PROJECT NARRATIVE

The applicant seeks to conduct repairs on a groin located near the Village of Buxton in Dare County. This groin is part of a three-groin structure near the Village of Buxton and is the southernmost of the three. The attached drawings depict the proposed repairs and the current assessed condition of the structure (Attachment 1).

The deteriorated condition of the structure limits sand-trapping capacity and has negatively impacted beach widths on the updrift (north) side, which has contributed to habitat loss and property damage along the Village of Buxton as well as the periodic closure of public beach accesses in the area. A brief history of the installation and maintenance of the structure is outlined below; a more detailed narrative is provided in a 2006 engineering report included as an attachment to this document (Attachment 2).

The structure was originally installed in 1969, and included a total length of 1,670 ft in three groins. The repairs proposed herein are only for the southernmost groin. This groin was initially constructed to a length of 610 ft as depicted in the attached drawings (Attachment 3 Figure 2.1). In 1975, damaged and/or destroyed sheet piles were repaired in place (Attachment 3 Figure 2.3). Figure A depicts the condition of all three groins in September 1978, before a storm in March 1980 damaged the original structures.

Figure A. Much of the original 1,670 ft length of the three groins remained in place as of September 1978 as shown here. *Photo by T. Kana*.

Following the 1980 storm, between 1980 and 1982 an additional ~300 feet of sheet piles were installed at the landward end of the southernmost groin and at an angle to the original piles (Attachment 3 Figure 2.5). This extended the total length of the southernmost groin to 910 ft, with 300 ft angled as an upland tie in and 610 ft oriented shore perpendicular. The total length of all three groins as of 1982 was 1,970 ft. By 1984, armor stone scour protection had been installed along the structure as shown in Figure B, along with a number of sandbags around the base of the Cape Hatteras Lighthouse.

The most recent repairs made to the structure (in 1994) consisted of new sheet piles driven adjacent to the original sheet piles, and additional scour protection at the base of the structure. According to engineered drawings (Attachment 3 Figure 2.7), ~180 ft of sheet piles were installed. By 1999, much of the scour protection was buried along with the sandbags as shown in Figure C.

Figure B. By 1984, following the landward extension of the southernmost groin by 300 ft, armor stone scour protection had been installed along the structure and sandbags had been installed at the lighthouse. *Photo by T. Kana*.

Figure C. By 1999, most of the scour protection and sandbags had been buried or removed. *Photo by USAF*.

As of October 2024, sheet piles remain in place along approximately 410 feet of the linear footprint of the southernmost groin (Fig D, E). An additional ~20 feet of buried sheet piles remain at the landward tie-in of repairs constructed following the 1980 storm. The proposed repairs consist of driving steel sheet piles along 640 ft of the original linear footprint of the southernmost groin (Fig E). Following a similar design as the original work, this length approximates the length of sheet pile repairs made in 1975, 1980-1982, and 1994 along the southernmost groin. These repairs would involve placing sister sheet piles along the existing damaged portions of the structure (black segments, Fig E), and placing new sheet piles to close the gaps in the structure created by storm damage (red segments, Fig E). The maximum crest elevation of the proposed repairs is 8 ft NAVD, matching the original permitted design (Fig F, Fig G, Attachment 4). Final design elevations of the crest may be lower, to reduce the force of incoming wave energy and create an equilibrium beach profile closer to the natural slope. Scour protection would be placed adjacent to the shore normal section of the repaired structure below mean low water (Fig G).

The total length of the groin system at Buxton including original construction and permitted extensions is 1,970 ft. The proposed repairs would restore functionality to 640 ft of the southernmost groin. Therefore, repairs do not require a Major Permit application according to Code 15A NCAC 07J .0210 ‘REPLACEMENT OF EXISTING STRUCTURES’ (Attachment 5).

Figure D. As of late 2024, approximately 410 ft of the sheet piles remain in place along the original linear footprint of the southernmost groin. *Photo by D Giles.*

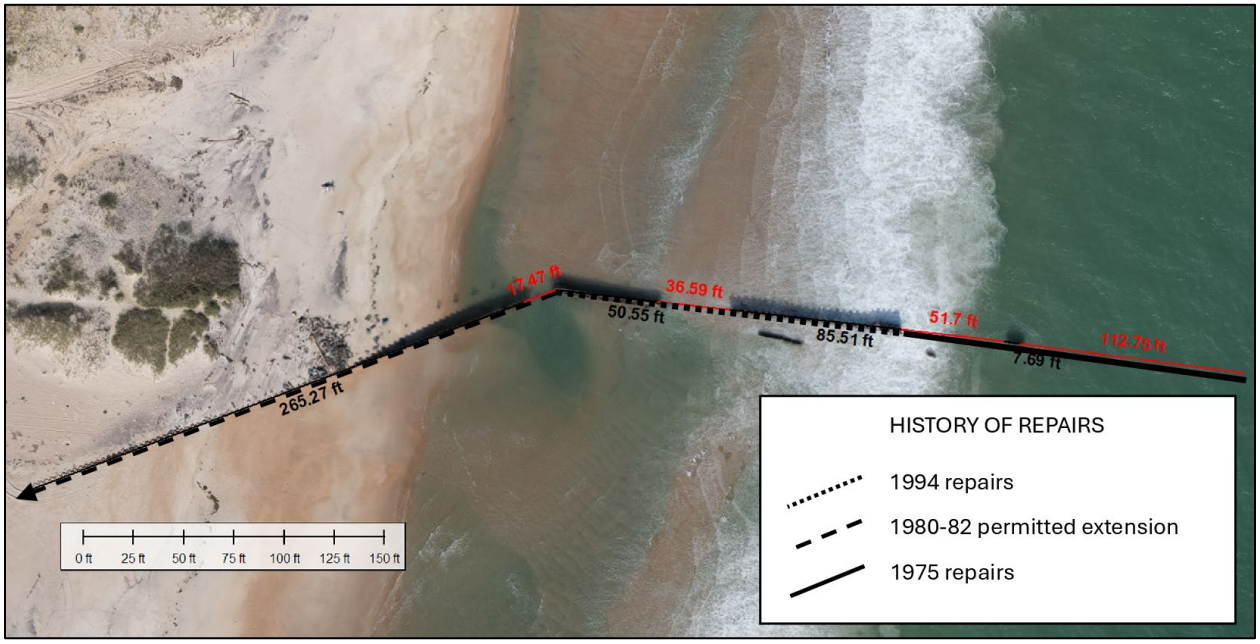


Figure E. Proposed repairs consist of placing sister sheet piles along 640 ft of the original footprint of the structure. Black segments indicate portions of sheet piles remaining in place, while red sections indicate portions of sheet pile lying below MSL (eg heavily damaged).

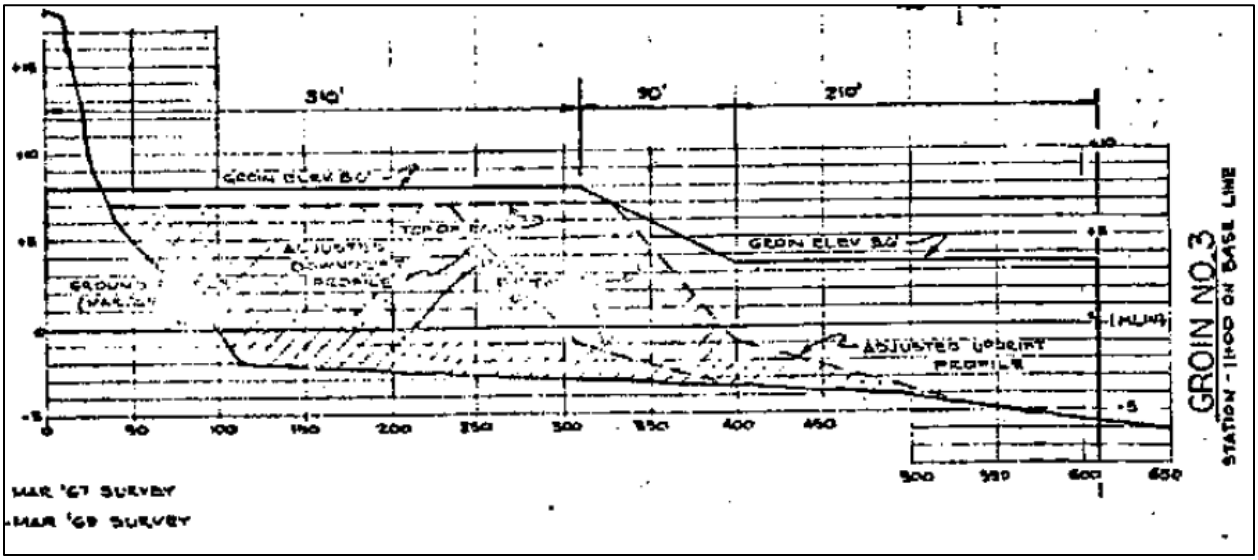


Figure F. The original groin profile designed and constructed by the US Navy in 1969. The proposed repairs emulate the 8-ft elevation portion of the crest between 90 and 310 ft on the x axis shown above, but do not include the 300-ft sloping section with lower crest elevations. A full copy of the original design plans is included in Attachment 4 to this request.

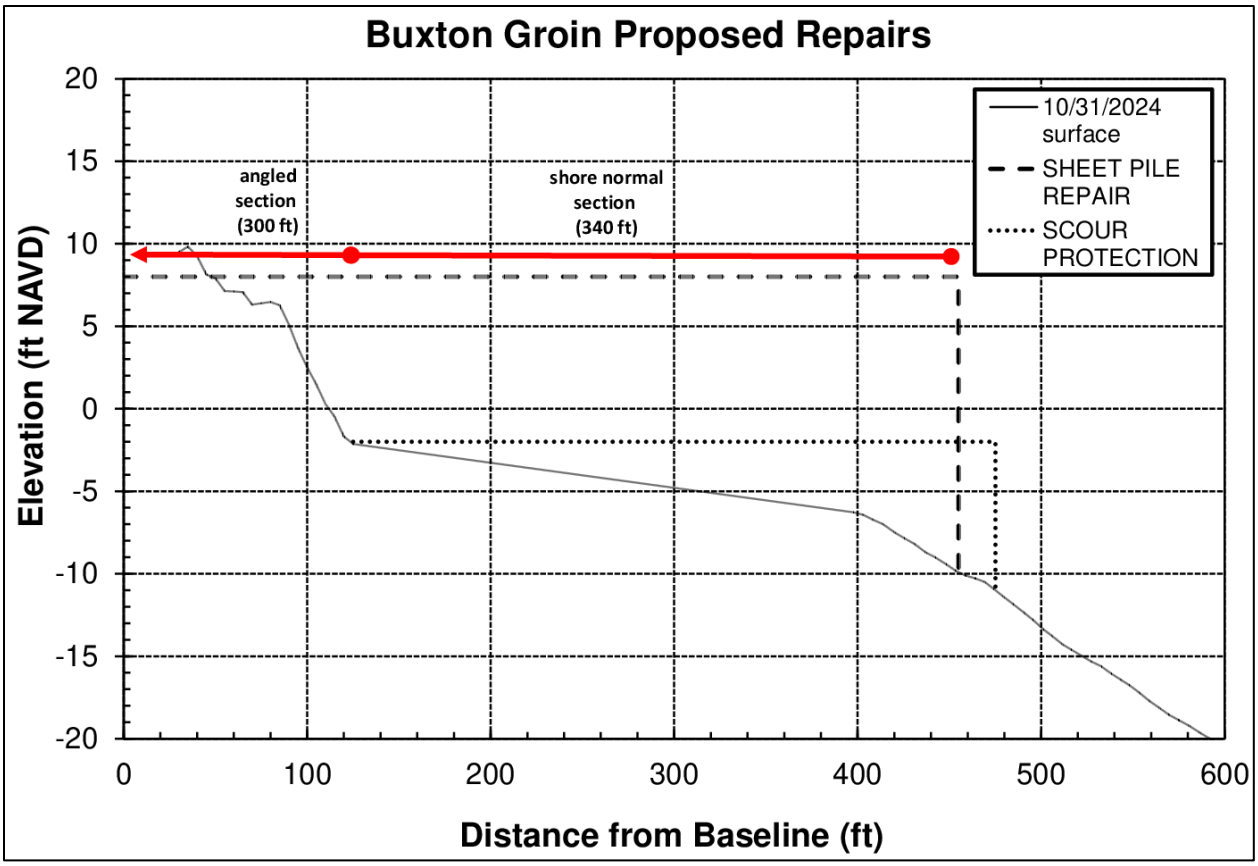


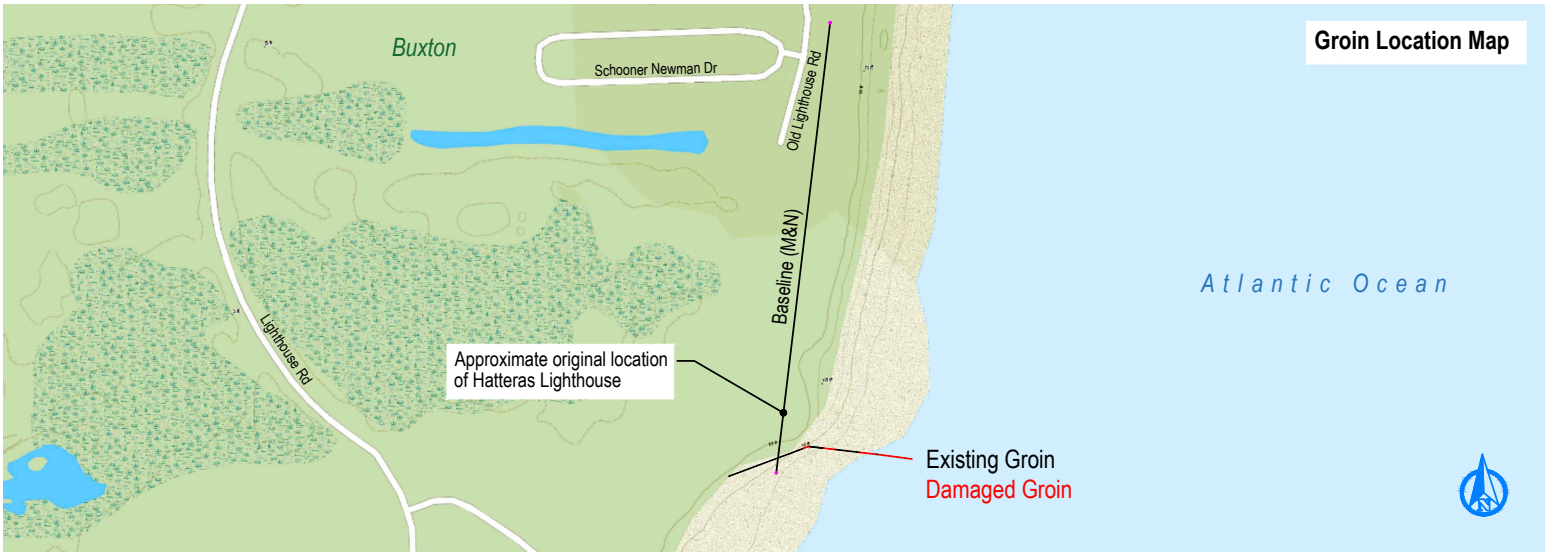
Figure G. Proposed repairs consist of placing sister sheet piles along 640 ft of the original footprint of the structure. The shore normal section measures 340 ft in length while the angled upland tie-in section measures 300 ft in length. Scour protection will be placed along the shore normal section from below MLW to below existing grade at the time of construction.

