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RHODE ISLAND WATERBORNE PASSENGER TRANSPORTATION PLAN

State Guide Plan Element 651

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ABSTRACT

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Two Capitol Hill
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One Capitol Hill
Providence, RI 02908-5872
(401) 222-1220

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ABSTRACT: This plan addresses Rhode Island's potential for expanded and enhanced waterborne passenger transportation. The development of the plan was guided by the goals of state agencies, federal government, and local governments, as well as the interest expressed by private operators, interest groups, and the public. The plan discusses state goals, conditions, conceptual services, designs, possible financing scenarios, and action plans.

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PREFACE

This plan was prepared by the Rhode Island Department of Transportation to analyze the potential for expanded use of Rhode Island's waters for passenger transportation, and to make recommendations for long-range development of water transportation services and facilities.

The Department provided the draft plan to the Statewide Planning Program for adoption by the State Planning Council as an element of the State Guide Plan. The draft was reviewed by the Council's Technical Committee, Transportation Advisory Committee, and staff.

Persons at the Rhode Island Department of Transportation who were instrumental in insuring that this study was completed include Marjorie A. Keefe, Ed.D., Project Manager for Water Transportation; William Chuck Alves, Chief of Intermodal Transportation Planning; and William D. Ankner, Ph.D., Director. Consultants were Philip H. Braum, Project Manager, from Barton-Aschman Associates, Inc.; Martha Reardon, The Harbor Consultancy International; David R. Westcott, AICP, Maguire Group, Inc.; Alice Boelter, Boelter & Associates; and Walter Wohleking. At the Statewide Planning Program, the draft plan was reviewed by David M. Tonnessen, Supervising Planner (retired); John E. Brownell, Chief Civil Engineer; Susan P. Morrison, Chief; and Michael C. Moan, Senior Planner.

Funding support was provided by the Federal Transit Administration and the State of Rhode Island.

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Executive Summary

The Rhode Island Waterborne Passenger Transportation Study was undertaken to determine the potential for the use of the State of Rhode Island's bays, harbors, and rivers for passenger transportation, and to develop a plan for waterborne passenger transportation in Rhode Island for the year 2010.

The potential for successful waterborne passenger transportation services is suggested by Rhode Island's extensive history of the use of its waterborne passenger ways for transportation, beginning with the first settlers and explorers, and running through the era of rowing and sailing vessels (1600–1920), the canal epoch (1828–47), the age of steamboats (1792–1942), and into the present.

The feasibility of waterborne transportation was investigated as a function of:

- the suitability of different vessel technologies, particularly high-speed ferries, to conditions in Narragansett Bay and on Rhode Island/Block Island Sound,
- the availability of strategically located landing/terminal locations accessible by both land and water,
- the passenger demand for the type and frequency of service that can be provided on alternative routes,
- the costs of providing the services,
- the feasibility of publicly and/or privately financing and operating services, and
- the ability to minimize any adverse impacts of siting new terminals and other support facilities.

The study was guided by the goals of state agencies, the federal government, and local governments, as well as the interest expressed by private ferry operators, interest groups, and the public. It draws upon a vast array of published materials, current and recent studies, and coastal management plans. Policies that have been articulated by Rhode Island agencies across the spectrum of transportation, the environment, historic preservation, economic development, and tourism shaped the study as well.

Existing services were the starting point for the study:

- Year-round routes
  - Block Island Ferry
  - Prudence Island Ferry
- Seasonal Ferries
  - Providence and Newport to Block Island
  - New London to Block Island
  - Occasional service to bay islands
- Excursions
  - Warren to Newport, Quonset, Wickford, Rocky Point, Pawtucket, Providence, and Dutch Island
  - Harbor traffic in Newport and Galilee

Present marine facilities were the basis for consideration of future facilities, because existing locations may offer the opportunity for easier development of new facilities. An inventory of existing facilities on waterways all across the state was prepared from reference documents and field inspections. The inventory included those types of facilities with some potential to accommodate waterborne passenger transportation services. Some military sites as well as small-scale sites were excluded.

Marine navigation conditions were examined, including channel length, depth, markings, and lighting; tidal currents; visibility; obstructions; speed restrictions; turning basins; and potentials for marine traffic conflicts.

Possible physical barriers to navigation in the bay were analyzed. The Fox Point Hurricane Barrier was found to accommodate under any tide condition boats that draw 9.4 feet or less, and that require less than 21 feet of vertical clearance and less than 35.5 feet of horizontal clearance. Existing bridges in Providence Harbor create more of a barrier, limiting vertical clearance to 8 feet and horizontal clearance to 14 feet.

A variety of vessel types could be candidates for use. The study used two categories of vessels as prototypes for analysis–conventional and high-speed vessels. Conventional ferries are less expensive, but high-speed vessels have the potential to attract more riders. High-speed vessels provide opportunities for waterborne passenger transportation that do not exist with conventional vessels. Speed often offers a way to improve both revenues for the operator and conditions for the customer. Vessel characteristics were based upon data gathered in surveys of vessel builders and present operators, modified to reflect expected advances by 2010.

Routes were identified that appeared to have favorable operating and market characteristics; those routes were then subject to more-detailed analysis of the ridership markets and the services that could be operated. The market for transportation services was the most important factor in the selection of routes.

For each of the selected routes, future travel demand was estimated, to provide a basis for projecting the type and amount of service that would be needed and the financial performance of the route.

Financial performance characteristics of each route were estimated using a computer model that uses vessel characteristics, route characteristics, ridership projections, operating profiles, and assumed unit costs of inputs to the operation. The model produced an indication of the viability of operation on each route, subject to variations in the input costs.

Potential terminal sites were identified from those inventoried. Evaluation criteria included ease of land access, the size of the site and its availability, compatibility with adjacent land uses, ease of water access, the existence of docking and support facilities, and waterborne passenger transportation operational concerns.

Financing options were examined to identify sources of funds and ways of combining funding types to support the various cost elements of waterborne passenger transportation facilities and services. Funding is related to the roles of public agencies and private businesses, which were also considered.

