overdredge allowance) 4,625 CY

Living Shoreline Enhancement

- On-Site Quickreef Sills 464 sf

Off-Site Mitigation (see attached mitigation plan)

- Off-Site Living Shoreline +/-0.34 acres
- Off-Site Enhanced Marsh Protection (Quickreef Sills @ 2 locations) +/-0.28 acres
- Riprap Breakwater +/-0.3 acres

- Enhanced Marsh Plantings (2 locations) +/-1.03 acres planted

Overriding Public Benefit

As was described above, the need for a large public boat launch facility on the mainland side of Bogue Sound has long been recognized. It is therefore strong belief of the County that this project will have a significant positive benefit to the citizens of eastern North Carolina and should therefore receive special consideration under the N.C. Coastal Resources Commission's "overriding public benefit" rule (15A NCAC 07H.0208(a)(3). 15A NCAC 07H.0208(a)(3) provides for certain projects to deviate from CRC rules and standards if the public benefits of the project outweigh the adverse effects of the project, which is clearly the case here. Additionally, as outlined elsewhere in this narrative, there is no reasonable alternative available to meet the purpose and need of this project, and significant measures have been implemented to avoid, minimize and mitigate the impacts associated with the project. Avoidance, minimization and mitigation measures associated with the project are provided below.

It is for these reasons that Carteret County requests that the proposed project be favorably reviewed during the Coastal Area Management Act application review process. The County also suggests that utilizing 15A NCAC 07H.0208(a)(3) should not be considered precedent-setting for other projects in coastal North Carolina, as the County believes the proposed project has a greater need than elsewhere in the coastal zone, and the proposed facility will to the County's knowledge be the largest public boat launch facility in the State.

Avoidance and Minimization Measures

Impact avoidance and minimization measures include the following:

- The project location was originally chosen for purchase by the County based on lack of SAV (per existing NCDEQ data layers).

- Based upon an analysis of flushing models for various basin design, a modified and shortened basin was design was chosen to ensure proper flush of the basin. The flushing model is provided as an addendum to this application package.

- The proposed access channel base width was reduced from a desired 75' base width down to 50' base width to lessen impacts to shallow bottom and SAV habitat.

- The basin location was chosen in a way that provided for excavation through the narrowest coastal wetland fringe along the County's property.

- Shellfish surveys conducted at the same time as preliminary SAV surveys indicate no significant accumulation of shellfish within the area of the proposed new channel. However, Carteret County does propose to implement a shellfish relocation effort (following coordination with the N.C. Division of Marine Fisheries) within the area of the new access channel prior to the initiation of dredging activities.

- The design of the facility was done in a manner that should lead to no shellfish closures in waters outside of the basin.

- Channel markers (four total) will be utilized to delineate the boundaries of the new channel, which will help ensure that boats utilizing the facility will not stray into adjacent areas of SAV (see permit drawing sheet N-101).

- In order to limit impacts to adjacent shorelines, coastal wetlands, and SAV habitat, Carteret County will request that the entrance channel to the new basin be designated as a "No-Wake Zone" by the N.C. Wildlife Resources Commission.

- Carteret County, in coordination with the N.C. Coastal Federation, will install informational kiosks and signage on high ground educating the public to the importance of avoiding SAV impacts.

- The upland basin will be excavated "in the dry" by leaving an earthen plug between the area to be excavated and the waters of Bogue Sound. A 24-hour period (minimum) after completion of excavation of the basin will elapse prior to plug removal to prevent unnecessary siltation into the adjacent waters.

Mitigation

To compensate for the unavoidable loss of approximately 0.78 acres of SAV, a conceptual SAV mitigation plan, which is attached to this permit application package, has been prepared for this project. This mitigation plan also provides for the enhancement of coastal wetland using marsh protection revetments and the planning of 44, 976 sq of marsh planting.

State Water Quality Standards for ORW waters, specifically 15A NCAC 02B.0225 (c)(2) prohibit dredge activities that would result in a reduction of beds of SAV. The implementation of the attached mitigation plan will offset any SAV impacts associated with the project, thereby resulting in no overall net loss of SAV habitat, which should allow the N.C. Division of Water Quality to determine that the proposed project is not inconsistent with this the ORW Standards.

Miscellaneous

N.C. Division of Water Resources Pre-Filing Notification

Two scoping meetings were held for this project, one on August 18, 2021 and one on November 1, 2022. The N.C. Division of Water Resources was present at both scoping meetings. Carteret County therefore understands that the 30-day 401 Water Quality Certification pre-filing requirements have been satisfied.

