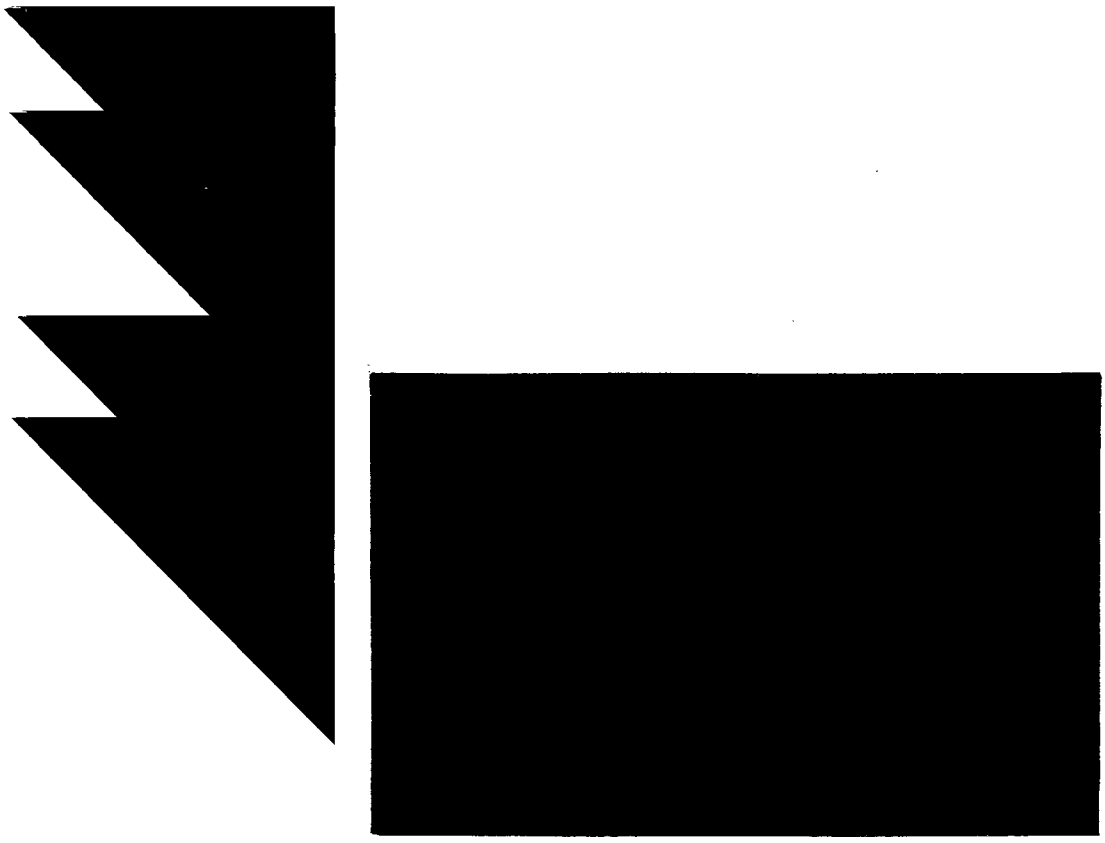
Project #94-4-6



- CIVIL
- MARINE
- PLANNING
- STRUCTURAL
- TRANSPORTATION

AEI

Appledore Engineering, Inc.

PISCATAQUA RIVERWALK

FEASIBILITY STUDY

June, 1995

Prepared For:

City of Portsmouth
PO Box 628
1 Junkins Avenue
Portsmouth, New Hampshire 03801

Prepared By:

Appledore Engineering, Inc.
600 State Street, Suite D
Portsmouth, New Hampshire 03801

This report was funded in part by a grant from the Office of State Planning, New Hampshire Coastal Program, as authorized by the National Oceanic and Atmospheric Administration (NOAA), Grant Award Number N470Z0237.

(784-025.DOC)

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Appledore Engineering, Inc.

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I. INTRODUCTION

1.1 Scope and Purpose

The City of Portsmouth proposes to construct a downtown waterfront walkway along the Piscataqua River, adjacent to Bow Street in Portsmouth, New Hampshire (See Vicinity map). The development area consists of approximately 800 feet of waterfront bounded by; the cities waterfront deck on Ceres Street to the west, the Harbour Place public wharves to the east, the existing buildings along Bow Street to the south, and the U.S. Army Corps of Engineers Federal Navigation Channel to the north (see Existing Conditions Plan).

The basic purposes of the proposed facility are:

