Torpedo Plant Dock and Piers:

Technical Analysis and Design Recommendations

City of Alexandria, Virginia

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Torpedo Plant Dock and Piers:

Technical Analysis and Design Recommendations

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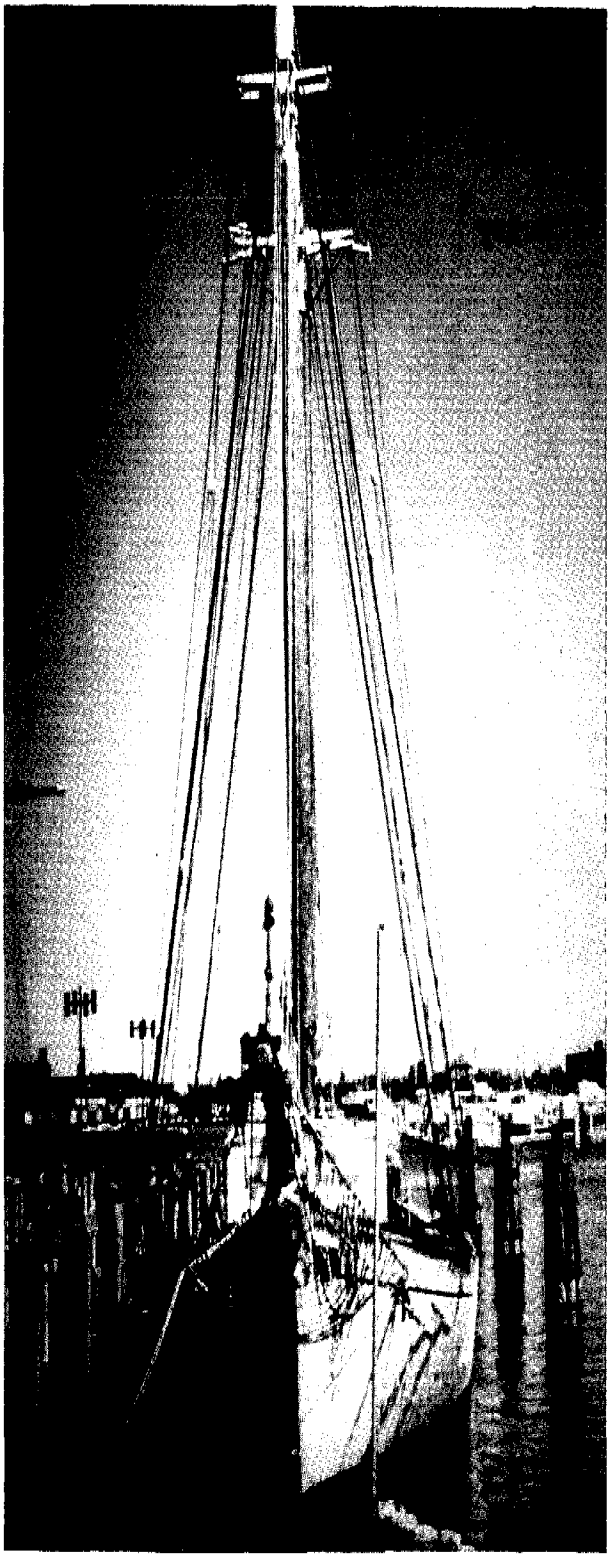

This study has been partially funded by a federal grant from the Office of Coastal Zone Management, Department of Commerce and the Heritage Conservation and Recreation Service, Department of the Interior under the Coastal Zone Management Act of 1972.

This study was prepared by the City of Alexandria, Department of Planning and Community Development with the assistance of TAMS/Modjeski and Masters, Engineering Consultants; Timber Products Inspection Company, Conyers, Georgia; James A. Taylor, Timber Products Specialist, Fairfax, Virginia; and, the Department of Forest Products, Virginia Polytechnic Institute and State University.

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*Source: Naval Torpedo Assembly Plant, Alexandria, Virginia Construction Drawings, September 20, 1927.

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Introduction

TORPEDO PLANT DOCK AND PIERS–TECHNICAL ANALYSIS AND DESIGN RECOMMENDATIONS is a study of the ways in which publicly-owned property at the heart of Alexandria's Potomac River Waterfront can be put to active use. The principal goal of the project is to promote public recreational use of this portion of the City Waterfront through increased site access, waterfront activity and visibility.

Funds for this study were provided from two federal agencies, the Office of Coastal Zone Management, Department of Commerce and the Heritage Conservation and Recreation Service, Department of the Interior, through the State of Virginia Coastal Zone Management Office.

The Coastal Zone Management Act of 1972 has focused much attention on the nation's coastal areas. This Act outlines a national policy for the management of coastal resources and provides a process to accomplish the policy's goals. The process provides for coastal states to develop and administer resource-management programs in the coastal zone by federally funded grants. Additionally, the Act encourages states to manage their coastal resources by establishing a comprehensive program for dealing with land and water use issues having more than local significance.

This grant enabled the City of Alexandria Department of Planning and Community Development to research marina design and study marina operations in such other municipalities as Annapolis, Baltimore and Philadelphia. Engineering consultants, paid by grant monies, investigated the structural foundations of the dock and piers. Their recommendations are included in this report.

This report is in two parts: **PART 1: FINDINGS AND RECOMMENDATIONS** contains an outline of the engineers' findings from their structural investigation of the existing piers, dock and river bottom. Part 1 also includes recommended design alternatives, cost estimates and detailed information for proposed marina facilities, such as the High School Rowing Facility, cruise ships and historic vessels. **PART 2: TECHNICAL INFORMATION** contains the consultants' complete analysis and recommendations for the structures.

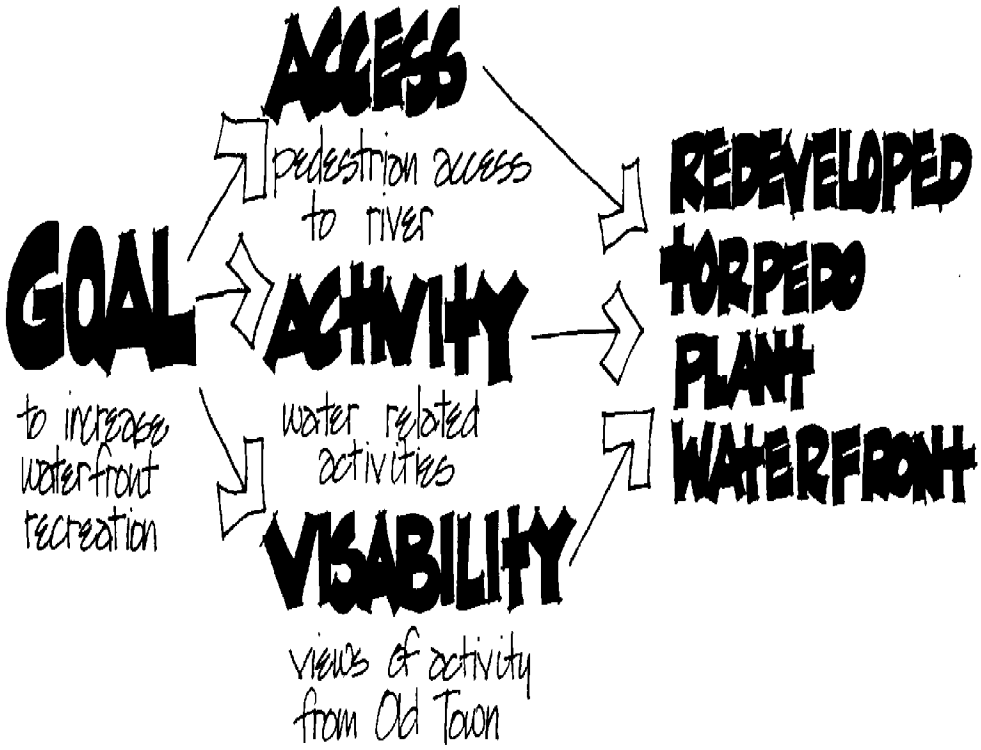
Purpose

The purpose of this study is to provide the technical analysis and information needed to complete a comprehensive design plan for the City-owned Torpedo Plant Waterfront. With this information as a base it is anticipated that the resulting renovations and related uses reflect the overall goal of opening the Waterfront and realize the full recreation potential of this valuable urban resource.

Additionally, the compilation and publication of this information is critical to the total Torpedo Plant development process. The City and the selected developer are to begin negotiating the final design and financial package of the complex in September 1979. The **Torpedo Plant Prospectus** will be used as a guideline for these negotiations. In the **Prospectus** it states under "*Ownership Conditions*" that ... "*The City will retain ownership of Waterfront open space ... and easements to allow public access to the Waterfront ...*"

This study was prepared as a guideline for the design of the public portion of the Waterfront. The technical analysis supplies information on the present condition of the dock and piers needed to develop a comprehensive design plan. The two types of marina layouts shown are workable within the site limitations. Cost estimates are included to give an approximation of the basic costs attributable to the renovation and redesign of the existing piers.

Figure 3



Objectives

More specifically this report has successfully met the following objectives which were established at the beginning of the process:

1. To assess structural information on existing dock and piers
2. To recommend cost-effective renovations
3. To establish the best design layout for a transient marina given the site limitations
4. To recommend additional activities and facilities necessary to support an active Waterfront

Plan Summary

The study area is made up of approximately five acres of publicly-owned land at the center of Alexandria's frontage along the Potomac River. It is located at the foot of King Street, one of Alexandria's major shopping areas and it is included in the limits of the Old and Historic District. The Torpedo Plant Complex includes four buildings, two constructed during World War I and two during World War II.

The Torpedo Plant Waterfront contains the only public dock currently in operation in the City. Because of its location this dock presents a tremendous potential for commerce and recreation if the site is developed as a transient marina with compatible facilities.

A summary of the technical and related findings is presented, along with the specific recommendations formulated to meet the stated goals and objectives of this study.

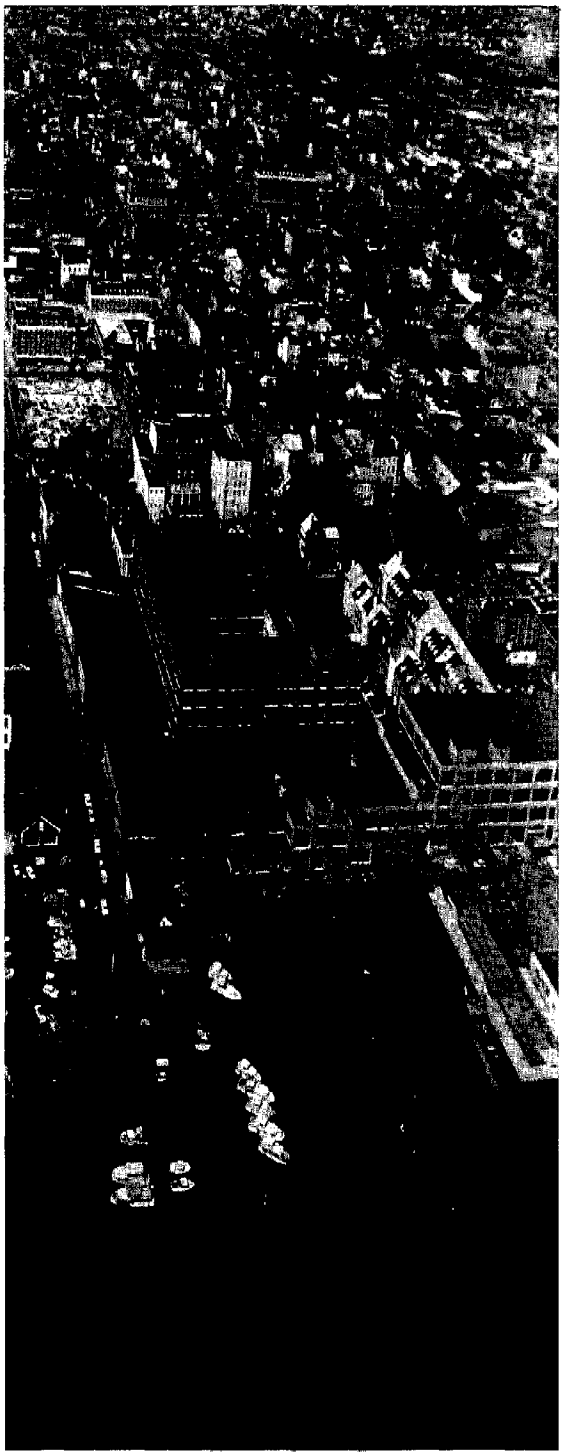


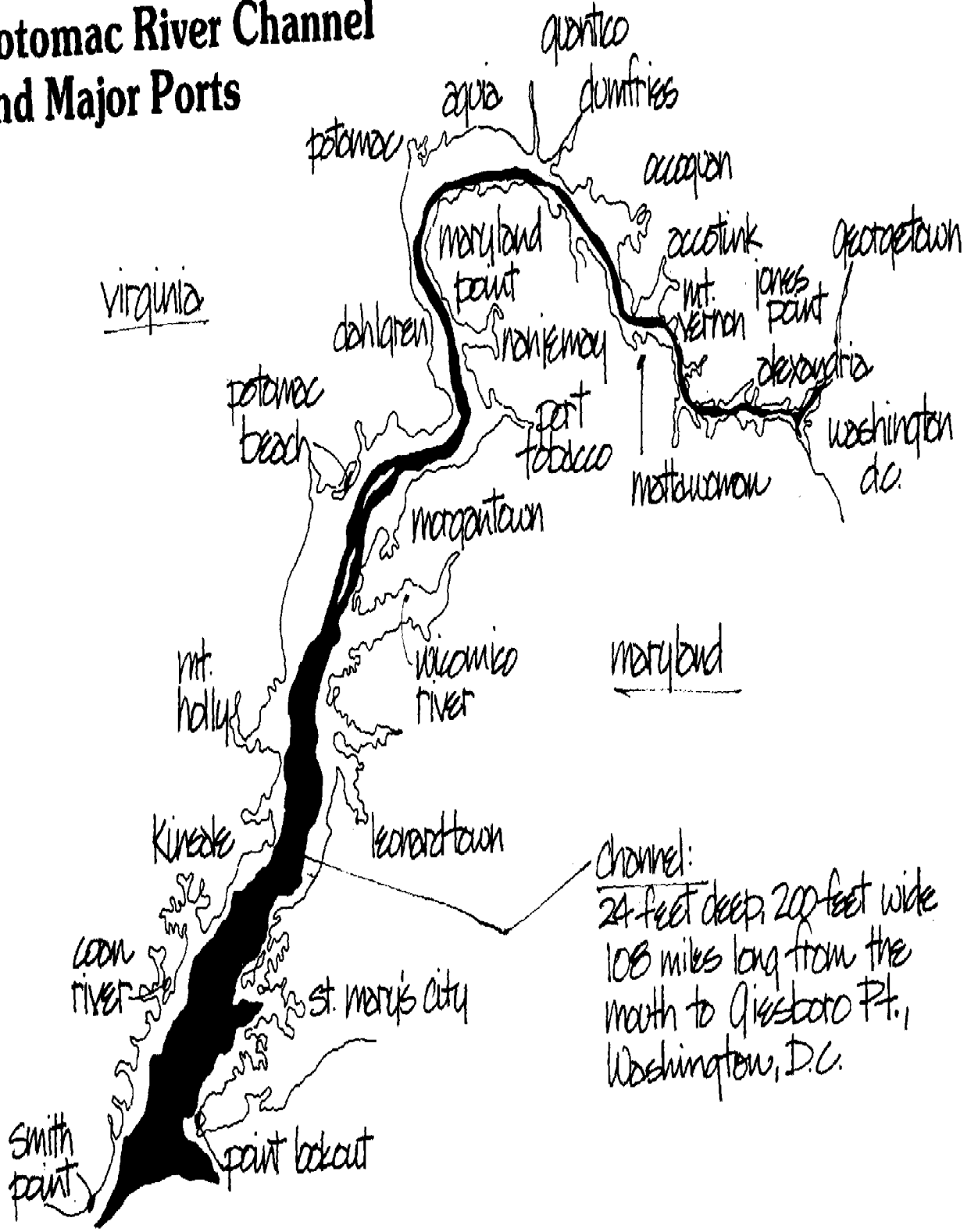
Figure 4 Perspective down King Street—Torpedo Plant Complex is located at right foreground

Findings	Recommendations
• The basin is silted to the extent that the maximum water depth at high tide is 3 feet	• That the basin be dredged to a water depth of 10 feet
• Only the substructure of the South Pier is in generally good condition	• That the South Pier be reconstructed from the substructure up
• The structure and foundation of the North Pier are in generally good condition	• That the North Pier be renovated
• The existing City dock area is basically unusable	• That the City renovate the City dock
• The existing piers and channel depth are not adequate for cruise ship docking	• That the facilities be upgraded to facilitate cruise ship docking and the channel be dredged by the Corps of Engineers to its authorized depth of 24 feet
• The existing Torpedo Plant Waterfront is not easily accessible and does not attract the public to the Waterfront	• That easy access and water-oriented facilities and amenities be provided to attract the public to the Waterfront—these could include a restaurant boat, fish market, historic vessel docking and a new high school rowing facility
• Presently there is no special designation of a maritime district in the City Code	• That the City consider a Maritime District Code

Based on these findings and recommendations two alternative plans for the Torpedo Plant Waterfront are presented. Under the Recommendations section (p. 17) of this report an analysis of both plans and cost estimates are provided.

Figure 5

Potomac River Channel and Major Ports



Background

Potomac Port History

The Alexandria Waterfront has a long tradition as an active urban port. As early as the mid-seventeenth century ships were arriving at Oronoco Bay to trade copper, tobacco, furs, dyes and oil. In the mid-18th century Alexandria became the largest tobacco port and warehousing facility on the Potomac River. By the 1770's Alexandria had been established as a foreign commerce port; shipbuilding industries were producing large ocean-going vessels and trade with foreign countries was active. Before the Revolutionary War the City was handling cargo tonnages comparable to those of the ocean ports of New York and Boston. After the war the City's reputation as a major North Atlantic Trading center was firmly established.

Within fifty years, however, Alexandria's importance as a port and maritime center had begun to decline. Baltimore, with its location at the head of the Chesapeake Bay and near the Susquehanna River, a major gateway to the western farmlands, had begun to compete successfully as a port. Serious fires and cholera epidemics had struck Alexandria in 1803 and 1832. The failure and bankruptcy of the Alexandria-Georgetown Canal and the growing importance of the railroads seriously eroded the local port's capability. The Union occupation of the City during the Civil War effectively curtailed trading activity along Alexandria's Waterfront. By the end of the nineteenth century the port had declined almost totally, with only fishing boats anchored there.