Compliance with N.C. Environmental Policy Act (SEPA)

In accordance with NCGS 113A-12(6), a review under the North Carolina Environmental Policy Act is not required for projects requiring a CAMA Major Permit.

Adjacent Property Owner Notifications

The following adjacent riparian property owners have been notified of the proposed development:

N.C. Coastal Federation
3609 Highway 24
Newport, NC 28570

John and Tonya Stanley
205 Madison Court
Swansboro, NC 28584

A signed statement of no objection is attached from the N.C. Coastal Federation. John and Tonya Stanley have been notified by certified mail (certified mail receipt attached). A copy of the return receipt (green card) will be provided to your office as soon as it is received.

Fee

A permit application processing fee of $475 will be provided shortly.

SINCE 1959

WESTERN CARTERET BOAT RAMP
CONCEPTUAL COMPENSATORY MITIGATION PLAN FOR SUBMERGED AQUATIC VEGETATION IMPACTS

Prepared For:

State and Federal Resource/Permitting Agencies
(A Component of the Carteret County CAMA Major Permit Submission by Moffatt and Nichol)

Prepared By:

Quible & Associates, P.C.
Dr. Judson Kenworthy
NC Coastal Federation
Carteret County

Project Number P21130
March 30, 2023

RE: Western Carteret Boat Ramp Conceptual Submerged Aquatic Vegetation (SAV) Mitigation Plan

TO: State and Federal Resource/Permitting Agencies

FROM: Brian Rubino, Quible & Associates, P.C.

Dear Resources Agency Representatives,

This Conceptual Compensatory Mitigation Plan has been developed by a team of environmental scientists that includes North Carolina Coastal Federation (NCCF), Dr. Judson Kenworthy, Don Field and Quible & Associates, P.C. (Quible), with support from Moffat and Nichol (M&N) on behalf of Carteret County. The Mitigation Plan is intended to compensate for impacts to submerged aquatic vegetation ("SAV"), SAV habitat, and shallow water habitat associated with proposed dredging of a single boat channel to accommodate needs for a public [Wildlife Resources Commission (WRC)] boat ramp.

The Mitigation Plan primarily includes "in-kind" mitigation to specifically offset SAV impacts. The in-kind proposal is also intended to be part of a concentrated effort of NCCF and Carteret County to enhance and restore SAV resources to waterways within the region that are being lost at alarming rates due to sea level rise, storm-based erosion and boating (wake and prop scar) impacts.

We introduced our mitigation plan components to State and Federal Resource Agencies during a November 10, 2022 scoping meeting that was held via Webex, starting at 2:00 pm. The purpose of that meeting was to discuss our baseline SAV surveying results, our proposed mitigation measures and to gain feedback from the various resource agency representatives. It was understood from the meeting that NC Division of Coastal Management would take the lead in coordinating permit application review and that a description of proposed mitigation would be included in the submission.

Proposed in-Kind Mitigation includes:

- **Method 1 (Primary Mitigation Concept)**; See **Appendix I** and **Exhibits A-D** for a full description.

- **Method 2**- Living Shoreline protection for a 1,062 linear foot (lf) section of sand bar barrier island directly across from the Project Area. See **Exhibit E**. This is considered an in-kind mitigation measure since this is a very sensitive barrier island location that supports SAV beds on the south side. Living shoreline measures are intended to protect the island, enhance coastal wetlands, and in doing so, will protect important SAV meadows on the south side. While this is not our primary mitigation method, the importance of this protection should not be minimized. Without protection, this functioning barrier island area will undoubtedly become fragmented and then lost in the near future, which will impact robust SAV resources that would otherwise be lost.

- **Method 3**- Establishing a permanent water quality monitoring station and at least five SAV monitoring stations in selected Bogue Sound locations that would allow all to better understand SAV trends, growth patterns, and associated

water quality. We will select monitoring station locations based on consultation with resource agencies and others (NCDMF, NMFS, APNEP, etc.) that may already be involved with SAV mapping programs. The intent is to expand the database of SAV and water quality conditions and to make this readily available.

- **Method 4**- Living Shoreline Protection of the shoreline of the Project Area on either side of the future boat channel entrance (the entire balance of shoreline). See **Exhibit A and B** and CAMA Major Plans by M&N.

After review of the permit application package and our Conceptual Compensatory Mitigation Plan, we look forward to receiving your valuable input.