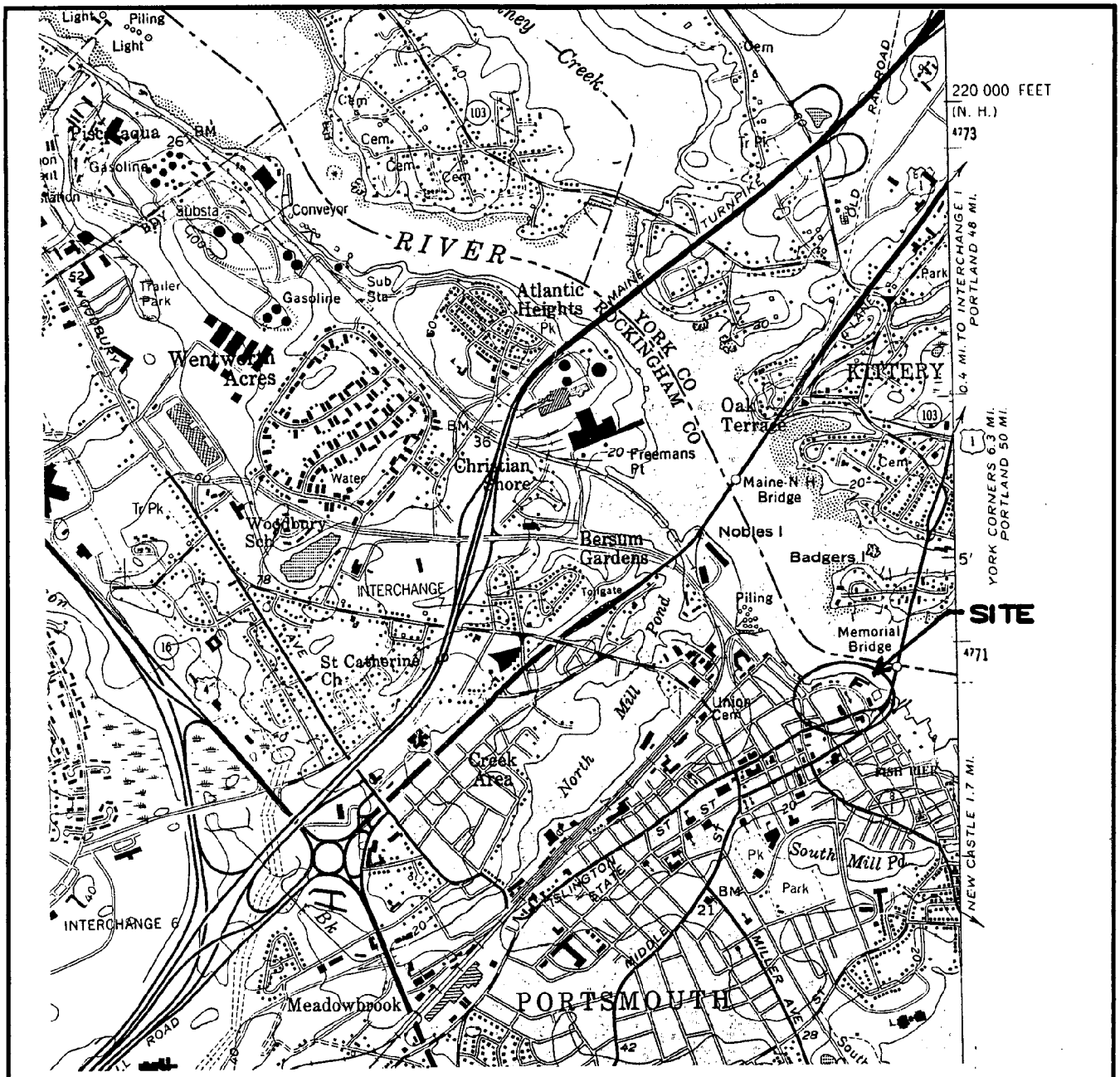
1. Link the existing public waterfront wharves at Harbour Place with the City, public waterfront wharf on Ceres Street, and

2. Revitalize the City's historic downtown waterfront.

The proposed facility studied herein centers around providing public access to the waterfront within the study area. This study has been undertaken in order to assess the feasibility and viability of such an endeavor and to recommend an optimum means of accomplishing the projects basic purposes.

1.2 Project Background

The proposed Piscataqua Riverwalk project is focused on reconstructing the once-bustling waterfront along Bow Street in Portsmouth, New Hampshire. The Riverwalk will not only serve as a waterfront promenade, but also as an education tour highlighting its noteworthy past. The Bow Street wharves were a significant commercial center during the eighteenth and nineteenth centuries, and the area itself was part of the original Strawbery Banke, where the earliest Portsmouth settlers landed and built their homes in 1631. The old wharf system, which occupied all of the Bow Street shoreline, rotted away or "fell in" sometime in the 1920's after 220 years of serving the merchants of Portsmouth.



AEI Civil Marine Planning Structural Transportation

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Portsmouth, NH 03801 (603)433-8818

REFERENCE:

USGS QUAD PORTSMOUTH, NH—ME
1:24,000

DATE: JULY 1995

VICINITY MAP

0 1,042 2,083 4,167

(IN FEET)

PISCATAQUA RIVERWALK FEASIBILITY STUDY

CITY OF PORTSMOUTH
P.O. BOX 628
1 JUNKINS AVENUE
PORTSMOUTH, NH 03801

FIGURE 1

(784VIC)