Waterborne Passenger Transportation Plan

The Rhode Island Department of Transportation will undertake a program to develop and enhance water transportation services. The program is based upon several principles:

Waterborne passenger transportation services should be operated by private enterprises. The state should not assume that role, but rather RIDOT, working cooperatively with the Rhode Island Public Transit Authority, should seek ways to assist private-sector initiatives.

Waterborne passenger transportation facilities should be built or funded with state assistance where those facilities would serve the public interest by improving the function of the state's transportation system and by accommodating large numbers of people. Where the state participates in the development of facilities, it should retain some property interest in the facilities to assure their continued use for transportation purposes.

Waterborne passenger transportation services and facilities can be most effective when developed and operated in a coordinated way. The Rhode Island Department of Transportation must participate in service development and enhancement, as well as in the construction and improvement of facilities, by providing guidance, information, and encouragement to both private companies and other public agencies that are involved in waterborne passenger transportation. RIDOT's role in coordination will be fundamental to system development.

The Rhode Island waterborne passenger transportation program that is supported by these principles includes policy initiatives, service development, facility improvement, and funding measures. The Rhode Island Department of Transportation will undertake the following actions:

Policy Initiatives

Promote the value of existing waterborne passenger transportation operations in the state, and implement measures to preserve and enhance them through the other program elements below.

Work with other public agencies, private businesses, nonprofit organizations, tourism organizations, and local governments in the development and improvement of waterborne passenger transportation services as a component of the state's transportation system that complements highways and public transit.

Promote and encourage, in cooperation with the Economic Development Corporation, the use of waterborne passenger transportation by tourists, commuters, and the general public.

Service Development

Focus on the most feasible markets for service development:

Providence-Newport
Providence-Pawtucket
Newport-Martha's Vineyard
Block Island-Point Judith
Block Island-New London

Assure that waterborne passenger transportation services support and complement the state's roadway, public transit, bicycle, and pedestrian systems.

Review proposed waterborne passenger services to identify needs for improved access to marine terminals via new or revised RIPTA bus services.

Facility Improvements

Develop major shoreside waterborne passenger transportation terminals for tourist and commuter traffic in Providence and in Newport using as examples the conceptual terminal designs in this report.

Encourage the development of satellite shoreside waterborne passenger transportation terminals for tourists and commuters at any marine terminal constructed or modified to accommodate cruise ships.

Encourage development of Quonset Point/Davisville as a future waterborne transportation site.

Seek to locate terminal facilities in places where intermodal connections can be easily made between waterborne transportation and automobiles, RIPTA buses, tour and charter buses, bicycles, and pedestrians.

Help owners of waterfront property seeking to develop terminals for use by passenger ferries by providing information on permitting, design, and/or construction.

Develop policies and regulations, in cooperation with the Coastal Resource Management Council and the Department of Environmental Management, that encourage the development of environmentally compatible marine terminals for tourist and commuter use, and that expedite review and approval of facilities devoted to such purpose while assuring compliance with clean air and congestion management requirements.

Cooperate in the development of a state policy on dredging, including the identification of long-term disposal sites.

Work with the City of Providence and the involved federal agencies to complete the dredging of the Providence River channel from the Providence Hurricane Barrier to the Crawford Street Bridge to ensure navigability to Waterplace Park in Providence.

Funding Measures

Pursue vigorously all available sources of federal funding, especially funds for alternative transportation projects and air-quality projects, to promote and develop waterborne passenger transportation.

Develop state funding mechanisms that will leverage private investment and match federal funding sources to develop waterborne passenger transportation.

Work with the Economic Development Corporation to pursue funds for demonstration projects for the construction of vessels suitable for high-speed passenger transport in Narragansett Bay and offshore.

Establish a clearinghouse to provide information and guidance to present and potential providers of waterborne passenger transportation in identifying and obtaining funding to support the operation of demonstration routes with the potential to serve significant numbers of people.

PART 651.01: INTRODUCTION

01-01 PURPOSE OF THE STUDY

The Rhode Island Waterborne Passenger Transportation Study was undertaken by the Rhode Island Department of Transportation to explore the potential for the expanded use of the State of Rhode Island's bays, harbors, and rivers for passenger transportation, and to develop a plan for water transportation in Rhode Island for the year 2010.

In Rhode Island, as in many areas, the need to consider alternatives to private auto use is growing. Increasing traffic volumes, and the resulting congestion, will place greater strains on the roadway network, both in the urbanized areas of the state and, in summer, at the access points to Rhode Island's beaches and recreational areas. Opportunities to expand roadway capacity are limited for community, environmental, and fiscal reasons. Consequently, the development of enhanced public transportation services, including waterborne passenger transportation, will be an appropriate means of improving the transportation system.

Often overlooked in the latter part of the 20th century, waterways are natural transportation rights-of-way. They can be especially valuable for transportation purposes because of the difficulty of creating new or expanding existing rights-of-way for land transportation. In many locations where expanded transportation facilities are needed, the land is already developed. Developing land-transportation rights-of-way in populated communities can disrupt neighborhoods, and be time-consuming and expensive. Using waterways for new transportation services and facilities can avoid this problem. Because boats have the ability to carry large numbers of people, navigational channels offer rights-of-way for over-the-water high-occupancy-vehicle (HOV) transportation, especially when developed in coordination with bicycle and pedestrian facilities and other types of public transit services.

Historically, waterborne transportation played an important role in the development of Rhode Island and its coastal communities. Today, island communities continue to rely upon ferries as a vital link with the mainland. In the future, the need for expanded waterborne passenger transportation services in Rhode Island will grow with:

- increases in coastal corridor and bridge traffic,
- the need to offer travel alternatives during the reconstruction of aging bridges and highways,

- the desire to make island state parks and beaches more accessible to Rhode Island residents and tourists alike, and

- the recognition that new waterborne passenger transportation routes may be able to carry as many people and vehicles at less cost and with less environmental impact than expensive highways and bridges.

Although existing ferry services have played an important role in meeting the transportation needs of Rhode Island travelers, no comprehensive study of the potential for expanded ferry services had been made prior to this study. In an era of dwindling public budgets and growing traffic, however, ferries and other waterborne craft have become increasingly attractive modes for transporting different kinds of travelers (business, recreational, tourist) between coastal communities and island destinations.