TABLE OF CONTENTS

APPENDIX I

Primary Seagrass Mitigation Proposal for the Western Carteret Bogue Sound Boat Ramp

Summary

To mitigate for the loss of an estimated 0.77 acres of seagrass habitat in Bogue Sound, we are proposing a nature-based solution to establish suitable environmental conditions for seagrass growth over approximately 3.34 acres of subtidal area in the Sound. The area we are proposing for the primary mitigation method is located on the south side of a series of dredge spoil islands in Bogue Sound, Carteret County, approximately centered at 34.700459°N and -76.975774°W (**Exhibit A**). The spoil islands in this region of Bogue Sound were originally constructed as part of the expansion and maintenance of the Intracoastal Waterway (ICW). Inspection of a time series of aerial photography dating back to 1981 shows how effective these spoil islands have been in creating and sustaining healthy seagrass habitat (**Figure 1**).

Figure 1*. Historical time series of aerial photos from May 1992 (left panel), May 2006 (center panel) and May 2020 (right panel) showing the development of a breach (yellow arrow) in one of the spoil islands.*

The islands attenuate boat wake wave waves and tidal energy and function like our larger NC barrier islands to establish ideal conditions for seagrass growth, especially on their south side (**Figure 1**). In Figure 1, the darker subtidal areas parallel to the south side of the islands are meadows of primarily two species of seagrass, *Zostera marina* and *Halodule wrightii* which have persisted in these locations for at least four decades.

For the past several decades, some of the islands have been experiencing significant deterioration in size and elevation due to boat wake waves from vessel traffic on the ICW, wind, and severe storms. Some of the islands have been breached (**Figure 1**), creating channels with strong tidal flow and boat wake wave exposure resulting in the loss of seagrasses on the south side of the islands. The island site we are proposing was breached sometime between 1992 and 2006 and the impacts of the breach and the loss of seagrasses have continued to expand since (Figure 1). To prevent further expansion, we propose to build a barrier in one of the breaches to baffle waves and currents and promote sediment stability to recreate the conditions suitable for seagrass growth. Once the hydrodynamic conditions are modified by the barrier, seagrasses in the adjacent meadows will naturally recruit into the mitigation site by seed (*Zostera marina*), clonal growth (*Halodule wrightii & Zostera marina*) and vegetative fragments (*Zostera marina & Halodule wrightii*). We expect that within five years the rate of natural seagrass recovery will exceed the seagrass lost at the channel dredge site; the seagrass meadow at the mitigation site

will have higher density, significantly greater coverage, and more diversity than the channel dredge site.

Supporting Data and Site Surveys

Channel Dredging Site

To determine the potential impacts of the dredging activity we surveyed the distribution and abundance of seagrasses and the bathymetry in the vicinity of the proposed dredged channel footprint. The presence and abundance of seagrasses was surveyed along three shore normal transects on May 27, 2022. The transects were approximately 135m long spaced 30 m apart aligned parallel to the proposed boat ramp channel out to a depth of 1.4 m (**Figure 2** and **Exhibit B**; full-sized scaled drawing).

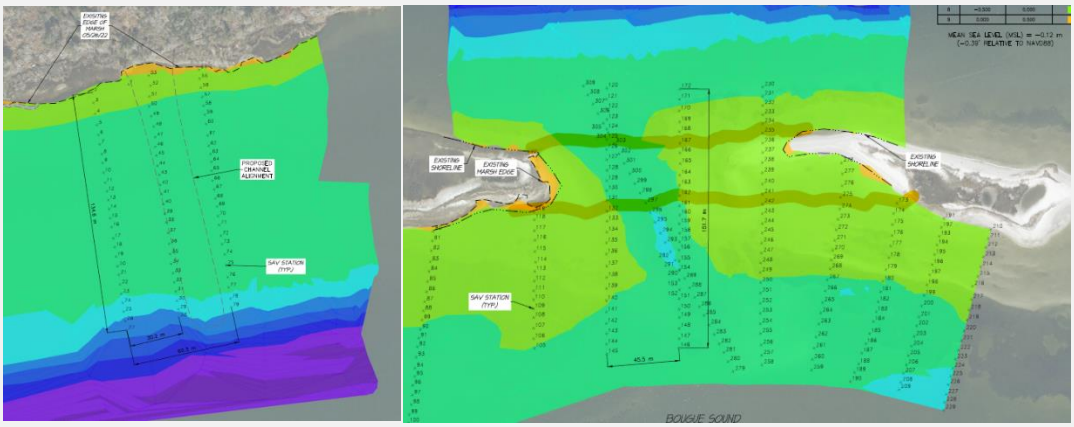


Figure 2*. Illustration of the benthic survey transects at the dredge channel site (left panel) and the mitigation site (right panel); See* ***Exhibits B and C*** *for scaled drawings with legend.*