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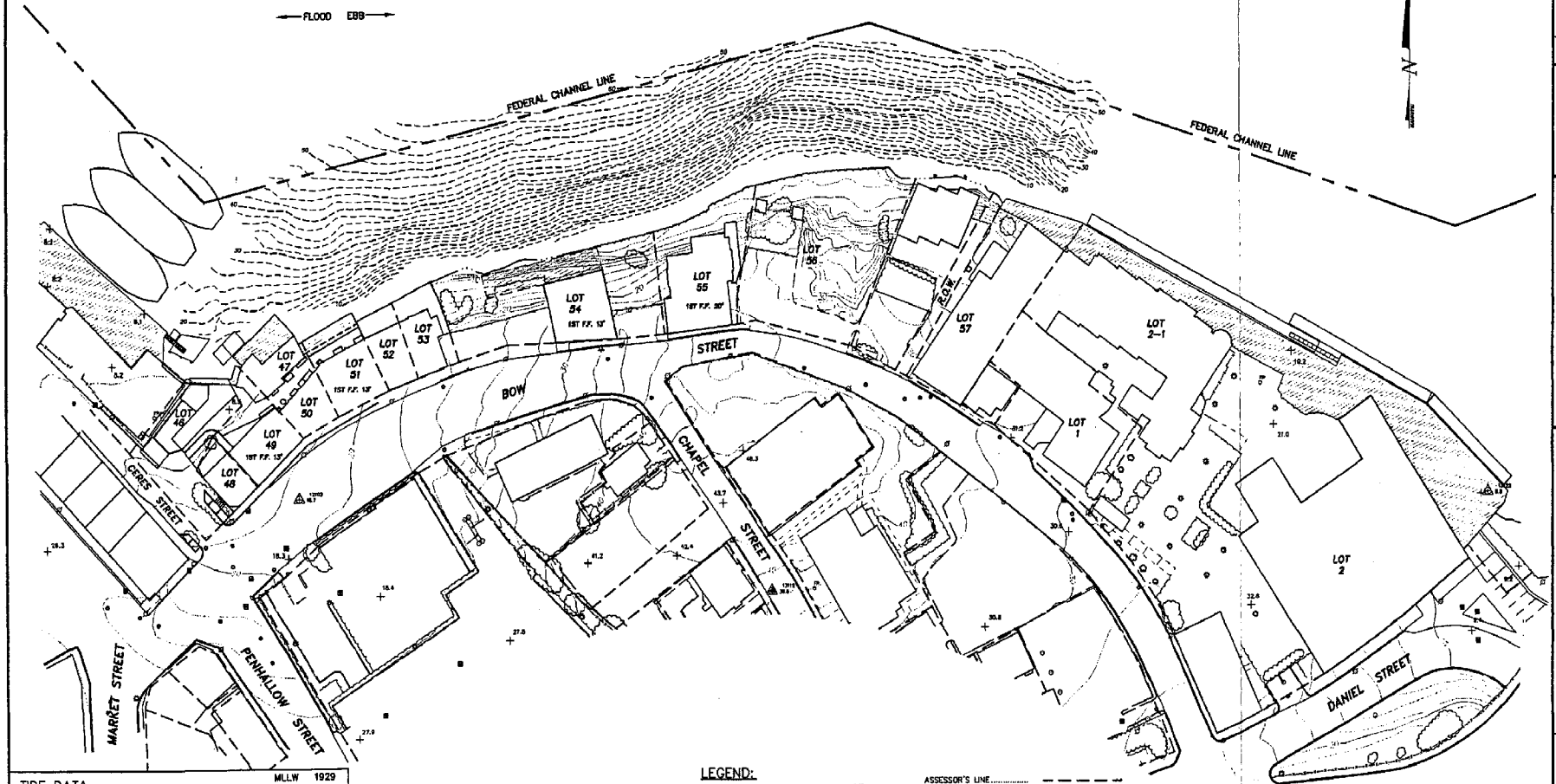
NH Coastal Program

PISCATAQUA RIVER
PORTSMOUTH HARBOR
FLOOD EBB



TIDE DATA	MLLW DATUM	1929 NGVD
ESTIMATED 100-YEAR FLOOD ELEVATION (STILLWATER)	13.3	8.9'
HIGHEST OBSERVED WATER LEVEL (2/7/78)	12.78	8.39'
ESTIMATED ANNUAL HIGH WATER	10.5±	6.0±
MEAN HIGH WATER (1960-1978 TIDAL EPOCH)	8.46	4.07'
NATIONAL GEODETIC VERTICAL DATUM - 1929	4.39	0
MEAN LOW WATER (1960 - 1978 TIDAL EPOCH)	0.33	-4.06'
MEAN LOWER LOW WATER (1960-1978 TIDAL EPOCH)	0.0	-4.39'
ESTIMATED ANNUAL LOW WATER	-1.8±	-6.19'
LOWEST OBSERVED WATER LEVEL (12/10/77)	-3.00	-7.39'

LEGEND:
INDEX CONTOUR
INTERMEDIATE CONTOUR
WATERLINE
UTILITY POLE
LIGHT POLE
MANHOLE
CATCH BASIN
WATERVALVE
ASSESSOR'S LINE
TREELINE
FENCE
RETAINING WALL
STRUCTURE
RAILROAD
GRAVEL ROAD
PAVED ROAD
POOL
CONTROL POINTS

20 0 40 80 120 160 FEET

EXISTING CONDITIONS PLAN

No.	Description	Appd	Date
	Revisions		

DATE: JANUARY 5, 1995 — ISSUE FOR APPROVAL
SCALE: 1" = 40' — CONSTRUCTION ISSUE
DESIGNED BY: RMS
DRAWN BY: ACMO
APPROVED BY: RMS
PROJECT NO: 784
FILE NO: 784BASE — RECORD ISSUE

RECONSTRUCTION OF PISCATAQUA RIVERWALK

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Portsmouth, New Hampshire 03802-0628
(603) 431-2000 FAX (603) 427-1526

Appledore Engineering, Inc.
Old Marine Planning Structural Transportation
383 State Street, Suite B
Portsmouth, New Hampshire 03801 (603) 433-8818

Historical research of the old Bow Street wharves is ongoing, but has already revealed its significant role as an import hub. There were individual wharves at least as early as 1699, and it is believed that the complete wharf system came to be in the late-eighteenth century, during the commerce and shipbuilding boom of the Piscataqua region from 1783 to 1812. Trade was heavy with the West Indies during this period, the chief imports being rum, sugar, coffee, and molasses. One of the more active merchant families on Bow Street at the time, the Havens, imported 506,000 ponds of sugar, 26,000 gallons of rum, and 597,000 pounds of coffee in 1806 alone. During the War of 1812, little or no shipping came in or out of Portsmouth at all, and the Bow Street merchants were among those who contributed money and sailors from their own vessels to the privateering cause. After the war, the region's economy recovered and prospered, resuscitating the Bow Street import market. Influence on West Indian trade was still strong, but merchants also began bringing in European and Oriental goods. On any one of the wharves in the 1820's, one would be likely to find 70-ton piles of Sweede's iron, 2,000 gallons of spring-pressed sperm whale oil, Calcutta sugar, cordage, tar, paint, carpeting, or men's silk hats, just to name a few! Although it never regained the fervor pitch of the pre-1812 period, activity at the wharves was consistent through most of the nineteenth-century until it faded away around 1900. Time and the swift current of the Piscataqua erased some 60 years ago the reminder of what was once an active and vital waterfront.

