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HYDROLOGIC FEASIBILITY STUDY

FOR THE NORTH MARINA

AT

CAMDEN WATERFRONT PARK

FOR

COOPER'S FERRY DEVELOPMENT ASSOCIATION

BY

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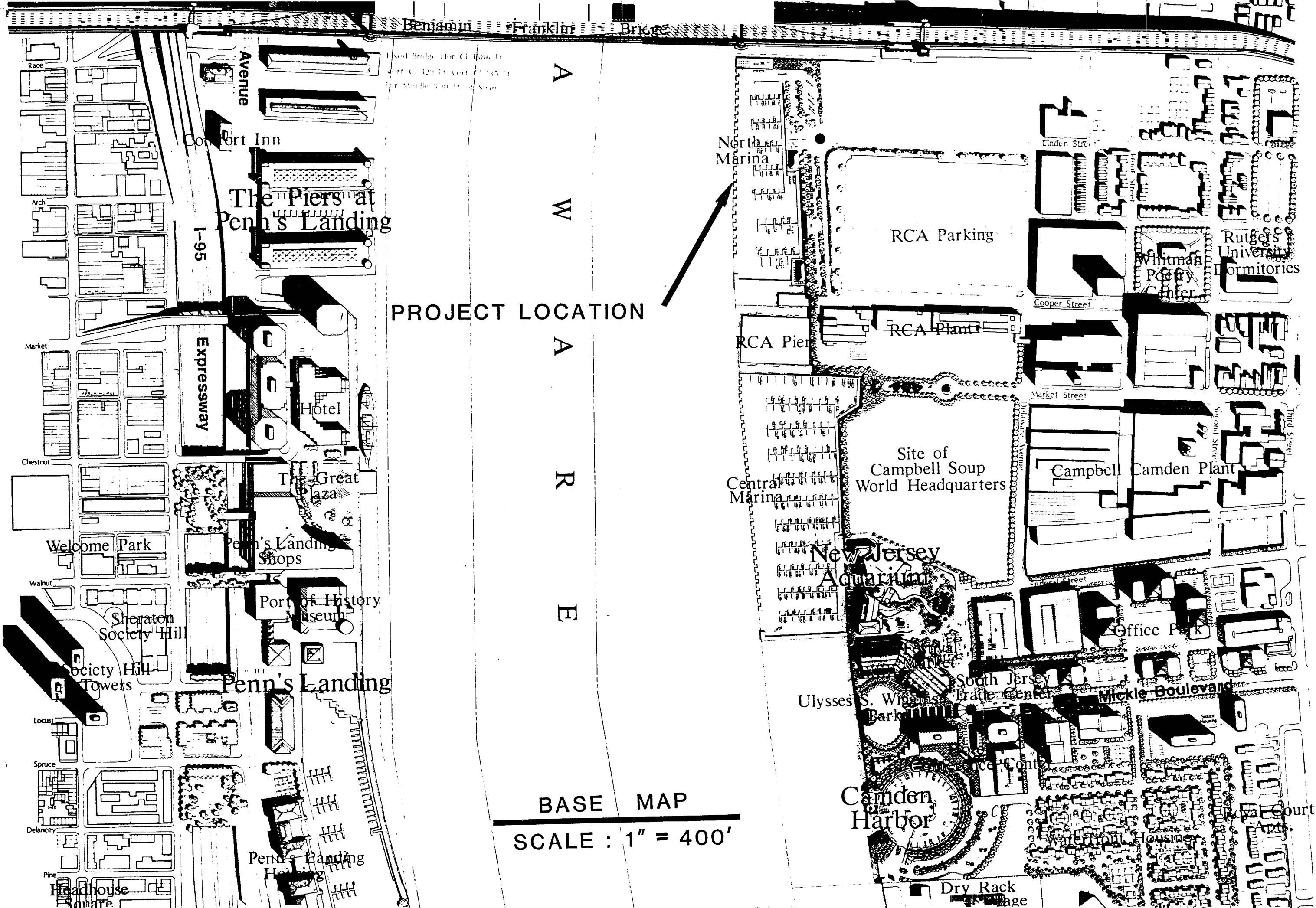
HYDROLOGIC FEASIBILITY STUDY FOR
THE NORTHERN MARINA

INTRODUCTION

Following is the Phase I Hydrologic Study of a proposed two phase feasibility study for a North Marina at the Extended Wiggins Waterfront Park. Given the growing demand for boating and waterfront recreation, this proposed public marina, along with planned Wiggins Park improvements, would serve to establish Camden's waterfront into an attractive center of activity.