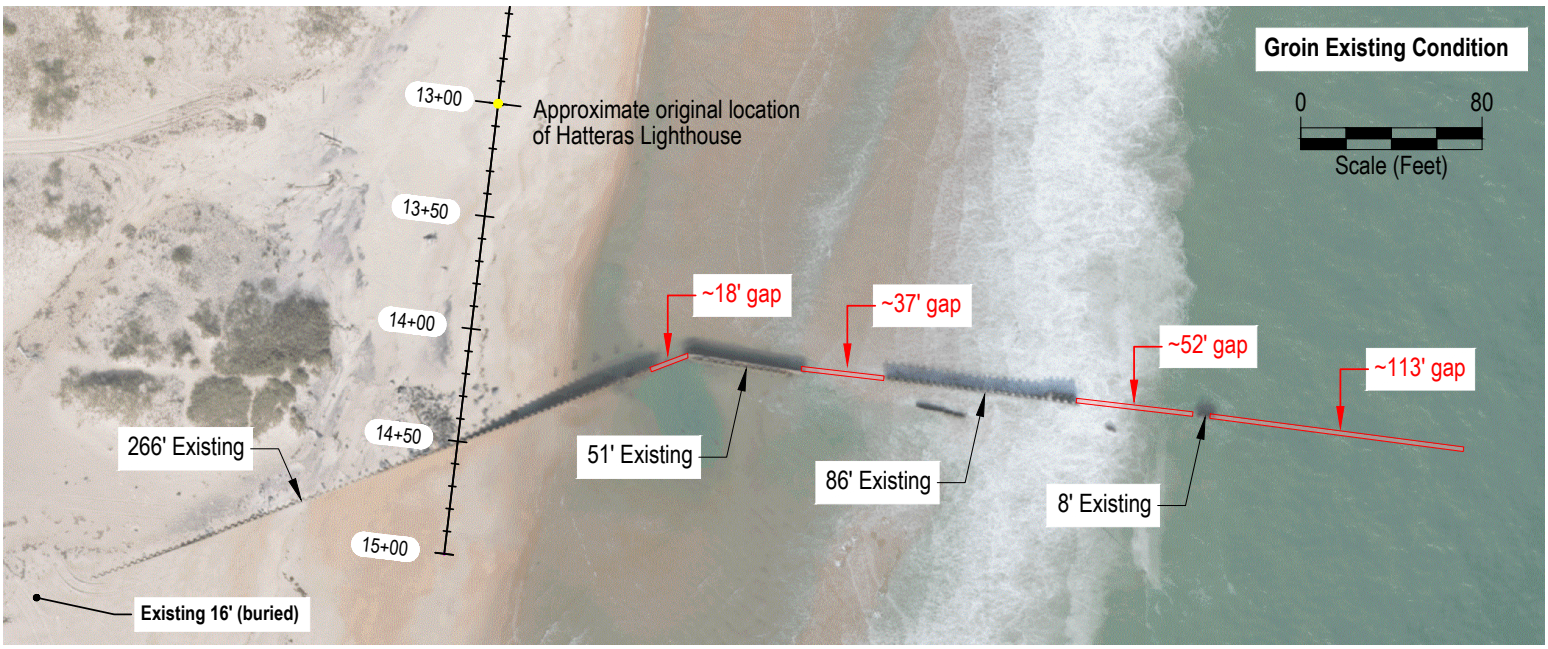
ATTACHMENT 1

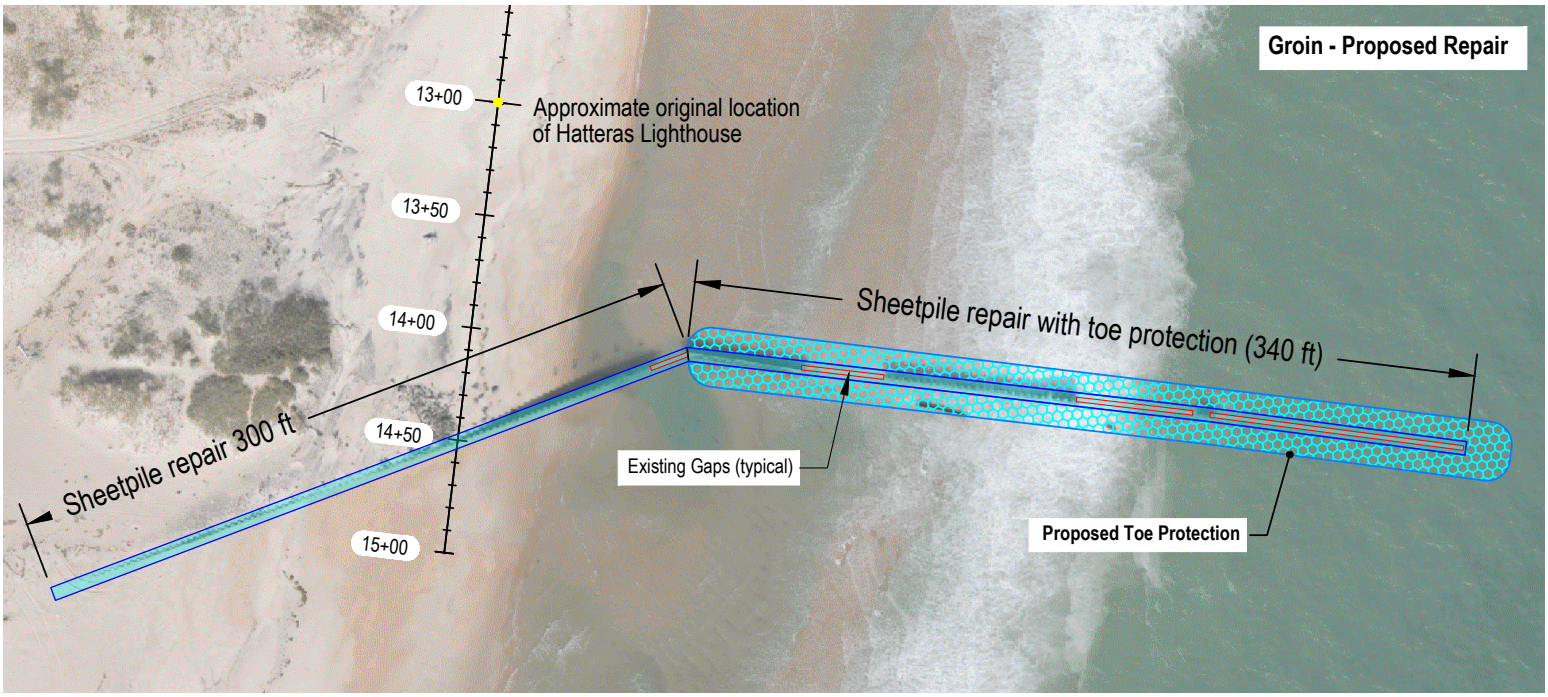
Proposed Repairs

and

Current Conditions


Groin Location Map
Buxton
Schooner Newman Dr
Old Lighthouse Rd
Baseline (M&N)
Lighthouse Rd
Approximate original location of Hatteras Lighthouse
Atlantic Ocean
Existing Groin
Damaged Groin


Groin Existing Condition
0
80
Scale (Feet)
13+00
Approximate original location of Hatteras Lighthouse
13+50
14+00
14+50
15+00
~18' gap
~37' gap
~52' gap
~113' gap
266' Existing
51' Existing
86' Existing
8' Existing
Existing 16' (buried)


Groin - Proposed Repair
13+00
Approximate original location of Hatteras Lighthouse
13+50
14+00
14+50
15+00
Sheetpile repair with toe protection (340 ft)
Sheetpile repair 300 ft
Existing Gaps (typical)
Proposed Toe Protection

ATTACHMENT 2

Moffat and Nichol

2006 assessment report

Prepared For:

COUNTY OF DARE
NORTH CAROLINA

EXISTING GROIN REHABILITATION FEASIBILITY STUDY

CAPE HATTERAS, NORTH CAROLINA

5 JULY 2006

TABLE OF CONTENTS

Submitted by:

Moffatt & Nichol

1616 East Millbrook Road, Suite 160
Raleigh, North Carolina 27609

COUNTY OF DARE, NORTH CAROLINA

EXISTING GROIN REHABILITATION FEASIBILITY STUDY

CAPE HATTERAS, NORTH CAROLINA

TABLE OF CONTENTS

1.0 INTRODUCTION

This Existing Groin Rehabilitation Feasibility Study was prepared under the direction of the County of Dare, North Carolina. The purpose behind the project was the recent need of the County to investigate the possible repair or replacement of three existing groin structures located in the Atlantic Ocean adjacent to the USCG Station property which housed the original Cape Hatteras Lighthouse. Each of these existing groin structures has exhibited some form of failure or repair since the original construction.

The subject property is currently owned by the United States Government and once housed a United States Coast Guard (USCG) station. The USCG station has recently become inactive and the Department of Homeland Security has determined that the site is no longer required for operational purposes. Therefore, the County of Dare is considering the opportunity to take over the long term lease on the waterfront property. This study will be utilized by the County of Dare to aide in the decision to lease the site and will assist in determining if additional beach erosion preventive measures will be required for this area. However, this study does not address the actual coastal engineering solutions for beach erosion prevention in the vicinity.

Authorization for the completion of the study was provided to Moffatt & Nichol (M&N) on November 29, 2005. The services associated with the performance of this project included: a detailed inspection of the three existing groin structures; review of the existing groins construction history; a wave loading analysis; and schematic design developments, including opinions of probable costs for the most practical repair or replacement alternative. As part of this work, M&N also determined the value of the existing groin structures to meet the requirements of the "North Carolina Administrative Code" Section 15A NCAC 07J.0210. This task provides preliminary research into North Carolina Division of Coastal Management (DCM) permitting issues that could possibly arise with regards to this proposed project.

2.0 HISTORY OF EXISTING GROINS

The main reason for constructing the three original groins was to stop or slow down beach erosion near the original location of the Cape Hatteras Lighthouse. The 1969 construction of the three precast concrete sheet pile groins are shown in plan on Figure 2.1 in Appendix A. Figure 2.2 shows the original conceptual construction details. Groin 1, the northern most groin, was approximately 530 feet long. Groin 2, the middle groin, was also approximately 530 feet long. Groin 3, the southern most groin, was

closet to the original lighthouse location. Groin 3 was originally constructed to be 610 feet long. Storms occurring between 1969 and 1975 destroyed portions of these original groins.

In 1975, steel sheet piles were installed, which appeared to be a PZ-27 size based on the field dimensions that were taken during this inspection. At Groin 1, steel sheet piles replaced approximately 250 feet of the original concrete sheet piles. At Groin 3, steel sheet piles replaced approximately 140 feet of the original concrete sheet piles. No repairs were performed on Groin 2 at this time. Figures 2.3 and 2.4 in Appendix A show conceptually the construction that was performed in 1975.

Between 1980 and 1982, Groin 3 had approximately 300 feet of steel sheet piles installed mostly near the landside end of the original construction. These sheets ran approximately at a 30 degree angle to the south of the existing bulkhead line. The steel sheets were PZ-27 sheet piles and appeared to have sacrificial anodes installed near the top of each sheet. Figure 2.5 and 2.6 in Appendix A show conceptually the construction of this improvement.

In 1994, additional improvements were made at Groin 3. Approximately 180 feet of PZ-40 steel sheet piles were installed near the landside end. Additionally, drawings and records indicate some scour protection was installed at Groin 3 in 1984 and 1994. Figures 2.7 and 2.8 in Appendix A show conceptually the construction that was performed for these improvements. There appeared to be sacrificial anodes installed toward the top of each sheet.

In 1999, the Cape Hatteras Lighthouse was relocated approximately 2,900 feet to its current location. No additional groin improvements were considered. Appendix G provides a more detailed history of the lighthouse and the groins.

3.0 CONDITION OF EXISTING GROINS

M&N performed a top side an underwater inspection of Groins 1, 2, and 3 on February 21, 2006. Groin 1 is in very poor condition with the only usable portion of the groin being buried inland. We estimate the buried portion of the groin that extends towards the shore to be approximately 146 feet. The original precast concrete sheet piles are leaning significantly to the north. There are only small portions of the steel sheet piles remaining. The remaining 18 steel sheets total have approximately 75% to 100% loss of

section due to corrosion. Photographs 1 through 3 in Appendix B show the conditions of Groin 1. All report photographs are found in Appendix B.

Groin 2 was found to have twenty five, four feet wide, precast concrete sheet piles still remaining near the shoreline and in fair condition. Additionally, we estimate there is 146 feet of concrete sheet pile wall that is buried and extends inland. Except for the twenty five sheets mentioned above, the remaining concrete and steel sheets have failed or have corroded to the point that they are no longer capable of resisting storm wave forces. Photographs 4 through 6 show the conditions of Groin 2.

Groin 3 was found to have most of the 1969 precast concrete sheet to be in very poor condition and not able to resist the storm wave forces. The improvements performed between 1980 and 1982 are still present. The sacrificial anode cathodic protection appears to be past its useful life. These PZ-27 sheets have sustained approximately 16% loss of section, and still have enough section to perform their function. Photographs 7 through 13 show the conditions of Groin 3.

The Groin 3 PZ-40 steel sheet pile improvements performed in 1994 appear to have lost approximately 16 feet of the original 180 feet due to storm damage. The remaining 164 feet has sustained approximately 18% loss of section due to corrosion. The sacrificial anode cathodic protection system appears to be past its useful life. Due to the more shallow depth, the existing sheets can still function with some normal overstresses during storm conditions.

4.0 REHABILITATION ALTERNATIVES

Upon consulting with DCM staff it became apparent that the most likely way to be able to strengthen the groins (from a permitting standpoint) was to repair them in kind. The two kinds of existing construction were precast concrete sheet piles and steel sheet piles. Therefore, these were the two alternatives that M&N considered.

In order to review the feasibility of these two alternatives, M&N performed a wave study for this area. The wave loads study provided pressures so that a structural analyses could be performed of two alternatives. For shallower areas of the groins closer to land, the wave loads produced lateral pressures on the order of 420 pounds per square foot (psf). The deeper areas further away from shore produced lateral

pressures ranging from 590 psf to 710 psf. The wave load and sheet pile calculations are found in Appendix D.

4.1 PRECAST CONCRETE SHEET PILE ALTERNATIVE

The first alternative evaluated was precast sheet piles similar to the original construction performed in 1969. Groins 1 and 2 would need to increase the thickness to at least 18 inches and be 29 feet deep. Groin 1 has approximately 146 linear feet of usable groin which was buried from sight. Groin 2 has approximately 246 linear feet of usable groin. At Groin 2, approximately 146 linear feet of the 246 linear feet is buried from sight.

It was found at Groin 3, for it to resist the wave forces, the precast sheets would need to be greater than over 24 inches in thickness which is not a typical precast concrete sheet pile section. Therefore, for Groin 3 the precast sheet pile alternative was not considered feasible from a practical construction aspect. M&N could not locate a precaster, who has fabricated this thick of a concrete sheet pile, or a contractor that has installed this thick of a sheet, and therefore a quantitative cost estimate on this alternative was not provided for Groin 3.

4.2 STEEL SHEET PILE ALTERNATIVE

The other alternative consisted of installing steel sheet piles groin similar in kind to the 1994 improvements at Groin 3. It was found that for Groins 1 and 2, a 29 foot long PZ-27 A690 grade would be able to resist the wave loads. For Groin 3, a 38 foot, PZ-40 Grade A690 sheet would be sufficient to resist the wave loads. Since it is extremely difficult to maintain coatings or a sacrificial anode cathodic protection system, we recommend a more durable A690 grade which provides a better corrosion resistive composition than A328 carbon steel.

4.3 RECOMMENDED ALTERNATIVES

Groins 1 and 2 could be repaired with either precast concrete sheet pile or steel sheet pile sheets since the estimated costs are comparable. If the county desires to pursue rehabilitating Groins 1 and 2, the decision for which alternative to use can be made during the final design phase. For Groin 3, we recommend using the steel sheet pile alternative since it is the only feasible alternative.

5.0 OPINION OF PROBABLE COSTS AND PERMITTING ISSUES

In discussions with the North Carolina Division of Coastal Management (DCM) staff, the existing groins are classified as hardened structures, and therefore are considered "non-conforming" structures along the oceanfront. In determining whether work on a structure is repair or replacement of the structure, the current physical value of the structure is used as the baseline for the 50% repair and/or replacement rule. The repair and/or replacement issue for non-conforming structures in the ocean hazard Area of Environmental Concern (AEC) is critical because replacement of non-conforming structures is **inconsistent** with current rules. The estimated cost to repair the entire structure "in-kind" (similar conditions to what it was when first constructed but up to current codes) and within the same footprint must be computed and then compared to the current existing value. If the estimated repair cost is more than 50% of the current existing value, the project will be considered replacement and a permit will be required. If the estimated repair cost is less than 50% of the current existing value, the structure may be repaired with no permit required. These repairs may be phased over time, but again, it is important to note that the repair cost must be computed for the entire structure.

It should also be noted that the Coastal Resources Commission (CRC) is considering revisions to the above rule. The draft revision also provides a separate method for determining if water-dependent structures like piers, bulkheads and groins need repair/replacement determinations. Under this latest proposal, work would be considered replacement if it exceeds more than 50% of the linear footage of the structure, as determined by DCM staff. We have provided a copy of the Coastal Area Management Act (CAMA) Handbook for Development in Coastal Carolina as Appendix F to this report.