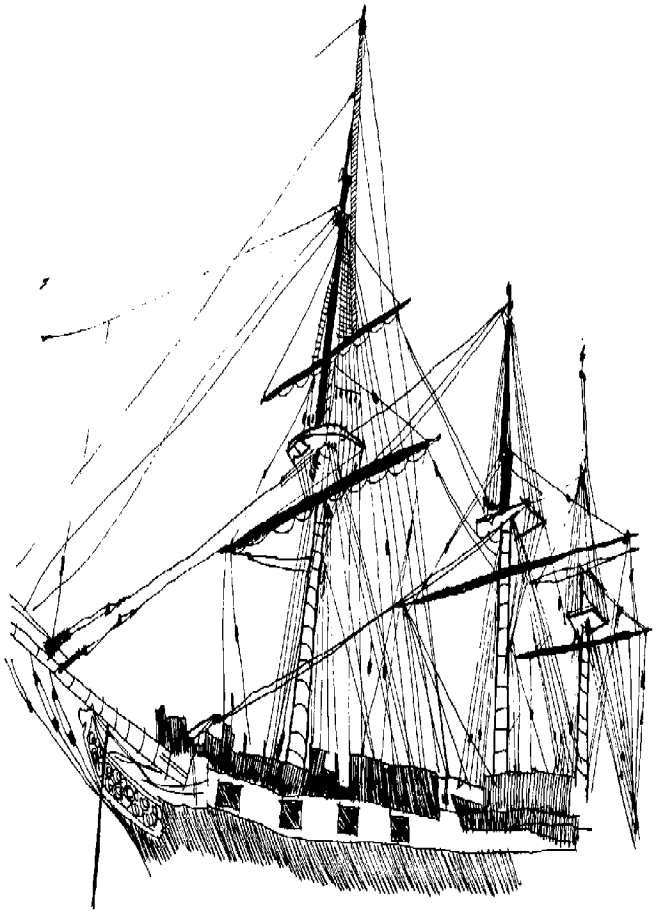


Figure 6 U.S. Frigate Constellation

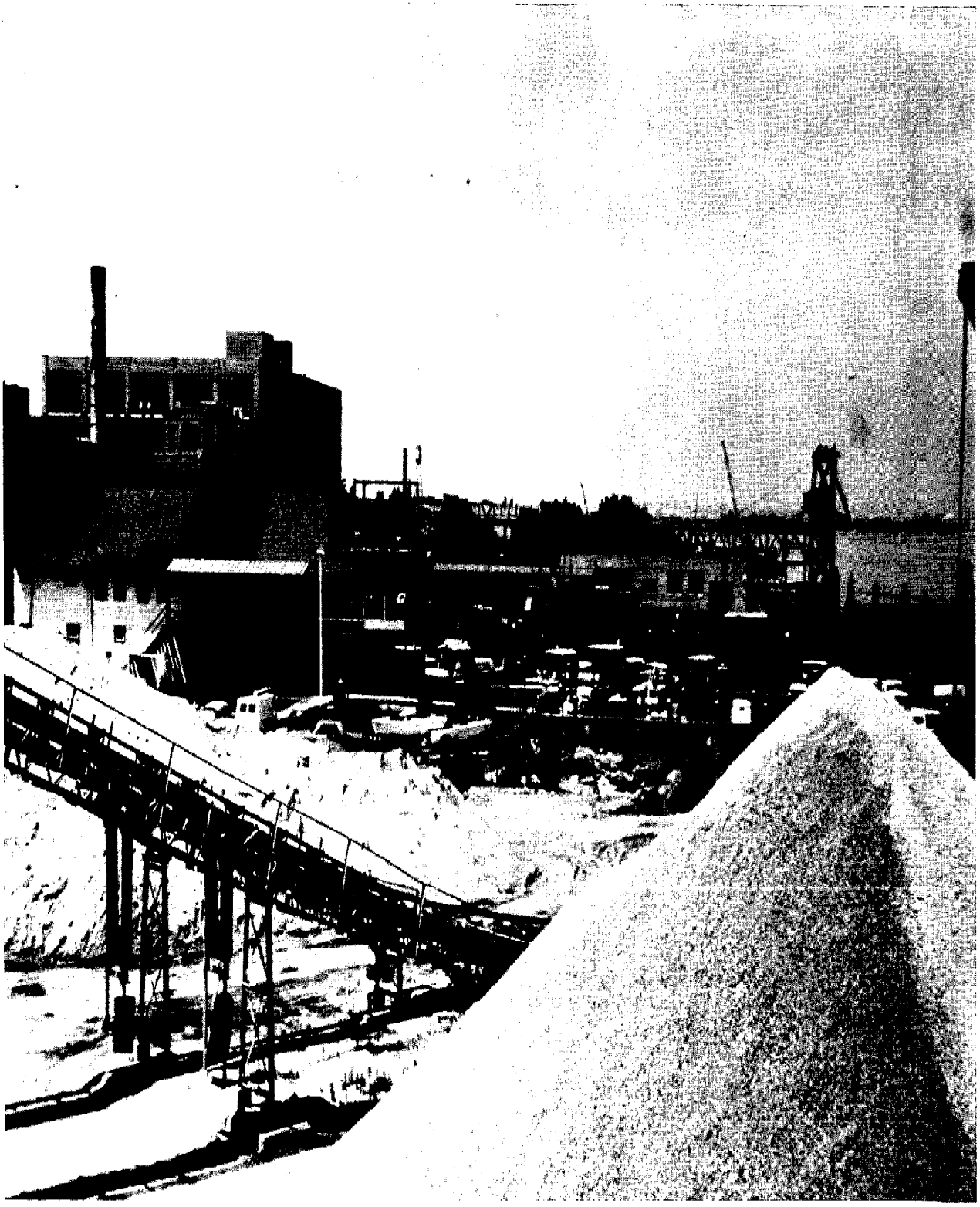


Figure 7 Historic View of Torpedo Plant Complex from the Old Virginia Concrete Plant Site

Torpedo Plant History

A short rejuvenation period came to the Waterfront in the early 1900's with private shipyards involved in building ocean-going vessels. Shortly before the end of World War I the central section of the present Torpedo Plant was begun. During World War II the Torpedo Plant was enlarged to its present size. After the war, the production of torpedoes ceased and the government used the facility to store captured Nazi war documents. During this time the buildings became known as the Federal Records Center. In the 1960's ownership was transferred to the General Services Administration, and the stored records were replaced by government furniture and artifacts from the Smithsonian Institution.

In 1969 GSA offered to sell the property as surplus to the City. A price of $1,570,000 was agreed upon. The deed to the property was conveyed to the City on March 10, 1970 with the stipulation that the federal government would retain the right to occupy the buildings for a period of five years. During this period, they would gradually phase-out their use of the complex and turn sections of the buildings over to the City. On March 9, 1975, the City received exclusive and unrestricted use of the property.

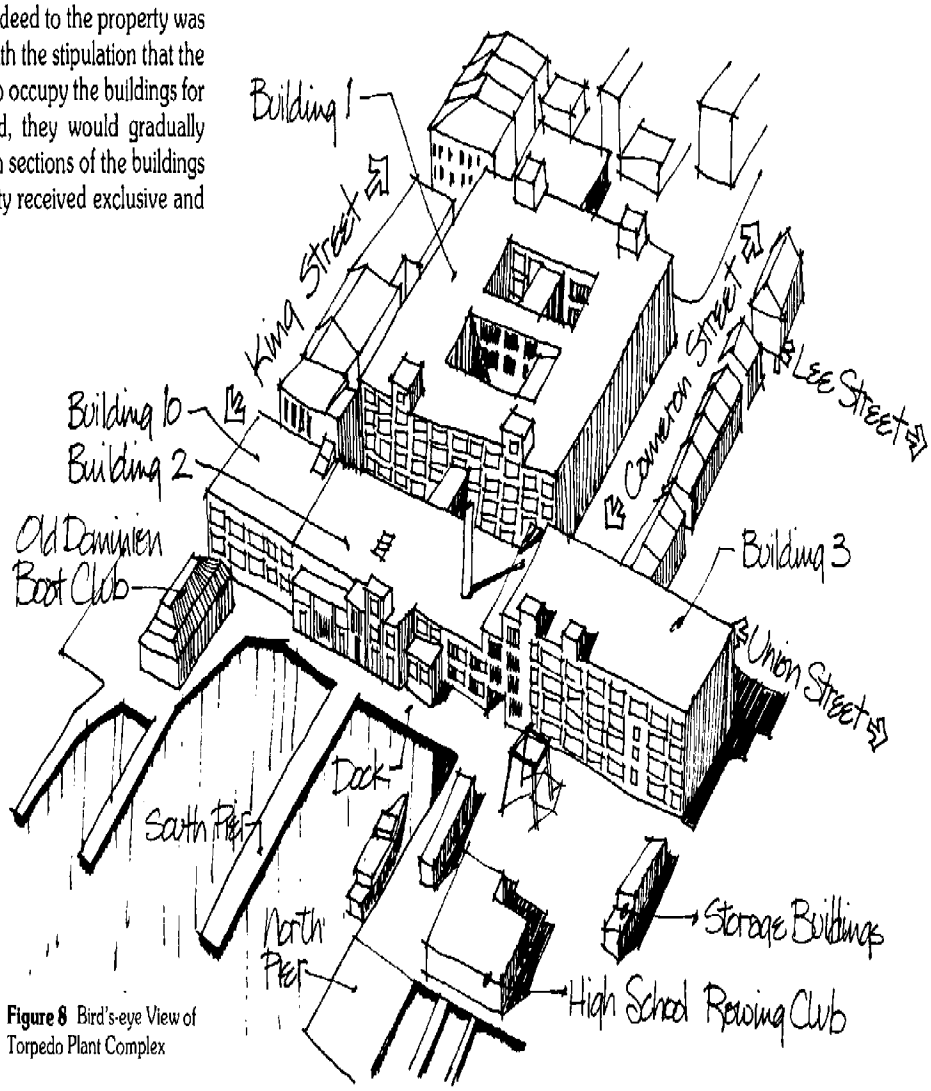


Figure 8 Bird's-eye View of Torpedo Plant Complex

Property Description

The Torpedo Plant property contains approximately 205,300 square feet of fast land area (4-1/4 acres) and 65,800 square feet (1-1/2 acres) of submerged land. The City-owned property extends into the Potomac to the bulkhead line.

The main building complex is made up of four separate structures designated as Buildings #1, #2, #3 and #10. Building #1 occupies the entire portion of the site between Lee Street and Union Street. The other three adjoin each other between Union Street and the river. Figures 8, 9 and 10 depict the existing site plan and aerial view of the Torpedo Plant and adjacent waterfront area.

The pierhead line lies 100 feet beyond the bulkhead line. Two piers presently extend to this line. The northern pier is concrete to the bulkhead line and wood to the pierhead line. It is in fair condition and operational. The southern pier is a wood structure and is severely deteriorated.

Figure 9 View of Old Dominion Boat Club located directly south of the Torpedo Plant

A number of smaller storage buildings occupy the northeast corner of the site. The largest of these has approximately 7,700 square feet and houses the High School Rowing Facility. The Old Dominion Boat Club, a private facility, occupies a wooden building just South of Building #10.

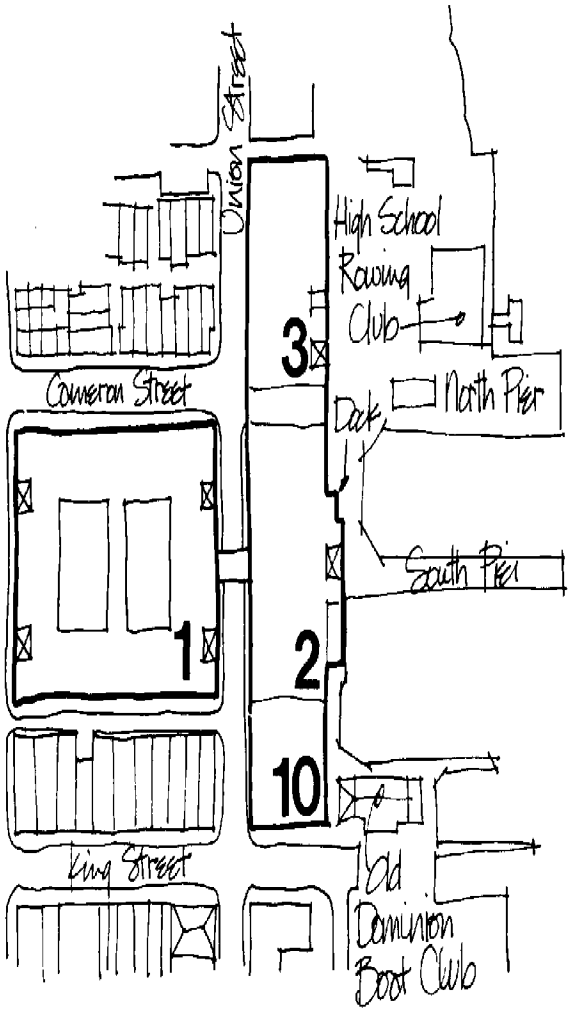


Figure 10 Existing Torpeo Plant Layout Plan

Redevelopment Chronology

Since City acquisition of the complex in 1970, various studies have been made to determine the best use or reuse of the complex. In 1974 the Torpedo Factory Art Center was formed. The majority of Buildings #10 and #2 house the artists' studios and exhibit areas. The Torpedo Factory Art Center has been acclaimed as an outstanding example of adaptive reuse and was included in a recent exhibit *("Buildings Reborn: New Uses, Old Places")* at the Smithsonian's Renwick Gallery.

In 1977 City Council acted to request private development to submit proposals to redevelop the Torpedo Plant complex. The result of this was the **Torpedo Plant Prospectus** issued in 1978. This Prospectus established the City's criteria for redevelopment and led to the following:

July 1978	City Council approved Torpedo Plant Prospectus and invited developers to submit proposals for redevelopment of the complex within the guidelines established by the **Prospectus.**
October 30, 1978	Four proposals were submitted by: 1) *the Lenkin Company*, 2) *OTV, Inc. and Watergate Developments, Inc.*, 3) *The Alexandria Waterfront Restoration Group, and* 4) *the Redstone Development Corporation.*
February 23, 1979	City Council received **Summary Evaluation of Torpedo Plant Proposals** prepared by staff.
May 8, 1979	City Council designated Alexandria Waterfront Restoration Group as the "preferred developer" under the terms of the **Prospectus.**
June 12, 1979	City Council reviewed guidelines for negotiations for the sale of Building #1 of the Torpedo Plant.
August 1979	City begins negotiations for the redevelopment.

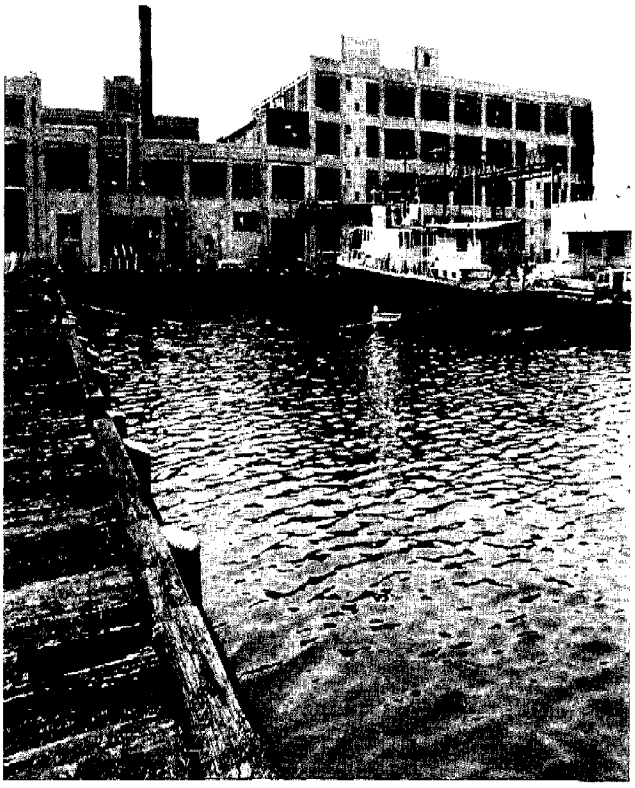


Figure 11 View of Buildings 2 and 3 from the South Pier

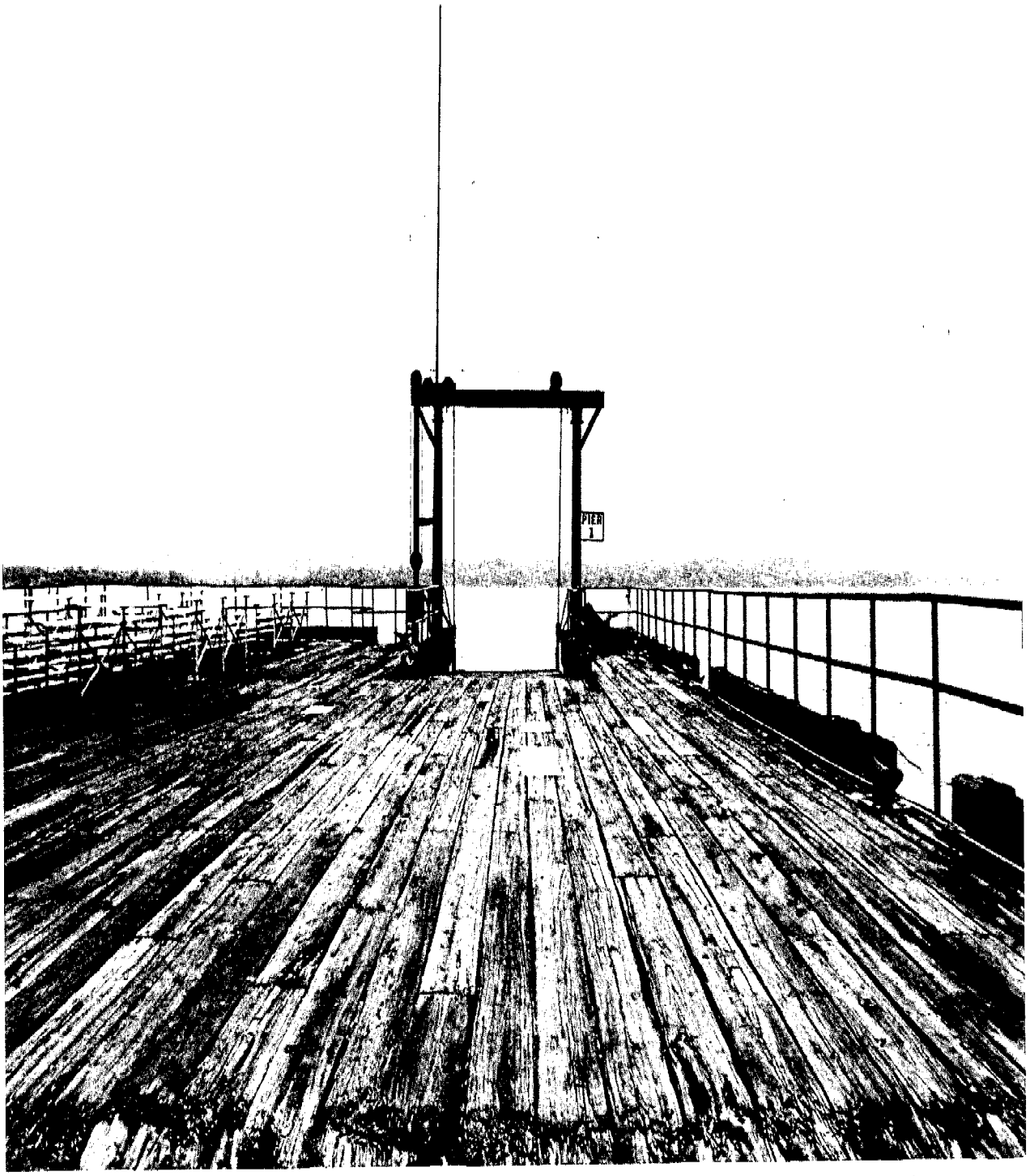


Figure 12 North Pier

Part I: Findings and Recommendations

Figure 13 Consultants taking wood borings of the piles to determine the structural condition of the North Pier

Outline of Engineers' Findings

(See Part 2 for complete Engineers' Report.)

The engineering firms of *TAMS/Modjeski and Masters* were contracted in March 1979 to consult with the Department of Planning and Community Development on the structural condition of the existing dock and piers. To support and confirm the engineers' preliminary findings, timber experts were hired to take core samples of the wood piles to determine the extent of deterioration in the structural framework of the piers. (See Section 2, and Appendix III, IV, V and VI for detailed laboratory reports.)

After extensive examination of the dock and piers the consultants reported the following:

North Pier

- **The North Pier is in generally good condition.**
  - The concrete portion which extends to the bulkhead line is in good condition.
  - The timber piles which support the wood pier between the bulkhead line and the pierhead line are good–31 percent showed decay of outer fibers only.
  - The internal bracing of the timber structure is in good condition.
  - 80 percent of the fender piles are deteriorated and need to be replaced.

Figure 14 Pulley system on North Pier

South Pier

- **The South Pier will require a new superstructure but the foundation piles appear sound and in good condition.**
  - The deck, stringers, headers and cross-bracing are badly deteriorated.
  - The foundation piles are sound with some surface deterioration.

Figure 15 Deteriorated timber deck on South Pier

Dock

- **The dock is in good condition but some headers, stringers and the fender piles need to be replaced.**
  - Access to the pilings is limited but the conditions are considered the same as for the North Pier.
  - Some foundation piles, headers and stringers are deteriorated and need to be replaced.
  - Decking is usable but deteriorating.
  - Fender piles are deteriorated and mechanically damaged.

Figure 16 The Existing Dock is considered structurally sound

Figure 17 Dolphin N-1

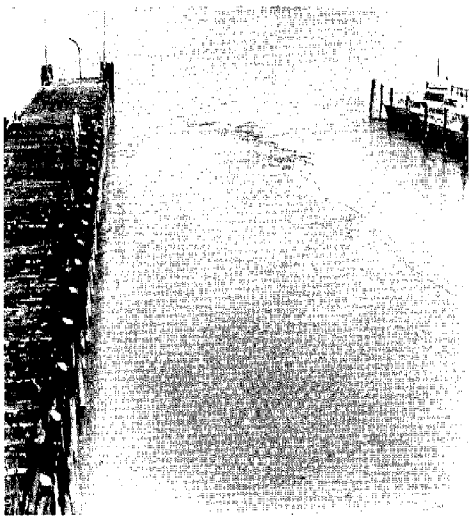


Figure 18 Water depth at low tide

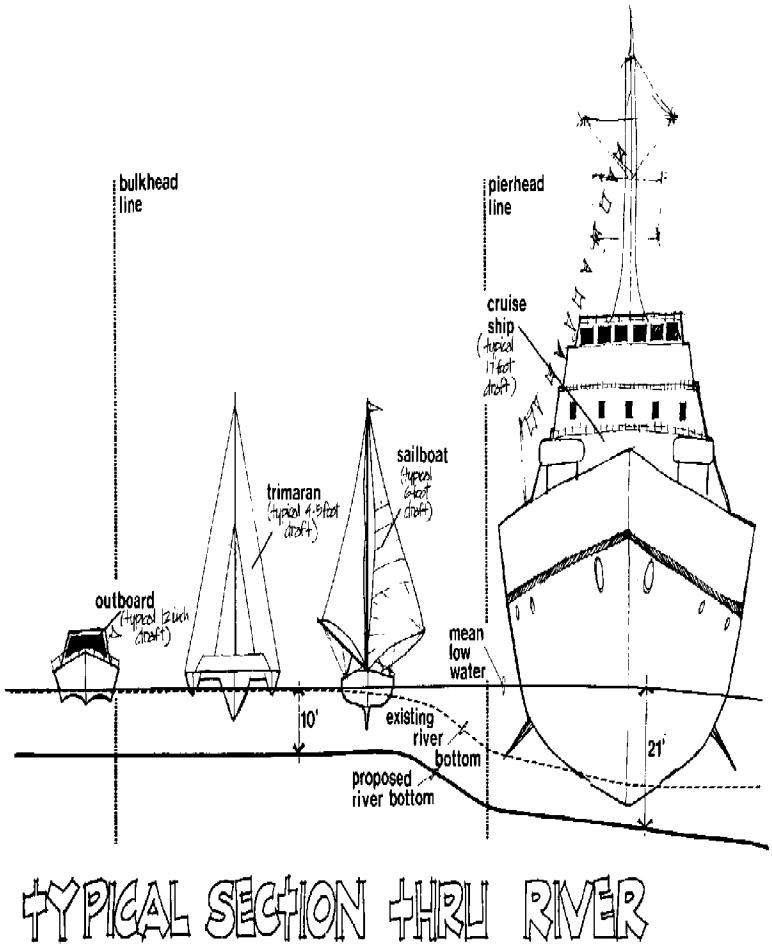


Figure 19 Typical Boat Drafts

Dolphins

- **Dolphins are in good condition.**
  - Piles in dolphins were sample tested and are considered in satisfactory condition.