As part of the Cooper's Ferry Development Association and Camden County's plan, which calls for increased public access and recreational facilities for the waterfront, Wiggins Park is being expanded north from its present Federal Street terminus to the Ben Franklin Bridge. This will occur in phases and initial interim improvements along the north shore will be connected with the southern permanent park improvements which are already complete. Thus a recreational open space park area approximately ten blocks long will be created.

The following study addresses the hydrologic feasibility of a public marina which has been proposed adjacent to the park for the area north of Cooper Street to the Benjamin Franklin Bridge. The study focuses on the existing shoreline conditions, the preliminary design based on the master plan marina configuration, assessment of dredging requirements, and cost estimates for marina facilities. Furthermore, this study addresses the



consistency of the planned marina with the goals of NJDEP as outlined in the Rules on Coastal Resources and Development.

This study does not address the economic feasibility with regard to current demand, operating costs, or projected revenues. A second study will be commissioned in order to complete this task.

PROJECT AREA

The area which is the focus of this study is at the northern edge of the Cooper's Ferry waterfront district. The Delaware River site, lying between the Benjamin Franklin Bridge and Cooper Street, is bounded on the north by Pier 7 and on the south by the RCA (now General Electric) pier. This site is adjacent to the southern park area where the aquarium is located. Discussions with General Electric are presently ongoing to create a public access route between the north and south park areas. This area is within the Waterfront Development Zone on the Delaware River and will require a permit from Coastal Resources.

PRE-APPLICATION DISCUSSIONS

On August 24, 1989, a draft of this report was reviewed with NJDEP Coastal Resource and Green Acres Personnel in Trenton.

The following people were in attendance:

John Foley - Green Acres

Andrew Gale - Waterfront Development

Darryl Jennus - Waterfront Development

Jay Watson - Green Acres

Peter Teluk - Cooper's Ferry Development Association

Joseph Mullin - S. T. Hudson Engineers, Inc.

A number of issues were raised and questions answered. We have incorporated into this final draft all the points raised at that meeting.

SHORELINE INVENTORY

A diver survey of the existing shoreline has been completed and shows a variety of structures. Most are in good condition but Piers 4, 5 and 6 have collapsed in some areas. Photographs of each structure with the location noted on a master drawing are contained in the appendix. Most of the repairs needed on Piers 2 and 3 involve repairing cracks or spalled sections of the concrete seawall and replacing the timber fendering system. By contrast, the condition of Piers 4, 5 and 6 is very poor.

These structures are in a state of collapse and will require removal and reconstruction to provide a stable edge. Edge stabilization from Pier 4 to Pier 6 will require sheet piling along the shoreline. Similar edge treatment will be required between Pier 6 and Pier 7. The inshore portion of Pier 7 is a timber crib structure for about 150 feet. This section of Pier 7 will also require edge stabilization.

A summary of edge conditions and recommended repairs is given below. This will serve as the basis for cost estimates to repair or replace the existing structures along the marina shoreline.

SHORELINE STRUCTURES

Shoreline Feature	Condition	Repairs Required	Extent of Repairs in Lineal Feet
Pier 2 and 3	Generally Good	Repair concrete seawalls and fender system.	860
Marginal Pier from Pier 3 to Pier 4	Generally Good	Repair seawalls and fender system.	375
Piers 4 and 5	Poor	Remove collapsed area. Install sheet pile edge or redeck.	600
Pier 6	Poor	Replace timber crib seawall.	380
Between Pier 6 and Pier 7	No edge stabilization	Install sheet piling.	230
Pier 7	Inshore 150' in poor condition	Install sheet piling to stabilize both sides.	300
	Outshore 225'	Repair seawall and fender system.	500

RIVER CHARACTERISTICS

The Delaware River is approximately 2000 feet wide at this location with the main channel very near the Philadelphia shore. The proposed marina is approximately 1700 feet from the channel on the opposite shore and, therefore, well removed from large ship traffic. This is an advantage in preventing any wake since there is natural attenuation of the waves generated by large ships in that 1700 foot distance. The disadvantage of this remote location from the channel is the shallow nature of the marina area. Average depth of water in this area is now 2 to 3 feet which is too shallow for a marina. Dredging to a 12 foot depth will be necessary over most of the marina area. This represents approximately 120,000 cubic yards of dredging which will be required but, because siltation is a continuing process, this estimate will require updating at time of construction. A benthic study was done in 1987 by Tom Lloyd Associates and showed no endangered habitats.