M&N estimates that at Groin 1, approximately 146 linear feet of the original 530 linear feet, is usable. The 146 feet consist of the buried portion of the original concrete sheet pile bulkhead. M&N could not confirm this length since it was buried. The remaining 384 feet of the original 530 feet of groin was almost completely gone or deemed unusable to resist the design wave forces. The estimated value of the 146 ft of usable groin is approximately $223,000. The estimated cost to repair in kind with an 18 inch thick precast concrete sheet pile repair or PZ-27 A690 steel sheet pile repair each being 29 feet in height of the remaining 384 ft in plan of groin would be approximately $496,000. For the new construction, we assumed that mobilization and demobilization will occur twice in case of severe weather. Since the cost of repairs of $496,000 is greater than 50% of the existing value of $223,000, the project would be considered a replacement, and a CAMA permit would be required. Figure 2.9 in Appendix A illustrates

the length of usable groin, and the amount of groin that would require replacement for Groins 1, 2, and 3. All opinions of probably costs can be found in Appendix C.

M&N estimates that at Groin 2, approximately 246 linear feet of the original 530 linear feet, is usable. The 146 feet consist of the buried portion of the original concrete sheet pile bulkhead. M&N could not confirm this length since it was buried. The additional 100 feet of bulkhead has such a shallow depth that is should be able to resist reasonable wave forces. The remaining 284 feet of the original 530 feet of groin was almost completely gone or deemed unusable to resist the design wave forces. The estimated value of the 246 ft of usable groin is approximately $341,000. The estimated cost to repair in kind with an 18 inch thick precast concrete sheet pile repair or PZ-27 A690 steel sheet pile repair each being 29 feet in height of the remaining 284 ft in plan of groin would be approximately $393,000. For the new construction, we assumed that mobilization and demobilization will occur twice in case of severe weather. Since the cost of repairs of $393,000 is greater than 50% of the existing value of $341,000, the project would be considered a replacement, and a CAMA permit would be required.

M&N estimates that at Groin 3, approximately 466 linear feet of the 910 linear feet of groin, is usable. The landside PZ-27 sheets and the newer PZ-40 sheets installed in 1994 still have adequate section to resist the storm wave forces. The remaining 444 feet of the original 910 feet of groin was almost completely gone or deemed unusable to resist the design wave forces. The estimated value of the 466 ft of usable groin is approximately $1,136,000. The estimated cost to repair in kind with a PZ-40 A690 sheet pile repair of the remaining 444 ft of groin would be approximately $1,281,000. For the new construction, we assumed that mobilization and demobilization will occur twice in case of severe weather. Since the cost of repairs of $1,281,000 is greater than 50% of the existing value of $1,136,000, the project would be considered a replacement and a CAMA permit would be required.

If all three groins were repaired, the approximate cost would be $2,170,000. If extremely poor weather occurs during construction the costs could be higher.

As can be seen from above, each one of the groins would be considered a replacement and as such, a CAMA permit will be required, and these historically have been found difficult to obtain. The fact that this structure is "non-conforming" to existing CAMA rules, a replacement of this type would be inconsistent with existing rules. Additionally, hardened structures are not currently allowed in North Carolina, a permit for replacement, even in-kind, is very unlikely.

6.0 RECOMMENDATIONS

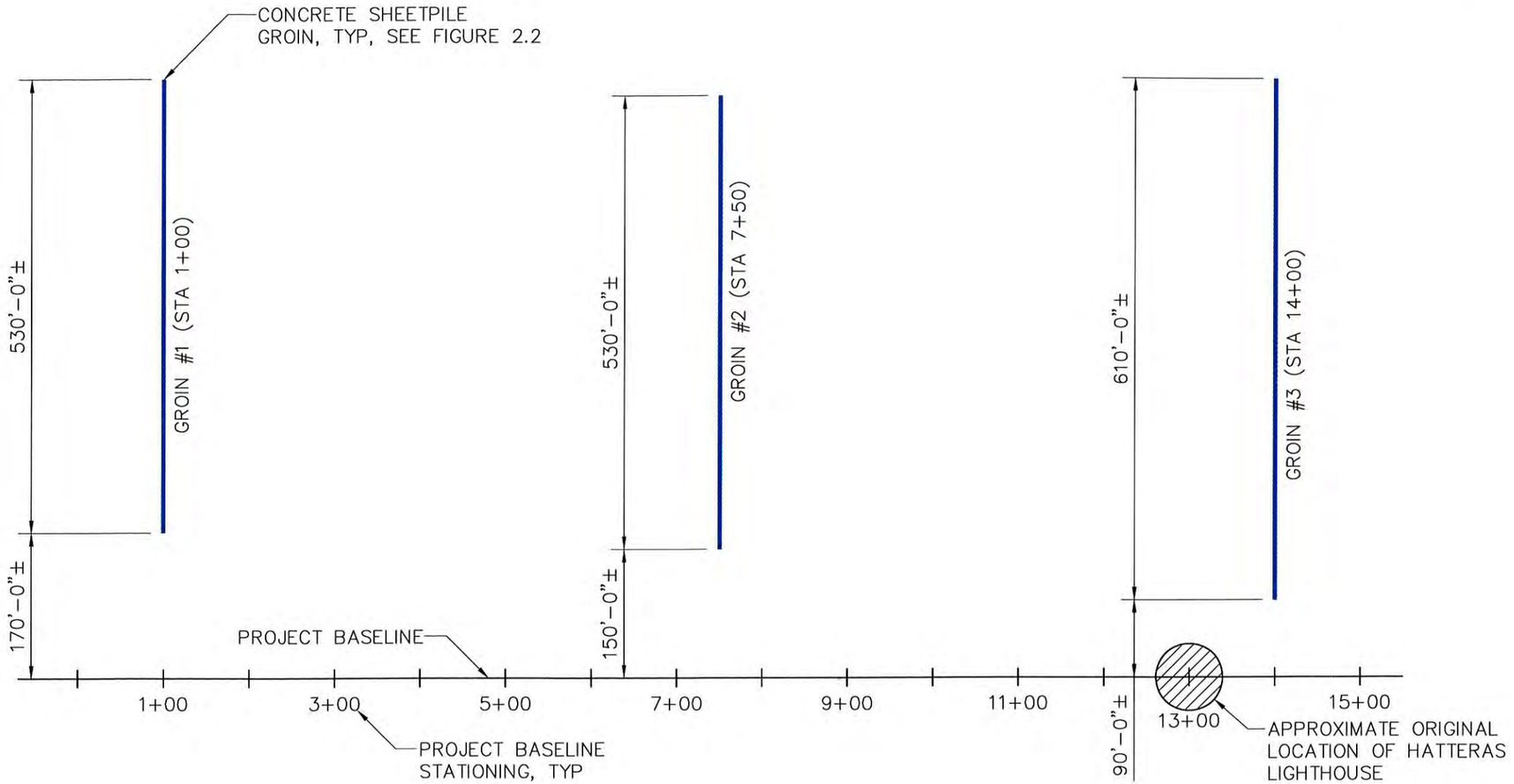
Our recommendation for the next step is to present this information to the DCM staff and verify the work completed to date, that a permit for replacement is not likely to be granted, and to determine what other types of shoreline protection alternatives may be allowed.

Another option to present to DCM staff is to rebuild the groins so that the value of the repairs is not over 50% of the present value of the existing usable groins remaining. M&N cannot determine at this time if this strategy will help the beach erosion at this area, or if it is currently allowed. Initial discussions with DCM staff have not been promising, as they have indicated that the structures must be replaced in-kind from a length and section standpoint. However, it appears if this strategy is allowed by DCM, that permits may not be required.

ATTACHMENT 3

Moffat and Nichol

2006 engineered drawings



NOTES:

1. APPROXIMATE GROIN LAYOUT BASED ON REFERENCE DRAWING IN APPENDIX E.
2. SEE REFERENCE DRAWINGS FOR SHEETPILE AND SHORELINE ELEVATIONS

LEGEND:

ORIGINAL GROIN CONSTRUCTION (1969)

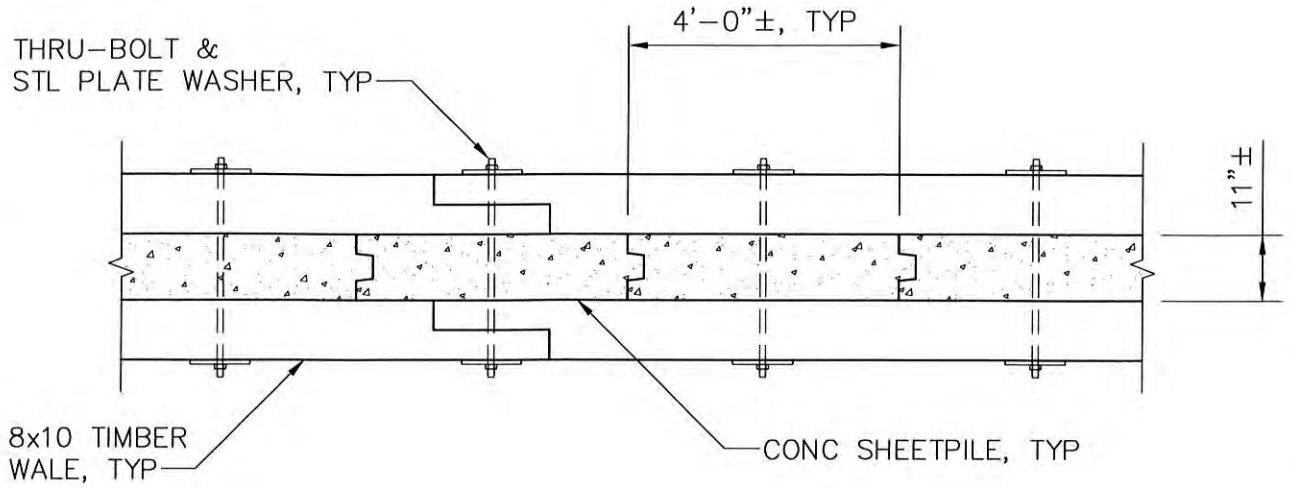
GROINS 1, 2 & 3 CONSTRUCTION (1969)

1"=150'-0"

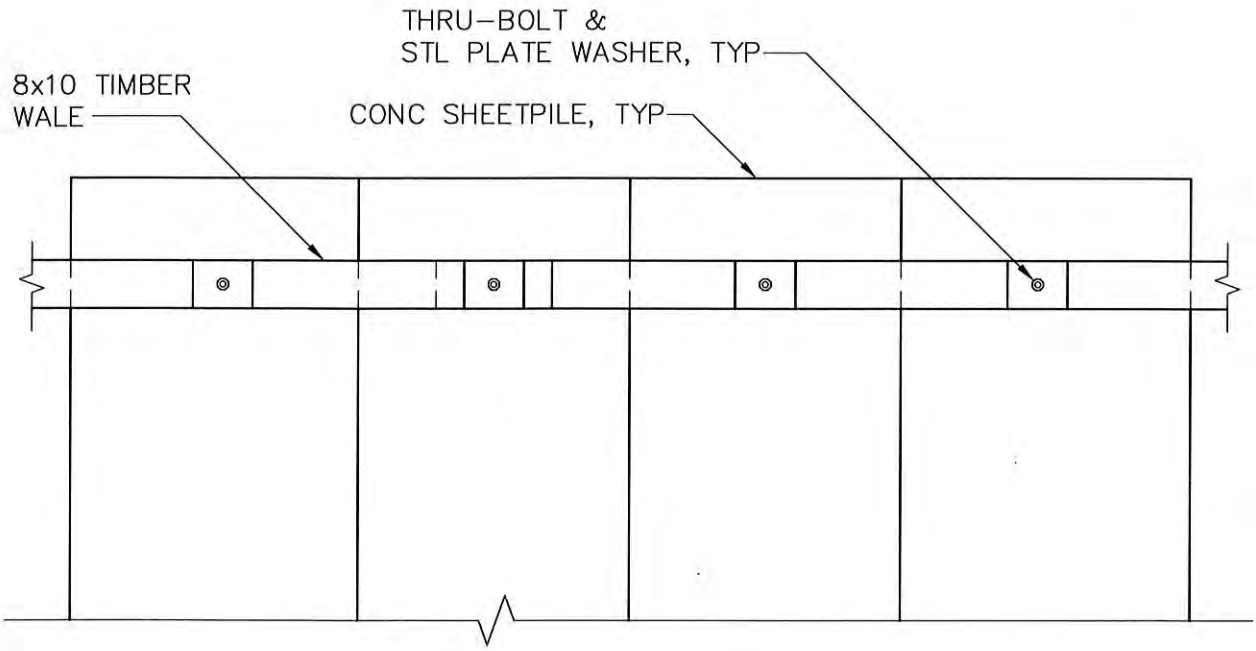
FIGURE 2.1

75' 0' 75' 150'
SCALE: 1"=150'

MOFFATT & NICHOL
1616 EAST MILLBROOK ROAD, SUITE 160
RALEIGH, NORTH CAROLINA, 27609
919-781-4626



PLAN



ELEVATION

NOTE:

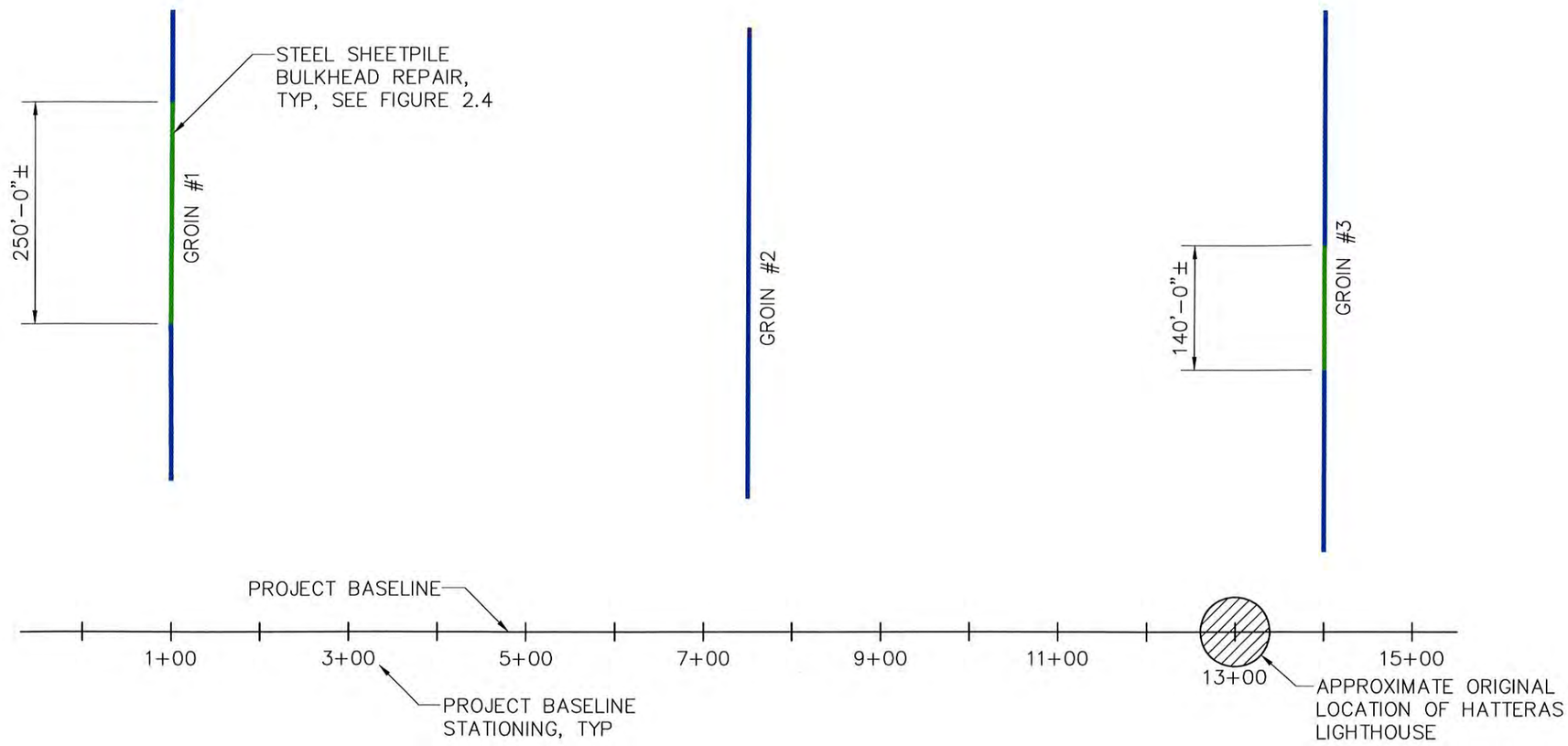
FOR ADDITIONAL INFORMATION NOT SHOWN, SEE REFERENCE DRAWINGS IN APPENDIX E.