For each transect we surveyed the presence/absence and cover of seagrass in each of three 0.25 m^2 quadrats placed at 5 m intervals along the transect using the Braun-Blanquet visual assessment method; the same method used by the Albemarle Pamlico Estuary partnership to monitor the abundance of seagrasses coastwide in NC. At each point we also determined the water depth using Carlson and Topcon RTK GPS. We sampled a total of 79 points on the three transects. On May 26, 2022, prior to seagrass surveying, we performed a complete bathymetric survey of both the proposed channel site and primary mitigation area. This was done on foot (using RTK GPS) in shallow nearshore waters and on boat with the use of a Seafloor Systems® single beam echosounder connected to RTK GPS.

Mitigation Site

We selected the mitigation site from an inspection of a series of aerial photographs dating back to May 1992 (Figure 1). We identified a breach in one of the spoil islands 1.35 km east of the proposed boat ramp channel created sometime between 1992 and 2006 which has persisted until the most recent aerial photography in May 2021 (34.700459°N and -76.975774°W). Using ARC GIS and geo-rectified images from May 1992 and May 2021 we delineated the area of seagrass

present on the south side of the island prior to the breach (May 1992) and seagrass absence in the same area after the breach (May 2021) (**Figure 3**; yellow rectangle). Based on these images and the surveyed water depths known to be suitable for seagrass growth in Bogue Sound (< 1.5 m), we estimate an area of potential seagrass mitigation habitat to be 3.34 acres in the polygon.

Figure 3*. May 1992 aerial photograph of the mitigation site prior to the breach in the spoil island (left panel) and May 2021 photo (right panel). Geo-rectified yellow polygon delineates seagrass present in 1992 and mostly absent in 2021.*

Using the same approach and methodology as described for the channel dredge site, we surveyed the presence and abundance of seagrasses on 10 transects around the proposed mitigation site on May 27 and June 22, 2022 (**Figure 2**; right panel and **Exhibit C**; full-sized scaled drawing). Four of the transects were positioned along a north south axis in the breach and six were positioned along an axis perpendicular to the islands to survey conditions in the existing seagrass habitat (Reference Site). Using the same techniques described for the channel dredging site we also recorded the water depth at each sampling station and mapped the bathymetry of the site (**Figure 2**; right panel and **Exhibit C**; full-sized scaled drawing).

Seagrass Distribution and Abundance at the Channel Dredge Site

Seagrasses were present in 76% of the quadrats sampled (**Table 1**). Most of the seagrasses at this site were small individual clones (patches) of *Zostera marina* seedlings that recruited the previous winter. Only six percent of the samples had *H. wrightii* and most of it was in a few small patches in shallow water adjacent to the shoreline. The average total seagrass Braun Blanquet value was 0.96 indicating <5.0% seagrass cover where the seagrass occurred (**Table 1**).

Seagrass Distribution and Abundance in the Mitigation Site (Spoil Island Breech)

Seagrasses were present in 51% of the quadrats sampled (**Table 1**). Like the channel dredge site, most of the seagrasses at this site were small individual clones (patches) of *Zostera marina* seedlings that recruited the previous winter (**Table 1**). Only eleven percent of the samples had *H. wrightii*. The average total seagrass Braun Blanquet value was 0.21 indicating <1.0% seagrass cover where seagrass occurred (**Table 1**).

Seagrass Distribution and Abundance in the Reference Seagrass Meadows Adjacent to Mitigation Site

In the adjacent reference meadows seagrasses were present in 73% of the samples (**Table 1**). The average total seagrass Braun Blanquet value was 1.76 indicating 5-25% seagrass cover where the seagrasses occurred. Unlike the channel dredge site and the breach, *H. wrightii* was more abundant in the reference meadow; occurring in 47% of the samples with an average Braun Blanquet score of 1.38.

Table 1. Results of field surveys of seagrass presence and Braun Blanquet cover at the proposed marina channel dredge site, the footprint of the proposed rock sill (attenuator) and the reference sites adjacent to the mitigation site. The acres shown in the Reference Site Column are the estimated acres of the mitigation site. Calculations for the mitigation metrics are; [1] Total seagrass abundance metric = percent seagrass present * total seagrass cover, [2] Seagrass loss or gain = acres * total seagrass abundance metric, and [3]seagrass mitigation ratio = 4.27 ÷ 0.59 = acreage of the proposed mitigation site.