This waterborne passenger transportation plan for Rhode Island:

- Recognizes that Rhode Island is unique in its geography and waterborne passenger transportation needs and opportunities.

- Respects the different functions and users; the different marine, geographical, and environmental constraints; the unique set of public and private policies and relationships; and situation-specific financial realities. What may work for another city or state may not work for Rhode Island.

- Reflects the importance of learning from previous waterborne passenger transportation development experiences. While Rhode Island is unique, there is still substantial benefit from reviewing and analyzing experiences of systems and technologies employed elsewhere.

- Acknowledges the importance of early and continual public participation in the planning process. Waterborne passenger transportation–like other modes in a balanced transportation system–requires the support of multiple agencies and groups. To be successful, waterborne transportation must be deeply rooted in public policy and the services designed to satisfy the needs of its potential riders.

01-02 STUDY APPROACH

The feasibility of expanded waterborne transportation in Rhode Island was investigated as a function of:

- the suitability of different vessel technologies, particularly high-speed passenger ferries, to conditions in Narragansett Bay and on Rhode Island/Block Island Sound,
- the availability of strategically located landing/terminal locations accessible by both land and water,
- the passenger demand for the type and frequency of service that can be provided on alternative routes,
- the costs of providing the services,
- the feasibility of publicly and/or privately financing and operating services, and
- the ability to minimize any adverse impacts of siting new terminals and other support facilities.

The study effort was organized in a set of tasks undertaken to pursue these functions. The first task explored the background of water transportation in Rhode Island–the history of waterborne transportation, a description of existing and proposed waterborne transit services, and a review of waterborne passenger transportation services in other cities.

In Task 2, existing marinas and harbors were located, waterside conditions inventoried, and harbor management plans reviewed. Task 3 investigated proposed ferry routes, and estimated demand by route and vessel type. In Task 4, an inventory was developed of landside conditions that exist at potential terminal sites, and an assessment made of the feasibility of using these terminal sites. Conceptual site plans were developed to demonstrate the types of facilities that would be appropriate for terminals.

Vessel technologies were explored as the subject of Task 5, with an inventory of physical and operating characteristics of different types of ferry vessels and the applicability of these to Rhode Island. Capital and operating costs of alternative ferry systems were outlined in Task 6. In Task 7, alternative waterborne passenger transportation systems were compared, and different types of services most appropriate to Rhode Island were recommended. Task 8 identified alternate funding sources and strategies to gain funding, and in Task 9, conclusions and

recommendations were developed, and a *Rhode Island Waterborne Passenger Transportation Plan* was presented.

01-03 STUDY MANAGEMENT ORGANIZATION

The study was performed under the direction of the Intermodal Transportation Planning staff of the Rhode Island Department of Transportation. Assistance was provided by a Project Advisory Committee established for the study. The Project Advisory Committee supplied information, reviewed study results, and participated in several public meetings, to which more than 200 individuals and organizations with particular interest in Narragansett Bay and potential ferry routes were invited. Technical analysis was provided by the consultant team of Barton-Aschman Associates, Inc.; The Harbor Consultancy International; Maguire Group Inc.; Boelter & Associates; and Walter Wohleking.

Information to support the analysis in the study was provided by a large number of people and organizations with an interest in waterborne transportation in Rhode Island, including state and local government agencies, tourism councils, economic-development organizations, transportation providers, vessel builders, and private individuals. The study benefited greatly from their generous contributions of time, energy, and knowledge.

PART 651.02: GOALS FOR WATERBORNE PASSENGER TRANSPORTATION

02-01 PUBLIC-SECTOR GOALS, POLICIES, AND INITIATIVES

The study was guided by the goals of the Rhode Island Department of Transportation, other state agencies, the federal government, and local governments. Policies that have been articulated by Rhode Island agencies across the spectrum of transportation, the environment, historic preservation, economic development and tourism shaped the study as well.

02-01-01 State of Rhode Island Transportation Goals

Transportation 2010: Ground Transportation Plan,[1] published in March 1992 by the Rhode Island Department of Administration, Division of Planning, is a comprehensive document that investigates every transportation mode in the state except waterborne transportation. The plan establishes goals, policies and recommendations for new projects.

Although *Transportation 2010: Ground Transportation Plan* does not address waterborne transportation, the general goals in the plan guided this study, including the state's goals to make more efficient use of existing transportation facilities, to reduce traffic congestion, to improve safety and mobility, and to minimize adverse environmental impacts on the state's transportation network. The plan enunciates these goals:

1. Provide a balanced transportation system in terms of the type and level of services needed to meet travel demand.

2. Improve existing transportation facilities and services in order to provide for safe, dependable, and convenient passenger travel.

3. Develop innovative transportation programs that will be cost-effective and will further other state goals.

5. Develop an energy-efficient transportation system.

6. Develop transportation programs that contribute toward implementing environmental, economic and other state policies.

7. Provide transportation services for elderly and handicapped persons.

8. Make plans and decisions in coordination with other states, state and local officials, interest groups, and the public.[2]

The plan includes highway improvements, bus transit, bicycle travel, programs for elderly and handicapped people, intermodal connections, transportation system management programs, regional transportation issues, and financing. The plan's recommendations address all of those elements, but do not include waterborne transportation, as state and federal transportation programs have not until recently considered nor provided financial support for waterborne transportation.

02-01-02 Other State of Rhode Island Goals and Policies

In 1974, *The Bay Islands Park Plan*[3] was developed by the Department of Environmental Management. A marine recreation plan for the state, the plan identified island resources and habitats, proposed points of access for the public, and specified eleven potential embarkation sites for a Bay Islands Park ferry system. In the intervening years, the focus of DEM's efforts has been the purchase and preservation of island and mainland park sites, development of interpretive materials and piers, and a short-term water-taxi service from Colt State Park to Prudence Island.

DEM's recent accomplishments include the purchase of significant properties on Prudence Island, and the construction of a new dock at Colt State Park. DEM's future goals target new small-craft access and dockage along the coast. A ferry landing at Goddard State Park as an access link to the Bay Islands is also a short-term goal. Cleanup and hazard mitigation goals for Fort Adams, Fort Wetherill, and South Prudence and Dutch Islands will make these islands more attractive to the public, and create additional park access demand. Finally, improvement of access to the shore and beaches is targeted.