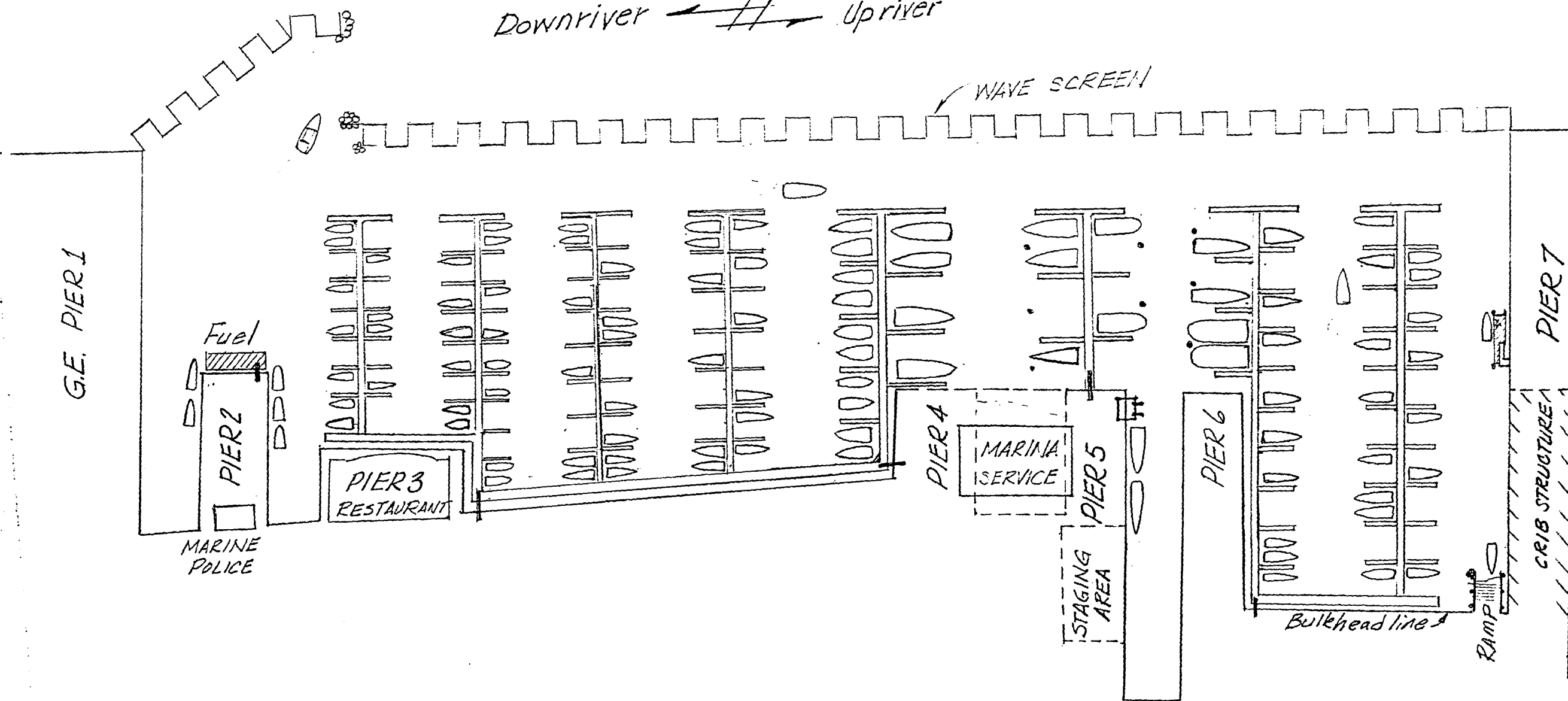
With proper dredging and the broad expanse of open water at this point in the river, it will be an ideal location for the marina. River traffic is concentrated on the opposite shore where the water is deepest thus minimizing traffic and giving small craft several hundred feet of open water to navigate as they exit the marina.

Some protection against ice will be provided by Pier 1 and Pier 7 as the ice is carried upriver and down with the ebb and flow of the tide. An outer barrier or wave screen will also help prevent ice from entering the marina in the central portion.