ACQUIRED SEAGRASS METRICS	MARINA CHANNEL FOOTPRINT	ROCK SILL FOOTPRINT	TOTAL ACRES IMPACTED	REFERENCE SITE
ACRES	**0.77**	**0.24**	**1.01**	3.34[a]
PERCENT TOTAL SEAGRASS PRESENT (PCP)	**76**	**51**		73
TOTAL SEAGRASS COVER (TSGC)	**0.96**	**0.27**		1.76
***ZOSTERA MARINA* PERCENT PRESENT / COVER**	**74.4 / 0.95**			
***HALODULE WRIGHTII* PERCENT PRESENT / COVER**	**0.8 / 0.008**			
DERIVED METRICS				

TOTAL SEAGRASS ABUNDANCE METRIC (TSGAM)[1]	0.73	0.14		1.28
SEAGRASS LOSS/ SEAGRASS GAIN[2]	0.56	0.03	0.59	4.27
SEAGRASS MITIGATION RATIO[3]				7.2

Discussion of Survey Results

Based on our survey results, the seagrass habitat in the vicinity of the channel dredge site can be characterized as a sparsely covered, seasonally ephemeral eelgrass meadow maintained annually by the recruitment of seedlings and an abbreviated period of clonal growth in spring and early summer. These eelgrass meadow characteristics are common throughout the NC estuarine system. We refer to these as mixed semi-annual eelgrass meadows (Jarvis et al. 2012). In March 2022, prior to our surveys, visual observations during low tide detected newly recruited seedlings across the site. In NC, *Zostera* seeds begin germinating in December during cooler temperatures and relatively clear water (Combs et al. 2020). The seedlings reproduce clonally and produce both vegetative shoots and flowers through the spring. Seeds are released from the flowers and settle into the sediment seed bank during April and May. In June and early July as water temperatures exceed the thermal stress threshold of eelgrass ($> 25^0$ C) and water turbidity limits the availability of light, most of the living plants senesce and die. At this location adjacent to the ICW and with the exposure to extremely frequent and large vessel traffic and boat wake waves, sediments are continuously resuspended. The turbidity generated by these resuspended sediments severely limits the amount of light needed for growth of eelgrass and the formation of large perennial meadows in shallow water.

At the mitigation site the seagrass growth in the channel breaching the spoil islands is very similar to the proposed channel dredge site; mainly consisting of relatively sparse eelgrass patches derived from seed. In March 2022, prior to our surveys, we also visually observed seedlings recruiting at this site.

In contrast, the seagrass meadows located to the south of the remaining spoil islands, on both sides of the breach, have almost twice the cover than either the proposed dredge channel site or in the breach (**Table 1**). These meadows not only have a substantially higher cover, but they are also more diverse. *Zostera* and *Halodule* are nearly equally abundant and the cover of *Halodule* is relatively higher (**Table 1**). This demonstrates that the physical conditions established by the presence of the islands, largely the attenuation of boat wake waves and tidal currents, favors the development of seagrass meadows with greater abundance and diversity. Based on our inspection of the historical aerial photography, these meadows have persisted for at least four to five decades.

Proposed Seagrass Mitigation

To mitigate for the loss of seagrass at the channel dredge site (primarily *Zostera marina*), we propose to install a wave and current attenuation system (consisting of a granitic rock sill) in the breach between the spoil islands (**Exhibit D**). By attenuating waves and water currents this system will mimic the effects of the islands and promote the recruitment and growth of seagrasses that once occurred in this location before the island was breached (Figures 1 & 3). This method does not propose to import sand fill to the washout area, but would allow longshore transport of existing sand on the south side of the island area to naturally migrate as the north side erosional forces are reduced. We will propose to gauge the amount of siltation on the south side of the sill to understand future accretion and/or erosion on the south side.

Based on our fundamental understanding of the growth and population dynamics of seagrasses in NC and supported by the observations and data from our surveys, we predict with high confidence that once waves and water currents are reduced in the breach, seagrasses will recruit naturally into the mitigation site without the need for planting. Eelgrass will begin to naturally recruit by seed into the mitigation site after the first flowering season and continue to recruit and establish during subsequent flowering seasons. At the same time, conditions will become more favorable for the recruitment of both *Zostera* and *Halodule* with vegetative fragments, as well as clonal growth from the existing reference seagrass meadows on the eastern and western boundaries of the mitigation site. *Halodule* rarely flowers in NC but spreads rapidly by horizontal rhizome growth. In favorable conditions, rhizomes can grow as much as 1-3 m $year^{-1}$.