When the Piscataqua Riverwalk is complete, it will be a twentieth-century interpretation of the old wharves for the public to enjoy and learn about the vivid past that's underfoot.

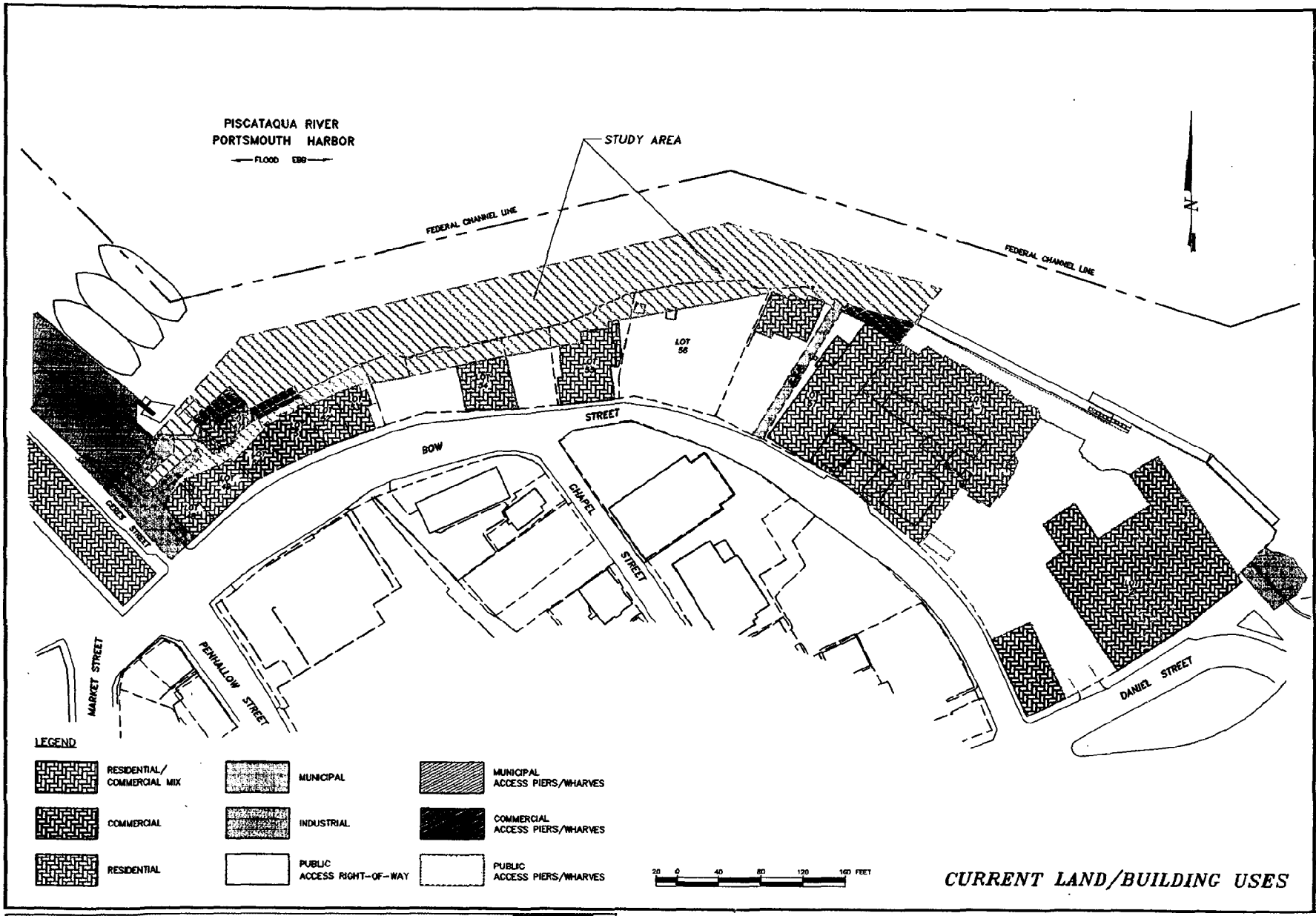
Current land/building uses in this area of the City is a mixture of residential, commercial, industrial and municipal uses (see current land/building uses plan).

BOW STREET WATERFRONT by DAVIS BROTHERS, ca.1886
COURTESY OF PORTSMOUTH ATHENEAUM

THIS FIGURE WAS FUNDED IN PART BY A GRANT FROM THE OFFICE OF STATE PLANNING, NEW HAMPSHIRE COASTAL PROGRAM, AS AUTHORIZED BY THE NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION (NOAA), GRANT AWARD No. NA47OZ0237.

NH Coastal Program

AEI Appledore Engineering, Inc.



CURRENT LAND/BUILDING USES

RECONSTRUCTION OF PISCATAQUA RIVERWALK

CITY OF PORTSMOUTH
Municipal Complex, P.O. Box 628
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DATE: JANUARY 5, 1995 ISSUE FOR APPROVAL
SCALE: AS SHOWN JK MC
DESIGNED BY: RMS RMS CONSTRUCTION ISSUE
DRAWN BY: ACAD JK MC
APPROVED BY: RMS JK MC
PROJECT NO: 784 RECORD ISSUE
FILE NO: 784BASE JK MC

No.	Description	Appd	Date
	Revisions		

Applecore Engineering, Inc.
Civil, Environmental, Planning, Structural, Transportation
460 Banfield Road, Suite B
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1 of 1