DELAWARE RIVER

MARINA CONFIGURATION
1" = 100'

Downriver ← / → Upriver



MARINA CONFIGURATION

The marina is planned to extend from Pier 2 to Pier 7 a distance of approximately 1000 feet along the shore and about 300 feet outshore. This represents about 6.9 acres and will provide about 200 slips depending on the mix. A wave screen is planned for the outer boundary to protect against wake and restrict traffic flow within and exit from the marina. A boat launch ramp and service facilities will be located near Pier 6. A fuel dock and pump out station are placed at Pier 2 near the exit and entry point. This would also be a desirable location for emergency rescue services and/or marine police. This sheltered area between the GE pier and the south end of the marina is well positioned for quick access to the river and near the entrance to the marina where a small craft in distress would head. A marina safety plan will be developed as part of the permit process.

The upriver end of the marina is protected by Pier 7 and the Benjamin Franklin Bridge pier nearest the New Jersey shore. Pier 7 extends approximately 350 feet outshore and is a low deck pile supported structure for the outriver 200 feet. The inner portion consists of 150 feet of crib structure and has deteriorated on both the upriver and downriver side.

FISHING PIER

Pier 7 represents the upriver limit of the marina and will house a public boat ramp on its south side. This pier may be used as a fishing pier and observation pier. It can also be fitted with a floating dock where boat passengers may disembark before the boat is removed from the water at the public boat ramp. It is anticipated that a standard launching fee will be assessed and that the fee will cover the expense of security at the boat ramp. The slip area between Pier 5 and Pier 6 penetrates the shore line and extends about 200 feet inshore of the bulkhead line. This area is adjacent to the proposed marina service facility and provides easy access for boats visiting the marina. A travel lift at this location would allow removal of boats at this location, also, a staging area will be provided adjacent to the travel lift. Administrative offices and shore facilities could be built at this location in order to provide offices for marina operations, a locker/shower facility, a marine supply store and a snack bar.

CONSISTENCY WITH NJDEP REGULATIONS

Since the marina is within the Waterfront Development Zone, it is governed by the Division of Coastal Resources. Policies which must be addressed in applying for permits for this water dependent activity include:

- 1) 7:7E-3.5 Finfish Migratory Pathways
- 2) 7:7E-3.7 Navigation Channels
- 3) 7:7E-3.10 Marina Moorings

- 4) 7:7E-3.16 Filled Water's Edge
- 5) 7:7E-3.18 Natural Water's Edge Floodplains
- 6) 7:7E-3.38 Public Open Space
- 7) 7:7E-4.10 Manmade Harbors, Docks, Boat Ramps and Dredging
- 8) 7:7E-7.3 Resort/Recreation Use Policies
- 9) 7:7E-7.11 Coastal Engineering
- 10) 7:7E-8.11 Public Access to the Waterfront

Most of these were discussed in our meeting on August 24, 1989.

COST ESTIMATES FOR PARK IMPROVEMENTS

SHORELINE STABILIZATION

Shoreline stabilization includes the installation of sheet piling in collapsed areas and along the shoreline where a vertical edge does not exist. About 1600 lineal feet of edge stabilization has been estimated based on the shoreline inventory of existing structures. The estimated cost to accomplish the edge stabilization is \$3,400,000. It is possible that this could be reduced somewhat by judicious selection of repair treatment and location but it appears that a first class marina will require at least \$3 million in edge stabilization.

DREDGING

The shallow area within the proposed marina configuration will require dredging to approximately 12 ft. depth. We estimate the total dredging required at about 128,000 cu. yds. of material at a cost of approximately \$1,020,000 if the material does not require special handling. Dredge spoil analysis will be required to ascertain the nature of the dredged material. The dredged material will then be disposed of at an approved disposal site depending on the results of the analysis.

Park Improvements Summary

a) Shoreline Stabilization.....	\$3,400,000
b) Dredging of Shallow Area.....	\$1,020,000
	<u>\$4,420,000</u>

COST ESTIMATES FOR MARINA

FLOATING WALKWAYS AND SLIPS

A total of 200 slips are proposed for the marina enclosed by the outriver limits of Piers 1 and 7. This represents about 7 acres and will require floating walkways and fingers to provide boat slips. We estimate the cost of floating equipment at \$2,800,000 including the wave screen and slips.

BUILDINGS

The only building anticipated as part of the marina complex is the Marina Services Building approximately 40'x100' in footprint. This building will provide administrative offices, locker/shower facilities, restrooms and a snack bar. The estimated construction cost is \$400,000.