This mitigation measure would be implemented after all State and Federal permits are issued for the ramp project and the overall site construction is underway. In addition to the rock sill a Quickreef® or similar shoreline protection system will be installed along a broad area of the remaining island system on the east and west sides (this in intended to protect other portions of the island from washing out which will be inevitable if nothing is done to address this). Island protection and enhancement is primarily to restore and protect SAV resources, and secondary environmental benefits include other habitat restoration. The rock protection will provide a viable oyster substrate and the associated native herbaceous plantings will help stabilize the island and will provide cover, habitat and food source for birds and marine organisms. The County proposes erecting reflective navigation hazard signs along the length of the rockwork.

For this proposal we are estimating a potential seagrass mitigation ratio of 7.2 using commonly measured metrics of seagrass abundance acquired in our surveys and the expectation that the mitigation site will achieve the same seagrass frequency and abundance as the reference sites (**Table 1**). For each site (marina channel impact site, rock sill footprint, and reference site) we computed; 1) the frequency seagrasses occurred (percent seagrasses present), 2) the total seagrass percent cover where they occurred (total seagrass cover), and 3) the area (acres). From these primary metrics we derived a total seagrass abundance metric to account for both how frequently seagrass occurred over the entire site and the cover where it occurred. We then

multiplied this derived metric by the acres at each site to calculate loss (marina channel + rock sill footprints) or gain (mitigation site). After accounting for the differences in the seagrass acreage, we divide the gain in seagrass (mitigation site = 4.27) by the loss (boat ramp channel & rock sill footprint = 0.59) to obtain the mitigation ratio (7.2). Assuming there are no catastrophic environmental disturbances (e.g., tropical cyclones) that interrupt seagrass colonization of the mitigation site, the mitigation ratio presented in table 1 (7.2) is a plausible but ambitious long-term target.

We expect there will be a succession of seagrass colonization of the mitigation site beginning with relatively rapid and sustained annual seed recruitment of *Zostera*. Within two years (two flowering seasons) we expect that the distribution and abundance of eelgrass at the mitigation site will equal or exceed the impacted sites. In the meantime, there will be a slower rate of clonal recruitment from the adjacent seagrass meadows by both *Halodule* and *Zostera*. We predict that within five years the loss of a sparse and patchy semi-annual *Zostera* meadow at the channel dredge site will be mitigated with a more dense and resilient mixed species seagrass meadow. Meadow resilience is an important co-benefit of our mitigation proposal. North Carolina lies at the interface of the temperate (*Zostera*) and tropical (*Halodule)* seagrass bioregions in the western Atlantic Ocean (Bartenfelder et al. 2021). The extremely warm temperatures limit *Zostera* growth and abundance in summer, while favoring *Halodule*. On an annual basis, a mixed species meadow sustains more productivity, persistent seagrass cover, and provides habitat and ecological services over longer periods of time than meadows with only one species.

Monitoring and Success Criteria

The mitigation site will be monitored twice annually for five years following installation of the rock sill. Seagrass monitoring will occur in April and September in order to assess the presence and cover of both the temperature species *Z. marina* and the tropical species *H. wrightii*. We will establish 10 equally spaced permanent transects oriented along the north-south axis of the 3.34-acre site and sample three 0.25 m^2 quadrats spaced approximately 5 m apart along each transect. Seagrass monitoring and metric analyses will follow the same protocols as described in the earlier sections of this document, with one exception; we will also determine the density of eelgrass flowering shoots in a subset of a least 25 quadrats in April to assess the reproductive effort during colonization of the mitigation site. In addition to the seagrass monitoring at the mitigation site, we will also monitor 10 permanent transects in the reference areas behind the islands on both sides of the mitigation site to assess whether environmental conditions in the general area of the mitigation continue to support the growth and abundance of the established seagrass meadows. The same protocols described earlier will be used in the reference site and including a subset of quadrats to assess eelgrass reproductive effort in April of each year.

In addition to the seagrass monitoring, we will also record water temperature, tidally corrected water depths at each sampling station, and the bathymetry of the mitigation site once each year for the duration of the monitoring period.