The Department of Administration, Division of Planning, issued *Ocean State Outdoors: Rhode Island's Comprehensive Outdoor Recreation Plan* in May, 1992. It includes a summary of recent tasks accomplished and short-term goals for the state park and recreational properties. A subsequent report, State Guide Plan Element 155, *A Greener Path...Greenspace and Greenways for Rhode Island's Future*, was published by the Division of Planning in November, 1994. It presents a long-range plan for open space and recreational facilities, including those in coastal areas.

In 1993, the Coastal Resource Management Council, Rhode Island Sea Grant, the University of Rhode Island, and the Coastal Resource Center produced *Public Access to the Rhode Island*

Coast,[4] a compilation of some of the parks, wildlife refuges, and beaches along the state's shoreline. The publication was part of the CRMC's efforts to provide greater opportunities for public use of the coastal zone.

02-01-03 State of Rhode Island Regulation of Transportation

Several provisions of state law affect the operations of waterborne transportation services in Rhode Island. They include the following:

Title 39 of the General Laws of the State of Rhode Island, "Public Utilities and Carriers," contains the law pertaining to transportation providers that offer service to the public (common carriers), as well as utilities that supply electricity, water, and so forth. The section of this title that defines the obligations imposed upon those engaged in such public services is Chapter 2, "Duties of Utilities and Carriers." Section 1 of this chapter requires that the charge for transportation service must be "reasonable and just."

Chapter 3 of Title 39, "Regulatory Powers of Administration," defines the oversight function of the state and its exercise through the Public Utilities Commission, and the Division of Public Utilities and Carriers. Section 3 of this chapter requires that a common carrier must obtain a certificate of public convenience and necessity from the Division of Public Utilities and Carriers in order to offer waterborne passenger transportation service.

Title 46, "Waters and Navigation," affects harbors and some aspects of the operations of waterborne transportation. Chapter 1 defines the duties of the Department of Environmental Management. Section 1 gives the Director of the Department of Environmental Management supervision of the harbors and tidewaters of the state.

Chapter 4 of Title 46 addresses "Harbors and Harbor Lines." Section 2 of this chapter authorizes any town or city council to appoint a harbormaster for any harbor within its borders, and to enact laws and establish fees and compensation to carry out the provisions of the section.

Chapter 9, "Pilots," establishes the requirements for the skills of pilots and their use on boats within the state.

Chapter 22, "Regulation of Boats," defines the requirements that are imposed upon boats that are used in the state's waters. Ferries are exempt from the provisions of this section.

02-01-04 Federal Transportation Policies

The Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991, which brought about significant changes in federal transportation programs, requires each state to undertake a transportation planning process. That process must consider, among other factors, "...identification of unused rights-of-way which may be needed for future transportation corridors," and "methods to expand and enhance transit services and to increase the use of such services." The act authorized increased funding for public transportation services and broadened the ways in which different categories of funds can be used. In addition, the act identified funds for ferry programs over the six-year life of ISTEA, including $100 million that was authorized for construction of ferryboats and terminals on routes that are part of the national highway system.

The Federal Highway Administration, Federal Transit Administration, Maritime Administration, United States Coast Guard, and National Transportation Safety Board are the principal federal agencies that affect ferry policy, design, construction, safety, and funding. These agencies do not explicitly support or oppose waterborne transportation, since most transportation decisions are a state and local matter. There are, however, policies and regulations that affect ferry operations. For example, ferry operators must comply with the regulations of the United States Coast Guard, which has authority in matters of marine safety, inspection and licensing of ferries for operation, vessel construction standards, navigational channels, speed and wake, and other matters.

The Clean Air Act, administered by the Environmental Protection Agency, has provisions that directly affect transportation system development. The act requires that transportation plans be consistent with state implementation plans to meet air-quality standards. Those implementation plans must include transportation control strategies to reduce emissions from motor vehicles, including such actions as improved public transit, fringe parking, and high-occupancy shared-ride services. States must measure their progress toward attaining air-quality standards through continued monitoring.

Complying with the Clean Air Act will require analysis of each proposed waterborne transportation service to identify its effects upon air quality, as the characteristics of each will be unique. The effect will vary depending upon several factors, such as the trip length, whether the service replaces auto trips or adds new travel that would otherwise not have occurred, and the type of powerplant used.

02-01-05 National Park Service

The National Park Service, in a coordinating interpretive role in the Blackstone Valley National Heritage Corridor, supports efforts to connect the corridor to Narragansett Bay by water and by bicycle. A new bicycle path is in the development stages along the canal.

The National Park Service will soon investigate the potential for the interpretation of the role of the City of Fall River in a Historic Coastal Trail. Because of the shared history of ferry and rail transportation and textile mills within Rhode Island, it is possible that the Fall River project will investigate the restoration of ferry connections as an element of any potential interpretive efforts.

02-01-06 Rhode Island Municipal Regulations

Municipalities have regulatory control over some vessel operations within their jurisdictions. The harbormaster in a community in effect exercises police power over vessels with respect to speed limits and other operating rules. The responsibilities of harbormasters complement those of the Coast Guard, with harbormasters having the advantage of being closer to local activities on a regular basis.

a. City of Providence

The Capital Center and Providence River projects, potential relocation of I-195, and completion of the India Point Park plan, now underway in Providence, have tremendous implications for the future of water-taxi and ferry connections to Rhode Island's capital city. Additionally, goals of the Providence Parks Department for public access to islands, goals of the Providence Foundation and the business community for a renewed waterfront and river district, and goals of the Rhode Island Historical Society for new interpretive centers and walkways are complementary to this effort.

The reopening and realignment of the Providence River will enable water-taxi service to connect sites along the river, from the Fox Point Hurricane Barrier to Waterplace Park. The proposed Waterplace Park water-taxi landing is near the Convention Center, and close to Kennedy Plaza, Providence's local and regional bus terminal. The proposed Capital Center landing is located within a few hundred yards of the Providence railroad station. Other sites include existing and proposed landings at Quay Port, Narragansett Electric Company, and the Court House.