A separate restaurant to be developed by others is shown on Pier 3. The timing of the restaurant will depend on the development of adjacent properties and is not included in the marina facilities.

Marina Improvements Summary

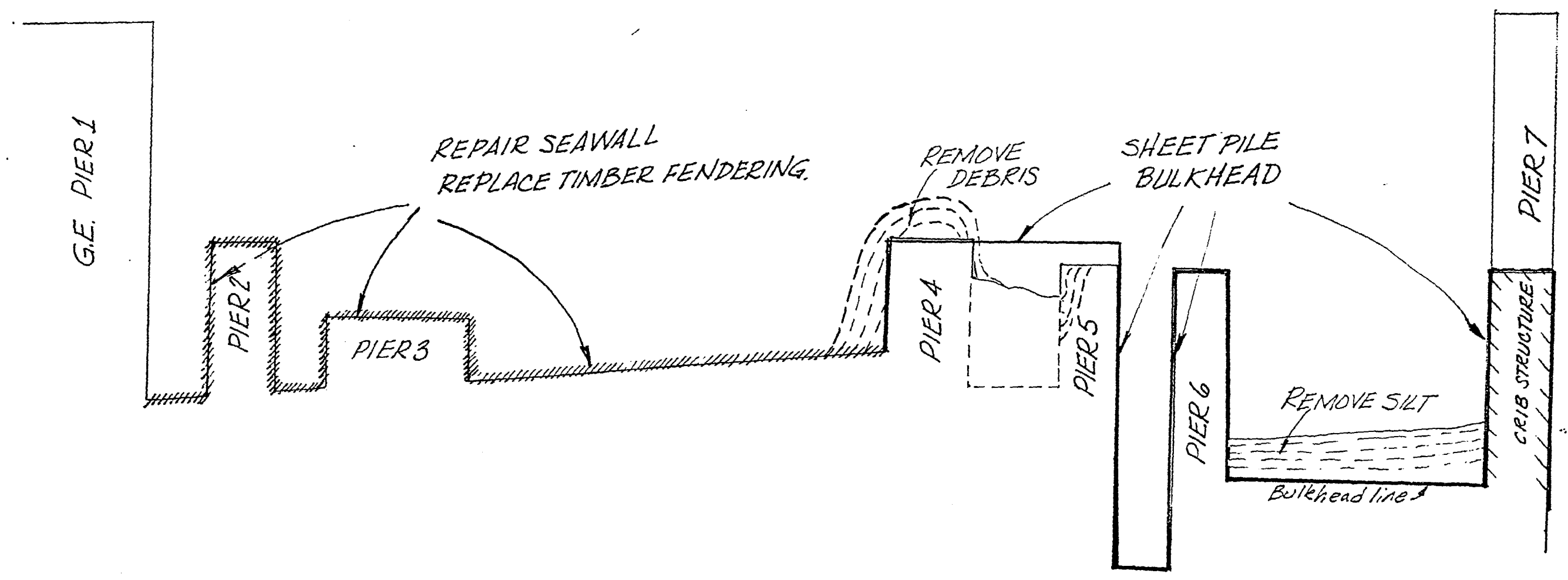
a) Floating Equipment.....	\$2,400,000
b) Building.....	\$ 400,000
	<u>\$2,800,000</u>

These are order of magnitude cost estimates. It is possible that a less sophisticated wave screen and lower cost floating equipment could be obtained. The numbers used here are for durable systems using concrete flotation to realize the lowest maintenance costs and longest life. Dredging costs must also be refined at time of construction.

SHORE LINE REPAIRS & STABILIZATION

DELAWARE RIVER

Downriver ← # → Upriver



APPENDIX

COST SHEETS

SHORELINE INVENTORY

COST SHEETS

CALCULATIONS

DATE 10/6/88 CONTRACT NO. H3597 PROJECT MARINA - NORTH
 PREPARED BY JM CHECKED BY _____ CLIENT COOPER'S FERRY SHEET NO. 1 OF 2

STRUCTURAL WORK ON SHORE LINE:

	QUANTITY
1. PIER 4 Replace timber crib seawall on perimeter	205 LF
2. AREA BETWEEN PIER 4 & 5 Drive sheet pile & fill	80 LF
3. PIER 5 Replace timber crib or drive sheet pile	250 LF
4. AREA BETWEEN PIER 5 & 6 Drive sheet pile	280 LF
5. PIER 6 Replace timber crib with sheet pile	380 LF
6. AREA BETWEEN PIERS 6 & 7 Drive sheet pile	230 LF
7. PIER 7 stabilize 150' of crib inshore both sides	300 LF
8. PIER 7 Repair outer 220' of seawall (2 sides)	440 LF
9. SEAWALL station 0+00 to 3+67 & replace timber	367 LF
10. SEAWALL ON PIER 3 repair & replace timber	210 LF
11. SEAWALLS ON PIER 2 repair & replace timber	320 LF

DREDGING

AREA $1150 \times 300 = 345,000$ SF

AVG DEPTH FROM 1987 SOUNDINGS ~ 2.0 AVG.