FIGURE 2.2

ORIGINAL CONSTRUCTION

3/8"=1'-0"

MOFFATT & NICHOL
1616 EAST MILLBROOK ROAD, SUITE 160
RALEIGH, NORTH CAROLINA, 27609
919-781-4626



NOTES:

1. APPROXIMATE GROIN LAYOUT BASED ON REFERENCE DRAWING IN APPENDIX E.
2. SEE REFERENCE DRAWINGS FOR SHEETPILE AND SHORELINE ELEVATIONS

LEGEND:

- ORIGINAL GROIN CONSTRUCTION (1969)
- GROIN REPAIR (1975)

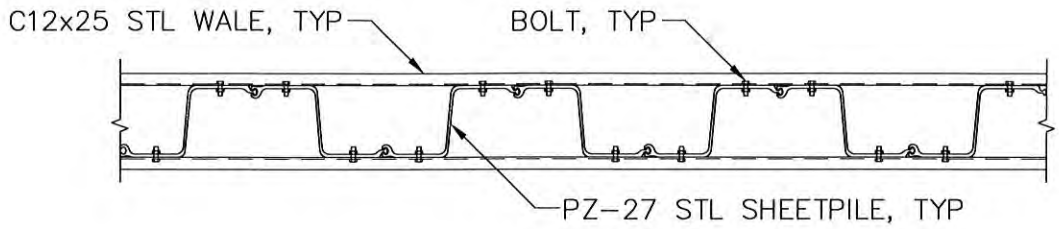
GROINS 1, 2 & 3 REPAIRS (1975)

1"=150'-0"

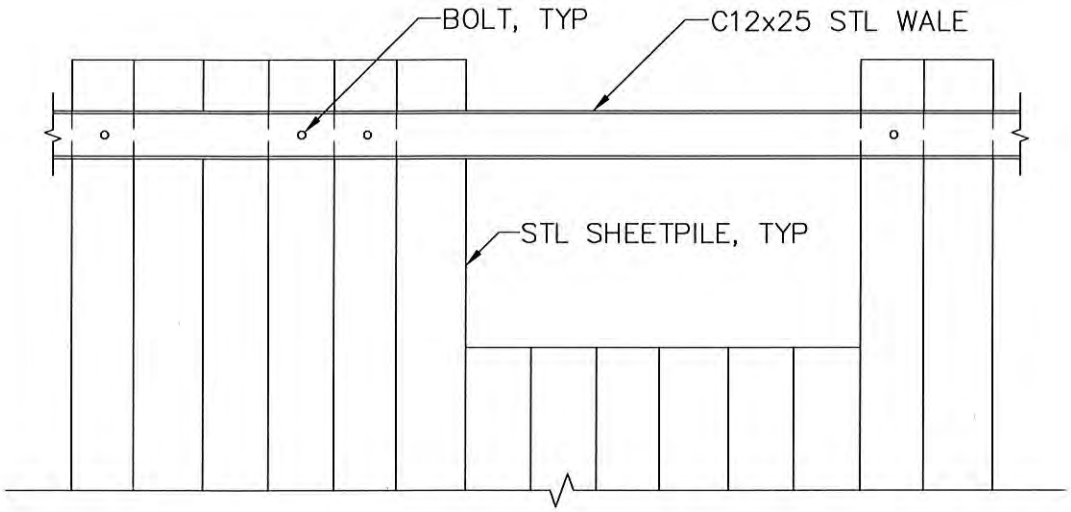
75' 0' 75' 150'
SCALE: 1"=150'

FIGURE 2.3

MOFFATT & NICHOL
1616 EAST MILLBROOK ROAD, SUITE 160
RALEIGH, NORTH CAROLINA, 27609
919-781-4626



PLAN



ELEVATION

NOTE:

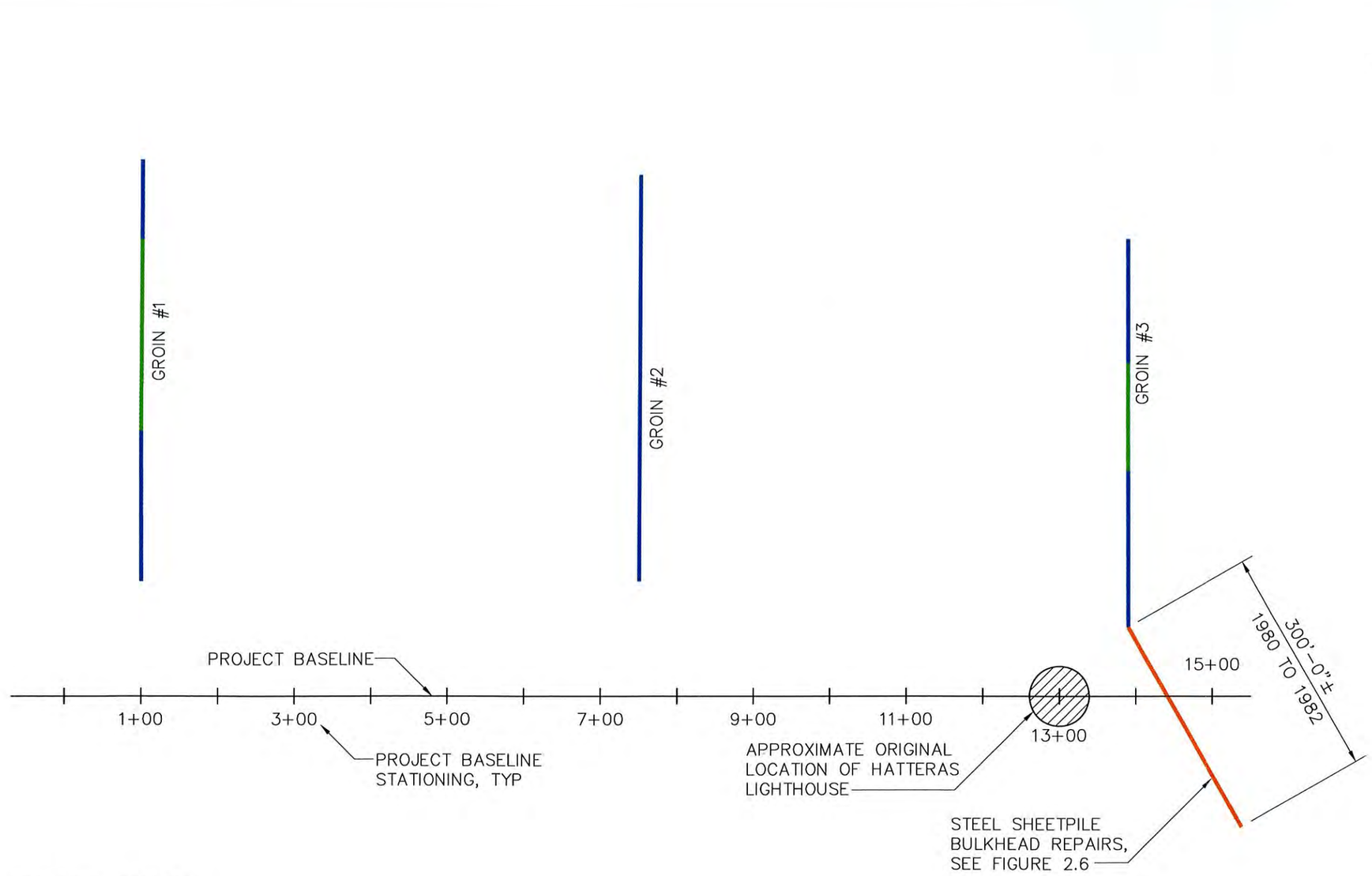
FOR ADDITIONAL INFORMATION NOT SHOWN, SEE REFERENCE DRAWINGS IN APPENDIX E.

FIGURE 2.4

GROIN REPAIRS (1975)

3/8"=1'-0"

MOFFATT & NICHOL
1616 EAST MILLBROOK ROAD, SUITE 160
RALEIGH, NORTH CAROLINA, 27609
919-781-4626



NOTES:

1. APPROXIMATE GROIN LAYOUT BASED ON REFERENCE DRAWING IN APPENDIX E.
2. SEE REFERENCE DRAWINGS FOR SHEETPILE AND SHORELINE ELEVATIONS

LEGEND:

- ORIGINAL GROIN CONSTRUCTION (1969)
- GROIN REPAIR (1975)
- GROIN REPAIR (1980 TO 1982)

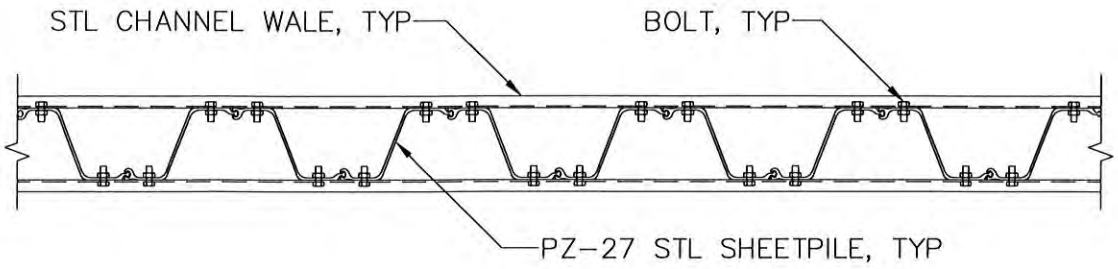
GROINS 1, 2 & 3 REPAIRS (1980 TO 1982)

1"=150'-0"

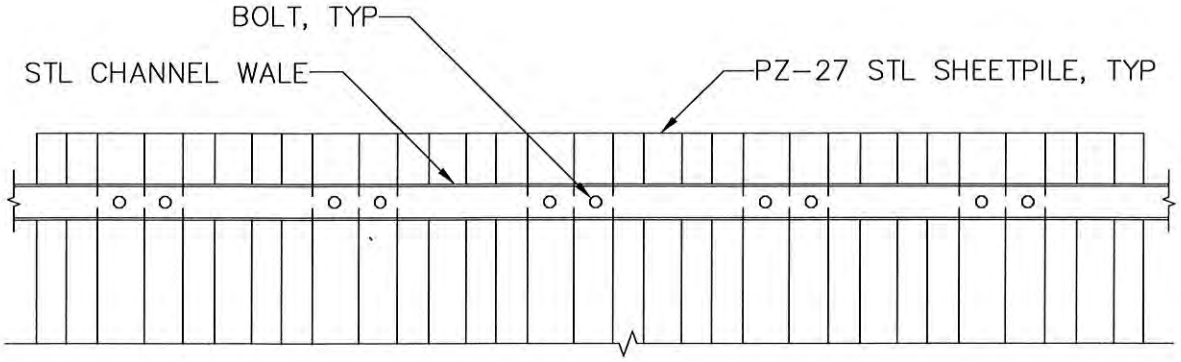
75' 0' 75' 150'
SCALE: 1"=150'

FIGURE 2.5

MOFFATT & NICHOL
1616 EAST MILLBROOK ROAD, SUITE 160
RALEIGH, NORTH CAROLINA, 27609
919-781-4626



PLAN



ELEVATION

NOTE:

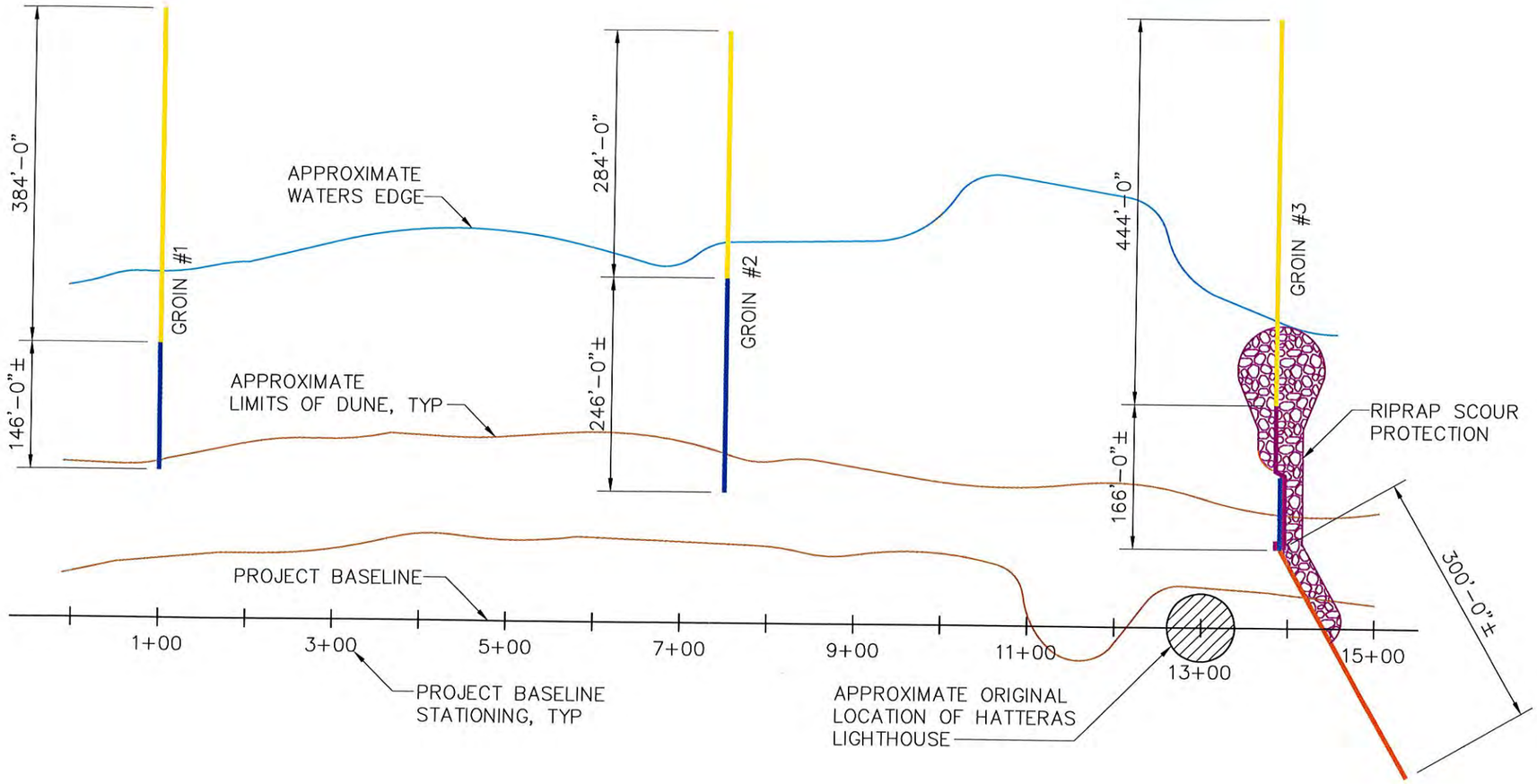
FOR ADDITIONAL INFORMATION NOT SHOWN, SEE REFERENCE DRAWINGS IN APPENDIX E.