City of Providence goals outlined in the India Point Park plan have been partially accomplished, with the construction of a ceremonial dock and ferry dock, and waterfront park accommodations

at India Point. Future planning includes space for a ferry terminal and interpretive center near the ferry dock. Realignment of access to India Point Park will depend upon the proposed relocation of I-195.

b. City of Newport

Waterborne transportation is an integral part of Newport's history and culture, and an important element of its economy. Newport's waterfront is one of the attractions that draw three million visitors to the city each year; some of those visitors arrive by cruise vessel and by yacht.

Efforts to enhance waterborne transportation in Newport have included consideration of improved terminal facilities. The city recently studied 16 potential sites for improved facilities, and recommended a multiphase approach that would develop several small terminals while preserving space for the fishing industry. RIDOT has also addressed the issue of marine terminal facilities in Newport. A study completed in 1991 examined the use of South Pier, which was purchased by the state in 1985. Another study was being done concurrently with this one; it examined alternative sites, with the objective of linking waterborne passenger transportation to the existing intermodal transportation facility, the Gateway Center. That study analyzed terminal options in more detail than was possible in this one. RIDOT received a grant to construct several terminal areas to accommodate high-speed and conventional ferries as well as water taxis and other passenger vessels.

c. Municipalities in the Blackstone Valley

RIDOT has received a grant to finance two Pawtucket-Providence water shuttles. Potential excursion ferry sites are also being considered.

d. Other Rhode Island Municipalities

Ferry terminals are subject to zoning and building codes of local communities, and the requirements of agencies and commissions that monitor and regulate construction in tidelands, from the U.S. Army Corps of Engineers to the local Conservation Commission. Each terminal presents a unique set of issues, and concomitant set of agencies and interests with regulatory or advisory directives.

With concern about pressures on natural resources, fragile coastal ecosystems, beaches, and rivers, and with the development of harbor management plans and historic preservation districts throughout Rhode Island, any ferry systems must be designed to be sensitive to the environment.

Some Block Island residents continue to express concern about current transportation pressures, and the impact of any future ferry service.

Several Rhode Island communities are exploring the renewal of ferry connections. East Providence is considering improvements to its waterfront in connection with Waterfront Drive. The City of Warwick is very interested in siting a ferry connection, with the anticipated rezoning and redevelopment at Rocky Point. In Galilee, RIDOT and DEM are restructuring access to the Block Island Ferry with terminal changes and realignment of traffic patterns. Pressure to grow, pressures to stay the same, and pressures to rethink problems of access all play a role in community planning dynamics. Harbor management plans and historic preservation studies could also shape community enthusiasm for any future waterborne passenger transportation services.

02-02 PRIVATE-COMPANY GOALS

Although not always stated as explicitly as public goals, private companies, especially ferry operators and boat builders, also have goals for waterborne passenger transportation. These goals typically relate to business opportunities in operating services or supplying the vessels that would be used. No list of private-company goals could be complete; some goals are not publicly stated because they are part of business strategies. Nevertheless, a review of some private-company actions demonstrates the breadth of interest in waterborne transportation.

Interstate Navigation and its affiliates, Blount Marine and its affiliates, Prudence Island Ferry Company, Bay Marine, Oldport Marine, Captain Joe Dempsey, Viking Lines, and Jigger III are some of the companies, individuals, or vessels currently in the business of providing car-ferry service, passenger-ferry services, excursions, harbor tours, or water-taxi connections within Rhode Island. They have an interest in continuing and expanding service. Investments in vessels built in Rhode Island and in the purchase of materials and services, including catering, generate jobs and substantial revenue for the Rhode Island economy.

Additionally, goals of present and potential private ferry operators, such as a proposal from Airwave Ltd., to link Newport, Portsmouth, and Providence with hovercraft service, have sparked renewed interest in the potential of waterborne transportation service between Rhode Island communities. Fishing vessels seeking additional income are exploring ferry and water-taxi links. One Newport venture is investigating high-speed links across Narragansett Bay, as well as to Providence. The motor vessel *Hurricane* is available on the Providence River for charter and river tours, and its owner is anticipating the advent of water-taxi services

as well. Entrepreneurs have proposed ferry connections to airport shuttle buses. Waterfront developers occasionally suggest waterborne transportation services to enhance their projects.

Recently, several new ventures have proposed cruise-ferry connections between New England and Nova Scotia. Nova Scotia itself has published an analysis of potential ferry connections that might augment the services now provided between Yarmouth, Nova Scotia and both Portland and Bar Harbor, Maine.

PART 651.03: HISTORY OF WATERBORNE PASSENGER TRANSPORTATION IN RHODE ISLAND

03-01 HISTORICAL PERSPECTIVES ON WATERBORNE TRANSPORTATION

This study, as the basis for a plan for waterborne passenger transportation, looks to future opportunities. But planning for the future is more effective when it is based upon knowledge of the past. That knowledge can provide an understanding of the reasons for present conditions and their implications for future change.

Evidence of waterborne transportation history can be found along the entire Rhode Island coast. At India Point in Providence, the skeleton of an oyster boat rests on the mud at low tide, and "bones" of old ferries can be found elsewhere in the bay. Remnant pier pilings line India Point, and emerge at historic pier locations such as Narragansett Pier; rock piles remain at Mount Hope and Rocky Point. Evidence also is found in street names–South Ferry Road in Narragansett, Ferry Road in Bristol, and Steamboat Avenue in Wickford, for example.

Graphic reminders of this history–photographs, murals, and paintings–are carefully preserved in historical societies and hang on walls in homes, in offices, and in theme restaurants in Newport. The Rhode Island Historical Society's "Balloon View of Narragansett Bay," published in the 1800s and shown in Figure 651-03(01), pictures island ferries, excursion steamers, and the large New York steamships traversing the bay, in the company of sailing sloops, freight schooners and square-rigged ships.

Other evidence of ferries and waterborne transportation is found in the memories and anecdotes of the Rhode Island residents who reminisce about the night boats to New York and excursion boats to shore dinners down the bay. Maps and books written in the days of the earliest discoveries, settlement, and conflicts of the "new world" identify types of transportation and patterns of trade and commerce that changed with the introduction of new settlers bringing new technologies.