DREDGING TO 12' DEPTH - CUT 10'

$$\frac{1150' \times 300' \times 10' \text{ CU FT}}{27 \frac{\text{CU FT}}{\text{CU YD}}} \times \frac{\#8}{\text{CU YD}} = \#1,020,000$$

QUANTITY = 127,500 CU.YD.

CALCULATIONS

DATE 10/6/88 CONTRACT NO. H3597 PROJECT MARINA-NORTH
 PREPARED BY JYM CHECKED BY _____ CLIENT COOPER'S FERRY SHEET NO. 2 OF 2

FLOATING EQUIPMENT

1. WALKWAYS :

FINGER WALK A	320' + 65' Tee	=	385 LF
FINGER WALK B	320' + 70' Tee	=	390 LF
FINGER WALK C	150' + 75' Tee	=	225 LF
FINGER WALK D	215' + 90' Tee	=	305 LF
FINGER WALK E	220' + 65' Tee	=	285 LF
FINGER WALK F	220' + 60' Tee	=	290 LF
FINGER WALK G	240' + 60' Tee	=	300 LF
FINGER WALK H	190' + 60' Tee	=	250 LF

MARGINAL WALKS

H TO G	130'	=	130 LF
G TO D	350'	=	350 LF
A TO B	160'	=	160 LF

3070 LF

ASSUME 7' WIDTH X 3070 LF = ~~219~~ 21,490 SF

2. BOAT SLIP FINGERS

3' WIDE FINGER COUNT = 56 @ 30'	=	5040 SF
4' WIDE FINGER COUNT = 10 @ 40'	=	1600 SF
3' WIDE FINGER COUNT = 20 @ 30'	=	<u>1800 SF</u>

TOTAL FLOATS 29,930 SF
 SAY ~ 30,000 SF

CALCULATIONS

DATE 10/7/88 CONTRACT NO. H/3597 PROJECT MARINA-NORTH
 PREPARED BY JYM CHECKED BY _____ CLIENT COOPER'S FERRY SHEET NO. 1 OF 2

FLOATING EQUIPMENT

Estimate based on Concrete Flotation Systems costs as received Sept. 1988 from W. Bell to be updated at time of budgeting.

ITEM	QUANTITY	COST
1. WALKWAYS & FINGERS	30,000 SF. @ \$24	\$720,000
2. WAVE SCREEN	1200 FT. @ \$1000/FT	1,200,000
3. PILING FOR SLIPS	120 @ \$800 Est. cost	96,000
4. ANCILLARY RAMPS, utilities		184,000
5. INSTALLATION		200,000

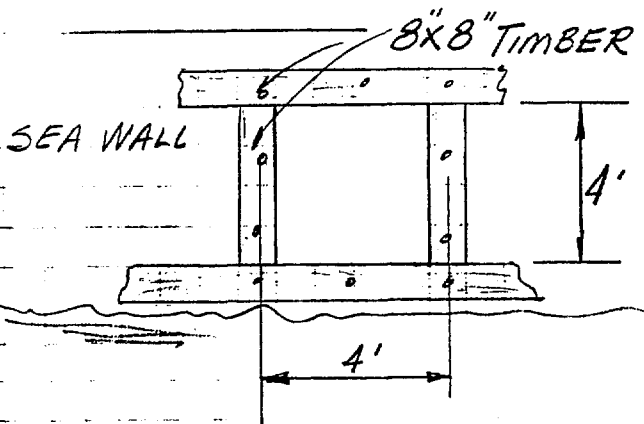
FLOATING EQUIPMENT TOTAL \$2,400,000

CALCULATIONS

DATE 11/30/88 CONTRACT NO. H3597 PROJECT MARINA - NORTH SHORE WORK
 PREPARED BY JVM CHECKED BY _____ CLIENT COOPER'S FERRY SHEET NO. 1 OF 2