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NOAA

NH Coastal Program

II. EXISTING CONDITIONS

2.1 Topographic and As-Built Surveys

The City of Portsmouth Department of Public Works - Engineering Division, completed a detailed topographic and As-Built survey of the cities waterfront area, by photogrammetric methods from aerial photographs taken on May 3,1 994. Digital data from this survey was used as the basis of this projects Existing Conditions Plan. This aerial survey data was supplemented with the following:

- Tax assessors maps for boundary lines
- U.S. Army Corps of Engineers Federal Channel Limits
- Cities Ceres Street lot property survey plan
- Field surveys by Appledore Engineering, Inc. (AEI) field crew

2.2 Bathymetric Survey

Bathymetric surveys have been completed in the River along the proposed Riverwalk corridor to determine water depths. A state-of-the art electronic "hydrosweep" multiple transducer acoustic sounding system was used to provided 100% coverage of the River bottom. This system incorporated a "real time" computer to measure pitch, roll, and yaw of the survey boat and associated transducers. Each of the four transducers took two (2) River bottom depth readings per second, producing very accurate bottom contours.

A differential Global Positioning System (DGPS) located the vessel using an array of seven satellites orbiting the earth. The vessel was located by the satellites once every second producing a very accurate "real-time" horizontal location of the entire operations.

2.3 Waterfront Inspections

A Routine Inspection was completed along the entire 800'± length of waterfront. Underwater component of inspection covered from the mudline up to the low water level. Above water component covered from low water level up to the high tide line.

The scope of work for Routine Inspection included:

- A Level I inspection was made on 100% of the structures to determine obvious problems.

  For the purpose of this study a Level I survey was essentially a "swim-by" or visual overview, with minimal cleaning of structural elements. The Level I examination confirmed as-built structural plans and detected obvious major damage or deterioration due to overstress (ship impact, ice), severe corrosion, or extensive biological growth and attack.

  The inspectors relied primarily on visual and/or tactile observations (depending on water clarity) to make conditions assessments. These observations were normally made over the total exterior surface area of the structure whether it is a quaywall, bulkhead, seawall, pile, or mooring. The dive was completed by four (4) of Appledore Engineering's professional Engineer-Divers. Water temperatures had dropped below 48 degrees Fahrenheit and therefore created the need for "dry suites". Both surface supplied air (Helmet Dive) and SCUBA (tanks) dive equipment were used due to the fast currents in the area and the need for voice communications to the support team located top side.

III. ENGINEERING STUDIES

3.0 General Discussions

The major sources of environmental loadings for the proposed riverwalk are wind, current, wave and sometimes ice. The New England environment is subject to highly variable and often rapidly changing meteorological conditions.

Damaging winter storms (Northeasters) can bring substantial hurricane force winds and are usually accompanied by abnormally high water levels and corresponding strong tidal currents.

This area is also affected by tropical storms that can bring shorter duration but stronger winds.

3.1 Subsurface

Past experience and previous geotechnical investigations indicate that subsurface conditions will typically be comprised of a thin layer (2' to 8') of sediment, fill and weathered rock fragments overlying a quartzite bedrock. This quartzite is commonly referred to as "Kittery Quartzite" and is actually metamorphic silt stone. The top 1' to 5' of this bedrock is typically weathered with RQD's of less than 50%.

3.2 Wind

Wind is a serious source of loading for vessel mooring structures. We have made the following observations:

- Extreme surface wind (peak gust) measured at Pease Air Force Base in September 1960 was 65 knots out of south-south-east.
- The mean annual extreme surface wind (peak gust) measured at Pease Air Force Base is 50.3 knots.
- Fastest-mile wind speed (30 feet above ground) for 50 year mean recurrence interval is 70 knots (80 mph) for this area.

3.3 Currents

Current loads on structures can be very significant due to the strong tidal currents in this area and the base flow of the Piscataqua River. We have made the following observations:

- NOAA tidal current listings indicate a maximum flood current of 3.3 knots and a maximum ebb current of 3.2 knots at this section of the river.

- A 1985 Army Corp of Engineers Navigation Improvement Design memorandum included Piscataqua River current study data. A series of current meters were installed across the river at this site (Range 2). Peak measured (depth averaged) current speeds reported were about 3 knots.

3.4 Wave

The project site is sheltered from large ocean waves or swells as it is located approximately three (3) miles up the Piscataqua River from the Harbor mouth. The maximum wave fetch is about a mile upriver. Under wind conditions of 50 knots, the site is expected to see wind generated waves of 2.5 feet with a corresponding period of three (3) seconds. It is not anticipated that such short period waves will induce significant loads.

3.5 Ice

Ice loads on marine structures can be tremendous. Review of historical data from the past few decades indicate that while the river has frozen up on rare occurrences, (1860, 1918) and ice has not been a significant recent problem to the berthing and/or mooring structures. During ice-out of Great Bay, large chucks of ice do impact on vessels and structures, but usually do not cause concern for the operators. It is recommended, however, that should an exceptional winter ice season occur, every effort be taken to minimize ice forces on moored vessels and structures.

3.6 Tide Levels

Tidal water levels significantly impact waterfront facilities. It should be noted that post-ice-age land subsidence is occurring in northern New England. In Portsmouth, New Hampshire, this general land subsidence relative to sea level has been occurring at about one foot per one hundred years, resulting in an apparent sea level rise relative to land based benchmarks.

During intense storm activity, abnormally high tides may be observed due to the effects of low atmospheric pressure, on-shore "pooling" of water from wind driven currents, and stormwater runoff.