FIGURE 2.6

GROIN REPAIRS (1980 TO 1992)

3/8"=1'-0"

MOFFATT & NICHOL
1616 EAST MILLBROOK ROAD, SUITE 160
RALEIGH, NORTH CAROLINA, 27609
919-781-4626



NOTES:

1. APPROXIMATE GROIN LAYOUT BASED ON REFERENCE DRAWING IN APPENDIX E.
2. SEE REFERENCE DRAWINGS FOR SHEETPILE AND SHORELINE ELEVATIONS

LEGEND:

- ORIGINAL GROIN CONSTRUCTION (1969)
- GROIN REPAIR (1980 TO 1982)
- GROIN REPAIR (1994)
- REQUIRED NEW GROIN

GROINS 1, 2 & 3 PROPOSED REPAIRS

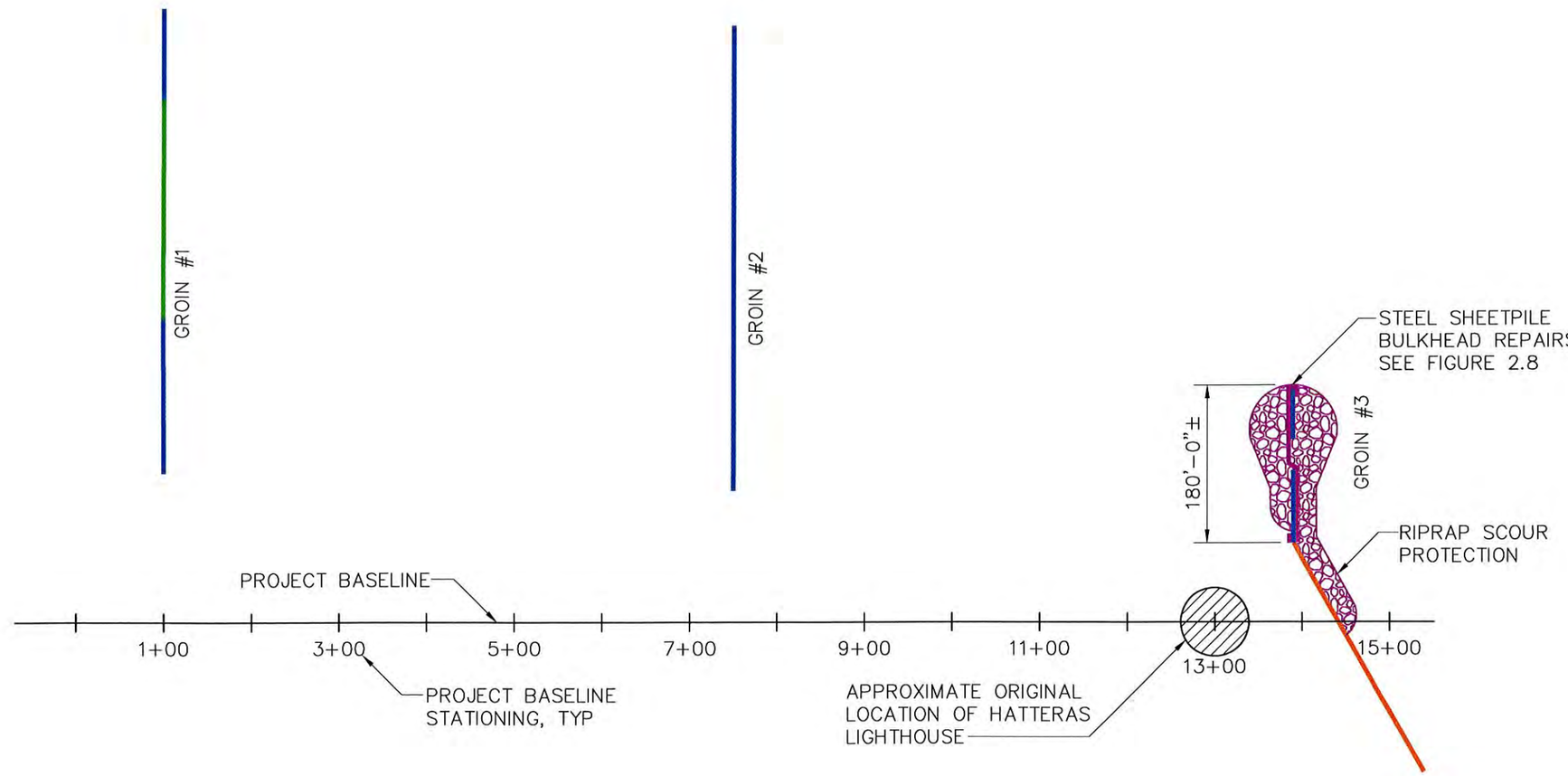
1"=150'-0"

75' 0' 75' 150'

SCALE: 1"=150'

FIGURE 2.9

MOFFATT & NICHOL
1616 EAST MILLBROOK ROAD, SUITE 160
RALEIGH, NORTH CAROLINA, 27609
919-781-4626



NOTES:

1. APPROXIMATE GROIN LAYOUT BASED ON REFERENCE DRAWING IN APPENDIX E.
2. SEE REFERENCE DRAWINGS FOR SHEETPILE AND SHORELINE ELEVATIONS

LEGEND:

- ORIGINAL GROIN CONSTRUCTION (1969)
- GROIN REPAIR (1975)
- GROIN REPAIR (1980 TO 1982)
- GROIN REPAIR (1994)

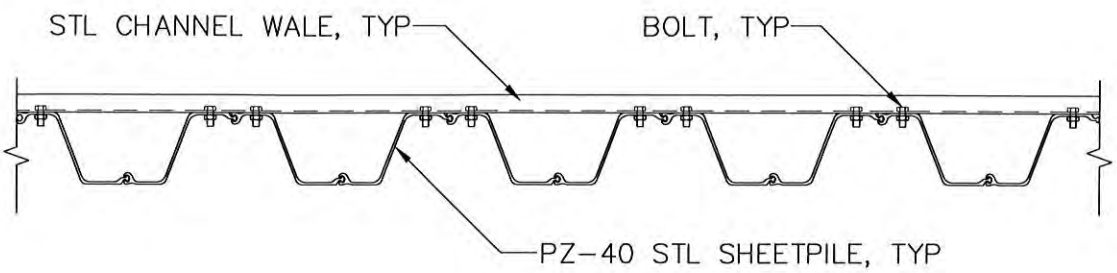
GROINS 1, 2 & 3 REPAIRS (1994)

1"=150'-0"

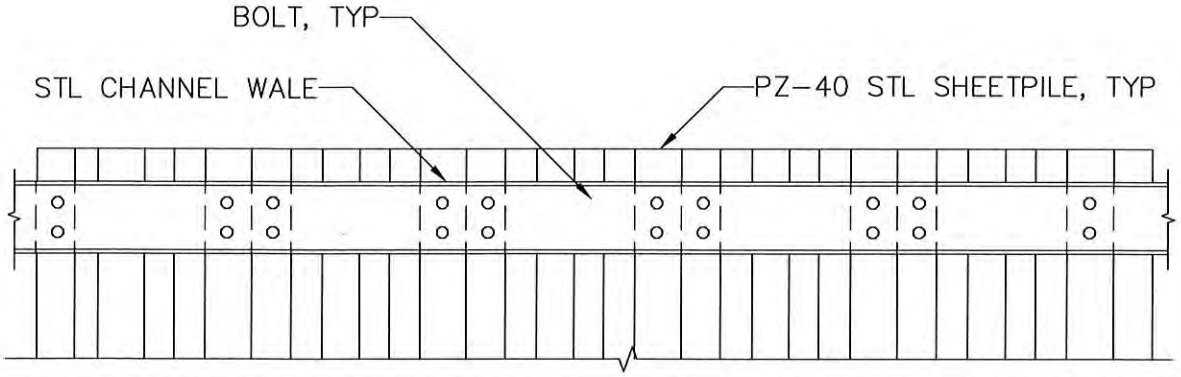
75' 0' 75' 150'
SCALE: 1"=150'

FIGURE 2.7

MOFFATT & NICHOL
1616 EAST MILLBROOK ROAD, SUITE 160
RALEIGH, NORTH CAROLINA, 27609
919-781-4626



PLAN



ELEVATION

NOTE:

FOR ADDITIONAL INFORMATION NOT SHOWN, SEE REFERENCE DRAWINGS IN APPENDIX E.

GROIN REPAIRS (1994)

3/8"=1'-0"

FIGURE 2.8

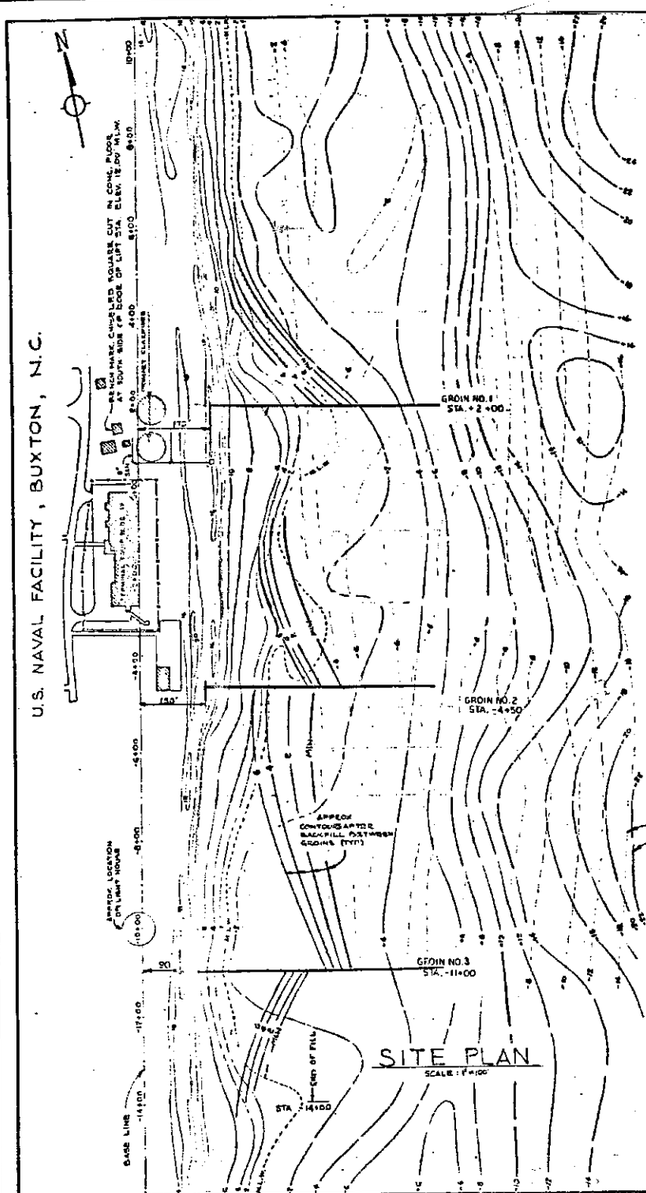
MOFFATT & NICHOL
1616 EAST MILLBROOK ROAD, SUITE 160
RALEIGH, NORTH CAROLINA, 27609
919-781-4626

ATTACHMENT 4

Original USN and USACE drawings

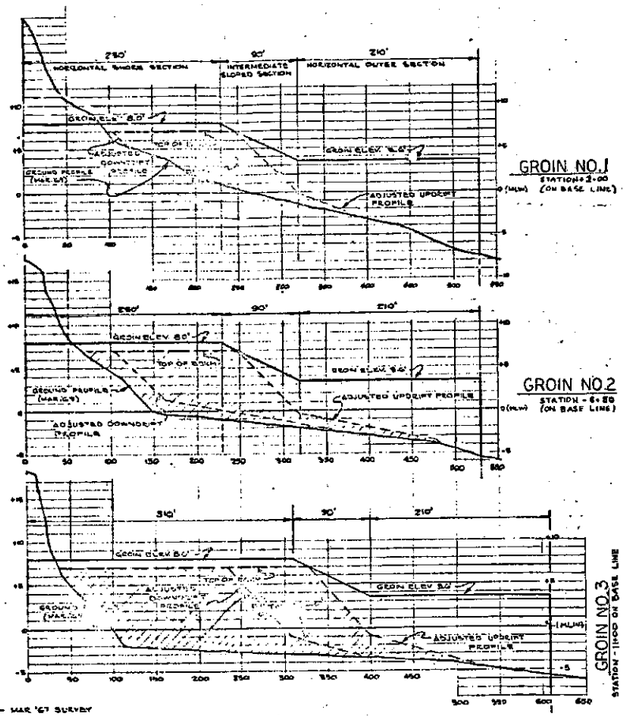
(1969, 1975, 1982, 1994)

U.S. NAVAL FACILITY, BUXTON, N.C.



SITE PLAN

SCALE : 1"=100'



PROFILES

SCALE : HORIZ. 1"=50' VERT. 1"=5'

FOR PILE PENETRATION SEE DRWG. NO. L-300,548.

NOTES

1. ALL ELEVATIONS SHOWN ARE IN FEET
2. CONTOUR INTERVAL = 2 FT
3. GROIN TYPE : IMPERVEABLE, FIXED, NORMAL TO THE SHORE (BASE LINE)
4. PLACEMENT OF FILL UPDRIFT OF EACH GROIN SHOULD BE CONSISTENT WITH GROIN CONSTRUCTION TO MINIMIZE EROSION OF THE SHORE IMMEDIATELY SOUTH OF THE GROIN SYSTEM.
5. SEA & SWELL — ANNUAL AVERAGE FOR SIGNIFICANT WAVES :

80.0 %	[illegible]	[illegible] FT.
18.5 %	[illegible]	[illegible] 12 FT. @

@ = FALLS WITHIN 1 ACCOUNT FOR 1.5 %

6. TIDES : MONTHLY 10.2 FT.
   - [illegible] 4.5
   - [illegible] 2.4
   - [illegible] 1.0
   - [illegible] 0.0
   - [illegible] -0.7

@ = ACCRETION [illegible] EROSION

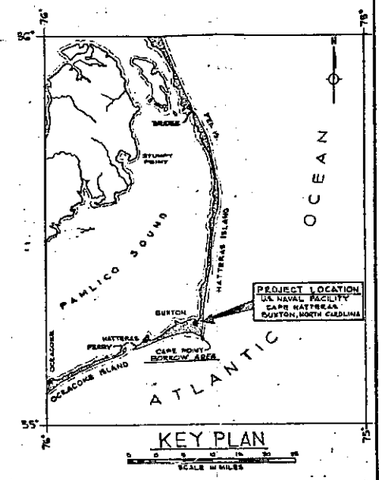
GRAPHIC SCALES

1"=5'

1"=50'

1"=100'

REVISIONS			
LTR	DESCRIPTION	DATE	APPROVED
C	REDRAWN; REVISED NOTES & RELOCATED GROINS	4-4-69	[illegible]



KEY PLAN

SCALE IN MILES

LEGEND

- CONTOUR LINE, BELOW MLW (MAR. '67 SURVEY)
- CONTOUR LINE, ABOVE MLW (MAR. '69 ")
- CONTOUR LINE, BELOW MLW (MAR. '69 ")
- CONTOUR LINE, MLW (MAR. '69 ")
- CONTOUR LINE, ADJUSTED MLW (THIS CONTRACT)
- EXIST. STRUCTURES
- EXIST. ROAD

NOTES (cont)

7. DUMPED OR DREDGED FILL BETWEEN GROINS CONSISTS OF SUITABLE COURSE-GRAINED SAND FROM CAPE POINT BORROW AREA, AS DETERMINED BY CIC, APPROX. 2.9 MILES FROM CONSTRUCTION AREA.
8. WIND — ON A YEARLY AVERAGE :

%	VELOCITY
66.5 %	4-27 KNOTS
30.0 %	LESS THAN 3 KNOTS
3.5 %	GREATER THAN 28 KNOTS

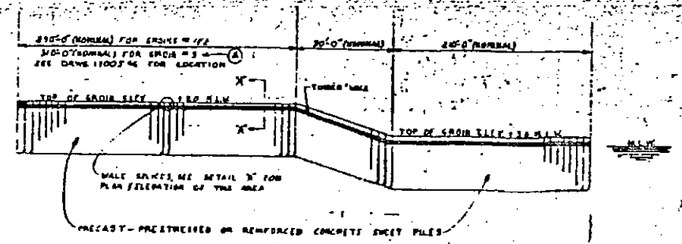
9. GROIN NO.3 SHALL BE BUILT FIRST IF GROINS ARE CONSTRUCTED ONE AT A TIME.
10. IN CONSTRUCTING GROIN NO.2 ALL CONSTRUCTION ACTIVITY & OPERATIONS SHALL TAKE PLACE ON THE SOUTH SIDE ONLY; SIMILARLY, FOR GROIN NO.1, NORTH SIDE ONLY.
11. IMMEDIATELY BEFORE THE INSTALLATION OF SHEET PILING FOR EACH GROIN, A PROFILE OF THE EXISTING GROUND SHALL BE TAKEN (AT 10' INTERVALS) FOR THE FULL LENGHT OF THE GROIN BY THE CONTRACTOR AND SUBMITTED TO THE OFFICER IN CHARGE. THE CONTRACTOR WILL BE ADVISED BY THE OFF. IN CHARGE AS TO HOW HE SHALL PROCEED BASED ON PROFILE INFORMATION.