Dredging

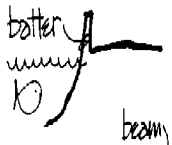
- **Dredging in the basin is necessary.**
  - In the pier areas existing water depths range from 0 feet to 3 feet at low tide.
  - At the Pierhead Line water depth averages 15 feet.
  - A water depth of 10 feet in the basin is required for small craft, (Figure 19), which will result in the removal of approximately 8,000 cubic yards.

*The River and Harbor Act of 1910 provides for a riverbottom depth of 24 feet between the Potomac River Channel and a line drawn 20 feet channelward of the established Alexandria Pierhead Line.

Technical Terms

Following is a list of technical terms used throughout this report:

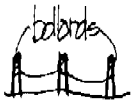
Batter Receding upward slope.



Beam Structural member supporting a load perpendicular to its long axis.

Bent Transverse section of pier structure.

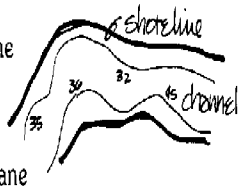
Bollard Single post fitting to which mooring lines from vessels are attached.



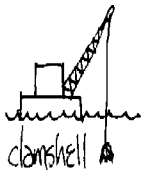
Bulkhead A structure designed to retain earth and consisting of a vertical wall sometimes supplemented by an anchor system.

Bulkhead Lines Lines which establish limits outside of which continuous solid-fill construction is not permitted.

Channel Lines Lines which establish the limits of navigable channels dredged and maintained by the federal government.



Clamshell Method Excavation by a crane using a clamshell bucket.



Cleat A mooring fitting having two horizontal arms for attaching mooring lines from vessels.

Dolphin A structure usually consisting of a cluster of piles. It is placed near piers and wharves or similar structures, or along shore, to guide vessels into their moorings or to fend vessels away from structures, shoals or shore.

Draft Depth of vessel hull below the waterline.

Dredging Excavation of riverbottom material.

Fender A device or framed system on the face of a pier, dock, etc., which takes the impact from berthing or berthed vessel. (Chock —A brace between fenders.)

Header A horizontal bearing member.

Pier A deck, supported above the water, built from the shore out into the harbor and used for berthing or mooring vessels.

Pierhead Lines Line which establishes the outboard limits for open pier construction.

Pile A long slender column of timber, steel or concrete driven into the ground to support a vertical load.

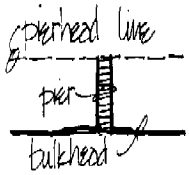


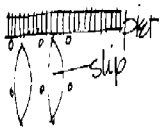
Plate Same as header.

Rafting A practice of tying alongside another boat rather than tying directly to a pier or wharf.

Slip A berthing space for a boat between piles, for mooring a boat.

Spur Pile A bracing pile driven on a batter to provide lateral stability.

Stringer A longitudinal member in a structural framework which supports the deck.



Recommendations

Two alternative concept design plans are presented as possible considerations for the kind of development envisioned for the Torpedo Plant Waterfront. The two plans are considered viable solutions for the renovation and reuse of the piers. These designs reflect consideration of the following:

- The technical analysis of the existing structures
- Existing water-oriented uses, i.e., High School Rowing Club, cruise ship docking
- Proposed water-oriented uses, i.e., pleasure boat marina, historic vessel docking
- The Torpedo Plant site limitations

The following program and concept plans take into account these considerations along with the City goal to increase waterfront recreation.

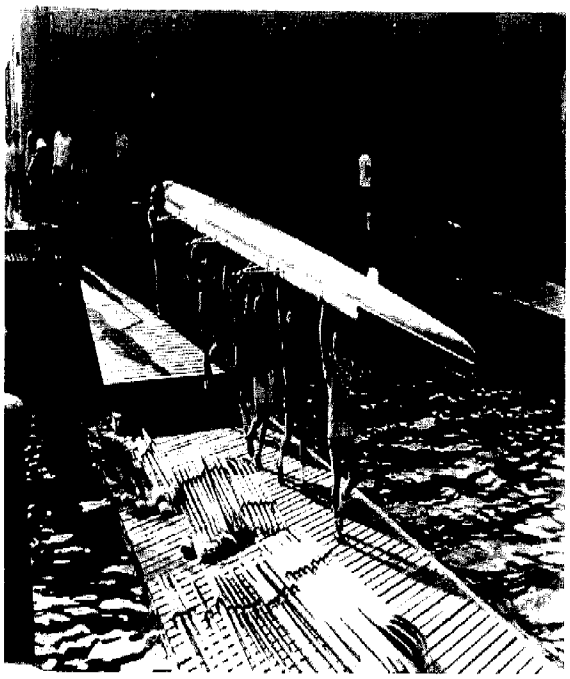


Figure 20 Rowers carry out shell at High School Rowing Facility

Program For Torpedo Plant Waterfront

North and South Pier-Axle load of fire engines and service vehicles will be considered in final design.

*Rowing Facility — 14,000 square foot building providing storage for 30 shells and facilities for 200 students and 9 coaches.

Transient boat slips

14 sailboat slips of drafts to 7 feet with 40 foot maximum boat length.
12 outboard slips with 2-foot drafts and 32 foot maximum length.

*Historic vessel slip of up to 10-foot draft and 100-foot length.

*Water taxi.

*Fisherman's Market/Produce Boat

*Restaurant Boat.

*Dockmaster's Office.

*See pages 30 to 35 for detailed descriptions of these amenities.

Transient Marina versus Permanent Marina

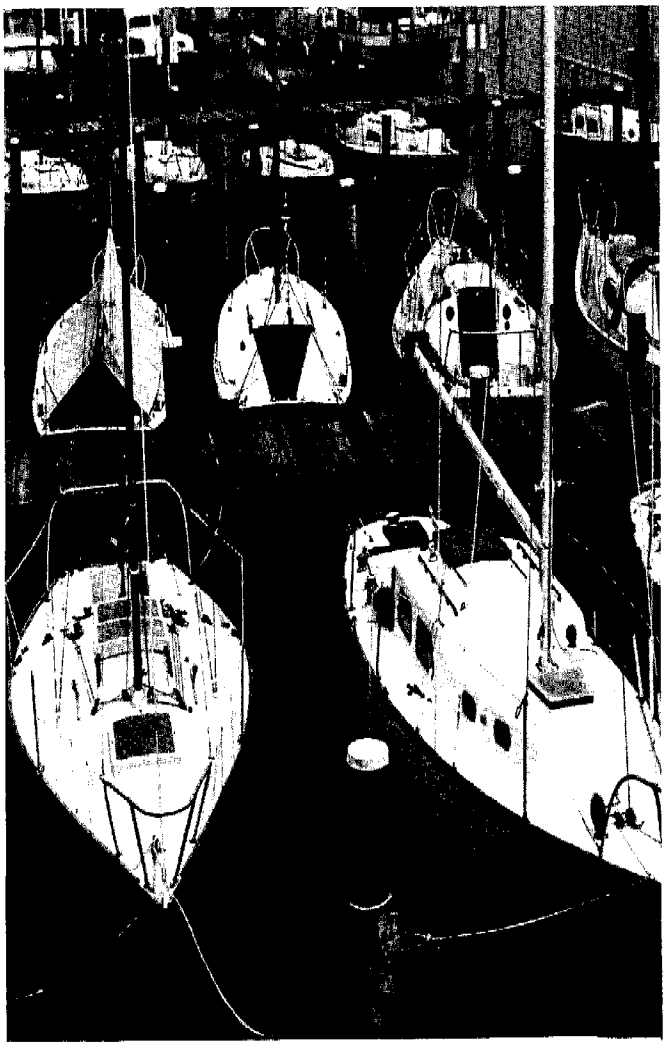
A view of the Potomac on a weekend or holiday will quickly assure the viewer of the importance of sail and motor boating as a major recreational activity.* The area's permanent docking facilities are presently filled. Both the Washington Marina and Old Town Yacht Basin, the closest facilities to Alexandria, are at capacity. Provision of boat docking facilities at the Torpedo Plant will add significantly to the waterfront atmosphere of the complex and provide a picturesque background for the restaurants and shops around the complex.

Due to the large volume of recreational craft on the Potomac, the Torpedo Plant site is an excellent location for a transient marina. Recent surveys estimate a total of 2,500 boats permanently docked within 5 miles of Alexandria. (See Figure 22). Additional pleasure craft visit the upper Potomac from the South and Chesapeake Bay. Day trips to Alexandria would be encouraged by providing transient docking, so that boaters could moor their crafts for a few hours or the day, to sightsee, shop or dine.

The location and layout of the Torpedo Plant facility is better suited to accommodate transient docking as opposed to permanent docking facilities. A full service mooring facility would need space for fueling, dry docking and boat repair which requires heavy equipment and large, open land areas with direct street access. The existing piers can accommodate approximately 30 slips. This figure allows spaces for other possible uses such as an historic vessel, water taxi and fisherman's market. Additional transient boats could be accommodated by rafting during peak periods.

**The Potomac River at Alexandria is currently considered safe for secondary contact (boating). Presently the fecal coliform count is over the standard for safe primary contact (swimming).*

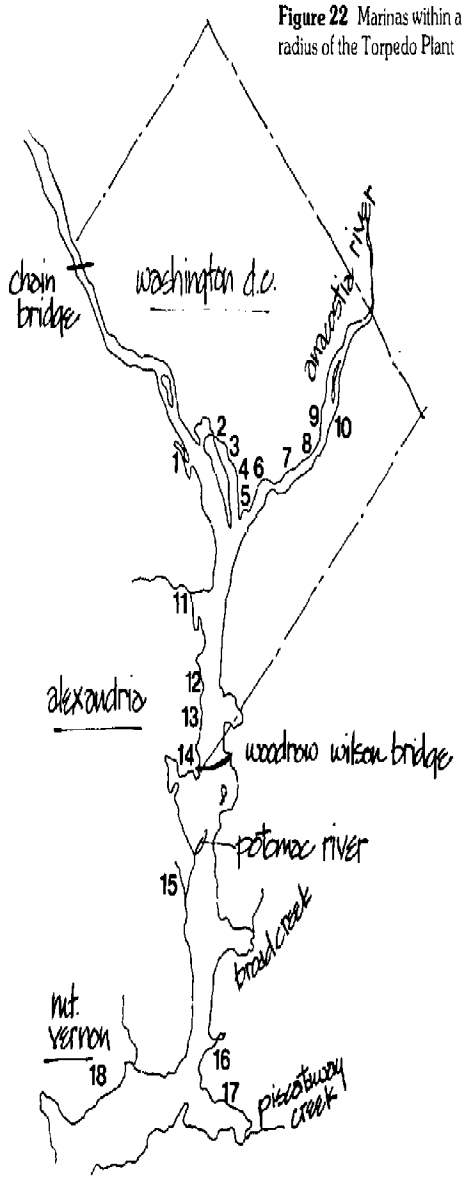
Figure 21 Sailboats docked at Annapolis Marina



Marinas Within 9 Mile Radius of Torpedo Plant

1. **COLUMBIA ISLAND MARINA,** Arlington, Va.
   Slips 500 at 1.45/ft./mo., transients $6/day min., storage 500 wet.
2. **WASHINGTON MARINA,** Washington, D.C.
   Slips 67, storage 67 wet.
3. **CAPITOL YACHT CLUB** (private)
4. **GANGPLANK MARINA,** Washington, D.C.
   Slips 230, transient at $10/day min., storage outside 20, 150 wet.
5. **FT. McNAIR YACHT BASIN,** Washington, D.C.
   Slips 158, transient at $6/day min., storage outside 20, 150 wet.
6. **BUZZARD POINT MARINA,** Washington, D.C.
   Slips 80, transients at $5/day min., storage 35 outside 80 wet.
7. **DISTRICT YACHT CLUB,** Washington, D.C. (private)
8. **WASHINGTON YACHT CLUB,** Washington, D.C. (private)
9. **ANACOSTIA MARINA INC.,** Washington, D.C.
   Slips 3 covered, 40 open, transient at 15¢/ft., storage outside 150, wet 40
10. **SEAFARERS BOAT CLUB,** Washington, D.C. (private)
11. **WASHINGTON SAILING MARINA,** Alexandria, Va.
    Slips 185, 374 dry sail stalls, storage 185 wet, 72 racks.
12. **OLD DOMINION BOAT CLUB,** Alexandria, Va. (private)
13. **ALEXANDRIA MARINE SERVICE,** Alexandria, Va.
    Slips 15.
14. **OLD TOWN YACHT BASIN,** Alexandria, Va.
    Slips 170, storage outside 75, wet 170.
15. **BELLE HAVEN MARINA,** Fairfax, Va.
    Slips 100, Storage 50 outside, 100 wet.
16. **TANTALLON YACHT CLUB,** Tantallon, Md. (private)

Figure 22 Marinas within a 9-mile radius of the Torpedo Plant



17. **FT. WASHINGTON MARINA–YACHTS AMERICA, INC.,** Ft. Washington, Md.
    Slips covered 36, open 250, transients at $3/day min., storage outside 200, wet 300.
18. **MT. VERNON YACHT CLUB,** Mt. Vernon, Va. (private)

*Source **BOATING ALMANAC,** Vol. 4, 1979, published by BOATING ALMANAC CO., INC. Severna Park, Md.

Plan A

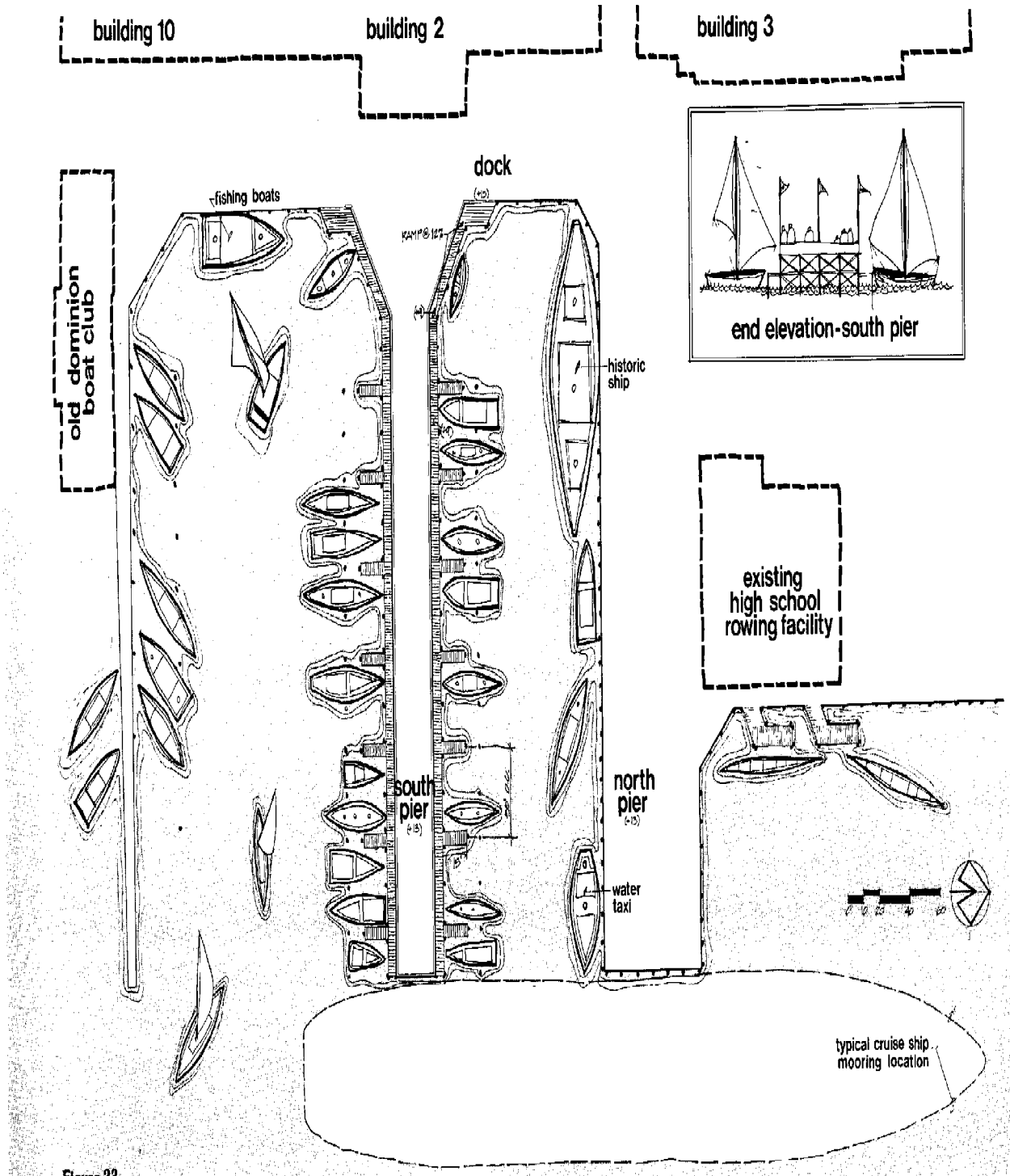


Figure 23

Proposed Plan A

Plan A consists of retaining the existing pier layout and renovating the north and south piers. The south pier would be demolished to the pile caps and at that time the substructure would be tested. If these tests show the foundation piles to be structurally unsound total replacement of the foundation piles would be required.

Development of the marina and docking facilities in accordance with the proposed Plan A will require the primary items listed below. The estimated costs (based on prices in June 1979) for the major items expressed as groups of repairs are as follows:

ITEM	COST
1. **North Pier**—Retain and rehabilitate. Rehabilitation to include fumigation of the existing piles, repair of structural members and deck timbers; replacement of fender system along the north, east and south sides; permanent support for ramp and removal of existing overhead metalwork; restoration of guard timbers, mooring facilities and pedestrian railings as required to accommodate an historic vessel, a floating restaurant and a water taxi or other similar uses.	$121,000
2. **South Pier**—Demolish superstructure to top of existing pile caps.	50,000
a Construct new superstructure (similar to existing)	250,000
b. Walkways and mooring piles	100,000
(c. total replacement of foundation piles, if required.)	*(110,000)*
3. Additional **mooring dolphin**—vicinity of South Pier for mooring deep draft vessels, if required.	20,000
4. ***Utilities**—Water and electrical service for small boat slips.	35,000
5. **Dock rehabilitation**	35,000

6. **Dredging**

a. Marina area—excavated to depth of 10 feet below mean low water.

Estimated Quantity

35,000 c.y. at $20/c.y.	$700,000	
Contingencies at 10%	70,000	770,000

b. Riverfront (area between pierhead line and channel limits)

Excavated to provide a depth of 24 feet.

Estimated Quantity

8,000 c.y. at $20/c.y.	$160,000	
Contingencies at 10%	16,000	$176,000
(With existing South Pier foundation piles)	TOTAL	$1,557,000
Possible total replacement of foundation piles for South Pier	*(+110,000)*	
(With South Pier foundation piles replaced)	*(TOTAL*	*$1,667,000)*

*Sewage pumpout facility (if required) and area lighting not included. Federal law, effective on existing boats as of January 30, 1980 provides an option requiring either a sewage retention device or a certified treatment system. The Virginia State Water Control Board is seeking more stringent protection of Virginia shellfish waters and is working on regulations to impose more stringent requirements than the federal regulations against discharges. The Northern Neck tributaries of the Potomac River are included in the regulations. (SOURCE: Water News, July, 1979, published by the Virginia Water Resources Center, Virginia Polytechnic Institute and State University.)