Changes in the use of Rhode Island's waterways can be attributed to a range of colorful causes, including plagues, hurricanes, wars, depressions, economic competition, monopolies, fires, and collisions, but principally to more-efficient and cost-effective modes of transportation. The changes are a process that began in Rhode Island's earliest years and continues through the present.

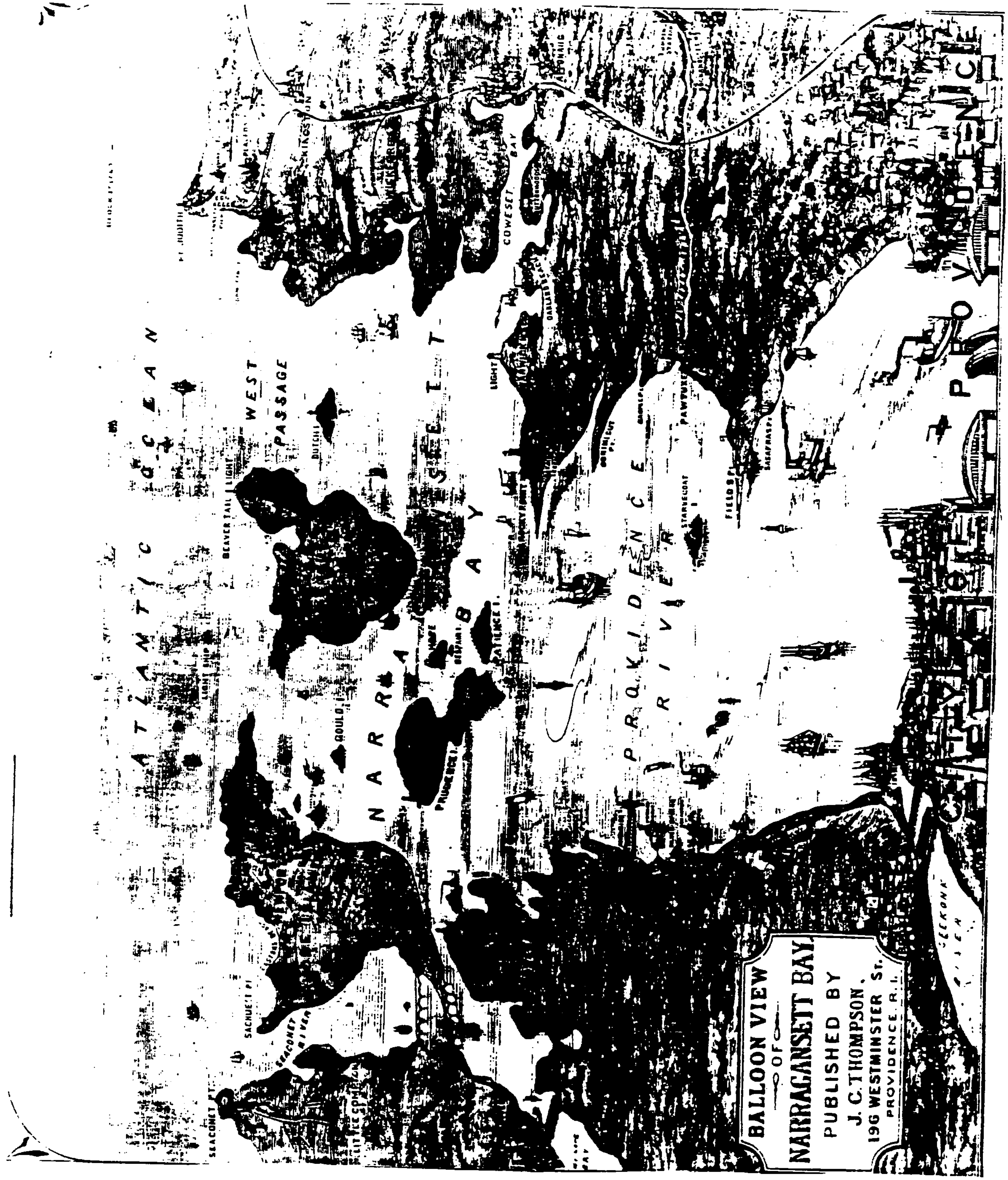


Figure 651-03(01)
Balloon View of Narragansett Bay[1]

03-02 EARLY ENCOUNTERS

New England's coast is the cradle of the United States. With first settlers who can be traced back 13,000 years, New England took shape in the European imagination and was named and defined by discoveries, written references, and maps from the days of the Vikings to the explorations of the 1500s and 1600s.

One of the first references to what is today known as Rhode Island appeared in a map developed as the result of an expedition made by Giovanni da Verrazano in 1524, who was seeking a route to China. Narragansett Bay is identified on his chart as a place of refuge, "Refugio." Verrazano was received with welcome by the American Indians, who led him to what is now Newport, where he spent a fortnight. He mentioned their dugout canoes, circular houses, and other customs, which were later described by other settlers. These dugout canoes provided the first indigenous waterborne transportation described in writing. "They use...sharp stones, in the place of iron. They also use the same kind of sharp stones in cutting down trees, and with them they construct their boats of single logs, hollowed out with admirable skill, and sufficiently commodious to contain ten or twelve persons."[5]

Trading with the Dutch settlers began in the early 1600s, with maps indicating transportation uses of bays and channels. Adrien Block, for whom the island is named, arrived in 1614. Trading posts at Charlestown and Dutch Island were approached via Sloop's Bay (the west passage of Narragansett Bay) and Anchor Bay (the east passage), according to a Dutch map of 1648.

Drawings of Americans Indians line the edges of an illustrated map of New England and New York (Nova Belgica et Anglia Nova), dated 1635, and of Dutch origin. One of the boats drawn is a dugout canoe paddled by several people. This was of the type identified earlier in Narragansett Bay and described as "navis ex arboris trunco igne excavata," a boat made of the trunk of a tree and excavated by fire.