DSGN L. METHVIN	DEPARTMENT OF THE NAVY	WASHINGTON, D. C.
DR. L. WATSON	NAVAL FACILITIES ENGINEERING COMMAND	
CHK. ID	U.S. NAVAL FACILITY	CAPE HATTERAS, N.C.
SPEC. NO.	BEACH PROTECTION	
EST. NO.	SITE PLAN & PROFILES	
DATE	SIZE: F / CODE IDENT. NO.: 80091 / NAVFAC DRAWING NO.: L-300,546	
APPROVED	CONSTR. CONTR. NO.	
DATE	SCALE AS SHOWN	

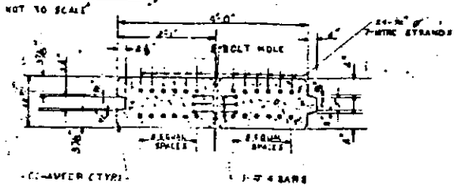
END DRAWING L-2495

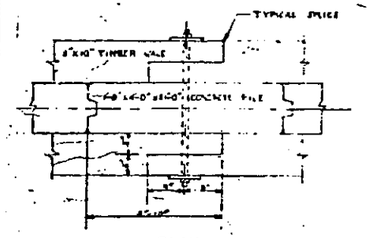
70-0815

Ⓒ	LENGTH OF BC SECTION OF GRO FROM #80' TO #10' AND ... OF DRAWINGS.
Ⓑ	ADDED CONTRACT NO. AND SPECIFICATION NO. ADDED NOTE TO SECT. A-A, & ALTERED NOTE A-A, & EPD DWG. NO.

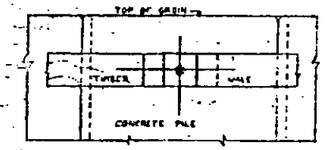


GROIN ELEVATION
NOT TO SCALE



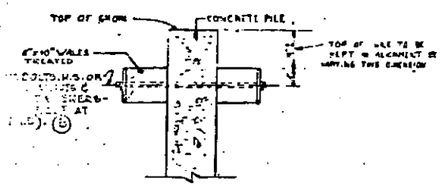


PLAN
SCALE: 1"=1'-0"

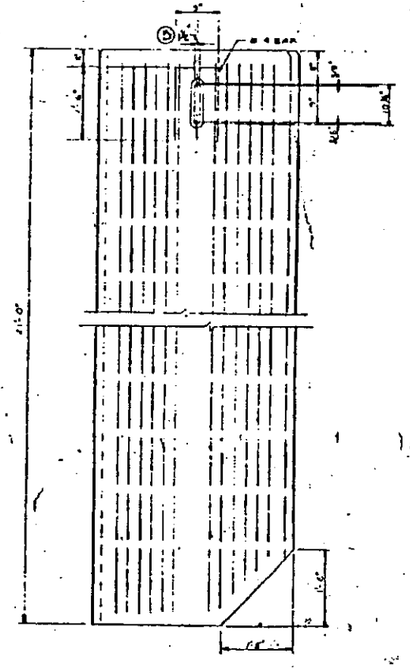


ELEVATION
SCALE: 1"=1'-0"

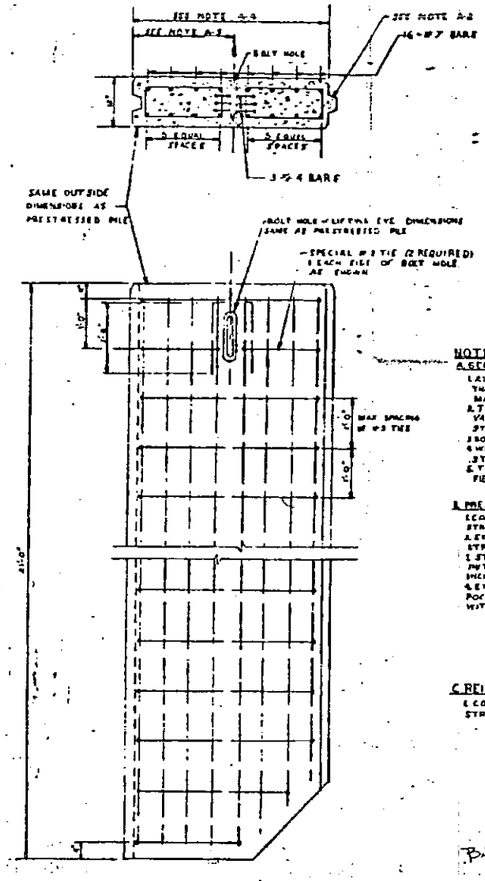
DETAIL "A"



SECTION A-A
SCALE: 1"=1'-0"



PRESTRESSED PILE
SCALE: 1"=1'-0"



REINFORCED PILE
SCALE: 1"=1'-0"

NOTES:

A. GENERAL:
1. ALL STEEL SHALL BE FABRICATED AND PLACED SO THAT A MINIMUM CONCRETE COVER OF 3 INCHES IS MAINTAINED.
2. TONGUE AND GROOVE DIMENSIONS SHOWN ARE VARIED TO CONFORM TO THE MANUFACTURER'S STANDARD.
3. BOTH TYPE CONCRETE PILES TO BE JETTED USED FOR WIDTH OF INDIVIDUAL PILES IS [illegible] SEE B
4. STEEL AREA PER UNIT LENGTH
5. THIS DIMENSION MAY BE VARIED FOR FIELD PLACEMENT. (SEE PLAN)

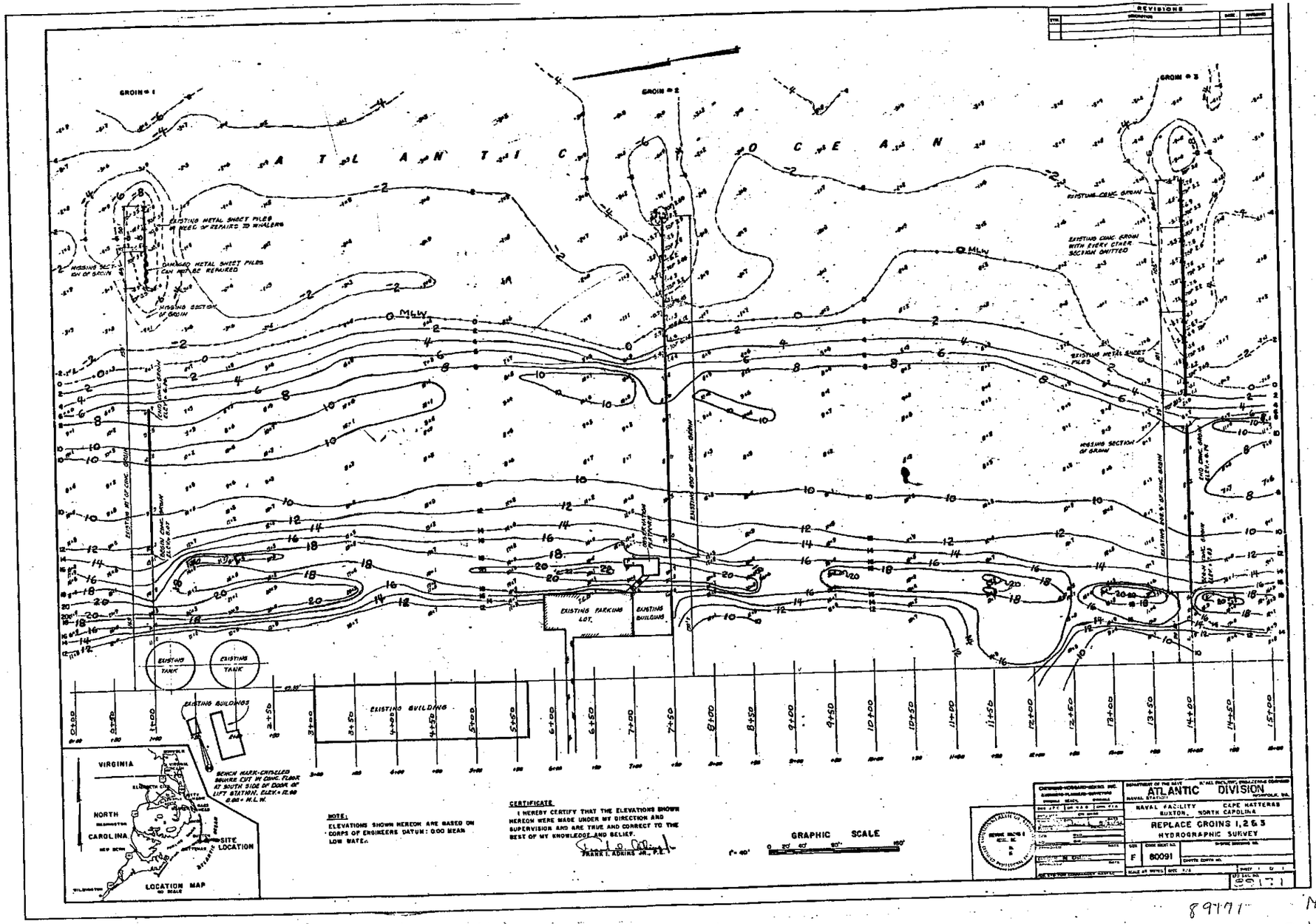
B. PRESTRESSED PILES
1. CONCRETE SHALL HAVE A MINIMUM COMPRESSIVE STRENGTH OF 6,000 POUNDS PER SQUARE INCH AT 28 DAYS
2. STEEL STRANDS SHALL [illegible]
STRENGTH OF 250,000 POUNDS PER SQUARE INCH
3. STEEL STRANDS SHALL BE STRESSED TO AN INITIAL UNIT STRESS OF 175,000 POUNDS PER SQUARE INCH
4. ENDS OF STRANDS SHALL BE TERMINATED IN GROUT POCKETS 8 INCHES DEEP. POCKETS SHALL BE GROUTED WITH EPOXY RESIN GROUT AFTER FABRICATION.

C. REINFORCED PILES
1. CONCRETE SHALL HAVE A MINIMUM COMPRESSIVE STRENGTH OF 6,000 POUNDS PER SQUARE INCH

Please Return To Code 04 File

Tracing of this drawing can be found, please file this.
Only Print Available.

70-0815



MAKE THIS LINE

THIS LONG

This is an increase factor of 1.65 in order to produce a map scale of 1" = 50 ft.

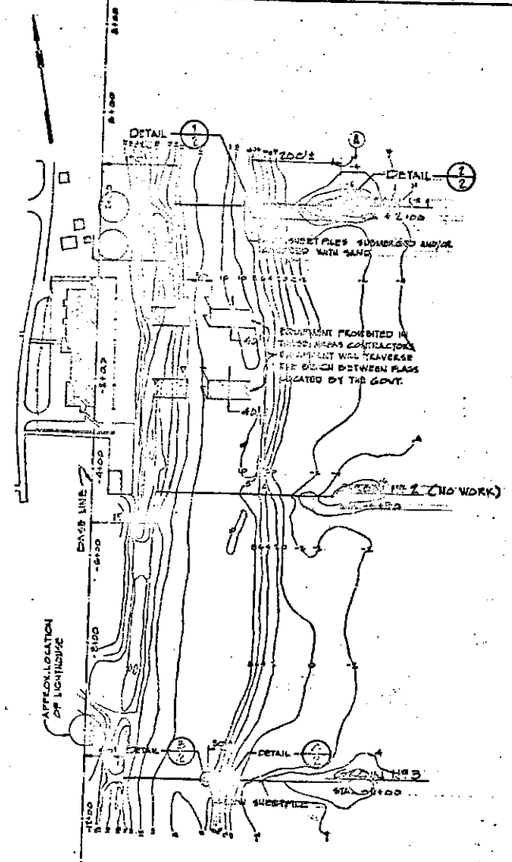
89991 N/A

Approx. Scale of This Reduction: 1:1000

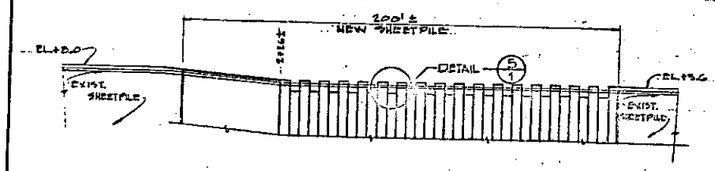
Actual Scale " " " 1" = 82.5'

" " " " " 1:990

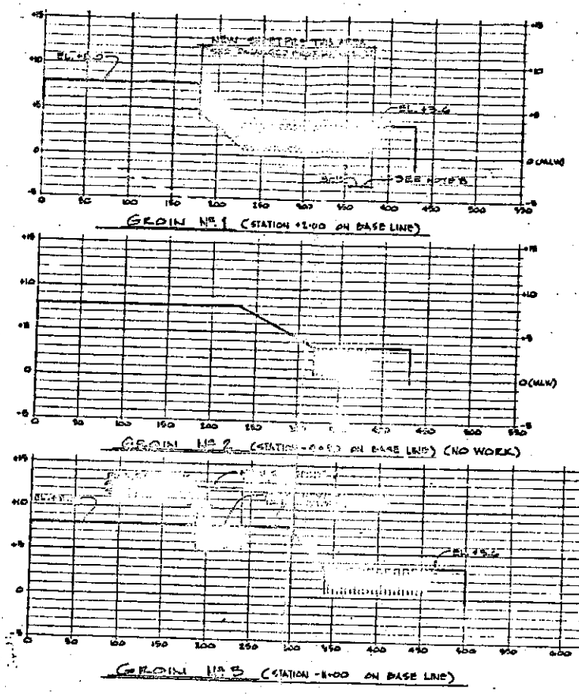
REVISIONS			
NO.	DESCRIPTION	DATE	APPROVED
1	ADDED CONTOUR ELEVATIONS	7/11/74	JFF



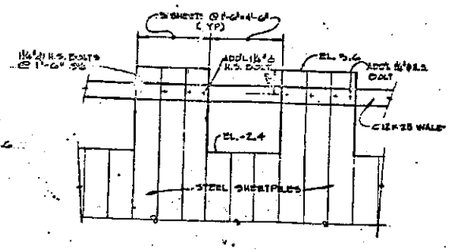
SITE PLAN
SCALE: 1"=100'



ENLARGED PROFILE OF NEW SHEETPILING GROIN No 3
SCALE 1"=20'

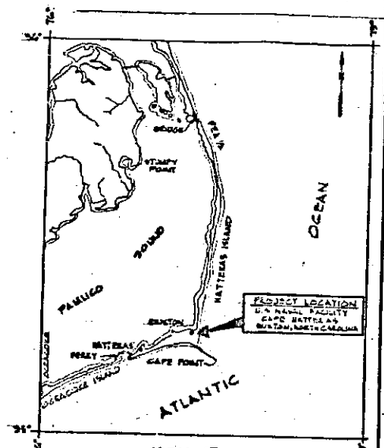


EXISTING PROFILES
SCALE: HORIZ. 1"=50' VERT: 1"=5'



DETAIL
SCALE ½"=1'-0"

GRAPHIC SCALES
1"=6'-0"
1"=20'
1"=100'



KEY PLAN
SCALE IN MILES

GENERAL NOTES:

1. ALL ELEVATIONS ARE SHOWN IN FEET.
2. CONTOUR INTERVAL = 2 FT. CONTOURS ARE BASED ON A SURVEY COMPLETED IN APRIL, 1974.
3. SEA & SWELL - AVERAGE FOR SIGNIFICANT WAVES:

%	HEIGHT
94.9	LESS THAN 8 FT.
1.4	GREATER THAN 10FT*

*FALL & WINTER ACCOUNT FOR 4.5%

4. TIDES:

HIGHEST	10.9 FT**
SPRING RANGE	4.3
MHW	3.6
MEAN TIDE LEVEL	1.8
MLW	0.0
LOWEST	-2.0

**-ASTRONOMICAL + STORM SURGE

5. WIND - (YEARLY AVERAGE)

%	VELOCITY
86.5	4-27 KNOTS
9.0	LESS THAN 5 KNOTS
3.5	GREATER THAN 27 KNOTS

6. IMMEDIATELY BEFORE THE INSTALLATION OF SHEET PILING FOR GROIN #1 A PROFILE OF THE EXISTING GROUND SHALL BE TAKEN @ 10' INTERVALS ⊥ TO THE FULL LENGTH OF THE REPAIR BY THE CONTRACTOR & SUBMITTED TO THE OICC. THE CONTRACTOR WILL BE ADVISED BY THE OICC AS TO HOW HE SHALL PROCEED BASED ON PROFILE INFORMATION.
7. ALL NEW SHEETPILE TO BE Z27 OR EQUIV. SECTION 30' LONG, DRIVEN SHEET PILE EXPOSED AT LOW TIDE. CONTRACTOR SHALL HOME BACK SHEETS THAT INTERFERE WITH THE DRIVING OF NEW SHEETS. AT HIS OPTION, THE CONTRACTOR MAY REMOVE THESE SHEETS.