Plan B

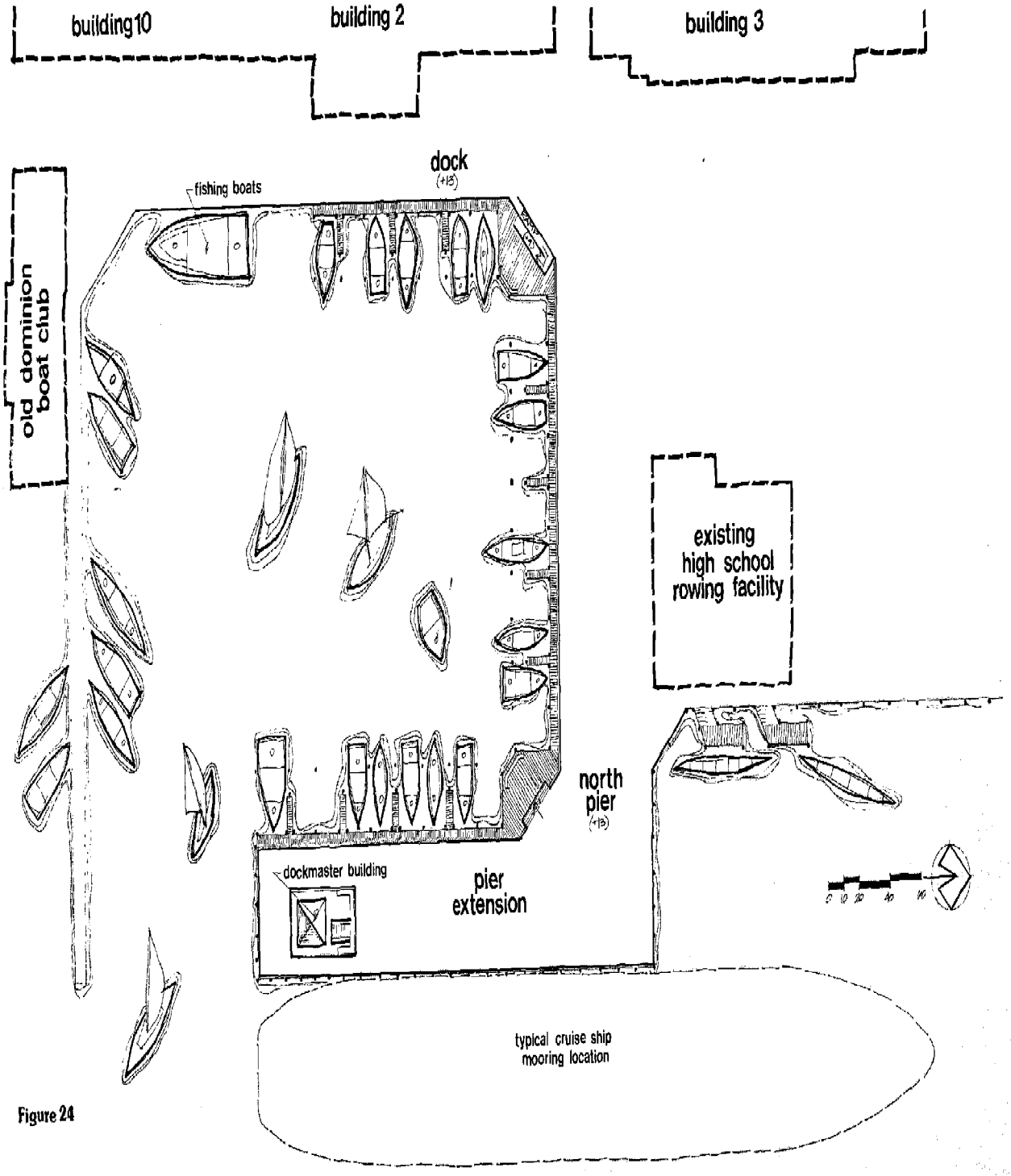


Figure 24

Proposed Plan B

Plan B involves demolishing the South Pier and building an extension to the North Pier, south along the pierhead line. The result would be an L-shaped pier layout.

Development of the marina and docking facilities in accordance with the proposed Plan B will require completion of the major items listed below. The estimated costs (based on prices in June 1979) for the items are as follows:

ITEM	COST
1. **North Pier**—Retain and rehabilitate. Rehabilitation to include fumigation of existing piles; repair of structural members and deck timbers; replacement of fender system along the north, east and south sides; permanent support for ramp and removal of existing overhead metalwork; restoration of guard timbers, and addition of railings.	$ 90,000
2. Construct timber **extension to North Pier,** paralleling pierhead line. Width of new structure—50 feet. Approximate length of addition—200 feet.	600,000
3. Provide **walkways and mooring piles** for small boat slips and construct corner deck areas.	80,000
4. Additional **mooring dolphin**—South end of north-south addition, if required for mooring deep draft vessels.	20,000
5. **South Pier**—Demolish superstructure, remove existing bearing and fender piles to a depth greater than 10 feet below mean low water.	$ 75,000
6. **Dock rehabilitation**	35,000
7. ***Utilities**—Water and electrical service for small boat slips.	35,000

8. **Dredging**

a. Marina area—Excavated to depth of 10 feet below mean low water.

Estimated Quantity

35,000 c.y. at $20/c.y.	$700,000	
Contingencies at 10%	70,000	770,000

b. Riverfront

Excavated to provide a depth of 21 feet.

Estimated Quantity

8,000 c.y. at $20/c.y.	$160,000	
Contingencies at 10%	16,000	176,000
	Total	$1,881,000

*Sewage pumpout facility (if required) and area lighting not included.

NOTE:

The estimated costs indicated to complete the various items of work for either Plan A or Plan B, are based on present indices. They are preliminary figures based on limited site information acquired during execution of the work included in the scope of the feasibility study. As such, they represent budget figures satisfactory for planning in progress at this time.

When a particular plan is selected and development begins, provisions for more detailed investigations, engineering and estimates should be included in the budget planning. Costs for these services (i.e., preliminary and final engineering design, investigations, inspection of construction activities, etc.) in addition to the City's administrative costs, may be estimated at 10 to 15% of the anticipated construction costs.

Recommended Plan

Plan A
(existing pier layout)

Layout	**Offers an efficient marina layout with additional space for attractive amenities, i.e., restaurant boat, historic vessel**
Security	Offers no real sense of "entry point" into marina
Cruise Ship	Cruise ship position limited when the gangway lines up directly with pier
Historic Value	**Renovation of historic Torpedo Plant piers**
Views	**View offers a complete panorama of the river**
Costs	**Estimated total cost $1,557,000**

Plan B
(L-shaped pier layout)

Layout	Marina layout can work but leaves wasted space in central portion. Perimeter footage of pier is less for additional amenities
Security	**Control can be maintained by central entry**
Cruise Ship	**Gangway can open anywhere along dock**
Historic Value	New layout
Views	Views may be blocked by new pier
Costs	Estimated total cost $1,881,000

Of the two alternatives presented, Plan A is the better plan. Plan A offers a more efficient and historic pier layout than Plan B. The perimeter footage around the two piers in Plan A offers more area for boat slips and additional mooring space for historic vessels, a restaurant boat and a water taxi. The number of pleasure craft slips is approximately the same in both plans. Plan A basically involves the restoration of the historic torpedo plant piers while Plan B is a new layout with little historic relationship to either the Torpedo Plant or the City. Views from the ends of either pier will remain the same although views from the dock in Plan B may be blocked by the new pier addition.

The financial aspect of both plans as presented is an important factor in selecting a preferred layout. The cost of Plan A is less because it is a renovation plan rather than a new construction plan, as is Plan B. Plan A is therefore recommended as the more cost conscious and best design plan for the Torpedo Plant Waterfront.

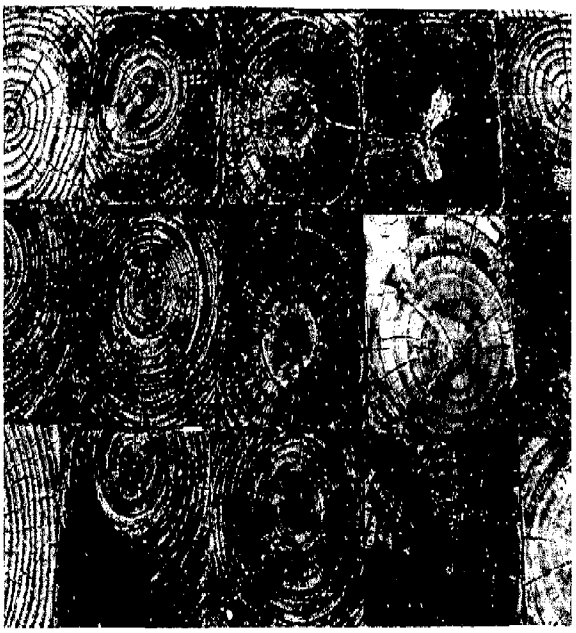


Figure 25 Nautical wood block paving pattern at Annapolis City Pier.

Financing

In addition to general obligation bonds, there are two other likely funding sources for the proposed public improvements:

Developer Contribution

This is anticipated as a primary method of financing. As stated in the City Objectives section of the **Prospectus:** "*The City seeks to achieve the development objectives described herein in such manner that the cost of public improvements are supported by the revenue received from the sale of lands and buildings for private uses and the tax revenues generated from those private uses. The City will earmark for public improvements all proceeds from the sale of lands and buildings for private uses.*" The amount of the private contribution will depend on the negotiations currently underway between the City and the selected developer.

Grants

The Land and Water Conservation Fund administered by the Virginia Commission of Outdoor Recreation holds substantial promise for assisting the city to fund the public improvements at the Torpedo Plant. The Commission funds projects incorporating such elements as 1) acquisition of land for development of outdoor recreation facilities and support facilities; 2) acquisition of frontage on rivers, streams and lakes; 3) development of swimming pools, bathhouses, beaches and boat ramps; 4) development of trails and bikeways; and 5) architectural and engineering fees. In 1978 the City received $431,000 from the Virginia Commission of Outdoor Recreation for the Holmes/Cameron Run Biketrail Project. City and State sources indicate a Grant request for the Torpedo Plant of at least this magnitude would be reasonable. The funding limit for the Grant is $1 million dollars with thirty percent of that amount funded by the local jurisdiction. Additionally, Historic Maritime Trust Grants are available from the Heritage Conservation and Recreation Service of the U.S. Department of the Interior and the National Trust for Historic Preservation for building or acquiring historic vessels (p. 34) and for the renovation of historic pier areas.

Other possible revenues to the City could come from collection of fees for marina services. These services could include transient docking fees and utility hookup charges, wet boat storage during the winter and concessions on rentals for canoes, sailboats and fishing tackle.

Figure 26 Bollard

Marina Related Facilities

Following is a summary of the available information regarding existing and proposed marina related activities and facilities.

Alexandria High School Rowing Club

The Alexandria High School Rowing Club is currently the largest high school rowing club in the United States. This year the senior boys team placed second in the Nationals and were invited to row in the Henley Regatta in England.

The rowing program is operated jointly by the Alexandria School Board, the City and the Alexandria Crew Boosters. The Crew Boosters have provided the rowing equipment and coaches' equipment for the past twenty-seven years. The School Board pays the coaches' salaries, supplies the uniforms and pays for the building maintenance, while the City provides the building and pays the utilities.

Originally, the rowers used the facilities of the Old Dominion Boat Club but as this program expanded, the City provided use of the old Torpedo Plant storage building. This 7,700 sq. ft. building, constructed in 1943, provides storage for 20 of the 28 rowing shells. Due to lack of space the remaining eight shells are stored outside. Minimal renovations were done in 1974 to provide men's and women's locker rooms and shower rooms. Because this facility is regarded as temporary the locker rooms are inadequate and do not meet City Code. A small weightlifting room and coaches' office are also located in the existing facility.

Rowing Season

The official rowing season is from February first to Memorial Day. During the season the students use the facility after school until dark, Monday through Friday. The regattas are held on weekends.

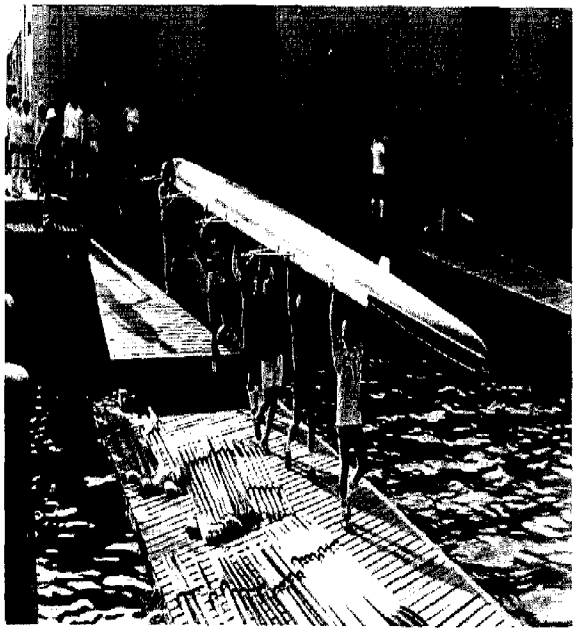


Figure 27 Rowers carrying shell

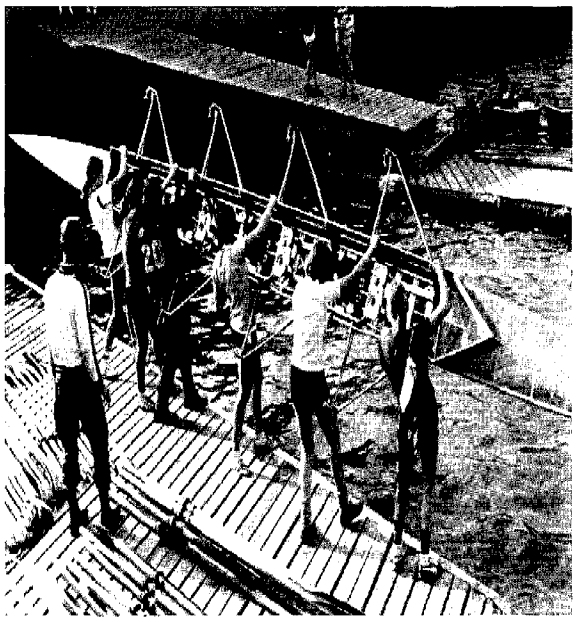


Figure 28 Rowers set shell in River

Proposed Program for New Facility

Current program participants:	200 high school students 9 coaches
Equipment:	Storage for 30 sixty-foot shells
Men's locker room:	3 water closets 3 urinals 2 lavatories 20 showers
Women's locker room:	3 water closets 2 lavatories 20 showers
Coaches' locker room:	10 lockers
Additional facilities:	Weightlifting room-- ± 400 sq ft. Coaches' office and first aid room--250 sq. ft. Storage room--150 sq. ft.
Anticipated total building square footage:	14,000 sq. ft.

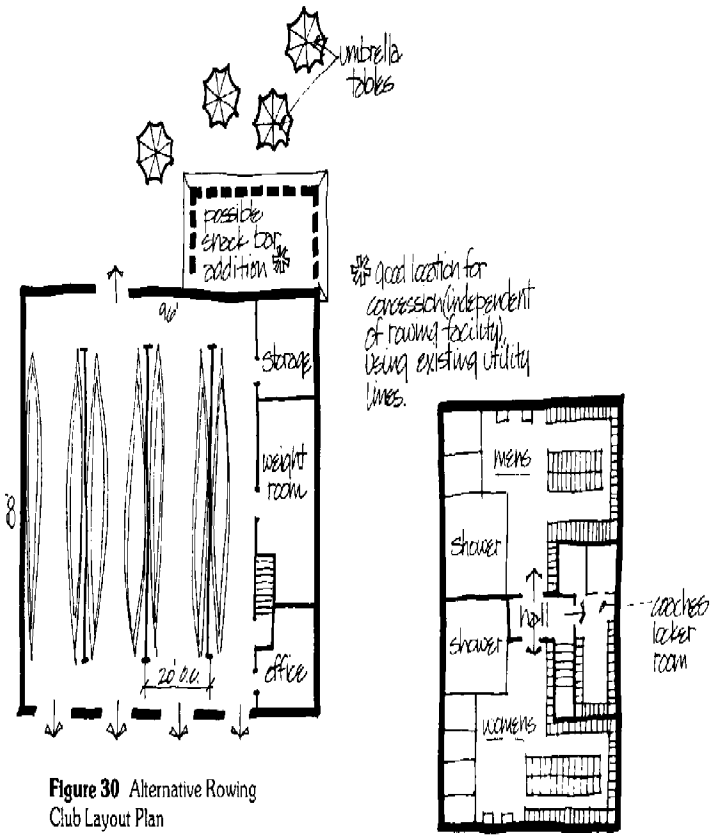


Figure 30 Alternative Rowing Club Layout Plan

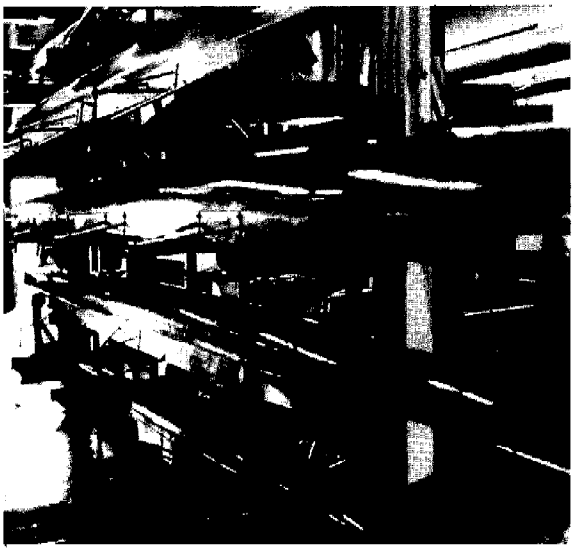


Figure 29 Shells stacked in rowing facility

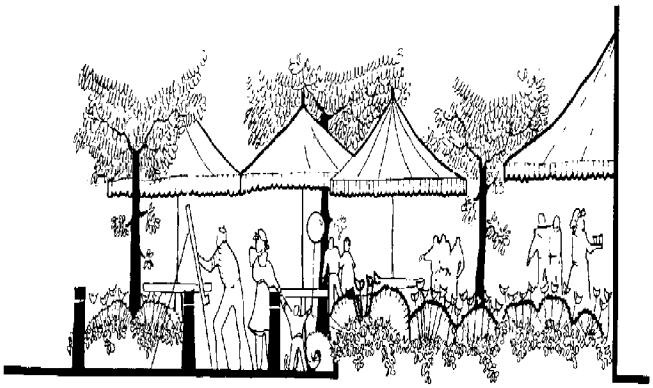


Figure 31 Elevation on deck area

Cruise Ships

Cruise ship activity is relatively new to Alexandria. The M/S CARIBE, the first passenger ship to dock in Alexandria in decades, made a successful cruise from the City in the fall of 1978 and has planned at least two visits in the fall of 1979.

Costs related to the 1978 cruise

City costs relative to the November 1978 cruise amounted to approximately $5,000. The City received total reimbursement from the owner, Commodore Cruise Lines, and the agent, U.S. Travel Agency.

The breakdown of the direct costs shows that the City's reimbursement expenditures were as follows:

Police protection	$1,780
Water connection	980
Traffic barriers	360
Administrative overhead	1,880
	$5,000

Anticipated costs of 1979 cruise

The proposed November 1979 cruises will be facilitated on the completion of specific improvements to the dock facility. Both the North and South Piers are deteriorated. As discussed on p. 37 most of the fender piles along the faces of both piers are not in good condition. The piles are not expected to provide safe docking for a large ship. With the absence of strong fender piles serious permanent damage to the piers can be expected if a large cruise ship is permitted to dock.

Recently the City contracted with Thomas H. Andrews, Inc. located directly upriver to complete necessary pier repairs and modifications. The total contract cost is $40,000 and includes:

1) Replacement of fender piles for North Pier along pierhead line.

2) Installation of timber chocks between fender piles.

3) Installation of temporary plywood decking.

4) Installation of new dolphin.

Figure 32 M/S CARIBE docked in Alexandria

The cruise ship captain also requested that the City dredge outside the pierhead line. The draft on the M/S CARIBE is 17 feet, while at the point the ship will dock the water depth is approximately 15 feet. Minimum dredging costs to the City were estimated at approximately $80,000. Because of the high costs, this expenditure was not approved by City Council at this time.

Estimated direct costs to the City for the 1979 fall cruises of the M/S CARIBE are approximately $2,775 for each anticipated cruise. The City will be reimbursed for this amount by Commodore Cruise Lines. The City has estimated that its tax revenues will be a total of $1,164 for the November docking of two cruises.

Providing customs facilities for these cruises poses a problem with the existing building layout. The only space considered adequate for handling customs is the tunnel between Buildings #2 and #3. The ideal location for a customs facility would be in the location of the existing rowing club. It could either be incorporated into the design of a new rowing club or be an added facility in the Torpedo Plant Redevelopment. The customs location is important to the cruise ship activity and needs to be examined further.

Dockmaster

The most cost-effective way for the City to operate the transient marina would be to employ a dockmaster to supervise marina operation. Annapolis, for example, employes a full-time harbormaster and two assistants to supervise the maintenance and operation of the City docks, collect fees, patrol creeks, enforce City codes, and operate the City Market. Due to the limited operation and scope of the Torpedo Plant Marina the City would need to employ a dockmaster full-time, 8 AM to 8 PM, during the summer months only. During the winter months, no marina traffic is expected, therefore the dockmaster would be employed part-time to oversee maintenance on the piers and supervise operation of the City Market.