Success will be assessed at the end of the five-year monitoring period using the total seagrass abundance metric (**Table 1**). Assuming the mitigation goal is to replace the seagrass lost in the dredge channel we calculated the cumulative loss of seagrass over the five year period. Based on the data in **Table 1**, the annual total seagrass abundance loss at the boat ramp channel and the footprint of the rock sill is estimated to be 0.87 (0.73 + 0.14) and therefore, over five years the total loss in seagrass abundance is 4.35 (5 * 0.87). For each year following the initiation of the mitigation we will calculate the total seagrass abundance metric at the mitigation site and calculate the cumulative gain of seagrass abundance each year. Given these data metrics, we propose three success criteria. First, at the end of five years the abundance of seagrasses at the mitigation site should at least equal the impacted site and therefore the total seagrass abundance metric must ≥ 0.87. Second, the mitigation should at a minimum replace the seagrass lost over the five-year period, therefore at the end of five years, the cumulative gain must be $\geq$ the cumulative loss (4.35). The third criteria goes one step further and addresses the challenging issue of perpetual loss at the impact site for each year beyond the five year monitoring period. For this, we propose to use the slope of the regression line calculated from the rate of gain at the mitigation site over the five year monitoring period to project future gains (or no change if the slope = 0) in abundance at the mitigation site. The cumulative annual total seagrass abundance predicted from the slope of the regression must equal the cumulative loss at the dredge site.

Human Access and Notice

The restoration area described above will allow people paddling/operating small craft and on foot access to the SAV Mitigation Area and will not interfere with public trust rights. The County does not plan to propose restrictions of access, but there is County and NCCF support for creating a no-wake zone and they will commit to talking to USACE Navigation Branch and US Coast Guard (USCG) about the ability to due so.

To minimize human impact to the Mitigation Area and the two Reference Areas, the County and NCCF will install signs on the land at the eastern and western extremes of the island restoration area that make three statements (in descending type size, provided that the third statement will not be smaller than one inch in height), “Seagrass enhancement area, [over the statement] Please do not disturb emergent or submerged plants, [over the statement] See NCCF for additional information.”

References

Bartenfelder A, Kenworthy WJ, Puckett B, Deaton C and Jarvis JC (2022) The Abundance and Persistence of Temperate and Tropical Seagrasses at Their Edge-of-Range in the Western Atlantic Ocean. Front. Mar. Sci. 9:917237. doi: 10.3389/fmars.2022.917237

Combs, A.R., Jarvis, J.C., Kenworthy, W.J. 2020. Quantifying variation in *Zostera marina* seed size and composition at the species’ southern limit in the western Atlantic; Implications for eelgrass population resilience. Estuaries and Coasts, https://doi.org/10.1007/s12237-020-00839-5.

Jarvis, J.C.,Moore, K.A., Kenworthy,W.J., 2012. Characterization and ecological implication of eelgrass life history strategies near the species' southern limit in the western North Atlantic. Mar. Ecol. Prog. Ser. 444, 43–56.

EXHIBIT A

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BOAT RAMP SITE

LIVING SHORELINE SITE

PRIMARY MITIGATION SITE

SANDERS CREEK

BOUGE SOUND

TAX INCGRID

*PARCEL & AERIAL DATA SHOWN, BASED ON COUNTY GIS DATA.

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EXHIBIT A - OVERALL VIEW

W CARTERET BOAT RAMP

CARTERET COUNTY

NEWPORT

NORTH CAROLINA

0 600 1200

GRAPHIC SCALE IN FEET 1"=600'

PROJECT	DRAWN BY	CHECKED BY	DATE
P21130	JTM	BDR	09/06/22

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EXHIBIT B

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EXISITNG EDGE OF MARSH 05/26/22

EXISTING OYSTER BAG/ CONCRETE QUICKREEF SILLS

PROPOSED 92 LF BY 5 FT WIDE MARSH PROTECTION QUICKREEF SILL

PROPOSED 99 LF BY 5 FT WIDE MARSH PROTECTION QUICKREEF SILL

PROPOSED 79 LF BY 5 FT WIDE MARSH PROTECTION QUICKREEF SILL

PROPOSED 94 LF BY 5 FT WIDE MARSH PROTECTION QUICKREEF SILL

PROPOSED 100 LF BY 5 FT WIDE MARSH PROTECTION QUICKREEF SILL

SAV STATION (TYP.)

PROPOSED CHANNEL ALIGNMENT

EXISITNG PIER W/ SLIPS

TAX/NCGRID

BOUGUE SOUND

Elevations Table			
Number	Minimum Elevation	Maximum Elevation	Color
1	-13.000	-12.000	
2	-12.000	-11.000	
3	-11.000	-10.000	
4	-10.000	-9.000	
5	-9.000	-8.000	
6	-8.000	-7.000	
7	-7.000	-6.000	
8	-6.000	-5.000	
9	-5.000	-4.000	
10	-4.000	-3.000	
11	-3.000	-2.000	
12	-2.000	-1.000	
13	-1.000	0.000	
14	0.000	1.000	

*PARCEL & AERIAL DATA SHOWN, BASED ON COUNTY GIS DATA.