The following table presents tidal water levels based on the latest NOAA and FEMA data, based on mean lower low water (MLLW) datum as used on NOAA navigation charts. These tidal water level data are based on the tide gauge located at the PNSY, Seavey Island:

	MLLW Datum
Lowest Observed Water Level (12/10/77)	-3.0'
Estimated Annual Low Water	-2.2'
Mean Lower Low Water	0.0'
Mean Low Water	0.33'
Mean Sea Level (1929 NGVD)	4.11'
Mean High Water	8.46'
*Annual High Tide Line (seasonal high tide)	10.46'
10 year Recurrence High Tide	12.11'
50 year Recurrence High Tide	12.71'
100 year Recurrence High Tide	13.01'
500 year Recurrence High Tide	13.61'
Highest Observed (2/7/78)	12.78'

*Assumes HTL is 2' above MHW

3.7 Workshops and Public Meetings

During December, 1994 and January, 1995 Bob Snover, of Appledore Engineering, Inc., City Attorney Bob Sullivan and City Planner Cindy Hayden met individually with many Bow Street property and business owners. The purpose of these meetings was to identify issues and concerns relative to the proposed Riverwalk.

Issues discussed at these meetings included:

- The pros and cons of the various potential routes for the Riverwalk along the Bow Street waterfront.
- Potential impacts on waterfront views.
- Potential impacts on economic development in the downtown area.
- Permitting constraints and opportunities.
- Private and public property rights.
- Issues associated with the alleyway including access and obstacles for pedestrians and deliveries.
- Future maintenance responsibilities and liability issues.
- Potential use of the Riverwalk to dock tall ships, cruise ships, and/or pleasure boats.
- Navigational issues regarding the tug boats.

IV. ALTERNATIVE ANALYSIS

Numerous type, size and location alternatives were studied within the project area. The following three (3) basic concepts were selected for more detailed study:

Concept A: 200'± western end to be reconstructed to 30'± width to provide for increased public access and accommodate existing commercial uses (restaurants), in same approximate configuration. Remaining 600'± to be constructed to relatively narrow walkway width of 12'±, and located close to the shoreline, immediately in front (Riverside) of existing granite quaywall. This concept does not provide accommodations for the berthing of vessels.

Order of magnitude, 1995 construction cost estimate is $750,000 for this concept, which includes construction overhead and profit. This estimate excludes inspections, surveys, studies, architectural/engineering services, project administration, land/easement acquisition, business relocation, and legal costs which may be 12% to 15% of construction costs for this size project.

Concept B: Similar to Concept A, this concept provides for the 200'± western end to be reconstructed to 30'± width to provide for increased public access and accommodate existing commercial uses (restaurants), in same approximate configuration.

Remaining 600'± to be constructed to relatively wide walkway width of 20'±, and located away from the shoreline, such that the front (riverside) of the walkway is located in approximately 18' of water (at low water). This concept provides accommodations for the berthing of tall ships and cruise ships up to 300' in length.

Order of magnitude 1995, construction cost estimate is $1,500,000 for this concept which includes construction overhead and profit. This estimate excludes inspections, surveys, studies, architectural/engineering services, project administration, land/easement acquisition, business relocation, and legal costs which may be 10% to 12% of construction costs, for this size project.

Concept C: 200'± western end to be reconstructed to 30'± width to provide for increased public access and accommodate existing commercial uses (restaurants), in different configurations from either Concept A or B.

Similar to Concept B, this concept provides for the remaining 600'± to be constructed to relatively wide walkway width of 20'±, and located away from the shoreline, such that the front (riverside) of the walkway is located in approximately 18' of water (at low water). This concept provides accommodations for the berthing of tall shops and cruise ships up to 300' in length.

Order of magnitude 1995, construction cost estimate is $1,500,000 for this concept which includes construction overhead and profit. This estimate excludes inspections, surveys, studies, architectural/engineering services, project administration, land/easement acquisition, business relocation, and legal costs which may be 10% to 12% of construction costs, for this size project.

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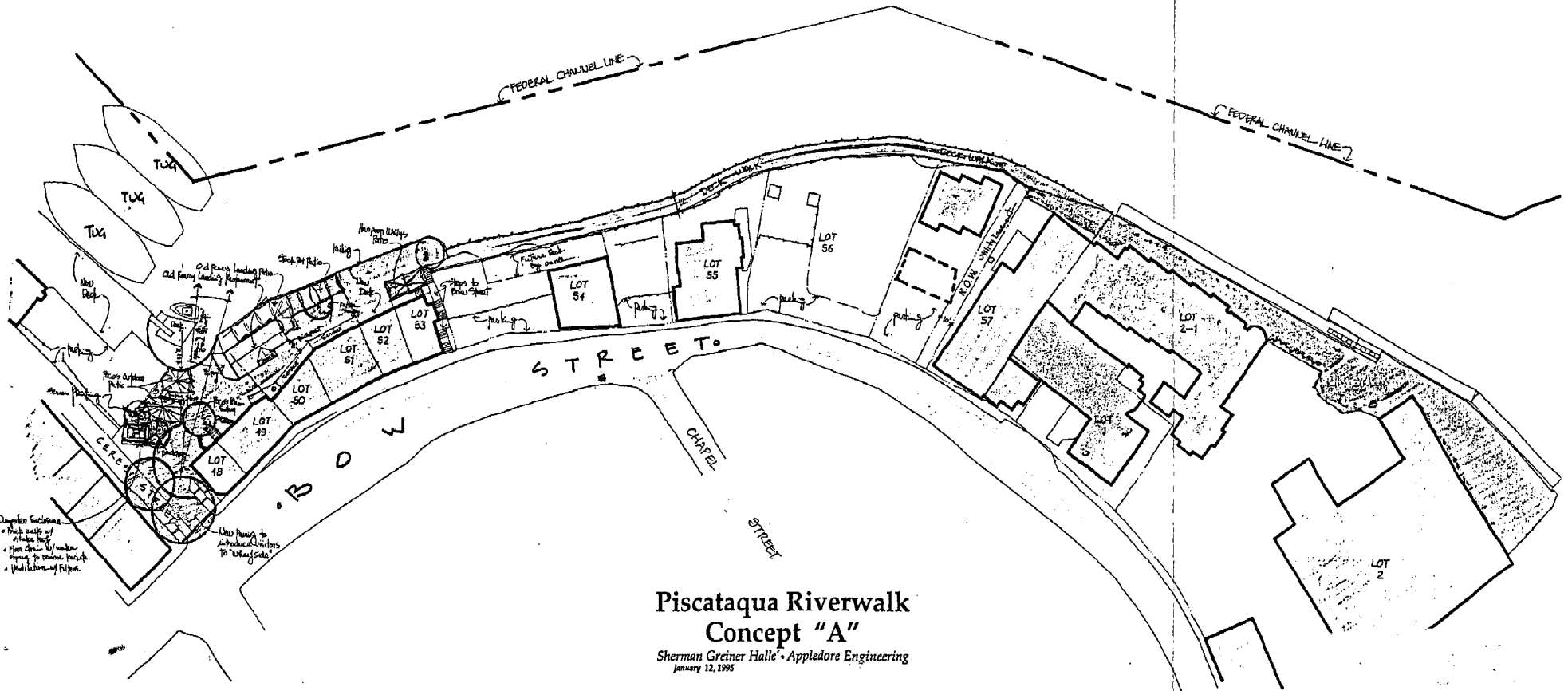