RECORD DRAWING
LETTER DATED 1 NOV 74
NO MARKED AS-BUILT PRINTS AVAILABLE

DEPARTMENT OF THE NAVY — NAVAL FACILITIES ENGINEERING COMMAND
ATLANTIC DIVISION
NAVAL BASE, NORFOLK, VA.
CONTRACT NO. 11 — CAPE HATTERAS, BUXTON, N.C.

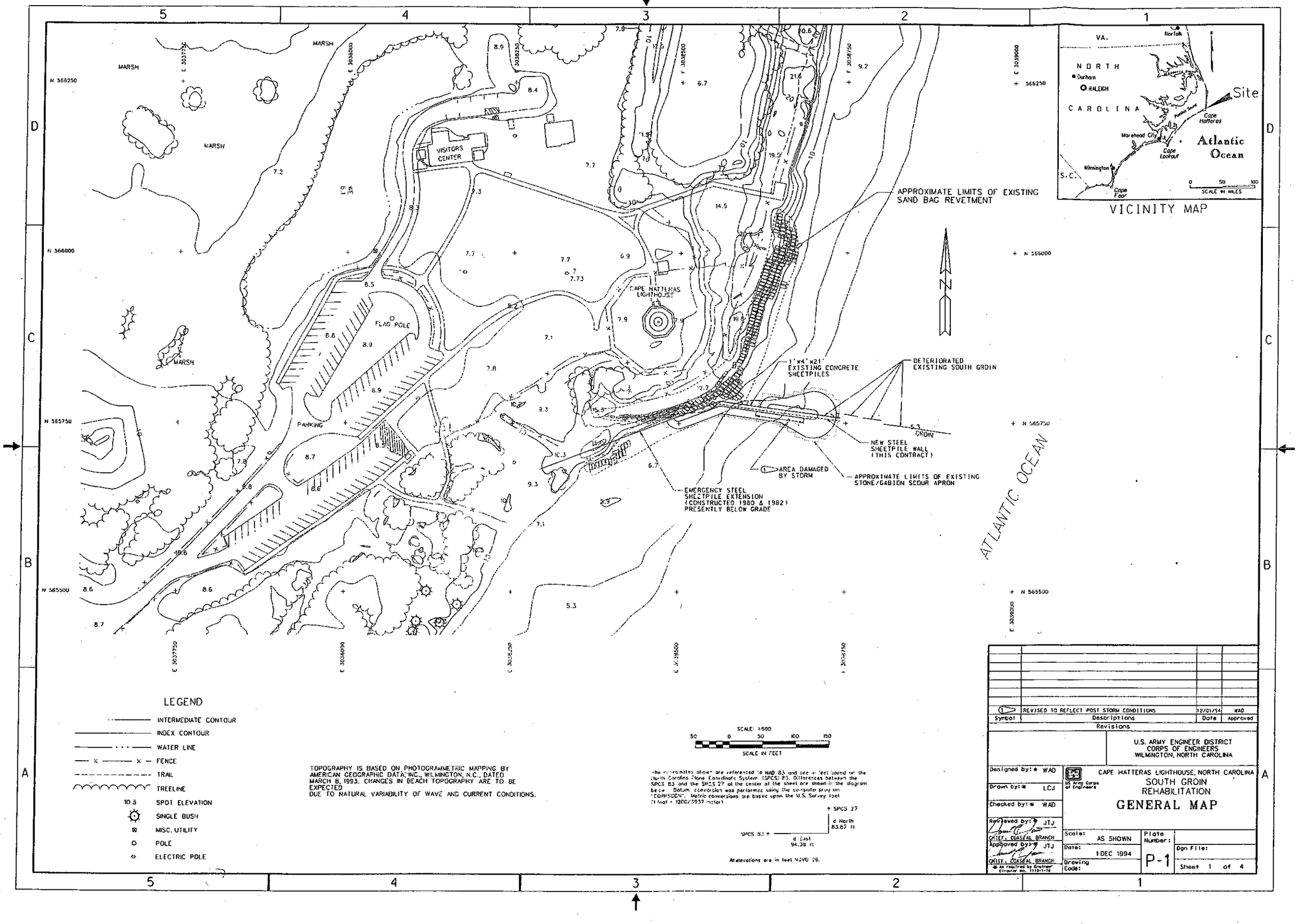
REPAIR GROINS
DETAILS
STRUCTURAL

SIZE	IDENT. NO.	SHEET
F	80091	32

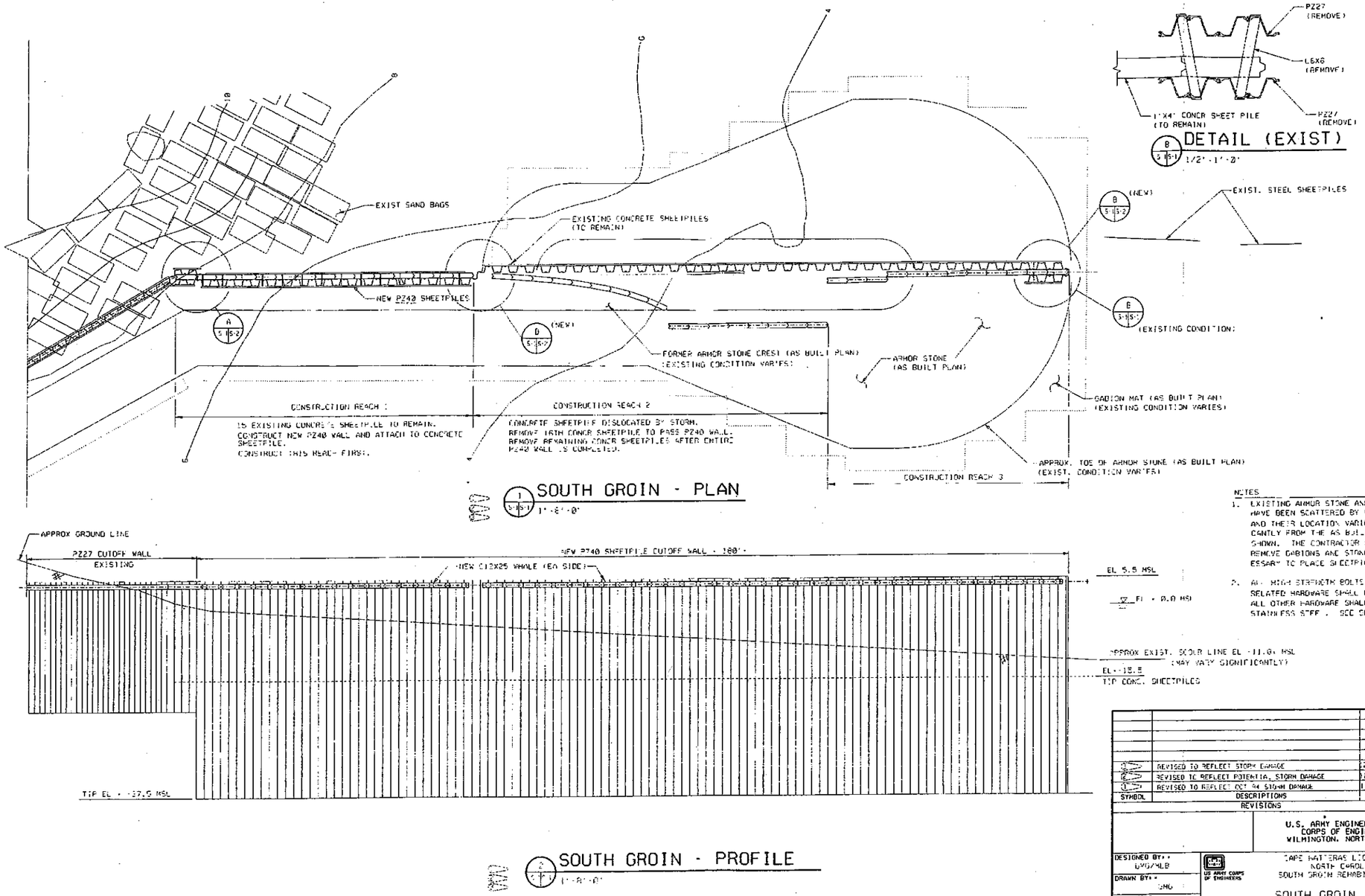
SCALE AS NOTED — DATE 10-74 — 115-1500

74-1390

115452



AS TRANSMITTED TO NPS 12/2/94



NOTES

1. EXISTING ARMOR STONE AND GABIONS HAVE BEEN SCATTERED BY WAVE ACTION AND THEIR LOCATION VARIES SIGNIFICANTLY FROM THE AS BUILT OUTLINES SHOWN. THE CONTRACTOR SHALL REMOVE GABIONS AND STONE AS NECESSARY TO PLACE SHEETPILES.
2. ALL HIGH STRENGTH BOLTS AND RELATED HARDWARE SHALL BE GALVANIZED. ALL OTHER HARDWARE SHALL BE TYPE 316 STAINLESS STEEL. SEE SPECIFICATIONS.

SYMBOL	DESCRIPTIONS	DATE	APPROVED
	REVISIONS		
3	REVISED TO REFLECT STORM DAMAGE	02/21/95	GMG
2	REVISED TO REFLECT POTENTIAL STORM DAMAGE	01/21/95	GMG
1	REVISED TO REFLECT OCT 94 STORM DAMAGE	11/7/94	GMG

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
WILMINGTON, NORTH CAROLINA

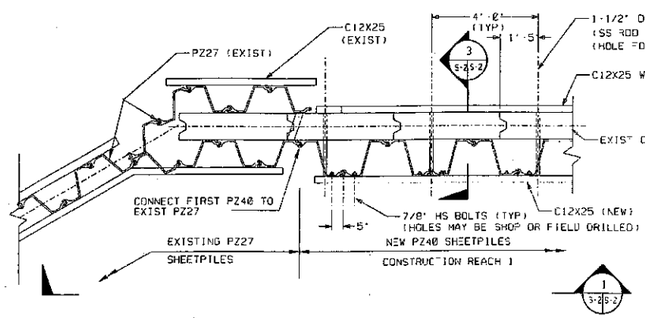
DESIGNED BY: DWD/MLB
DRAWN BY: GMG
CHECKED BY: JBF
REVIEWED BY: P.E. CHIEF, TECHNICAL SECTION
APPROVED BY: P.E. CHIEF, DESIGN BRANCH
* AS REQUIRED BY ENGINEER CIRCULAR NO. 1110-1-15

US ARMY CORPS OF ENGINEERS

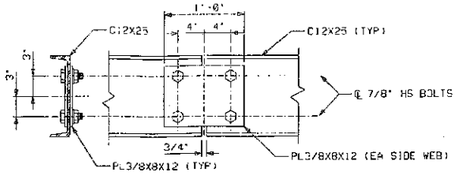
CAPE HATTERAS LIGHTHOUSE
NORTH CAROLINA
SOUTH GROIN REHABILITATION

SOUTH GROIN
PLAN & ELEVATION

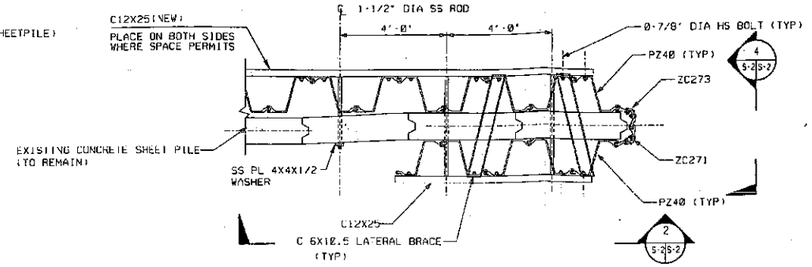
SCALE:
DATE: DEC 94
PLATE NUMBER: S-1
DRAWING CODE: CHL-HSGRO-101
SHEET 3 OF 4



A 5-15-2 **DETAIL**
1/2"=1'-0"

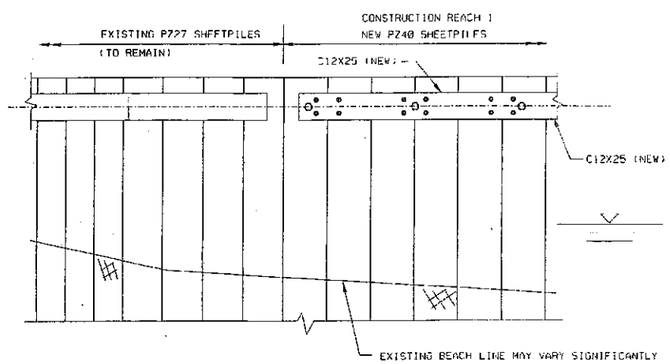


C 5-25-2 **CHANNEL SPLICE DETAIL**
1-1/2"=1'-0"

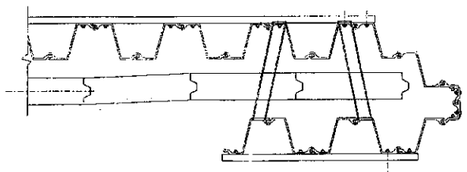


B 5-15-2 **END DETAIL (NEW)**
1/2"=1'-0"

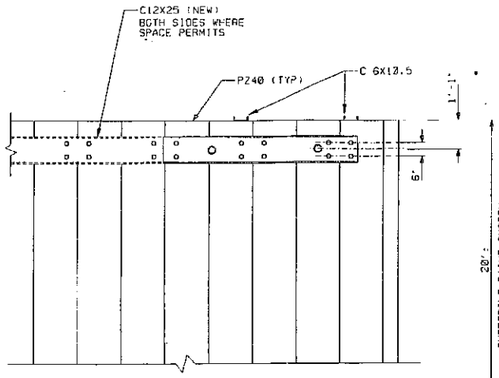
NOTE: EXIST PZ27 NOT SHOWN. REMOVE EXIST PZ27 (8 PILES)



1 5-25-2 **VIEW**
1/2"=1'-0"

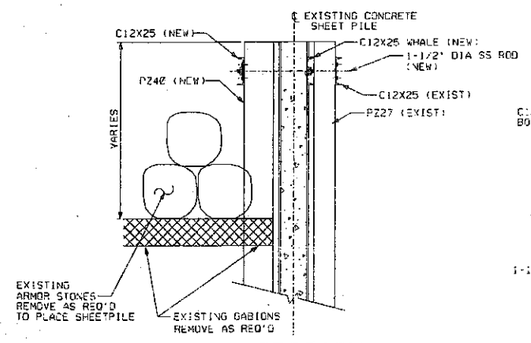


B 5-15-2 **OPTIONAL END DETAIL (NEW)**
1/2"=1'-0"

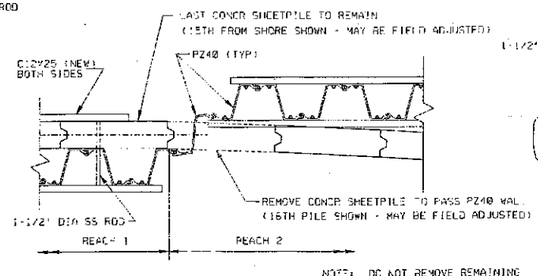


2 5-25-2 **VIEW**
1/2"=1'-0"

NOTE: STEEL PILES THAT ARE INSTALLED WITH THE PAINTED END DOWN DUE TO CHANGES NECESSITATED BY CHANGES IN FIELD CONDITIONS, SHALL BE FIELD PAINTED WITH THE SAME PAINT SYSTEM REQUIRED BY THE SPECIFICATIONS.

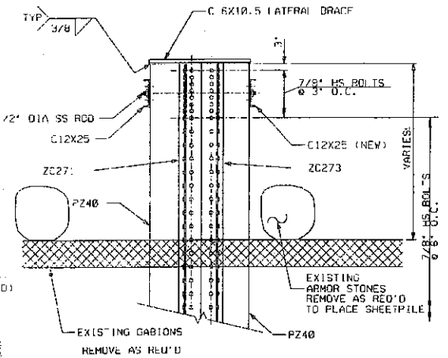


3 5-25-2 **SECTION**
1/2"=1'-0"



D **DETAIL**
1/2"=1'-0"

NOTE: DO NOT REMOVE REMAINING CONCRETE SHEETPILES UNTIL PZ40 WALL IS COMPLETED. CONTRACTOR SHALL PLACE TEMPORARY SHEETPILE CUTOFF WALL TO PREVENT WASHOUT PRIOR TO REMOVING ANY CONC PILE.