TIMBER REPLACEMENT ON SEAWALLS

① USE 8"x8" TIMBER IN VERTICALS SPACED 4 FT WITH TOP & BOTTOM RUNNERS CONTINUOUS



12 ft of 8x8 per 4' of WALL
 8"x8" Board feet per foot 5.3

$$12 \times 5.3 = \frac{63.6}{4} = 15.9 \text{ BF/FT WALL}$$

FENDERING USE 16 BF/FT WALL @ \$5 per BF = \$80 per ft

② SEAWALL REPAIR 6'x1'x25 /SF = $\frac{150}{230}$ per ft

③ REPLACE ALL HARDWARE @ $\frac{20}{ft} + 20$
 \$250 per ft

TOTAL SEAWALL:

PIER 2 320 LF

PIER 3 210 LF

3 to 4 367 LF

PIER 7 440 LF

1337 LF

SAY 1500 @ 250 = \$375,000

CALCULATIONS

DATE 11/30/88 CONTRACT NO. H3597 PROJECT MARINA-NORTH SHORE WORK
PREPARED BY JVM CHECKED BY _____ CLIENT COOPER'S FERRY SHEET NO. 2 OF 2

SHEET PILE PLACEMENT

- 1.) BETWEEN Pier 4 & 5 80 LF
 - 2.) PIER 5 250 LF
 - 3.) BETWEEN PIER 5 & 6 280 LF
 - 4.) PIER 6 380 LF
 - 5.) BETWEEN PIER 6 & 7 230 LF
 - 6.) PIER 7 inner 150' 300 LF
- 1520 LF USE 1600 LF

$1600 \text{ LF} \times \$1800 \text{ per LF} = \$2,880,000 \text{ SHEETING}$

FILL BEHIND BULKHEADS & EXCAVATION OF
COLLAPSED PIER STRUCTURES AT PIER 4 & 5

$14,500 \text{ CY EST. @ } \$10 \text{ CY} = \$145,000$

SUMMARY SHORE LINE REPAIR & STABILIZATION:

- (A) SEAWALL REPAIR & TIMBER FENDER \$375,000
 - (B) SHEET PILE EDGE 2,880,000
 - (C) EXCAVATION & REMOVALS 145,000
- \$3,400,000

CALCULATIONS

DATE 12/27/88 CONTRACT NO. H3597 PROJECT MARINA-NORTH
 PREPARED BY JYM CHECKED BY _____ CLIENT COOPER'S FERRY SHEET NO. 2 OF 2

SUMMARY OF COSTS
 FOR PARK IMPROVEMENTS

ITEM#	DESCRIPTION	Qty.	Unit Cost	SUBTOTAL
1.	SHORELINE STABILIZATION			
a.)	REPAIR EXISTING SEAWALLS AND REPLACE TIMBER FENDERING SYSTEM	1500 LF	\$250/LF	\$375,000
b.)	SHEET PILE TO STABILIZE & REPAIR VERT. EDGE	1600 LF	\$1800/LF	\$2,880,000
c.)	REMOVALS & FILL	14,500 CY	\$10/cy	\$145,000
				<u>\$3,400,000</u>
2.	DREDGING COSTS ALONG SHALLOW AREA (Estimated) Need confirming Soundings	127,500 CY	\$8/cy	\$1,020,000
TOTAL PARK IMPROVEMENTS				<u>\$4,420,000</u>

CALCULATIONS

DATE 12/27/88 CONTRACT NO. H3591 PROJECT MARINA - NORTH
 PREPARED BY TYM CHECKED BY _____ CLIENT COOPER'S FERRY SHEET NO. 1 OF 2

SUMMARY OF COSTS
 FOR MARINA

ITEM	DESCRIPTION	Qty.	Unit Cost	SUBTOTAL
1.	FLOATING EQUIPMENT			
	a.) WALKWAYS & FINGERS	30,000 SF	\$24	\$720,000
	b.) WAVE SCREEN	1200 LF	\$1000	1,200,000
	c.) PILING FOR SLIPS	120	\$800	96,000
	d.) Utilities & Ramps			184,000
	e.) Installation			200,000
				<u>\$ 2,400,000</u>
2.	MARINA BUILDING			
	a.) Administration offices	1000 SF	\$100/SF	
	b.) Services, showers	1000 SF	..	
	c.) Snack bar & supplies area	2000 SF	..	
				<u>\$ 400,000</u>