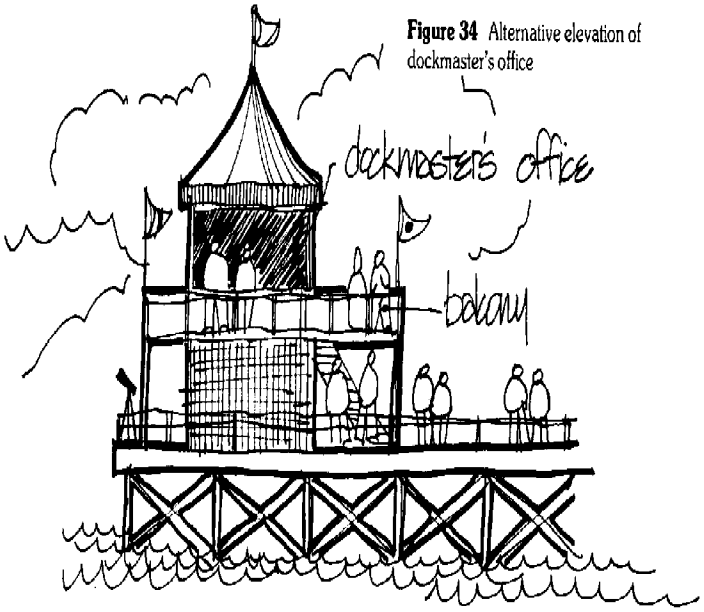


Figure 34 Alternative elevation of dockmaster's office

Figure 33 Harbormaster Building in Annapolis. Public Restrooms are located on ground floor and harbormaster's office is on second floor.

Dockmaster's Responsibilities:

To manage and supervise the maintenance and operation of the Torpedo Plant Marina, including:

1) *Collecting docking fees*—Rates and conditions would be established by City Council. (For comparable fee rates the Annapolis City dock charge is a minimum $12/day fee plus 50 cents per hour county tax. See Annapolis City Dock Information, Appendix I.)

2) *Enforce a maritime code*—An example of such code currently enforced in Annapolis is included in Appendix II.

3) *Supervise operation of a City Market* and Fisherman's Market*
This would include monitoring stall leases and operating lease space for the Fisherman's Market.

Dockmaster Facility:

A major factor in the location of the Dockmaster's office and operating space is that it must be easily accessible to the boat owners and have an open view of all boat traffic entering the marina. The best location for this facility would be to locate it on the pier, as shown in Plan B (p. 26).

Building Program:

Office	150 sq. ft.
First aid room	100 sq. ft.
Storage	100 sq. ft.
	350 sq. ft. total

*A covered City Market is proposed by the *Alexandria Waterfront Restoration Group.*

Historic Vessel

Historic vessels are frequent visitors to Alexandria, presently docking at the Old Ford Plant on Franklin Street. This dock is seven blocks south of the Torpedo Plant and generally out of the mainstream of Old Town Activity. The most recent vessels to visit Alexandria were the tall-masted sailing ships, the EAGLE and the YOUNG AMERICA. The EAGLE is now a U.S. Coast Guard cutter. It was built in Germany in 1936 and used as a cargo ship throughout World War II. The ship was brought to the United States in 1946, and currently serves as a cadet training vessel. The YOUNG AMERICA is a reconstruction of a 130-foot brigantine wood cutter of the 1700's.

The Torpedo Plant Marina is an ideal location for historic vessel docking, either permanently or on a visiting basis. The addition of such a vessel to the Waterfront would accentuate Alexandria's maritime history. The towering masts and sails would greatly enhance the views of the river down King Street and would do much to attract visitors to the pier.

Sound historic vessels are not readily available. Most require extensive renovations. An alternative would be to build a replica of a vessel at the Torpedo Plant Pier, as Baltimore did with the PRIDE OF BALTIMORE. Baltimore commissioned a builder of historic ships to fabricate an authentic clipper ship on a pier at the Inner Harbor. Total cost was approximately $300,000, partially funded by a Maritime Preservation Grant. Building the PRIDE did much to attract visitors to Baltimore's Inner Harbor.

Alexandria, too, could benefit from building an historic vessel at the pier. Grants for such an endeavor are available through Maritime Preservation Grants and the State Historic Trust. Building a replica on-site would provide the City with a choice of craft to exhibit and serve as an education tool.

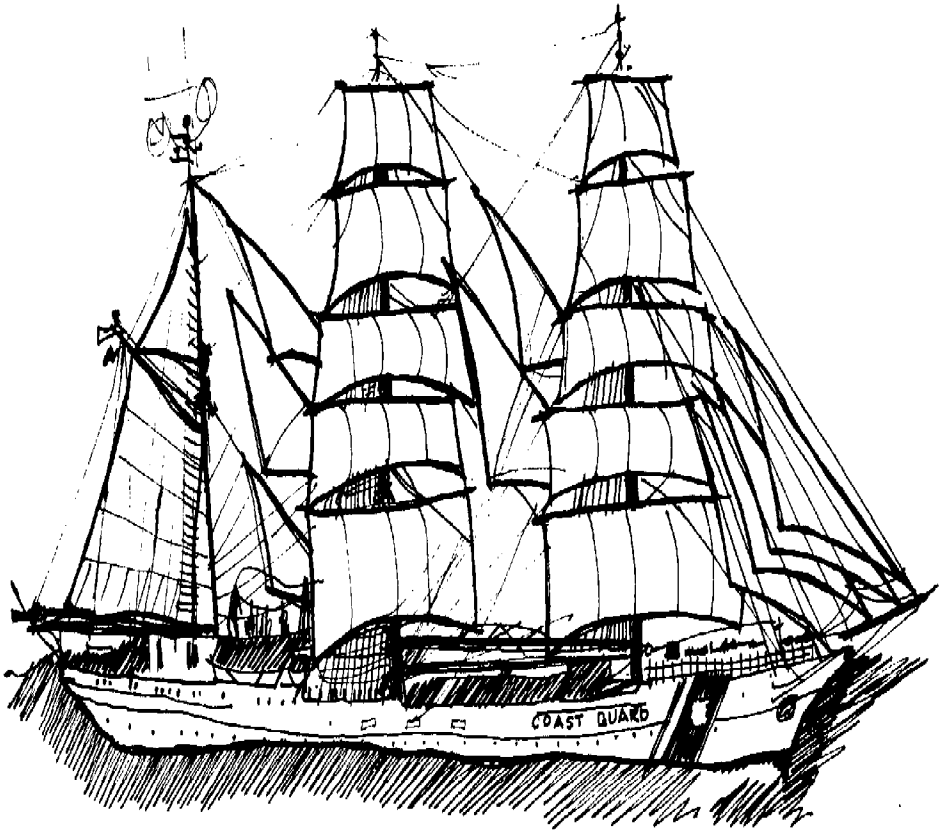


Figure 35 The EAGLE

Restaurant Boat

The Torpedo Plant Marina provides an ideal location for a restaurant boat. Daytime and evening diners would enjoy the special advantage of waterfront views. Depending on the type of boat, it would be possible to moor pleasure craft to the facility, thus allowing for additional mooring spaces for transient visitors coming to dine.

Restaurant boats are moored on many waterfronts. Philadelphia, Washington and Baltimore all have large restaurant boats that lease mooring space at City-owned docks. Operations of these facilities must be carefully worked out taking into account the City services provided such as water, electricity, sewer and parking. While this type of facility would require detailed planning at the onset, it could prove to be an attractive amenity to the Torpedo Plant Waterfront.

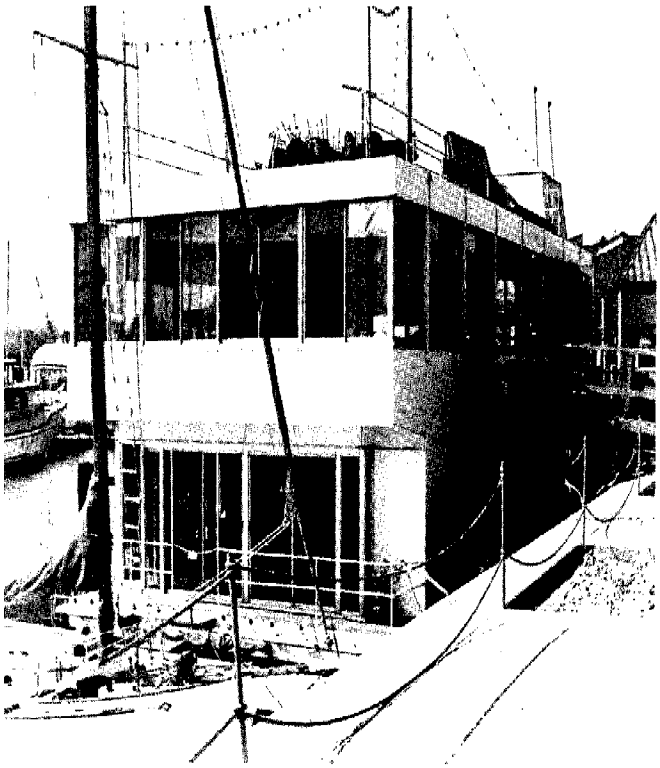


Figure 36 The Gangplant Restaurant Boat at Washington Waterfront

Water Taxi

Currently a water taxi operates in Annapolis. It is a classic 1930 motor launch called the MARY HARPER and can accommodate 44 passengers. The charge for a one-way fare is $1.00. It operates a daily commuter service from 9:00 AM to 4:00 PM, May 1 to September 15. This type of amenity could prove very attractive to the Torpedo Plant Marina both in terms of providing a service and attracting people who would like to approach Alexandria from the river but do not have access to a boat.

Fish Market/Produce Boat

A fisherman's market would provide an attractive amenity in conjunction with the City Market proposed for the redeveloped Torpedo Plant. It is envisioned that fishing boats could be moored at the dock for the primary purpose of selling fish. Problems with this type of amenity can be anticipated. Annapolis, for example, restricts retail selling over the docks because this type of commerce conflicts with the adjacent City Market. Another problem is the competition for mooring a fishing boat. A way to avoid this would be to lease the mooring space or operate the boat as a concession. Further problems would be in regard to utilities and trash storage and collection. Details for this type of amenity would need to be carefully developed before its implementation.

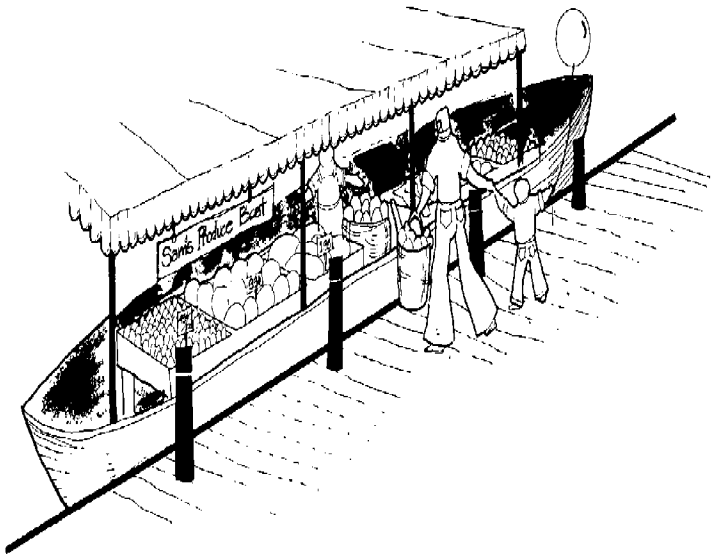


Figure 37 Fish Market Boat

Figure 38 View of the Torpedo Plant from the South Pier

Part 2: Technical Information Analysis of Existing Conditions

The following presents information pertaining to the condition of the existing primary waterfront structures. These include the North Pier, the South Pier, the adjoining dock and the three existing mooring dolphins. The river bottom in the vicinity of the Torpedo Plant is also discussed.

North Pier (Concrete/Timber Construction)

Description

This structure, almost directly opposite Cameron Street and the accessway between Building #2 and #3, is a concrete structure between the inshore bulkhead and the Bulkhead Line of the Potomac River. (Figure 8). The concrete section measures approximately 227 feet in length and approximately 26 feet in width. The structure is supported by timber piles, with the foundation area enclosed by a steel sheet pile bulkhead running along the south and east sides. (Figure 39.) The sheet pile bulkhead continues in a northerly direction and terminates at the northeast corner of the City's property. From the concrete pier to the north property line, the sheet pile bulkhead serves as a retaining element for that portion of the property currently being used as a parking area.

From the Bulkhead Line to the Pierhead Line, a distance of approximately 100 feet, the North Pier is a timber structure. The width of this section is approximately 64 feet with partial access by ramp from the parking lot level. In general, this section is comprised of timber piles, timber headers and a timber deck. The south, the east and the north faces are protected by a timber fender system comprised of piles and chocks. In addition, the northeast and southeast corners are further protected by clusters of timber piles. An adjustable ramp section, measuring approximately 12 feet by 40 feet, is located near the southeast corner.

This section of the pier has seventeen rows of piles in a west-east direction. There are ten rows of piles in the north-south direction. Near the low water line, the piles are braced with a 4-inch by 12-inch timber running in the longitudinal direction. At the top of the piles, there are two, 2-inch by 12-inch headers running longitudinally, supporting 6-inch by 12-inch stringers which are spaced on 24-inch centers. These support a deck of 4-inch by 12-inch timbers running in a longitudinal direction.

Existing Condition

The concrete portion of the pier is in generally good condition as noted during a visual observation of the exposed surfaces. Access to determine the condition of the foundation piles for this section is literally

non-existent, consequently, an evaluation of this portion of the substructure was not made.

The timber foundation piles supporting the timber section of the pier are in generally good condition. Of the interior piles inspected, approximately 31 percent exhibited evidence of decay in the outer fibers, but beyond that depth, the piles appear to be sound.

The fender piles around the perimeter of the North Pier have suffered the greatest deterioration and damage due to past usage and exposure, particularly in the tidal zone. It is estimated that approximately 80 percent of these piles, including the clusters at the northeast and southeast corners and along the south side of both the timber and the concrete sections of the pier will require replacement.

Recommendations

Based on limited historical information concerning the North Pier, particularly the timber portion, it appears that the design capacity for that portion may have been as high as 500 pounds per square foot. An analysis of the components in perfect condition appear to substantiate a design figure of this magnitude.

On that basis and considering the current condition of the concrete and timber sections of the North Pier, rehabilitation appears to be feasible. The requirements for the concrete section are basically cosmetic, except for the replacement of the timber fender piles.

For the timber section of the pier, rehabilitation can be accomplished by replacement of the pile bracing members, repair of the deteriorated or unsound decking, and replacement of the timber fender piles and pile clusters. The decay noted in the bearing piles can be arrested with the use of an internal fumigant. This action will prolong the expected life by approximately ten years.

Consideration should be given to replacement of the guard timbers around the perimeter of the deck where required, installation of mooring hardware compatible with anticipated usage and the installation of perimeter railings for the protection of pedestrians using the facility.

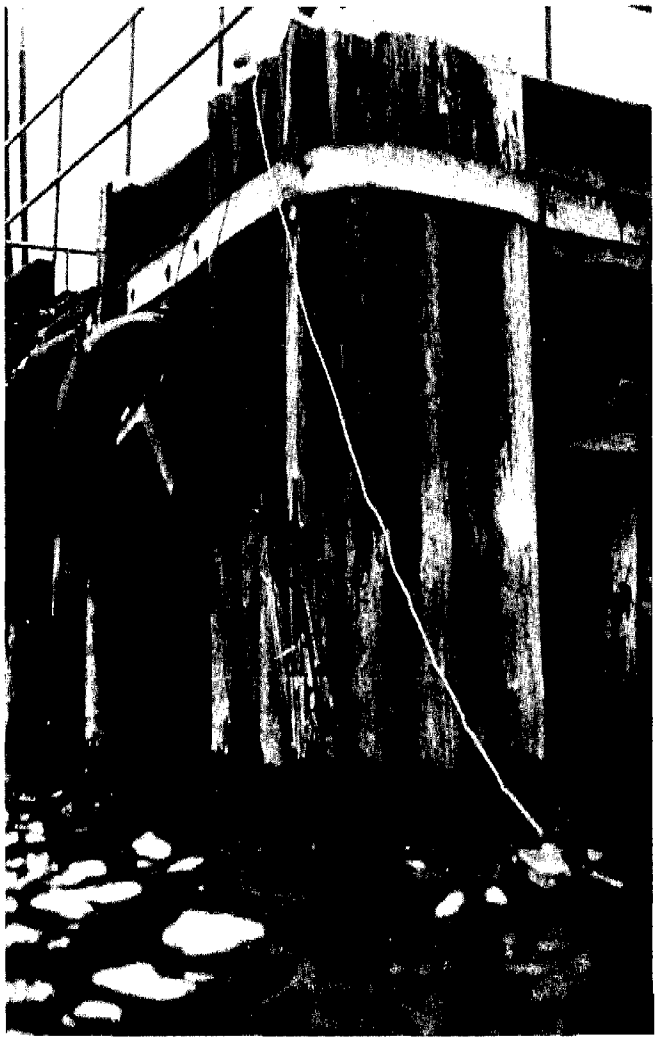


Figure 39 North Pier

South Pier (Timber Construction)

Description

This pier, located approximately 110 feet south of the North Pier, is constructed entirely of timber. It measures approximately 330 feet in length extending from the approximate center of the face of Building #2, to the Pierhead Line of the Potomac River. The width of the structure is 25 feet.

According to a limited number of available drawings and other historical information, this pier may have been built as early as 1919 with major modifications and rehabilitation occurring as late as the 1940's. The original construction included the use of timber foundation piles driven in bents of five piles each with the bents spaced 10 feet center-to-center in an east-west direction. In each bent, the piles were spaced at 6 feet center-to-center and a total of 33 bents were utilized to develop the approximate 330 feet of length. In addition to the five vertical piles, every other bent has two spur piles driven on a batter from the outside toward the center of the pier.

Each bent was cross braced and supported a 12-inch by 12-inch timber header. The headers in turn, supported by 6-inch by 12-inch stringers, spaced at 3 feet center-to-center, running longitudinally to support a 3-inch timber deck.

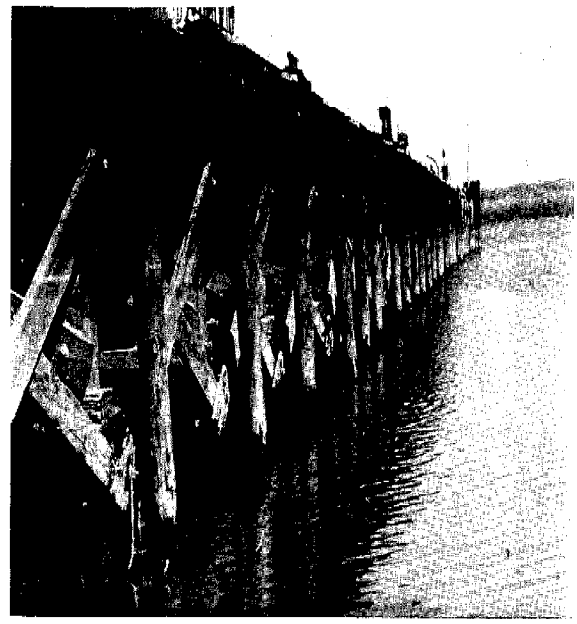
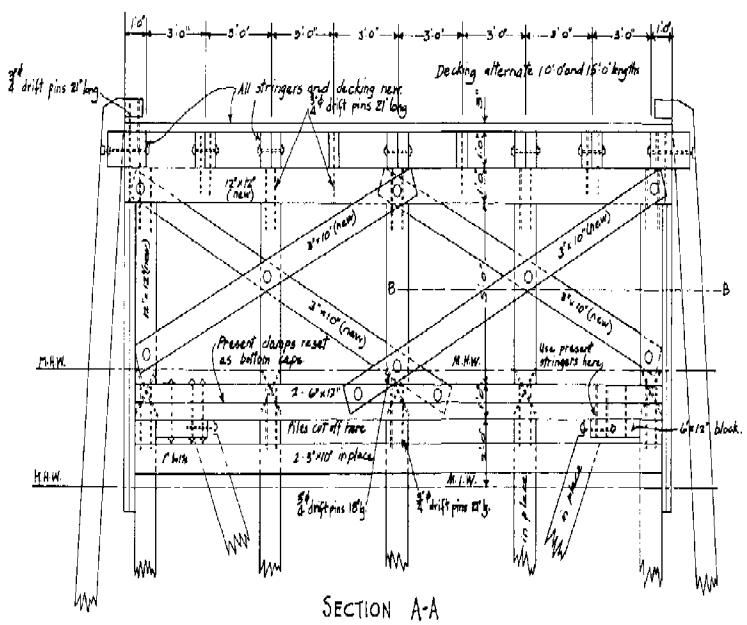
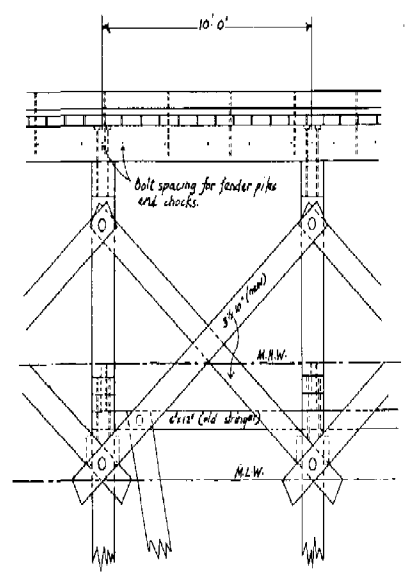


Figure 40 South Elevation View of South Pier



SECTION A-A

FOR BENTS 2 TO 33 INCLUSIVE



SIDE ELEVATION

SHOWING LONGITUDINAL BRACING FOR ALL OUTBOARD POSTS · FENDER PILES AND CHOCKS NOT SHOWN.