4 5-25-2 **END VIEW**
1/2"=1'-0"

SYMBOL	DESCRIPTIONS	DATE	APPROVED
	REVISIONS		
2	REVISED TO REFLECT STORM DAMAGE	12/21/94	GMG
1	REVISED TO REFLECT POTENTIAL STORM DAMAGE	11/21/94	GMG
0	REVISED TO REFLECT OCT 94 STORM DAMAGE	11/2/94	GMG

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
WILMINGTON, NORTH CAROLINA

DESIGNED BY: GMG/MLB
DRAWN BY: GMG
CHECKED BY: JBW
REVIEWED BY: [signature] P.E. CHIEF, STRUCTURES SECTION
APPROVED BY: [signature] P.E. CHIEF, DESIGN BRANCH
* AS REQUIRED BY ENGINEER CIRCULAR NO. 1110-1-70

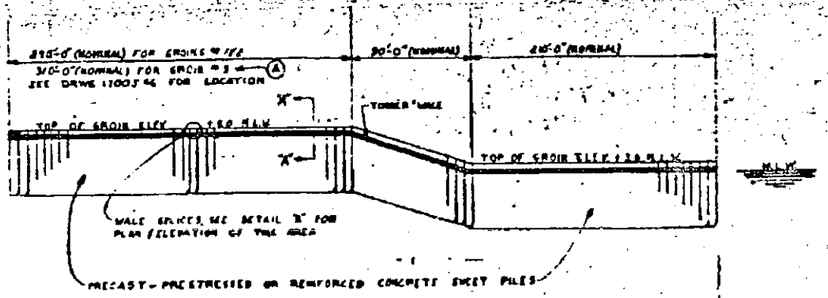
US ARMY CORPS OF ENGINEERS

CAPE HATTERAS LIGHTHOUSE
NORTH CAROLINA
SOUTH GROIN REHABILITATION

SOUTH GROIN
PLAN & ELEVATION
DETAILS

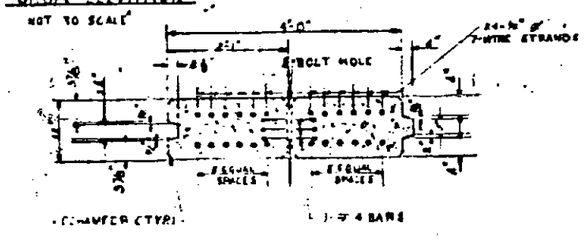
SCALE:
DATE: 1 DEC 94
DRAWING CODE: CHLH3MOD.DGN
PLATE NUMBER: S-2
SHEET 4 OF 4

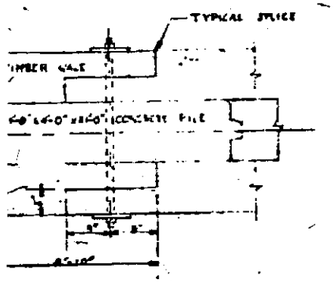
(a)	LENGTH OF RE… SECTION OF GR… FROM 260' TO 310' AND … OF DRAWING.
(b)	ADDED CONTRACT NO. AND SPECIFICATION NO.-ADDED NOTE TO SECT. A-A & ALTERED NOTE A-B & EFD DWG. NO. — 5/69



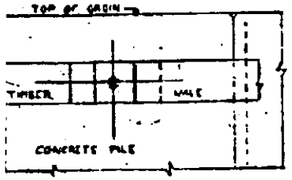
GROIN ELEVATION

NOT TO SCALE



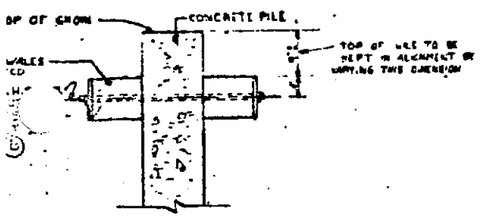


PLAN

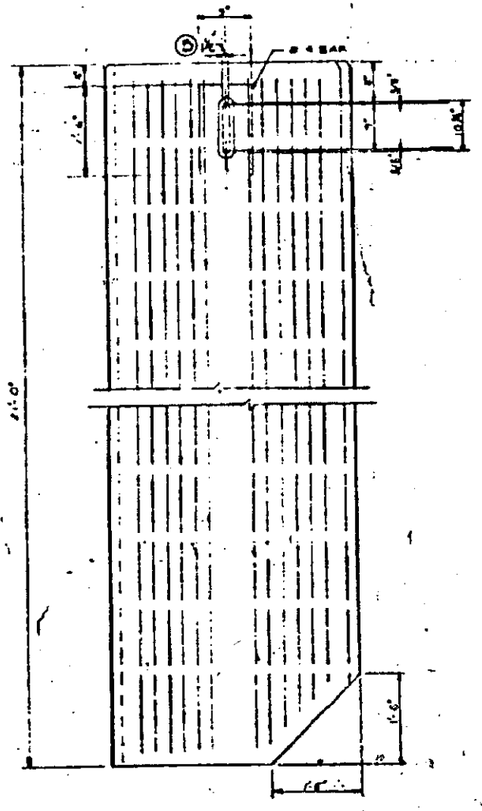


ELEVATION

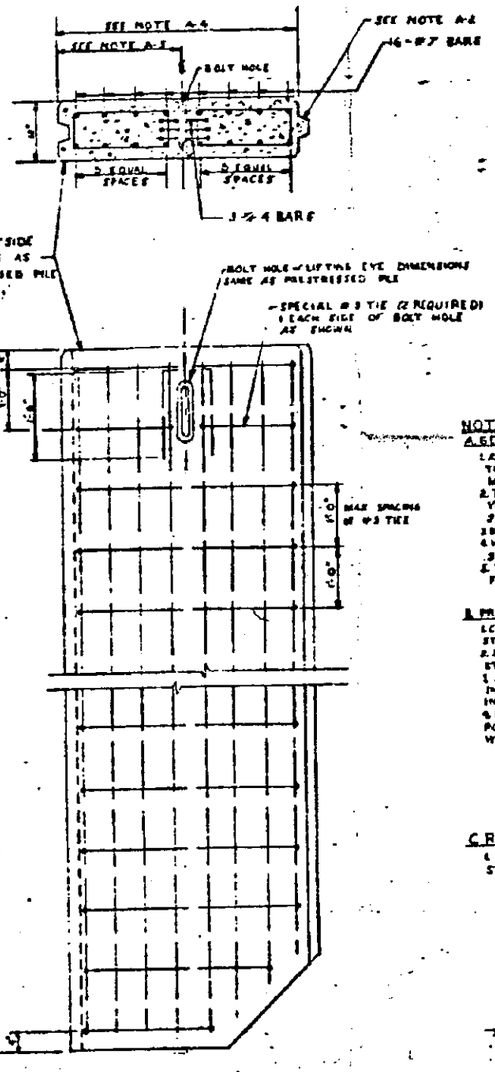
DETAIL "A"



SECTION A-A



PRESTRESSED PILE



REINFORCED PILE

NOTES:

A GENERAL:

1 ALL STEEL SHALL BE FABRICATED AND PLACED SO THAT A MINIMUM CONCRETE COVER OF 3 INCHES IS MAINTAINED.

2 TONGUE AND GROOVE DIMENSIONS SHOWN MAY BE VARIED TO CONFORM TO PILE MANUFACTURER'S STANDARD.

3 BOTH TYPE CONCRETE PILES TO BE JETTED INTO PLACE

4 WIDTH OF INDIVIDUAL PILES [illegible] SEE PLAN

5 STEEL AREA PER UNIT WIDTH [illegible]

6 THIS DIMENSION MAY BE VARIED IN THE FIELD PLACEMENT. (SEE PLAN) [illegible]

B PRESTRESSED PILES

1 CONCRETE SHALL HAVE A MINIMUM COMPRESSIVE STRENGTH OF 4000 POUNDS PER SQUARE INCH AT 28 DAYS

2 STEEL STRANDS SHALL BE [illegible] WITH A MINIMUM STRENGTH OF 250,000 POUNDS PER SQUARE INCH

3 STEEL STRANDS SHALL BE TENSIONED TO AN INITIAL UNIT STRESS OF 175,000 POUNDS PER SQUARE INCH

4 ENDS OF STRANDS SHALL BE TERMINATED IN GROUT POCKETS 3 INCHES DEEP. POCKETS SHALL BE GROUTED WITH EPOXY RESIN GROUT AFTER FABRICATION.

C REINFORCED PILES

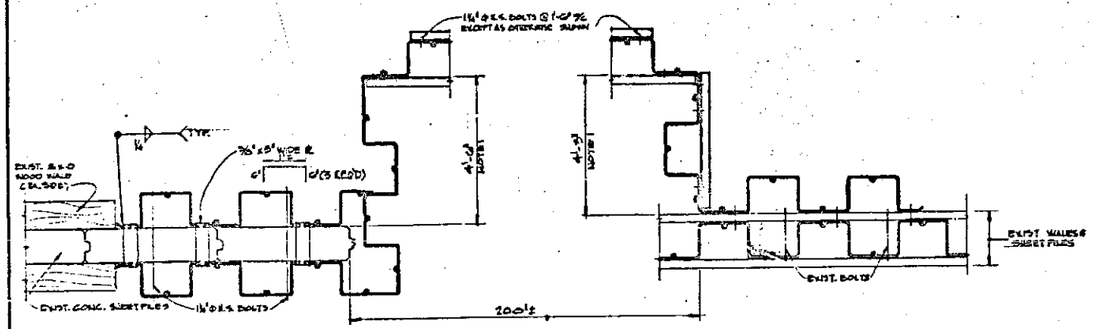
1 CONCRETE SHALL HAVE A MINIMUM COMPRESSIVE STRENGTH OF 4000 POUNDS PER SQ[illegible]

Please Return To Code 04 File

Note To Fi[illegible]

Tracing of this dwg can't be found, please file this. Only Print Available.

Bldgs in Col 2 [illegible]



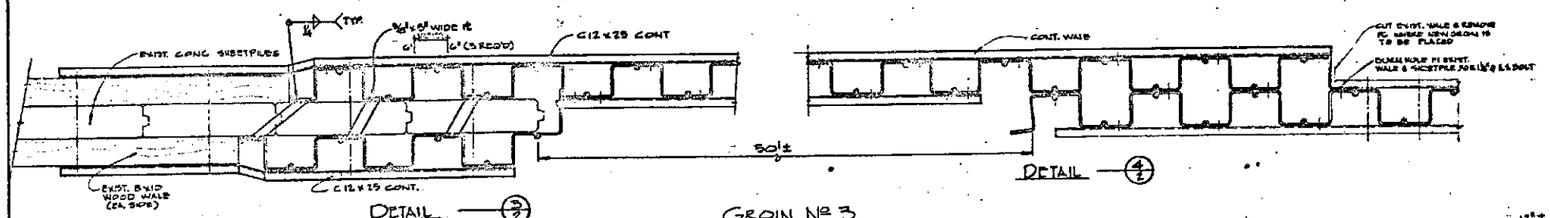
DETAIL ½

DETAIL ½

GROIN Nº 1

SCALE: ¾"=1'-0"

NOTE(S): ELEV. TOP OF SHEET TO MATCH EXIST

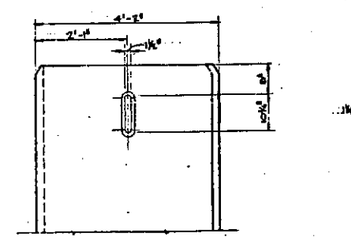


DETAIL ¾

DETAIL ¼

GROIN Nº 3

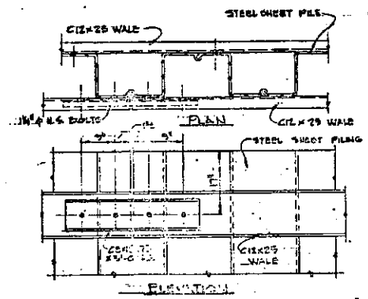
SCALE: ¾"=1'-0"



CONCRETE SHEET PILE ELEVATION

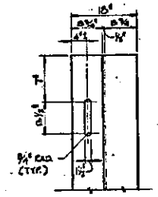
SCALE: ¾"=1'-0"

(REFERENCE ONLY)



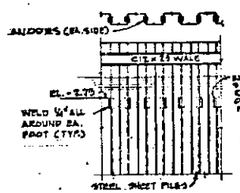
TYPICAL WALE SPLICE DETAIL

SCALE: ¾"=1'-0"



TYPICAL STEEL SHEET PILE

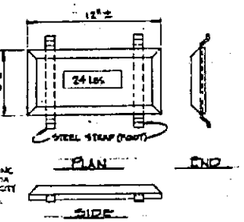
SCALE: ¾"=1'-0"



TYPICAL INSTALLATION DETAIL

NO SCALE

Note:
ANODES SHALL BE ZINC (GALVINA) OR ALUMINUM WITH EQUIVALENT CAPACITY



TYPICAL ANODE DETAIL

NO SCALE

SACRIFICIAL ANODES

GRAPHIC SCALES

1"=1'-0"

½"=1'-0"

RECORD DRAWING
LETTER DATED 11 SEP 87

NO MARKED AS BUILT PRINTS AVAILABLE

DEPARTMENT OF THE NAVY NAVAL FACILITIES ENGINEERING COMMAND
ATLANTIC DIVISION
NAVAL STATION NORFOLK, VA.
U.S. NAVAL FACILITY CAPE HATTERAS, BUXTON, N.C.

REPAIR GROINS
PLANS & PROFILES
STEEL TYPE

DES	DRAWING NO.	SHEET NO.
F	80091	4D1-53

SCALE: AS SHOWN DATE: 09-74-1390 SHT. 4 OF 6

74-1390

115453

ATTACHMENT 5

Code 15A NCAC 07J .0210

‘REPLACEMENT

OF

EXISTING STRUCTURES’

15A NCAC 07J .0210 REPLACEMENT OF EXISTING STRUCTURES

Replacement of structures damaged or destroyed by natural elements, fire or normal deterioration is considered development and requires CAMA permits. Replacement of structures shall be permitted if the replacement is consistent with current CRC rules. Repair of structures damaged by natural elements, fire or normal deterioration is not considered development and shall not require CAMA permits. The CRC shall use the following criteria to determine whether proposed work is considered repair or replacement.

(1) NON-WATER DEPENDENT STRUCTURES. Proposed work is considered replacement if the Department determines that the cost to do the work exceeds 50 percent of the market value of an existing structure either prior to a catastrophic event such as a fire or hurricane or if there is no catastrophic event, at the time of the request market value and costs are determined as follows:

(a) The market value of the structure shall be determined by the Division based on information provided by the applicant that is no more than one year old as of the date the request is made. The market value of the structure shall not include the value of the land or value resulting from the location of the property, the value of accessory structures, or the value of other improvements located on the property. The information provided by the applicant may include any of the following:

(i) an appraisal;

(ii) the replacement cost with depreciation for age of the structure and quality of construction; or

(iii) the tax assessed value.

(b) The cost to do the work is the cost to return the structure to its pre-damaged condition, using labor and materials obtained at market prices, regardless of the actual cost incurred by the owner to restore the structure. It shall include the costs of construction necessary to comply with local and state building codes. The cost shall be determined by the Division utilizing any or all of the following provided by the applicant:

(i) an estimate provided by a North Carolina licensed contractor qualified by license to provide an estimate or bid with respect to the proposed work;

(ii) an insurance company's report itemizing the cost, excluding contents and accessory structures; or

(iii) an estimate provided by the local building inspections office.

(2) WATER DEPENDENT STRUCTURES. The proposed work is considered replacement if it enlarges the existing structure in any dimension. The proposed work is also considered replacement if:

(a) in the case of fixed docks, piers, platforms, boathouses, boatlifts, and free standing moorings, more than 50 percent of the framing and structural components (beams, girders, joists, stringers, or pilings) must be rebuilt in order to restore the structure to its pre-damage condition. Water dependent structures that are structurally independent from the principal pier or dock, such as boatlifts or boathouses, are considered as separate structures for the purpose of this Rule;

(b) in the case of boat ramps and floating structures such as docks, piers, platforms, and modular floating systems, more than 50 percent of the square feet area of the structure must be rebuilt in order to restore the structure to its pre-damage condition;

(c) in the case of bulkheads, seawalls, groins, breakwaters, and revetments, more than 50 percent of the linear footage of the structure must be rebuilt in order to restore the structure to its pre-damage condition.

History Note: *Authority G.S. 113A-103(5)b.5.; 113A-107(a),(b);*
Eff. July 1, 1990;
Amended Eff. August 1, 2007;
Readopted Eff. January 1, 2023.