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EXHIBIT B - SAV REVIEW AREA 1

WEST CARTERET BOAT RAMP AND CHANNEL

NEWPORT — CARTERET COUNTY — NORTH CAROLINA

0 100 200

GRAPHIC SCALE IN FEET 1"= 100'

PROJECT	DRAWN BY	CHECKED BY	DATE
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EXHIBIT C

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Elevations Table			
Number	Minimum Elevation	Maximum Elevation	Color
1	−13.000	−12.000	
2	−12.000	−11.000	
3	−11.000	−10.000	
4	−10.000	−9.000	
5	−9.000	−8.000	
6	−8.000	−7.000	
7	−7.000	−6.000	
8	−6.000	−5.000	
9	−5.000	−4.000	
10	−4.000	−3.000	
11	−3.000	−2.000	
12	−2.000	−1.000	
13	−1.000	0.000	
14	0.000	1.000	

EXISTING SHORELINE

EXISTING MARSH EDGE

EXISTING SHORELINE

SAV STATION (TYP.)

BOUGUE SOUND

TAR NEUSE

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EXHIBIT C - SAV REVIEW AREA 2

PROPOSED RESTORATION & ENHANCEMENT SITE

CARTERET COUNTY

NEWPORT NORTH CAROLINA

0 120 240

GRAPHIC SCALE IN FEET 1"=120'

PROJECT	DRAWN BY	CHECKED BY	DATE
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BOUGUE SOUND

PROPOSED QUICKREEF REVETMENT 800 LF BY 5 FT WIDE BASE

PROPOSED RIPRAP SILL AND BREAKWATER 861 LF BY 12–18 FT WIDE BASE

PROPOSED QUICKREEF REVETMENT 605 LF BY 5 FT WIDE BASE

EXISTING SHORELINE

EXISTING SHORELINE

PROPOSED 10,000 SF OF NATIVE MARSH PLANTINGS

PROPOSED 20,000 SF OF NATIVE MARSH PLANTINGS

BOUGUE SOUND

TAX/NCGRID

Elevations Table			
Number	Minimum Elevation	Maximum Elevation	Color
1	−13.000	−12.000	
2	−12.000	−11.000	
3	−11.000	−10.000	
4	−10.000	−9.000	
5	−9.000	−8.000	
6	−8.000	−7.000	
7	−7.000	−6.000	
8	−6.000	−5.000	
9	−5.000	−4.000	
10	−4.000	−3.000	
11	−3.000	−2.000	
12	−2.000	−1.000	
13	−1.000	0.000	
14	0.000	1.000	

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EXHIBIT D

PROPOSED SAV ENHANCEMENT & ISLAND PROTECTION SYSTEM

NEWPORT

CARTERET COUNTY

NORTH CAROLINA

0 120 240

GRAPHIC SCALE IN FEET 1"=120'

PROJECT	DRAWN BY	CHECKED BY	DATE
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BOUGUE SOUND

PROPOSED
1,062 LF BY
5 FT WIDE
MARSH PROTECTION
QUICKREEF REVETMENT
ALONG MLW LINE

PROPOSED AREA
OF NATIVE MARSH
PLANTINGS
(14,976 SF)

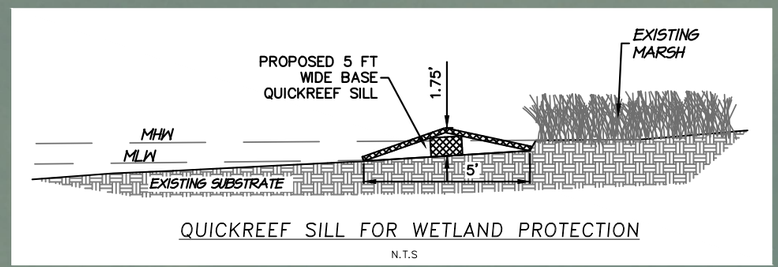
TAX/NCGRID

MEAN HIGH WATER

MEAN HIGH WATER

BOUGUE SOUND

*PARCEL & AERIAL DATA SHOWN, BASED ON COUNTY GIS DATA.



QUICKREEF SILL FOR WETLAND PROTECTION

N.T.S

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EXHIBIT B - LIVING SHORELINE ACROSS AIWW FROM RAMP

WEST CARTERET BOAT RAMP
PROPOSED SITE

NEWPORT

CARTERET COUNTY

NORTH CAROLINA

0 80 160

GRAPHIC SCALE IN FEET 1"=80'

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