Figure 41 Sections—South Pier

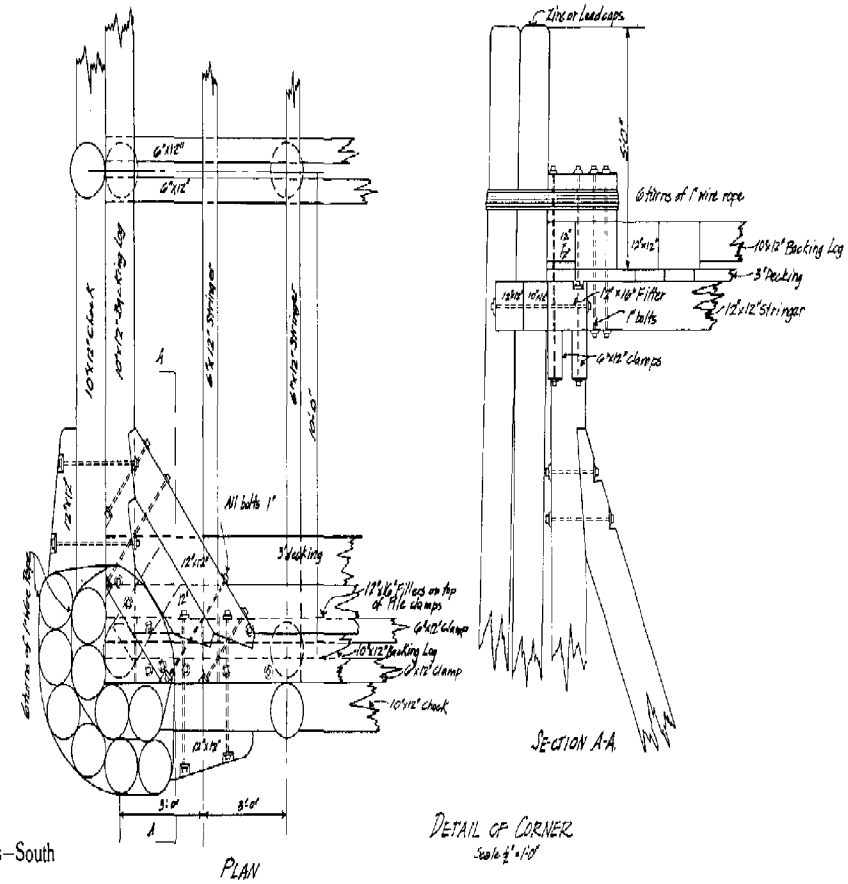


Figure 42 Corner details—South Pier

The pier was protected by timber fender piles driven at the ends of each bent. These piles were driven at a batter of 1 to 12. At the river end of the pier, the fender piles were spaced at approximately 6-foot centers and were supplemented by clusters of piles at the northeast and southeast corners. Each of these clusters included approximately 10 piles with appropriate banding and other hardware.

The original pier apparently had a 12-inch by 12-inch timber backing log running around the perimeter of the deck. Mooring bitts were spaced 4 to each side of the pier. Cleats were spaced to provide 6 on each side of the pier.

Available drawings indicate that the elevation of mean low water was +3.0 (Washington Navy Yard datum) and the elevation of the completed dock was +13.25. Other available drawings indicate that dredging of the area was proposed, or was completed to a level 15 feet below mean low water, or elevation −12.

Existing drawings, depicting modifications of the pier, are dated as early as 1927; however, it is believed that the actual work may not have been completed until the early 1940's. These modifications included cutting off the original foundation piles at a point 2 feet above mean low water or elevation +5.0. It is believed that damaged or deteriorated piles may have been replaced at this time and cut off at the same elevation. The piles, at this lower elevation, supported a header comprised of two, 6-inch by 12-inch timbers positioned with the 12-inch dimension in the horizontal plane.

Vertical sections of timber, 12-inch by 12-inch by 5 feet, were added above each pile location on (6 foot centers) to support a new 12-inch by 12-inch timber header, which supported 6-inch by 12-inch stringers.

The vertical members were cross braced in each bent and cross bracing (3-inch by 10-inch) was added between bents on the north and

south sides of the pier. The decking for the rehabilitated superstructure was 3-inch timbers with 10-foot and 16-foot sections used to accommodate the 16 feet of width.

The spur piles, located at every other bent, were not compatible for framing into the bents when cut off at a lower elevation. Six-inch by 12-inch stringer members were used to tie the spur piles together in a 3 bent sequence.

Fender piles were used at each bent along both sides and at the end of the pier to protect the structure. These were apparently again driven at a batter of 1 to 12. New backing logs, 6-inch by 10-inch, were installed during the rehabilitation, along with the necessary hardware.

On the north side of the pier, approximately 85 feet from the northeast corner, there is a separate concrete foundation supported by 9 timber piles. A similar foundation exists on the south side of the pier approximately 70 feet from the southeast corner. These foundations for pillar cranes were constructed independent of the foundations for the wooden pier.

The details noted above, while obtained from available drawings, were verified during inspections of the structure. The existence of numerous unused utility lines on the pier were also noted. These include sewer, water and electric utility services installed during earlier use periods of the South Pier.

Condition

The timber deck and the backing log timbers are very badly deteriorated. The timber stringers and headers are in poor to fair condition. The 12-inch by 12-inch vertical timbers in each bent, and the related cross bracing are in poor condition. The longitudinal cross bracing between bents and the fender piles are in poor condition due to decay or mechanical damage. A major factor contributing to the deterioration of the vertical and bracing members is the decay which developed in the many bolt holes used for connection of the members.

In general, based on conclusions formed during the site inspections and from review of the reports of investigations conducted by others, it appears that the condition of the pier superstructure, from the deck to the top of the piles, does not warrant the expenditures for repairs. (Figure 40.) The foundation piles, while exhibiting some shallow surface deterioration, are believed to be reasonably sound and in good condition. This is not unexpected, since these members are exposed for very short periods of time during very low tides. In similar cases where timber piles have been tested after more than sixty years of service, they have been found to have retained more than 80 percent of their bearing capability. (See Appendix VI)

Recommendations

From available information, it appears that this structure may have been designed to support a live load of 500 pounds per square foot. Analysis of the structure components in a new condition appears to support this information. Based on the reported condition of the superstructure, it is recommended that the upper portion of the pier be demolished down to the top of the foundation piles. This will involve removal of structural timbers, fender piles and utilities. Planned future use of the pier should be based on reconstruction from this level following a more detailed investigation of the then exposed timber bearing piles.

Dock (Timber Construction)

The dock is a timber structure which extends along the concrete bulkhead in front of Building #2 between the north side of the South Pier and the south side of the North Pier. The length is approximately 110 feet and the width is approximately 26 feet.

This structure is supported by timber foundation piles arranged in bents and stiffened by timber cross bracing. The piles support timber headers, which, in turn, support stringers to carry the timber decking. The edges of the deck are protected by timber backing logs and the east face of this structure is protected by timber fender piles.

The details are similar to those noted for the timber section of the North Pier, and based on limited information available, it is likely that the construction of this structure dates from the same era as that of the timber section of the North Pier. This time is believed to be in the 1940's.

Condition

The framing details of the dock and the large accumulations of debris under the structure make access for detailed inspection difficult. From limited investigations conducted in this area, it is reasonable to conclude that the conditions here are much the same as those noted during examination of the North Pier members.

Some of the foundation piles appear to be suffering deterioration, but only to a relatively shallow depth, with the remainder of the interior of the piles in sound condition. Other members, including the bracing, headers and stringers, are in fair condition with a small percentage of the members requiring repair or replacement as a result of deterioration or mechanical damage. The decking is deteriorating, but is in a usable condition for pedestrian and light vehicle use. Fender piles, as in other sections of the piers, are suffering deterioration, primarily in the tidal zone. There also is evidence of mechanical damage likely due to the accumulation of debris, as well as ice during the winter months.

Recommendations

It is recommended that this structure, if compatible with uses planned for other sections of the waterfront area, be examined in detail to determine the extent of required repairs. These will include replacement of random cross bracing members, stringers and deteriorated areas of the deck. In addition, consideration should be given to installation of a railing along the outboard side for the protection of pedestrians using the facility.

Figure 43 Debris collects at base of dock

Dolphins

Description

There are three mooring dolphins on the City property. These are located north of the North Pier, just inside the Pierhead Line, at approximate distances of 15 feet, 100 feet and 180 feet upstream of the northeast corner of the Pier. For purposes of identification in this report, they have been designated as N-1, N-2 and N-3, numbering in a south to north direction.

The dolphins are constructed of nineteen treated piles each, grouped in a circular pattern and banded with wire rope to constitute a stable mooring unit.

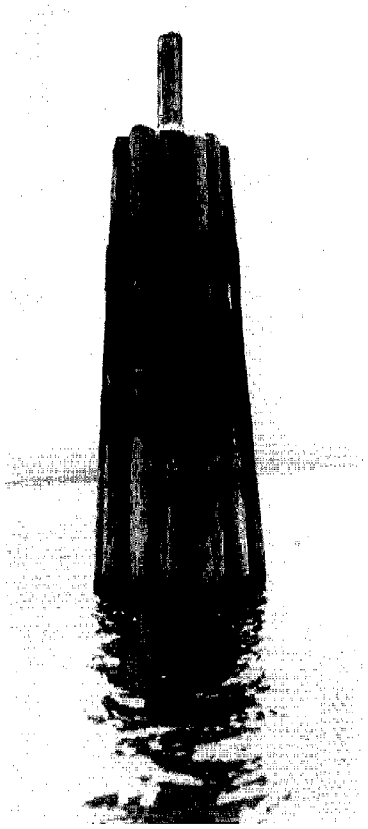


Figure 44 Dolphin No. N-1

Condition

At Dolphin N-3, half of the piles in the outer ring were sampled. While the piles appeared to have a marginal amount of preservative treatment, they were in satisfactory condition. (See Report by J. Taylor, Appendix IV.)

No cores were taken at Dolphin N-2.

Four piles were sampled in Dolphin N-1. Three were satisfactory. The fourth had a sound shell approximately one inch thick, but the heart was rotted.

Recommendations

Results obtained from the site investigations indicate that the three dolphins are in generally good condition and do not appear to require expenditures for replacement or repairs at this time.

River Bottom Conditions

It has been reported that under the Rivers and Harbors Act of 1910, the U.S. Army Corps of Engineers is responsible for maintenance of the channel in the Potomac River. This channel maintenance begins 20 feet east of, and runs parallel to, the Pierhead Line which marks the east ends of the existing North Pier and South Pier.

It has been further reported that the channel depth is maintained at 24 feet which is usually related to the depth below mean low water. According to available information, the river channel was last dredged in 1965. It has been indicated that a survey of the channel by the Corps began in June, 1979.

Maintenance of the river bottom in the 20 foot strip east of the Pierhead Line and the area between the Pierhead Line and the inshore bulkhead is the responsibility of the City. Limited historical information indicates that this area may have been dredged to, and maintained at, a depth of 15 feet below mean low water.

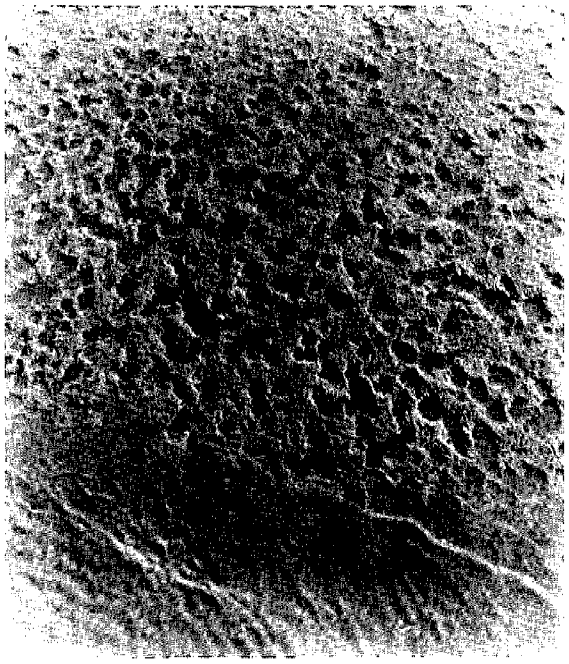


Figure 45 Riverbottom at Torpedo Plant Basin during low tide

Existing Conditions

As a result of surveys conducted during April, 1979, it was learned that the water depth in the pier areas had decreased considerably as a result of silting. Where earlier depths may have been maintained at 15 feet, depths ranging from three feet to zero, were encountered. While this indicates silting of 12 to 15 feet, the time period is undefined so that it is not possible to establish a silting rate.

Near the Pierhead Line, water depths range from 11 to 17 feet, rather than 24 feet which would conform with the maintained channel depth.

The material is a sandy silt deposited during various river stages, as well as by action of the tide, which has a nominal three-foot range in this area. In addition, the pier areas and particularly the inshore end of the slips are congested with driftwood and other debris brought in during high water. This requires that periodic maintenance work be done. The City Department of General Services recently had all accumulated debris removed. A sunken boat hull was noted along the north side of the South Pier during inspections, also located approximately 200 feet from the Pierhead Line.

Recommendations

To provide a satisfactory water depth for use by small pleasure craft, dredging the entire area appears necessary. A depth of 10 feet below mean low water is recommended to provide satisfactory access for the pleasure craft likely to use the facility. Based on the survey information obtained during April, 1979, it appears that dredging to the recommended depth will result in the removal of 35,000 to 40,000 cubic yards of material in the slip areas.

To provide a satisfactory depth for deep draft vessels calling at the City, it is recommended that the area immediately along the Pierhead Line be dredged to provide 21 feet of water at mean low water. To provide a transition from 10 feet to 21 feet, it is recommended that a distance of 50 feet be used to slope the river bottom material.

The volume of excavation resulting from providing for deep draft vessels is approximately 6,000 to 8,000 cubic yards, with the final figure dependent upon the amount of clean-up required immediately north and south of the City's property to provide access for the larger vessels.

To meet present requirements, it will be necessary to obtain dredging permits from the Corps of Engineers, the State of Virginia and other agencies involved in the permitting procedures. Related to this subject is the necessity of learning the type of dredging that will be permitted, as well as any restrictions concerning disposal areas for the material to be removed. Though mentioned as the concluding item concerning the river bottom conditions, the need to satisfy the requirements for permits, disposal areas, etc. is primary and should be considered in full detail before progressing with plans to improve the water depths at the City's waterfront property.

Dredging: Current Information

In February 1975, the City applied for a permit from the Corps of Engineers to dredge in the Potomac. The purpose of the project was to obtain the water depth required to dock two vessels with a draft of approximately 12-15 feet at the Torpedo Plant piers. The proposed work was to extend no more than 290 feet channelward of an existing bulkhead. It was estimated that 6,000 yards of sandy silt were to be dredged by clamshell method and disposed of at the Alexandria City landfill. Three months after submission the permit application was withdrawn from the files by the Corps because of Alexandria's failure to submit necessary revisions of the plan within a thirty-day time frame.

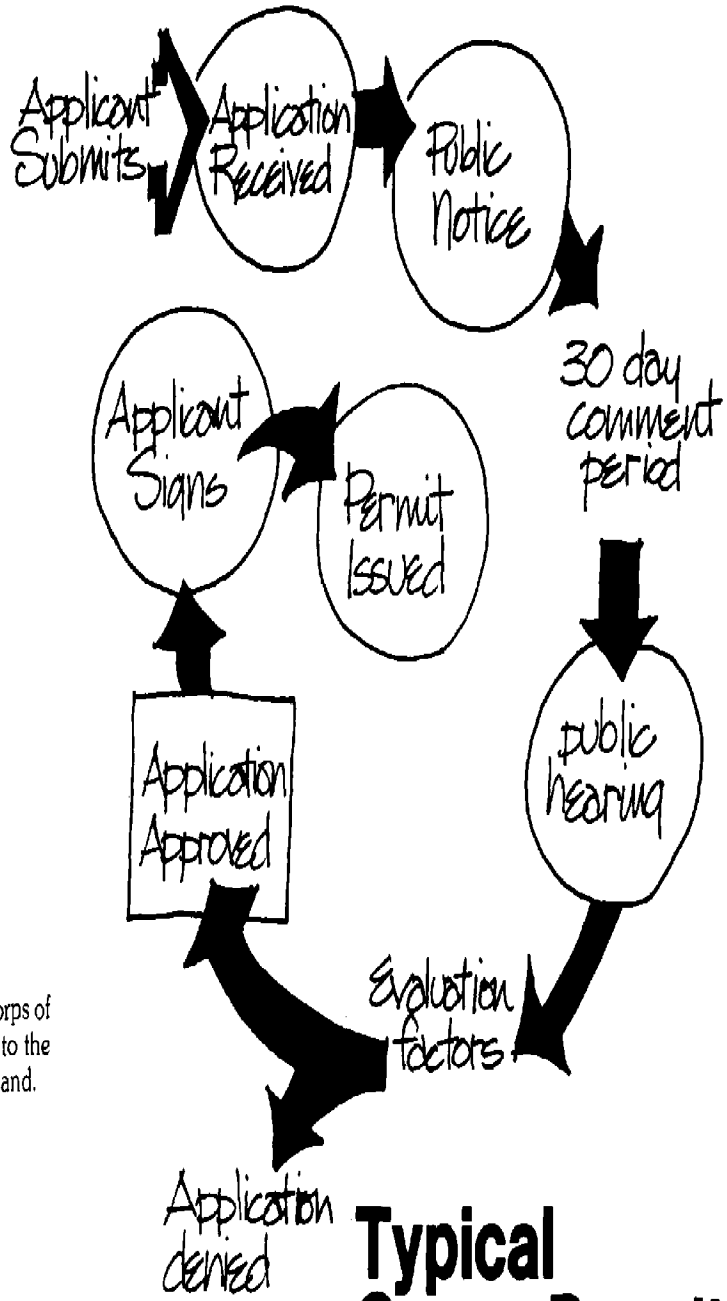
Robinson's Terminal, located 4 blocks north of the Torpedo Plant, is the only waterborne commerce industry still in operation on Alexandria's Waterfront. Robinson's has just completed a major dredging project. A local dredging company was contracted to dredge a depth of 24 feet using the clamshell method. Dredged material was transported to and disposed of at Rainwater Concrete Company in Fairfax County, Virginia. In order to maintain a sufficient depth for their abundant ship traffic, the river bottom must be dredged once every four or five years.

Dredging: Application:

Alexandria is included in the Baltimore District of the Army Corps of Engineers. Application for a dredging permit would be made to the District Engineer, U.S. Army Engineer District, Baltimore, Maryland.

Information Required in a Permit Application:

1) A detailed description of the proposed activity.
2) Names and addresses of adjoining property owners.
3) Complete information about the location.
4) A list of the status of all approvals and certifications required by other federal, state, and local government agencies.
5) Reasons that explain denial of any approvals or certifications required by other government agencies.



Typical Corps Permit Review Process

Figure 46 Corps Permit Review Process

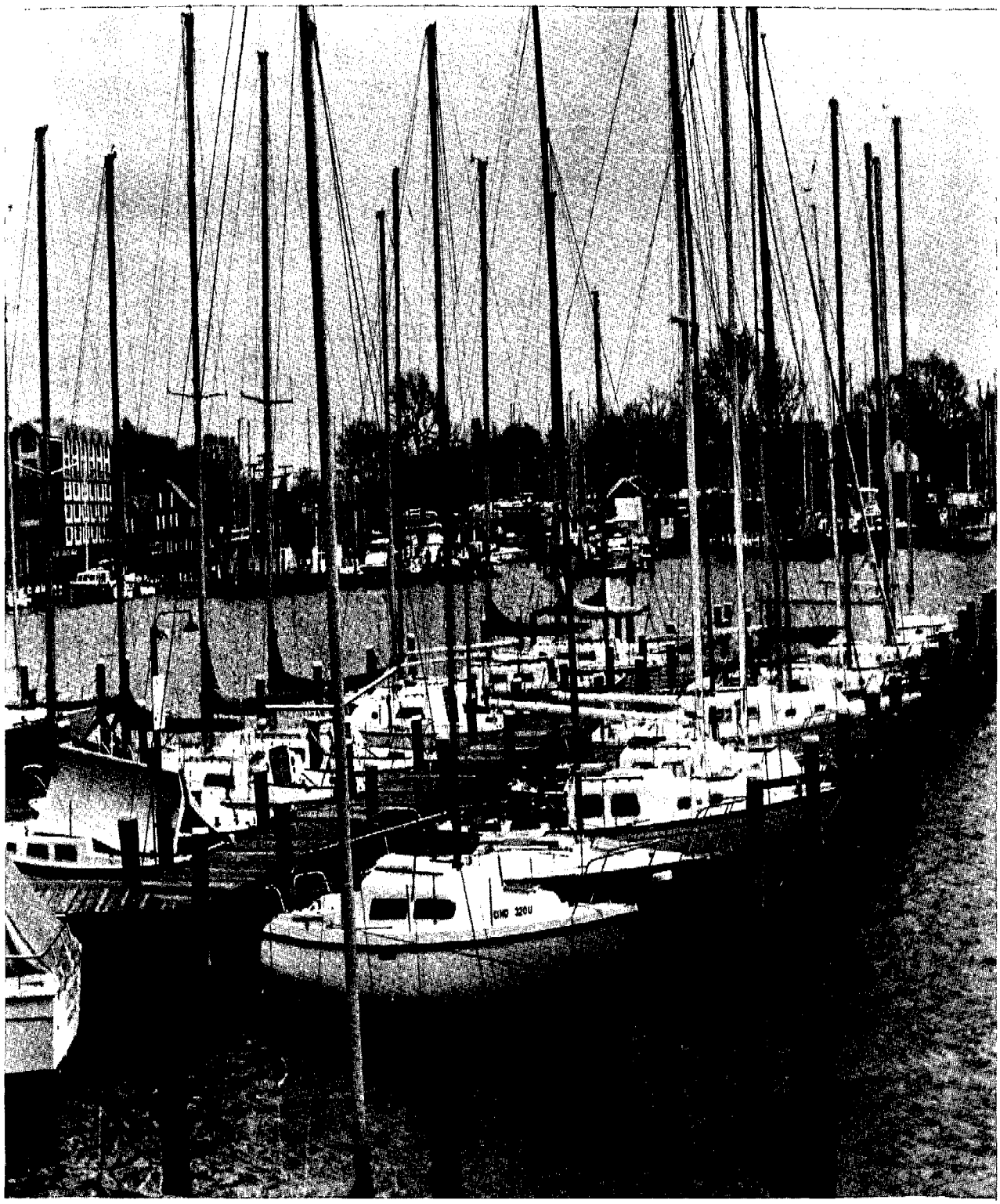


Figure 47 Annapolis Marina

Appendix I

INFORMATION ABOUT ANNAPOLIS CITY DOCK
June 1978

1. The City of Annapolis operates 18 finger slips for transient boats. Each slip provides water and 110v electricity at 20, 30, and some have 50 amps. Slips are available on a first-come-first-served basis and the procedure is to pull into a vacant slip not roped off or marked reserved. Most of the slips are about 12 feet wide; slip #13 is 13 feet wide and slip #19 is about 16 feet wide.