Bays and rivers were generally shared by linguistically related tribes of American Indians. Around Narragansett Bay, at the time of early trading with Europeans, there were distinct American Indian settlements and trading patterns. Narragansetts were found along the western shores of the bay, Wampanoags or Pockonockets along the eastern shores, and Nipmuck in the north. In fact, one meaning of Pawtucket is "meeting place" where the three tribes would meet.

Early trade within the American Indian communities brought wampum from the Narragansetts and furs through the Nipmucks over land and by water. Early illustrations also show American Indians engaged in fishing from dugout canoes and by setting fish wiers.

Landings of canoes linked to land passages that were identified by settlers in the Plymouth colony. The Nemasket Trail, for instance, follows the route of what is now Route 44. The north-south roadway between Massasoit's place, Sowams in Mount Hope (Montaup), and the Massachusetts Indians was another significant trail that became a highway, Route 138, over the years. According to references in Church's Diary, Plymouth was about 42 miles from Pocasset by Indian trails.

In Colonel Benjamin Church's account of King Philip's War (1675-76), ferry landings and ferries are located and described. Short crossings, prior to the building of bridges, existed throughout the state. Ferries ranged from canoes to rowing boats and sailing sloops. One ferry of this period was run by Abiel Trip, who lived in Portsmouth. Trip's Ferry and Howland's Ferry to Aquidneck Island, shown in Figure 651-03(02), were used for transport during the war. According to Church's diaries, "They...marched the same night to the ferry and were transported to Rhode Island, from whence the next night they got a passage over to Pocasset side in Rhode-Island boats and concluded there to dispose themselves in two ambuscudos before day, hoping to surprise some of the enemy...." Other references to ferries included tales of desertion and betrayal, absence of ferryboats, the need to take canoes to the encounters, and landings at Fogland by ferry from Rhode Island.

The *Rhode Island Atlas* attributes these dates to some early ferries:

Tiverton-Newport
Howland's Ferry, 1640
Fogland Ferry, circa 1700-circa 1776
Portsmouth-Bristol
Ferry (Trip's), before 1680
Providence
Weybosset Ferry, preceded building of bridge in 1660
Seekonk River Narrow Passage Ferry, 1678-79
Barrington-Warren
Warren River Ferry, 1678
Jamestown-Newport
Ferry, 1675-1969
Narragansett-Jamestown
South Ferry, before 1700

Since the date of the establishment of Howland's Ferry, the same Tiverton-Newport link has been crossed by four bridges, built in 1794 (First Bridge), 1865 (Railroad Bridge), 1905 (Stone Bridge), and 1956 (Sakonnet River Bridge).

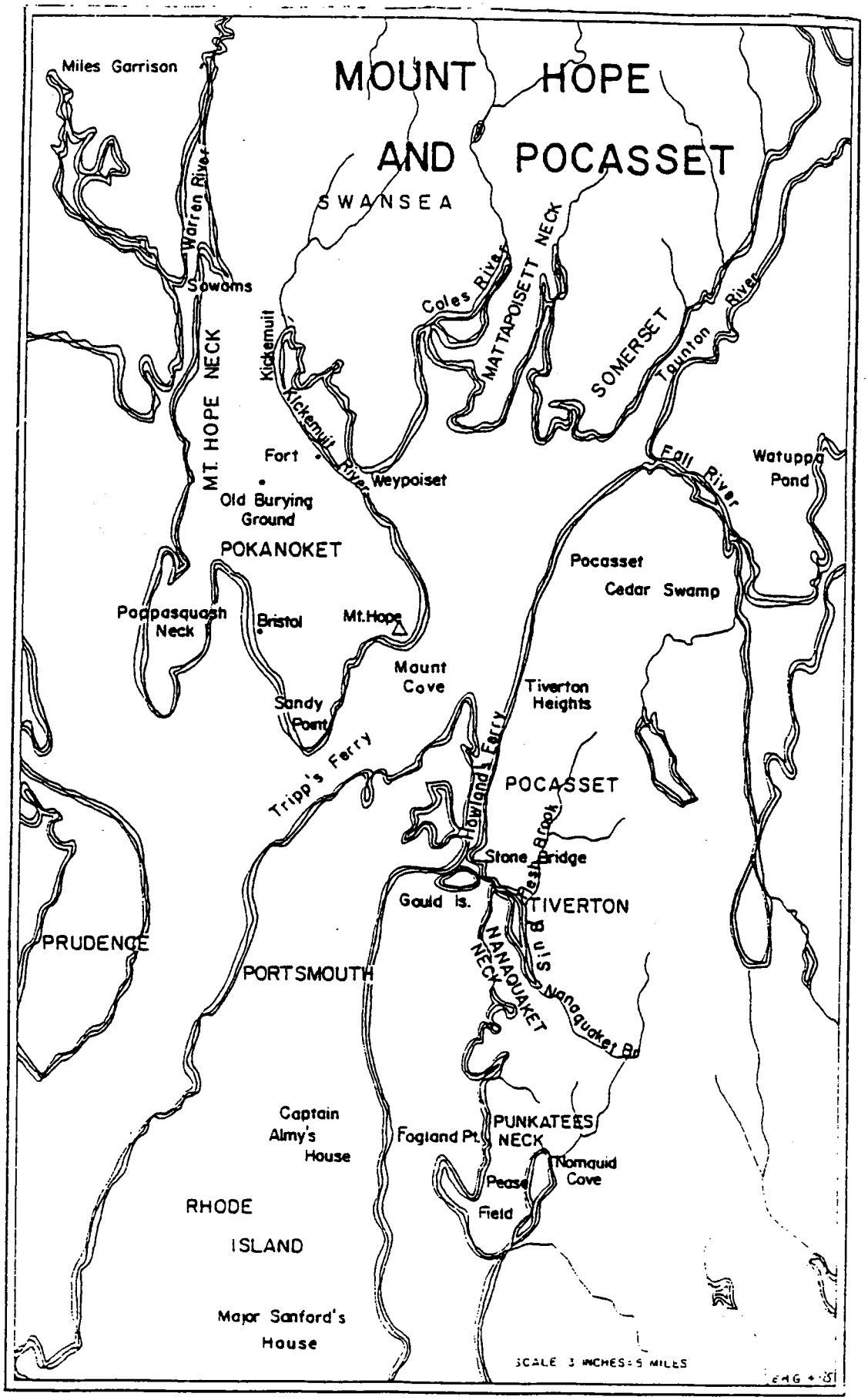


Figure 651-03(02)
Trip's Ferry and Howland's Ferry[2]