TOTAL MARINA IMPROVEMENTS \$2,800,000

SHORELINE INVENTORY

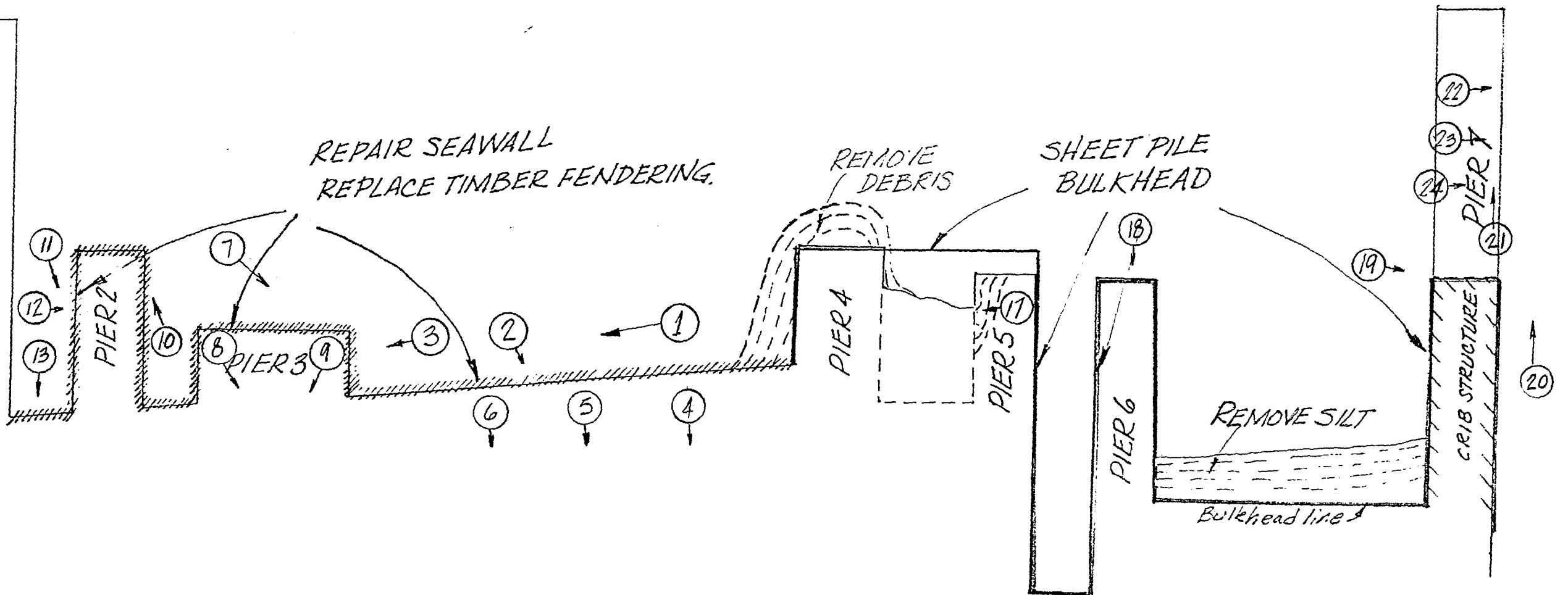
SHORELINE REPAIRS &
STABILIZATION
PHOTO LOCATIONS

DELAWARE RIVER

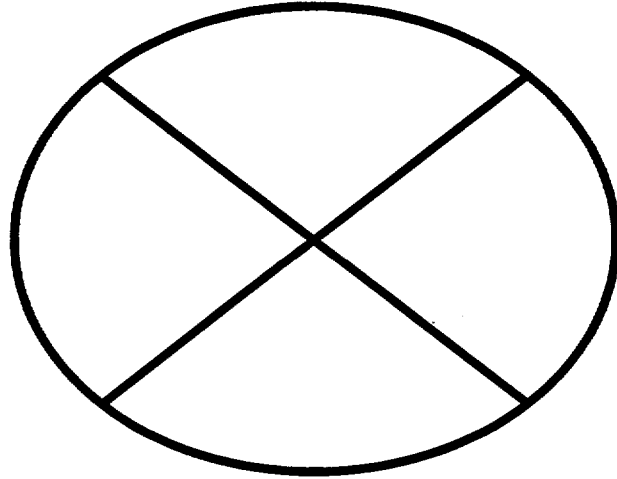
Downriver ← // → Upriver

PHOTOS
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Hydrolic Feasibility Study for North Marina
at Camden Waterfront Park

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