2. Boaters may also tie up to bulkheads where space is available, although no electricity nor water is provided. Rafting is discouraged but permitted during periods of heavy congestion. Please obtain permission from owner of boat to which rafted and the Harbor Master or one of his assistants.

3. The docking fee for transient boats is $12.00 minimum per day, plus 10% Anne Arundel County tax, or $.50 per hour plus tax for a maximum of five hours. All boats are subject to these rates whether in a slip, tied to a bulkhead or rafted off another boat. All rates and conditions are established by City Ordinance and the Harbor Master has no authority to make exceptions. Boaters requiring electricity will be required to pay $3.00 minimum per day or $.50 flat fee at the hourly rate. All rates are subject to change.

4. The City of Annapolis assumes no responsibility for the security, safety, liability for any loss, damage or personal injury while using City Dock facilities. Boaters are therefore advised that they are authorized to use the City Dock at their own risk.

5. Arriving at the City Dock Monday through Thursday, boaters should normally have little difficulty finding a vacant slip. The other days of the week find the City Dock crowded by noon. Should there be no slips available upon arrival, contact one of the Assistant Harbor Masters at the City Dock who may be able to help you obtain a slip. Some slips are often used by boaters on an hourly basis.

6. Public showers and toilets are available on the City Dock. This facility will be open from May through October from 8:00 A.M. to 8 P.M. Other months the times are subject to change. Boaters not paying the daily rate may use showers after paying $1.00 per person.

7. Winter daily rates are $7.00 per day plus 10% tax from November 1 to March 31. Electricity charge is $3.00 minimum per day. When authorized by the Mayor and Aldermen, certain slips may be rented during this period on a monthly basis. See Harbor Master for details.

Appendix II

MARITIME DISTRICT CODE: CITY OF ANNAPOLIS, MARYLAND

Chapter 10: Harbors, Docks and Similar Facilities

Section

10-1. Anchoring boats, etc., so as to obstruct navigation - Prohibited.
10-2. Same - Duty of harbor master.
10-3. Refusal to move vessel from public wharf or bulkhead.
10-4. Sunken Boats.
10-5. Discharge, etc., of refuse into city waters, etc.
10-6. Speed of motor driven boats.
10-7. Retail sale of seafood from vessel lying at city docks or wharves.
10-8. Boarding vessel without permission.
10-9. Tampering with, etc., vessel.
10-10. Condition and major repairs of boats docked in city harbor.
10-10.1. Removal of boats to storage facility.
10-11. Charcoal burning.
10-11.1. Swimming and water skiing prohibited.
10-12. Docking, etc., fees for daily, monthly, and yearly mooring.
10-12.1. Charge for electricity.
10-13. Leaving property on public wharf.
10-14. Permit to build wharf, pier, etc.
10-15. Private wharves and other facilities to be kept in repair.
10-16. Permits for mooring piles, floating wharves, buoys and boats anchored over forty-eight hours - Required; approval of port wardens; expiration and renewal; fees.
10-16.1. Same - Application for buoys, piers and bulkheads; fees.
10-16.2. Same - Notice of hearing of certain applications; notice of appeals.
10-17. Same - Limit upon number issued.
10-18. Same - Application; notice to nearby owners.
10-20. Same - Numbering permits and moorings.
10-21. Same - Removal of unauthorized moorings.
10-22. Number of boats at mooring, etc.
10-23. Compliance with orders of harbor master.
10-25. Expiration and nontransferability of permits.

10-1. Anchoring boats, etc., so as to obstruct navigation - Prohibited.

No person shall anchor any boat or other vessel for any period of time within the boundaries of the city in such a location or manner as to obstruct the free navigation thereof. (6-12-67)

10-2. Same - Duty of harbor master.

Whenever any vessel shall lie at anchor or be moored in the waters within the city in such a position as to obstruct the navigation thereof, it shall be the duty of the harbor master to order the owner or master of such vessel to remove the same immediately. Failure to remove the same shall constitute violation of this section. (3-10-69. Sec.2.)

Section

10-3. Refusal to move vessel from public wharf or bulkhead.

If the master or skipper of any vessel shall refuse to remove the same from any public wharf or bulkhead when so ordered by the harbor master or police officer, and unless the vessel shall be loading or discharging its load, he shall forfeit and pay one dollar for every hour he may remain thereafter. (3-10-69. Sec.2.)

10-4. Sunken boats.

Boats of any description, not in a condition to keep afloat, which shall be permitted to sink in any of the waters within the city, and left for more than two days, shall be considered as a public nuisance, and if not removed within five days after notice given by the harbor master, the boat so left shall be considered as forfeited to the city, and the harbor master shall proceed to sell the boat at public auction, after giving five days' notice thereof in a newspaper published in the city, and the purchaser shall obligate himself to remove the boat forthwith. The proceeds of such sale shall be paid into the city treasury. In the event no purchaser is to be had for such boat when offered for sale, it shall be the duty of the harbor master to proceed to remove or destroy the boat so left, in order to preserve the navigation and appearance of the waters. (3-10-69. Sec.2.)

10-5. Discharge, etc., of refuse into city waters, etc.

No person shall discharge or permit or allow any other person on a vessel under his control or command to discharge any human or animal excreta or other refuse from any head, toilet or similar facility on a vessel into the waters within the city. No person shall throw, dischage, deposit or leave or cause, or permit to be thrown, discharged, deposited or left, either from the shore or from any pier or vessel, any refuse matter of any description into the waters within the city or on the shore thereof where the same may be washed into the harbor or waters, either by tides, or by floods or otherwise. (3-10-69. Sec.2.)

10-6. Speed of motor driven boats.

It shall be unlawful for any motor driven boat or vessel to be propelled or navigated in any of the waters of the city except the Severn River at a speed greater than six miles per hour. (3-10-69. Sec.2.)

10-7. Retail sale of seafood from vessel lying at city docks or wharves.

No vessel shall be permitted to lie at any of the city docks or wharves for the purpose of selling fish or other seafood for retail. (3-10-69. Sec.2.)

Section

10-8. Board vessel without permission.

No unauthorized person shall climb into or upon any vessel moored, docked or anchored within the waters of the city without the consent of the owner or other person having charge therof. (3-10-69. Sec.2.)

10-9. Tampering with, etc., vessel.

No person shall willfully injure or tamper with, or break or remove any part of or from, any vessel within the waters of the city, or tamper with the lines securing such vessel, without consent of the owner or other person having charge thereof. (3-10-69. Sec.2.)

10-10. Condition and major repairs of boats docked in city harbor.

No person shall dock a boat which is not in an operating condition in the city harbor. No major repairs shall be made to boats in the dock area. The market and harbor master in his sole judgment shall determine major repairs under this provision. (Ord. No. 0-112-74. Sec.1.)

10-10.1. Removal of boats to storage facility.

Whenever a boat owner fails to comply with lawful requirements to remove his boat or the owner cannot be contacted after efforts to reach him have proved futile, the harbor master shall have the authority to have removed and placed in storage any boat warranting such action after giving notice required by applicable section of the city Code, or, in the absence of any specific provisions, by posting a notice in the local newspaper. Boats removed by direction of the harbor master shall be towed by an established operator to an operating boat yard for dry or wet storage as deemed appropriate by management of the boat yard facility and such boat will not be released with the boat owner or his authorized agent calls for the delivery of the boat with an order for its release signed by the harbor master or his assistant.

The owner shall be liable for the costs of towing and storage and other expenses incurred such as overtime costs incurred by city personnel, bailing costs to keep the boat afloat and other costs which may be incurred by the city. (Ord. No. 05-75. Sec.1.)

10-11. Charcoal burning.

No person shall cook by means of charcoal burning on his boat in the city dock or on the city dock property. (Ord. No. 0-79-74. Sec.1.)

Section

10-11.1. Swimming and water skiing prohibited.

No person shall swim or water ski in the city dock waters. (Ord. No. 0-47-75. Sec.1.)

10-12. Docking, etc., fees for daily, monthly and yearly mooring.

Any person who moors or ties his vessel to any portion of the city docks or other property belonging to the city designated for docking or rafts to another boat or boats moored or tied to any bulkhead in the inner harbor of the city dock areas shall first obtain permission of the harbor master for such docking privileges, and shall pay the following fees:

(a) For all transient slips, the minimum sum of twelve dollars ($12.00) and one dollar ($1.00) extra for each five-foot increment for boats over forty (40) feet not to exceed a maximum of fifteen dollars ($15.00) per day from April 1st to October 31st, and the sum of seven dollars ($7.00) per day from November 1st to March 31st, in addition the minimum of three dollars ($3.00) and one dollar ($1.00) extra for each five-foot increment for boats over forty (40) feet not to exceed a maximum of six dollars ($6.00) per day service charge for electricity for those boats using electricity.

(b) For all commercial boats:

(1) The sum of seventy-five dollars ($75.00) per month from April 1st to November 30th.

(2) The sum of fifty ($50.00) per month from December 1st to March 31st.

(c) For all work boats, such as those in the oyster fleet, clam fleet and related uses, the sum of fifteen dollars ($15.00) per month.

(d) For all buy boats, between September 1st and May 1st, the sum of fifty dollars ($50.00) per month.

(e) Port Welcome, the sum of thirty-five dollars ($35.00) each docking.

(f) For all private boats:

(1) The sum of fifty dollars ($50.00) per month from April 1st to September 30th.

Section

(2) The sum of thirty dollars ($30.00) per month from October 1st to March 31st.

(g) Exceptions to these rates may be granted, by resolution or lease, by the mayor and aldermen for special types of boats or classic boats which are not included in any category enumerated herein. (3-10-69, 2; Ord. No. 0-29, Sec.1; Ord. No. 0-16-74, Sec.1; Ord. No. 0-75-74, Sec.1; Ord. No. 0-111-74, Sec.1; Ord. No. 0-72-75, Sec.1; Ord. No. 0-34-76, Sec.1; Ord. No. 0-1-77, Sec.1; Ord. No. 0-12-77, Sec.1; Ord. No. 0-37-77, Sec.1; Ord. No. 0-44-77, Sec.1; Ord. No. 0-59-78, Sec.1. 10-9-78.)

10-12-1. Charge for electricity.

Any person docking a boat at city property shall pay the sum of one dollar ($1.00) per day for electricity, where a charge for the same is not specified in another section of this code or by contract. (Ord. No. 0-34-77, Sec.1.)

10-13. Leaving property on public wharf.

No person shall leave any property on any public wharf, or public property adjacent thereto, for a period of more than twenty-four (24) hours. (3-10-69, Sec.2.)

10-14. Permit to build wharf, pier, etc.

No person shall build any wharf, pier or improvement of any kind into the waters within the city or carry out any earth or material for that purpose, without first obtaining a permit therefor to be issued by the city engineer with the approval of the port wardens of the city. (3-10-69. Sec.2.)

Cross references - Building generally, Ch.6; licenses generally Ch.14.

10-15. Private wharves and other facilities to be kept in repair.

The owners of private wharves, piers, bulkheads or other facilities extending into, or adjacent to, the waters within the city shall keep them in proper repair so as to prevent injury, or hazards to navigation, and to prevent debris from the same from washing into such waters. (3-10-69. Sec.2.) Supp. No. 15, 11-78.

Section

10-16. Permits for mooring piles, floating wharves, buoys and boats anchored over forty-eight hours in any of the waters within the city without first obtaining a permit therefor from the city engineer. No such permit shall be issued without the approval of the wardens of the city, who shall meet at least once each month to consider applications for such permits. Every permit so issued shall expire on April 30th of each year unless renewed in the same manner as provided for the issuance of the original permit.

The following fees shall be paid prior to the issuance of the permits for a mooring pile, floating wharf and buoy each year:

Resident for private or noncommercial use.....$50.00

Non resident for private or noncommercial use.....$100.00

Rental to others or commercial use.....$100.00

(6-12-67; Ord. No. 0-25, Sec.1; Ord. No. 0-33, Sec.1; Ord. No. 0-34-73, Sec.1; Ord. No. 0-26-74, Sec.1)

10-16.1. Same - Application for buoys, piers and bulkheads; fees.

Every application for buoys, piers and bulkheads shall be filed with the city engineer. The costs for making such applications, which shall accompany the application and shall not be refundable, shall be:

(a) Buoys.....$10.00

(b) Piers.....$15.00

(c) Bulkheads.....$25.00

10-16.2. Same - Notice of hearing of certain applications; notice of appeals.

Whenever an application is filed with the port wardens of the city, the port wardens shall cause notice of the hearing of the application to be published once in each week for two (2) consecutive weeks in one newspaper of general circulation published in the city. The second advertisement shall be published at least seven (7) days prior to the hearing. The notice shall specify the name and residence of the applicant, the location of the projected improvement and description of the improvement sought and such other information as the port wardens shall direct. The cost of the publication of notice of hearing shall be borne by the applicant.

Section

In the event of an appeal from a decision of the port wardens to the mayor and aldermen, the city clerk shall cause notice of the appeal to be published in the same manner, and the cost shall be borne by the appellant. (Ord. No. 0-8-74. Sec.1.)

10-17. Same - Limit upon number issued.

Where the application for a permit as required by section 10-16 is for a location in water abutting property owned by the applicant, the number of permits to be granted shall be within the discretion of the port wardens based upon the considerations outlined in section 10-19. Where the applicant is not the owner of abutting property, then no more that two (2) such noncommercial permits, and no more than seven (7) such commercial permits shall be issued for the use of any one person. (6-12-67)

10-18. Same - Application; notice to nearby owners.

Applications for all permits as set out in section 10-16 shall be made upon such forms and contain such information as may be prescribed by the city engineer, and shall show the proposed location of the mooring applied for in relation to fixed landmarks or property lines along the shore. Upon receipt of an application for such permit, the city engineer shall give notice by ordinary mail to all owners of riparian property within one hundred fifty (150) feet of the location applied for notifying them to file with him, in writing, any objections they may have to the granting of the permit applied for within seven (7) days from the date of such notice. (6-12-67)

10-20. Same - Numbering permits and moorings.

Mooring permits issued by the city engineer shall be consecutively numbered, and the number on commercial permits shall bear the letter "C" as a prefix. Every mooring pile, floating wharf, buoy or boat shall also bear the letter "C" at least two (2) inches tall. (6-12-67)

10-21. Same - Removal of unauthorized moorings.

Any unlicensed mooring pile, floating wharf, buoy or anchored boat found within the water to which this chapter is applicable shall be posted with a notice requiring the owner thereof to remove the same within twenty (20) days from the date of the notice. Unless removed or a permit obtained within the time required by such notice, the same shall be removed by the police department of the city and may be disposed of.

Section

Any unlicensed mooring pile, floating wharf, buoy or anchored boat found restricting or blocking navigation may be removed immediately. (6-12-67)

10-22. Number of boats at mooring, etc.

No more than one boat or other vessel shall be moored at any one mooring pile or buoy. The number of boats at a floating wharf shall be within the discretion of the port wardens. (6-12-67)

No person shall fail to comply with any lawful order of the harbor master. (3-10-69. Sec.2.)

10-25. Expiration and nontransferability of permits.

A permit issued by the port wardens shall be valid for work commenced within a period of one year after issuance of the permit for the work by the U. S. Army Corps of Engineers; otherwise, it shall be void and of no effect.

No permit or authorization of the port wardens aforesaid shall be transferable and must only be used by the original applicant. Transfer of the property by the original applicant shall result in the termination of the permit or authorization to construct. (Ord. No. 0-24-75. Sec.1.)

Appendix III

Don Keefe
Lab and Treatment Q. C. Manager
884 Blacklawn Road
Conyers, Georgia 30207

April 27, 1979

On April 24 and 25, 1979 I checked the condition of wood in the South pier at the Torpedo Assembly Factory, Alexandria, Virginia.

Sketches No. 1 and 2 show pier cross sections for piece identification and location of check points.

On April 24 the check was started at a point called location 17 with location numbers proceeding shoreward. On April 25, the check was started at a point called location 1 and the lettering proceeded riverward. (Refer to sketch 2 for orientations.) Pilings and columns were numbered A thru E from south to north.

General Comments:

The piling and plates of the South pier are untreated (not preserved) wood. Both are under water except for short periods at low tide when the tops of the piling and all of the plates are exposed to air.

The water at this location in the Potomac River is reported to be fresh.[1]

The wood was checked by taking borings with an increment borer and by probing.

Softwood was encountered in all cases up to a 1/2" depth from the surface of the wood, and in several cases up to a 1" depth from the wood surface. However, after the initial soft core was penetrated, interior sound wood was found.

Many of the plates show obvious decay, however, even the plates showing obvious decay contain much interior sound wood.

Where holes drilled in both piling and plates were checked by probing, softwood was found on the wood surface around the holes, but solid wood was encountered after initial penetration.

The treated 12 x 12 wood columns have generally deteriorated at their bases and at bolt holes. Many of the columns - seven were found - contain serious interior decay. These columns are at locations 10, 11 and 12.

The treated x-braces for the most part are decayed.

Recommendations:

The treated columns and all the x-braces contain enough deteriorated wood to make any question of reuse doubtful. These should be removed.

[1]Basic freshwater salinity content approximately 1 part/thousand measured by the PEPCO Quality Reserach Division.

There is much sound wood in the plates and the piling cores. If reuse is desired for a lighter structure, reduction in cross section due to the soft outer shell must be considered.

If reuse is contemplated, each piling in the pier should be checked for sound wood at extreme low tide. This could best be done after the treated super structure of the pier has been removed.

The original proposal called for boring each piling to determine creosote retentions in the wood. Since the pilings were untreated this was not done.

Due to inaccessability and short periods of low tide all pilings were not checked. The original work called for one day's work. The low tide period on two consecutive days was used in order to check as much wood as possible.

Although the major emphasis of the work was directed at the water line, it was apparent that the upper deck stringers contained a large amount of deteriorated wood. This is especially true of one stringer located on the South side of the South pier at location No. 9.

General Comments: North Pier Creosote Borings

The first row of piling along the South side of the North Pier were checked by boring with an increment borer. The piling were numbered 1 through 17 proceeding toward the river.

Two borings were taken from pilings No. 1, No. 2, No. 5 and No. 7, one boring was taken from each of the other piling, total 18 borings. Piling No. 3 was not sampled due to obvious decay. Piling No. 2 was decayed. No penetration of preservative was found in piling No. 2. Pilings No. 4 and No. 6 are poorly penetrated and contain untreated sapwood.

The retention of creosote in the piling was found to be a 6.64 lbs/ft^3 when tested by AWPA method 6-76. This is less than the required 12 pounds per cu. ft. required by AWPA Standard C4 piling used in fresh water.

Recommendations:

Due to the above findings it is recommended that at least 40 more piling be checked at random on the North Pier.

Note - only one set of borings was taken due to inaccessibility and short duration of low tide.