Piscataqua Riverwalk
Concept "A"

Sherman Greiner Halle • Appledore Engineering

January 12, 1995

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RECONSTRUCTION OF PISCATAQUA RIVERWALK

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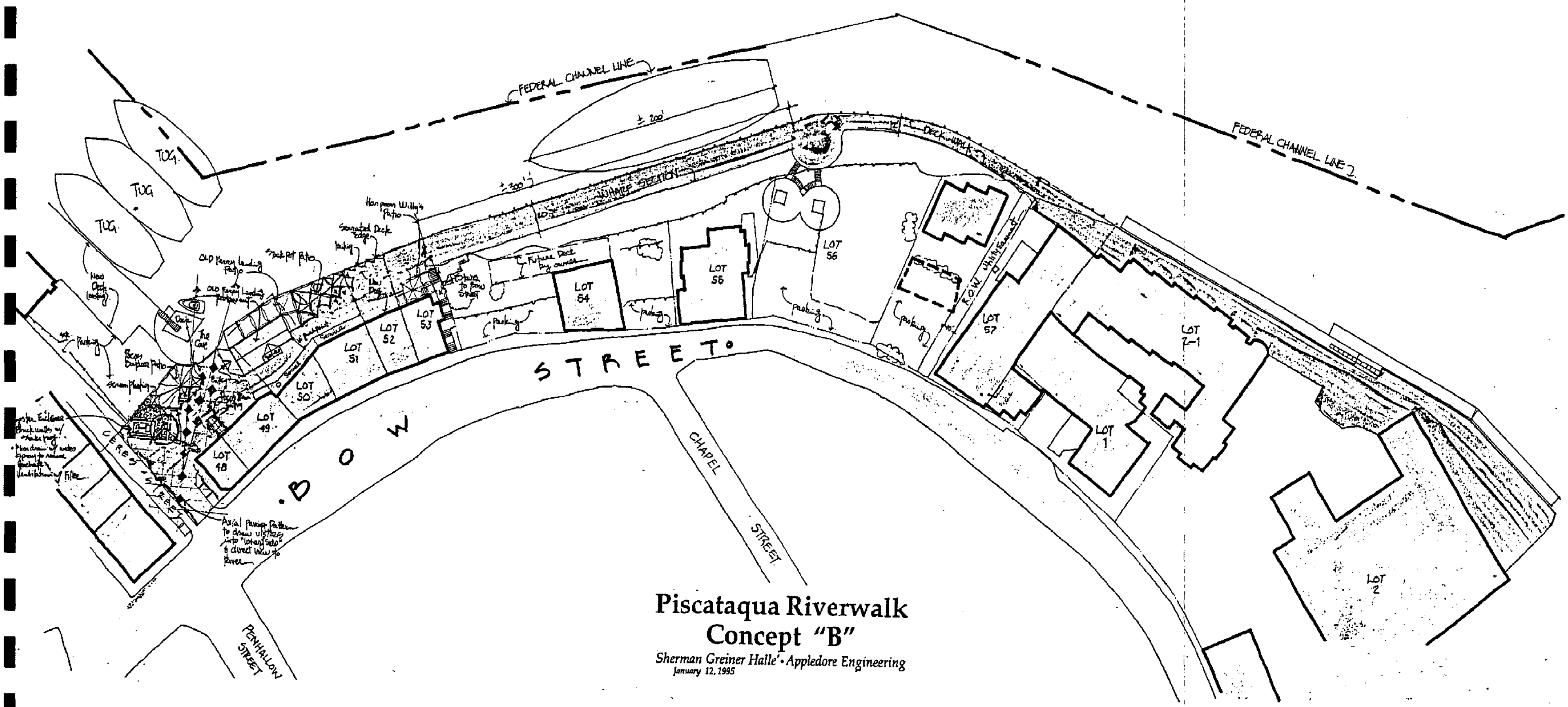

Piscataqua Riverwalk
Concept "B"

Sherman Greiner Halle' • Appledore Engineering
January 12, 1995

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RECONSTRUCTION OF PISCATAQUA RIVERWALK