*AWPA - American Wood Preservers Association

FINDINGS ON THE SOUTH PIER

Location No. 3
Piling A-appears sound
Plates-all appear sound

Location No. 4
Piling A,E-appear sound
Column A,B-appear sound

Location No. 5
Piling A-appears sound
Column A,B,C,D-decayed

Location No. 6
Column A,C-appear sound
Column B,D,E-decayed
x-Brace-all decayed

Location No. 7
Piling A,B,E-appear sound
Plates-appear sound

Location No. 8
Piling A,D,E-appear sound
Plates-appear sound

Location No. 9
Piling A,D,E-appear sound
Column A-decayed
Column B-appear sound
x-Brace-all decayed
Plates-appear sound

Location No. 10
Column B,E-decayed
Column C-poor treatment
Column D-appears sound
Plates-contain some decay

Location No. 11
Column A,B,C,D,E-decayed
x-Brace-all decayed
Plates-contain some decay

Location No. 12
Column A,C,D,E-decayed
Column B-appears sound
x-Brace-all decayed
Plates-contain some decay

Location No. 13
Column A,B,E-appear sound
Column C-decayed
x-Brace-all decayed
Plates-appear sound

Location No. 14
Column A,B,D-appear sound
Column C,E-decayed
x-Brace-all decayed
Plates-appear sound

Location No. 15
Piling B,C-appear sound
Piling D-soft
Column A,B,C-appear sound
Column E-decayed
x-Brace-all decayed
Plates-contain decay

Location No. 16
Piling B,E-soft
Piling C-appears sound
Column A-appears sound
Column B,C,E-decayed
x-Brace-all decayed
Plates-contain decay

Location No. 17
Piling A,B-soft
Column B,E-appear sound
Column C-decayed
x-Brace-all decayed
Plates-contain decay

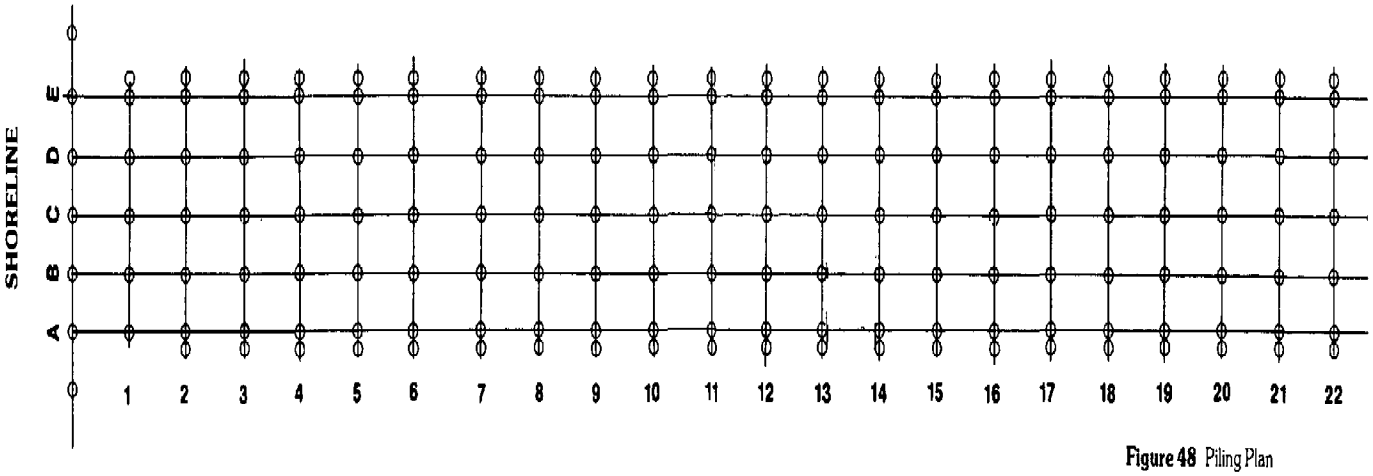


Figure 48 Piling Plan of South Pier

Appendix IV

James A. Taylor
Timber Products Specialist
3510 Kirkwood Drive
Fairfax, Virginia 22030 U.S.A.
703 591-5593

April 30, 1979

Re: Inspection of the wooden pier between Pierhead line and Bulkhead line projecting beyond the concrete pier (North Pier)

On April 28 and 29, 1979 I sample inspected a total of seventy-five piles in the 'North Pier' behind the Torpedo Plant at Alexandria, Virginia. Sixty-two of these were bearing piles or braces and thirteen were fender piles. A grid of the piles which I inspected is attached. This grid has a key to indicate the results found.

Of the sixty-two bearing piles or braces inspected, nineteen of them or approximately 31% had some decay in them. This was in the springwood or earlywood part of the wood. The glossary of the Wood Handbook describes this as being less dense and weaker mechanically than latewood. None of the decay found was severe and so this decay would have only a small effect on the strength of the piece.

The pine in these piles was generally slow grown with narrow annual rings, typical of virgin pine. This type of pine has the usual characteristic of a high resin content which gives it a great deal of natural durability. These piles appeared to have been originally well treated with a high residue creosote. In many cases the creosote smell was apparent in the borings. An assay will be run on the composited borings to determine the residual creosote remaining in the wood.

In my opinion the design of the pier appeared to be in excess of the current planned use. This observation should be confirmed by engineering evaluations.

I inspected thirteen fender piles and found ten of them or 77% needed replacement due to decay or mechanical damage or both. In my opinion the fender piles were considered to be expendable. They would be subject to mechanical abrasion and damage and therefore during the periodic repairs a marginal treatment was probably considered to be adequate.

There are three dolphins north of the pier. These were designated as N-1, N-2 and N-3 starting with the dolphin nearest the pier and working north. I sampled six piles in the outer ring of twelve piles in the N-3 dolphin. These piles had a marginal treatment but were in generally satisfactory condition. I sampled four piles in N-1 dolphin and found one with an inch of shell and the heart rotted.

The top timbers on the river side of the pier were in poor condition and will need to be replaced. These timbers probably were also considered to be expendable using the same reasoning as the fender piles.

The timbers on the top of the bearing piles appeared to be in good condition. There may be some decay on the top surface where the planking is nailed to them but the timbers appear to be overdesigned and more than adequate even if some surface softening is found. Minor decay voids, if found under the planking, can be repaired using techniques developed for railroad bridge trestle repair. Sections of the top planking have deteriorated and in some cases, metal sheets have been nailed to the deck to presumably cover holes. I did not remove any of these to inspect underneath.

Some of the plank bracing between the piles show signs of deterioration. If the engineers felt that they were essential and should be replaced, it is estimated that about 10% would be in this category.

The decay in the bearing piles can be arrested with an internal fumigation using EPA fumigants. This treatment is placed inside the pile and should protect against decay for at least ten years.

As top decking is replaced the top surfaces of the timbers should be given a coating of hot creosote as a routine procedure. In addition a dry sheet preservative is available which can be cut in strips and nailed to the top of the timbers before the new decking is installed.

It is my opinion that this pier merits renovation and should be kept in repair. The current planned use for the pier is one reason. Perhaps more important is the fact that it is usually a routine matter to obtain permits to repair existing facilities but should these facilities deteriorate beyond repair it might be impossible to obtain permits to remove a deteriorated facility and build a replacement.

If repairs and renovations are approved I would be glad to offer advice on the selection of the materials and the quality control procedures which should be followed to assure the long life of the renovated pier.

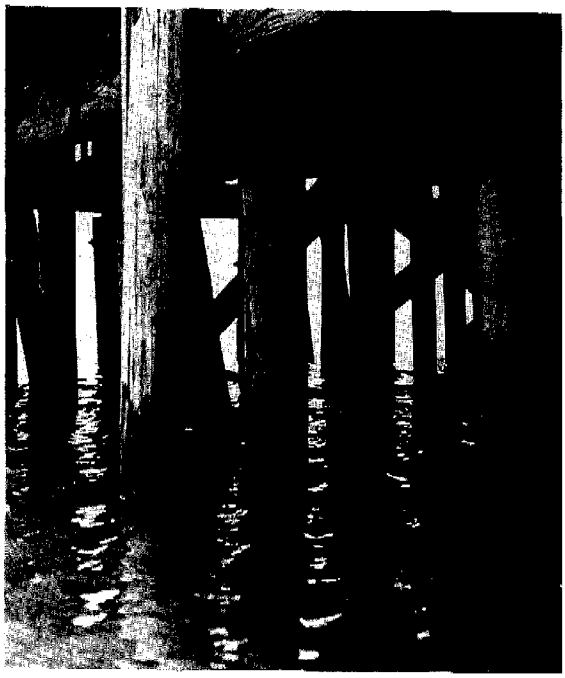
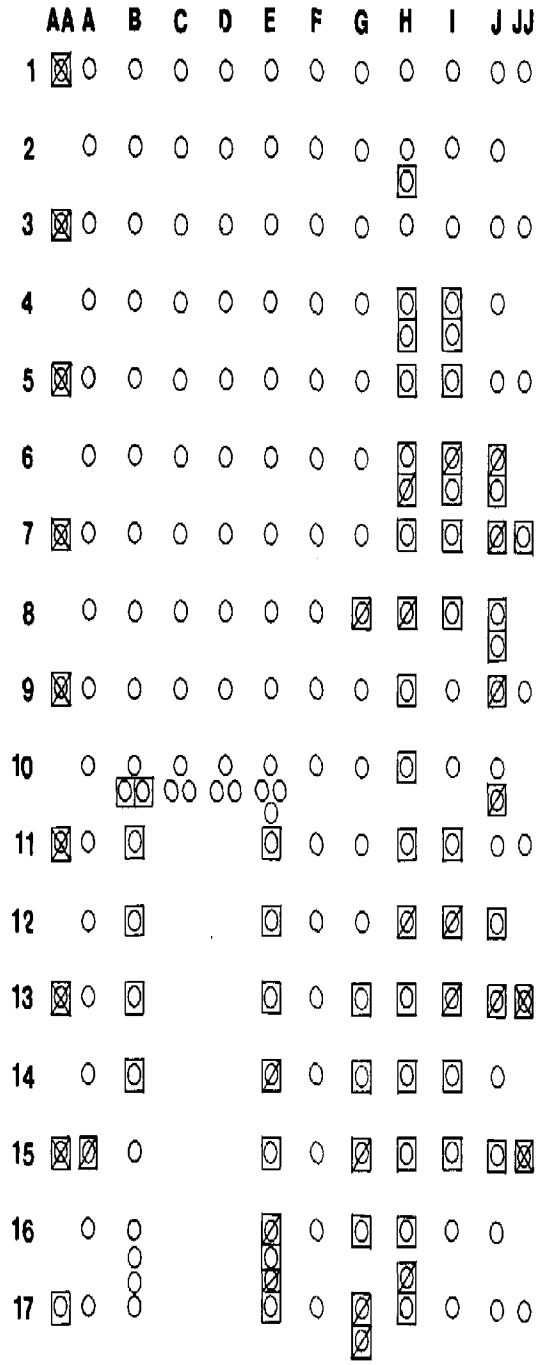


Figure 49 North Pier Piling



○ pile
□ pile inspected
⊘ pile w/ decay
⊠ pile-reject

Figure 50 Condition of Piles–North Pier

Appendix V

SITE INSPECTION BY REPRESENTATIVES FROM VIRGINIA POLYTECHNIC INSTITUTE

A field inspection trip was made on April 19, 1979 by Dr. Al Debonis and Mr. Fred Lamb of the Department of Forest Products, Virginia Polytechnic Institute.

Based on a two hour examination, the following observations were made regarding the wood structure of the South Pier:

a) The timber piles which had been cut off at the low water level, (probably 40 years ago) may still be usable. This is based on a very limited sample of the piles. Damage below the water level due to decay was not evident in the increment cores which were taken. A more rigorous sampling will be needed to make a reliable evaluation. The cores which were taken were returned to VPI & SU for microscopic analysis. No decay was found in these samples.

   It must be assumed that some of the original pile strength has been lost, however, the residual strength may be sufficient for intended use. This is subject to further investigation.

   The top sections of the piles sampled were found to be "spongy." This is typical of wood end grain which has been subjected to constant water submersion. This section, therefore, is limited in bearing capacity and is also subject to further investigation.

   Additional Sampling tests are required to make any additional recommendations. VPI may be able to finance a supervisor to coordinate these tests.

b) The timber structure above the piles is not expected to be salvageable. The effective cross-section of the structural members has been considerably reduced due to internal decay at the holes for the steel connecting bolts.

Figure 51 VPI Consultants checking surface conditions of South Pier

Condition Of Pine Piling Submerged 62 Years In River Water

14th Street Bridge Over Potomac River, Washington, D.C.

THEO. C. SCHEFFER, Pathologist
C. G. DUNCAN, Pathologist[1]
and
THOMAS WILKINSON, Engineer
Forest Products Laboratory,[2] Forest Service
U.S. Department of Agriculture
Madison, Wisconsin

IN 1963, THE question was raised by the bridge engineers as to whether the piling under the old 14th Street Bridge in Washington, D.C., was sufficiently sound to warrant constructing a new bridge on it. Our examinations in 1963 and 1967 of wood from representative piles indicated that it probably was not, but it was decided in 1968 that this should be corroborated with a third set of samples, and strength evaluations of the wood. The conditions of the piling was of more than practical interest because it gave us an opportunity to observe the condition of untreated wood with an authenticated history under fresh water for a long period of time.

In response to our desire to analyze more of the piling, Mr. George McSwain of the Washington office of the Forest Service, in collaboration with the engineer on the 14th Street Bridge, Mr. H. Emekli, arranged to have four more sections of piling sent to the Laboratory. These were examined microscopically and specimens from them were tested for strength. The findings, and conclusions derived from both the present and the earlier assays, are the subject of this report.

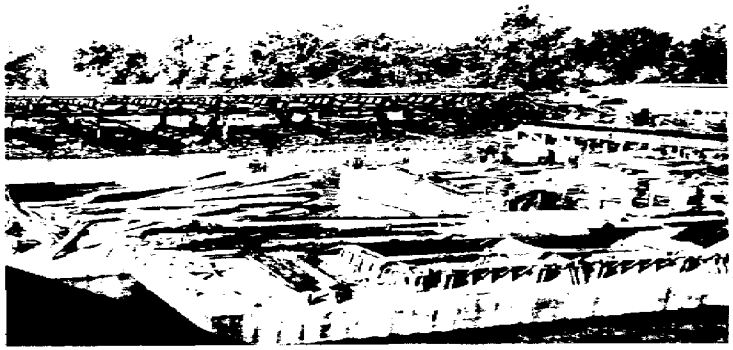
According to Mr. Emekli, the four sections had never been encased in concrete, since the concrete encasement on these particular piles started several feet below mudline. The sections were all from pier 9. Two of them, which will be referred to here as pile L1 and pile L2, came from just above the mudline; the other two, pile L3 and pile L4, came from just below the mudline, according to Mr. Emekli. The species of pine could not be established, but it seems logical to assume that it was one of the four major southern pines.

The sections were tested for strength in compression parallel to the grain. Specimens were 1 by 1 by 4 inches and they were tested in the green condition in accordance with the procedure outlined in ASTM D143. The location of the specimens is shown in Figure 1. The results are shown in Table 1.

The residual strength of the piles cannot be analyzed relative to known initial values, but it is possible to obtain some estimate of strength change by referring to the *average* crushing-strength (parallel to grain) values for southern pines. Using for reference the average strength of the weakest of the southern pines, loblolly and shortleaf (Table 1), one could conclude that the wood above mudline tended to have less than one-half its original strength and that below mudline no more than about 80 percent of its original strength. Thus, it seems that there was a definite and substantial reduction in crushing strength of the piles above mudline and a moderate reduction in strength below mudline. Although the apparent reduction in strength below mudline may not be statistically significant, it probably is a real one in view of microscopical evidence of bacterially caused changes in the wood.

The microscopical observations are summarized in Table 2. Bacteria were present in all portions of all pile sections. They were more prevalent in sections below mudline than in sections above, and the wood below mudline was correspondingly altered to a greater degree microscopically. The greater residual strength in the wood below mudline cannot be accounted for on the basis of the microscopical appearance of the wood, which was not as good as that of the wood above

[1]Deceased.
[2]Maintained at Madison, Wis., in cooperation with the University of Wisconsin.



The pilings that are on the barge are a few that were pulled when the 14th Street Bridge was razed.

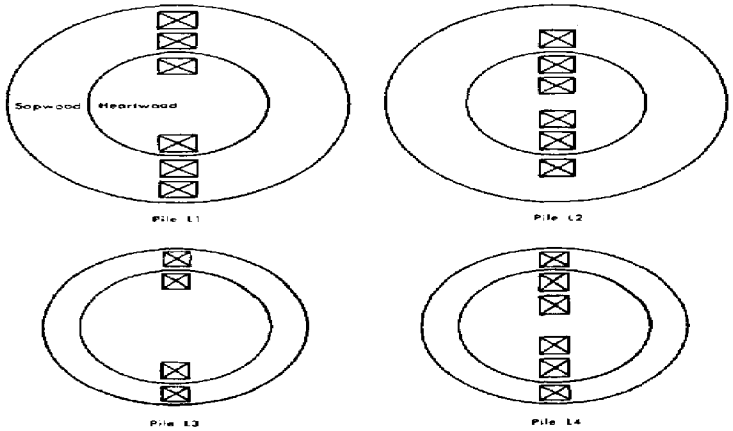


Diagram for cutting 1" by 1" compression parallel to grain specimens from pile sections obtained from pier 9 of the 14th Street Bridge, Washington, D.C.

mudline. It can only be suggested at this time that microscopically visible alterations of pine wood induced by bacteria are not a reliable index of the changes in wood strength of the magnitude found in this piling.

Fungus hyphae were present in the sapwood and outer heartwood, but not in the inner heartwood.

We conclude from the total evidence that the pine sapwood below mudline in the river water for 62 years had been substantially weakened in crushing strength by bacteria. The heartwood was affected less: judging from the condition of wood recovered from lakes and river bottoms after much longer periods than 62 years, however, the heartwood also probably would eventually have been seriously degraded.

The fungus infection probably was incurred before the piles were driven, since fungi are not known to be capable of seriously invading wood under water, and limited fungus infection of southern pine poles and piling on the storage yard is common. The fungus infection however, did not appear to be extensive enough to have been a sizable factor in the apparent reduced strength of the wood. ■

Table 1 — Results of compression parallel to grain test of 1 by 1 specimens cut from pile sections obtained from pier 9 of 14th Street Bridge, Washington, D.C.

Pile No.	Location in structure	Type of wood	Moisture content	Specific gravity	Crushing strength: Individual	Crushing strength: Average of specimens[1]
			Pct.		P.s.i.	P.s.i.
L1	Above mudline	Sapwood	113	0.430	1,380	—
			132	.394	1,200	1,290
		Sapwood	120	.395	1,140	—
			115	.402	1,420	1,280
		Heartwood	142	.420	1,320	—
			108	.434	1,680	1,500
L2	Above mudline	Sapwood	139	.421	1,550	—
			89	.465	1,310	1,430
		Heartwood	154	.381	1,370	—
			182	.380	1,250	1,310
		Heartwood	184	.369	1,040	—
			153	.399	1,280	1,160
L3	Below mudline	Sapwood	120	.390	2,230	—
			138	.367	2,180	2,200
		Heartwood	49	.431	2,880	—
			46	.429	2,840	2,860
L4	Below mudline	Sapwood	96	.424	2,740	—
			105	.435	2,920	2,830
		Heartwood	46	.446	3,370	—
			49	.453	3,200	3,280
		Heartwood	68	.430	2,880	—
			85	.414	2,650	2,760

[1]Average values (Wood Handbook) for sound, green southern pine wood:
Loblolly — 3,490 Longleaf — 4,300
Shortleaf — 3,430 Slash — 4,340

Table 2 — Summary of microscopical observations of thin sections from pine piling obtained from pier 9 of 14th Street Bridge, Washington, D.C.

Pile No.	Location in structure	Type of wood	Miscroscopical examination		
			Bacteria	Fungi	Wood deterioration
L1	Above mudline	Sapwood (outer)	Few	Occasional hyphae	Nothing to indicate wood deterioration. There are a few ray parenchyma cells gone but appear to be torn out by cutting rather than due to attack.
L1	Above mudline	Sapwood (inner)	Few	Occasional hyphae	Nothing to indicate wood deterioration. There are a few ray parenchyma cells gone but appear to be torn out by cutting rather than due to attack.
L1	Above mudline	Heartwood	Few	Occasional hyphae	Ray cells intact, as well as fibers, but there are as many bacteria in heartwood as in sapwood.
L2	Above mudline	Sapwood	Few	Occasional hyphae	Bacteria mostly in rays or in fiber ends adjoining rays. Very few parenchyma cells attacked.
L2	Above mudline	Heartwood (outer)	Many	Many	Some of ray cells attacked. Bacteria and a few fungal hypha in rays. Many hyphae also in fibers; these have caused bore holes and a thinning of wall. Clamps on hyphae also indicate this is a basidiomycete fungus and probably a white rotter.
L2	Above mudline	Heartwood (inner)	Few	None found	Rays and pits essentially intact and no fungal deterioration found.
L3	Below mudline	Sapwood	Many	Few	Definite bacterial attack — mostly in vicinity of rays or in fiber ending of rays. Many pits are being attacked or are gone. Around pits and in general area there are *minute* elognated cavities — many of which follow the microfibrils. These cavities contain bacteria.
L3	Below mudline	Heartwood (outer)	Few	Few	Bacteria in rays have caused some deterioration but not extensively like in sapwood.
L4		Sapwood	Many	Moderate No. of hyphae	Same as L3 sapwood.
L4	Below mudline	Heartwood (outer)	Few	Few	Fibers and rays free from deterioration.
L4	Below mudline	Heartwood (inner)	Few	None found	Fibers and rays free from deterioration.

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