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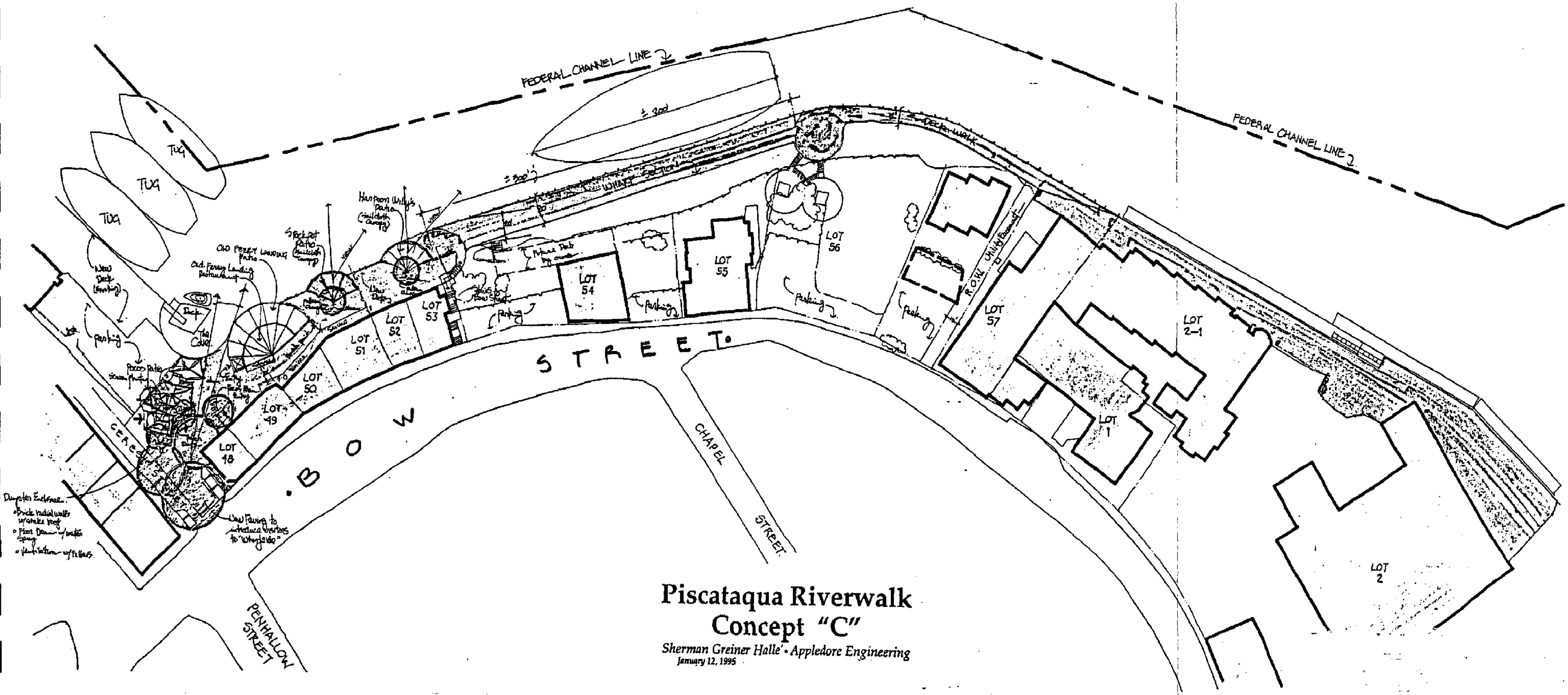

Piscataqua Riverwalk
Concept "C"

Sherman Greiner Halle' • Appledore Engineering
January 12, 1995

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RECONSTRUCTION OF PISCATAQUA RIVERWALK

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Municipal Complex, P.O. Box 628
Portsmouth, New Hampshire 03802-0628
(603) 431-2000 FAX (603) 427-1526

V. REGULATORY AGENCY PERMITTING

The regulatory agency permitting process has been initiated with all applicable regulatory agencies through both formal and informal meetings and pre-application work sessions. It is anticipated that this project will require permits from the following regulatory agencies:

U.S. Army Corps of Engineers
N.H. Wetlands Board
N.H.. Water Supply and Pollution Control (Water Quality Certificate)
N.H. Office of State Planning (CZM Certificate)
Portsmouth Planning Board
Portsmouth Historic District Commission

Permit processing time will vary with each agency and may take at least six (6) or nine (9) months, depending on the final complexity of the final project.

VI. RECOMMENDATIONS

While all three (3) concepts have been determined to be technically feasible, Concept B was determined to be the most flexible and viable concept that best accomplished the projects basic purposes, and as such is determined to be the preferred alternative.

It should be noted that Concept B was also endorsed at the following meetings:

January 12, 1995	Public Meeting
February 23, 1995	Portsmouth Planing Board work session
April 17, 1995	Portsmouth City Council meeting

We recommend that the next steps involve the completion of the following tasks:

- **Engineering Studies**

  A. Topographic Survey
  B. Subsurface Investigation
  C. River Current Study
  D. Quaywalls Investigation
  F. U/W Utility Crossing Investigation
  G. Environmental Assessment
  H. Design Criteria Study
  I. Type, Size, Location Study
  J. Ownership Assessment

- **Preliminary Design**

  A. Plans
  B. Specifications
  C. Estimated Final Engineering and Construction Costs

- **Regulatory Agency Permitting**

  A. U.S. Army Corps of Engineers
  B. N.H. Wetlands Board
  C. N.H. Water Supply and Pollution Control (Water Quality Certificate)
  D. N.H. Office of State Planning (CZM Certificate)
  E. Portsmouth Planning Board
  F. Portsmouth Historic District Commission
  G. Portsmouth Building Permit

- **Public/Private Participation and Project Meetings**

- **Final Design**

  A. Plans
  B. Specifications
  C. Bid Documents
  D. Estimated Construction Costs

- **Construction Administration**

  A. Bidding Process
  B. Contractor Submittals
  C. Construction Meeting
  D. Construction Inspections

(784-025.DOC)

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