03-03 ROWING AND SAILING VESSELS (1600-1920)

Rhode Island history also records the arrival of its founder, Roger Williams, by boat in 1636. Illustrations of Williams reaching land and being welcomed by an English-speaking American Indian with the words "What Cheer, Netop," reflect the legend. The site he selected as a settlement was located on the Providence River at the intersection of American Indian trails and rivers. Williams' diaries include reference to transporting American Indians to Prudence Island in his vessel. The first wharf recorded was built in 1680, and a second shortly thereafter on Weybosset Point. Other illustrations of the period depict King Philip fleeing Pocasset by water when pursued by English settlers. Dramatic arrivals and departures by sea, river, canoe, rowing vessel, and sailing shallop were part of the tapestry of Rhode Island history.

With the geography of Narragansett Bay, shipbuilding, fishing, and coastal trade were natural industries from the earliest days of Rhode Island. Newport became the center of maritime activity, and held its prominence until the Revolution.

Carr's Ferry from Newport to Jamestown is recorded as having started service in 1675, and is pictured as a sailing vessel, transporting both people and livestock. This route was served by ferries for 294 years, until the construction of the Newport Bridge in 1969.

Sailing packets were heavily engaged in the coastal trade during the 1700s, and into the age of steam. Sailing packet connections between Providence and Newport were initiated in the mid-1700s. In the early 1820s, the packets competed with the first steam vessels to arrive in Narragansett Bay. They were described as "beautifully modeled sloop-rigged vessels of from 75-100 tons...built with a view to speed, carrying capacity and comfort." There were weekly sailings from Providence to New York, with travel times ranging from 18 hours to one week, depending upon weather and winds. Generally, from 25 to 30 people were carried aboard, as well as freight.

Ferry connections listed in the *Rhode Island Atlas* as having initiated service in the 1700s included:

Seekonk River (South) Ferry, 1740
Barrington River Ferry, 1709
Bristol-Prudence Island Ferry, pre-1776
West Passage links to Jamestown: Saunderstown-Jamestown Ferry, 1707-1940
Warwick, Prudence, Portsmouth Ferry, 1742-1775.

Bristol Ferry in the 1800s used two sailboats, and a "horse-powered ferry" to move its passengers and vehicles. Steam power was not used until 1905 on this route.

Sailing vessels in international trade included sloops, brigs, and brigantines. Exports to East Coast, West Indies, South American, and European locations included lumber, fish, dairy products, livestock, items of local manufacture, and mixed cargo, depending on the market. Rhode Island merchants from Providence, Newport, Bristol, and Warren were active participants in the "triangle trade," which involved the shipping and exchange of molasses, rum, and slaves among ports in the West Indies, Providence, and Africa. The wealth of the 1700s was based on Rhode Island's prominence as a provider of transportation, with its vessels moving luxury goods and raw and manufactured materials among ports throughout the world.

India Point, today the location of Providence's new ceremonial pier and the Block Island ferry pier, was the center of East Indies trade in the late 1700s, and was established to handle large sailing vessels required for the longer voyages. Fifty-eight wharves lined Providence's waterfront in 1798. Merchants and sailors embarked here for Canton, and, in the 1800s, for the Treaty Ports in China.

Although international maritime commerce in Rhode Island began its decline in the 1820s, clipper ships that opened faster transport along sea routes to distant destinations such as San Francisco were both built in Rhode Island and owned by Rhode Island merchants. The clipper ship *Merchant* was owned by Suchet Mauran in 1868, for instance, and was home-ported in Providence. The clipper ship *Lookout* was built by Chase & Davis at Warren. In 1888, a four-masted square-rigged medium clipper, *Mount Hope*, was built in Maine for the Culver interests, to carry cotton from the South to mills in Rhode Island and along the Taunton River in Massachusetts. This vessel was in operation until the 1920s, and typical of the larger vessels that brought bulk cargo such as cotton and coal to the mills towards the end of the sailing epoch. Profit from the maritime trade was invested in cotton mills and manufacturing plants on the rivers and canals of Rhode Island.

03-04 THE CANAL EPOCH (1828-47)

During the development of the steam era, canals were built throughout the eastern United States to provide efficient transport of goods. In the late 1700s, it was said to be cheaper to carry goods to Europe from Boston by ship than overland from Boston to Worcester. Stagecoach travel linking Worcester with Providence was scheduled for only two round trips a week, taking up to 14 hours each way. Roads were poor, and travel was uncomfortable. It was inefficient to transport goods in bulk. Providence merchant John Brown initiated efforts to build the

Blackstone Canal in 1796 with the goal of providing a more economic link and transporting more goods between Providence and Worcester, but was unsuccessful. After much legislative maneuvering in the states of Massachusetts and Rhode Island, the Blackstone Canal was constructed and finally completed in 1828.

An engineering achievement, 45 miles long with 62 locks, the canal descended 451½ feet from Worcester to the tidelands of Providence. The estimated expense of the canal at the time of its engineering was $323,319. Actual costs amounted to $700,000, with $500,000 paid by Rhode Island. With much celebration, the canal was opened to passenger transportation on October 6, 1828, with the voyage of *Lady Carrington*, the first passenger boat to cover the entire length of the canal. Drawn by two horses, the canal boat traveled 4-5 miles an hour. Cargoes to Worcester included manufactured goods and coal, while cargoes to Providence included fresh produce and raw materials, including wool. With the establishment of Worcester as a port, lumber could be transshipped from the Great Lakes, through the Erie Canal, down the Hudson River, past New York, up the coast to Providence, and through the Blackstone Canal to Worcester.

Canal records include references as well to excursions over the years of operation, including participants of a Quaker picnic venturing from Newport to Uxbridge by ferry and canal boat. The canal was considered either a financial failure or a financial success, depending upon who was reporting. Worcester merchants saved significant tonnage charges for freight, but reliability of deliveries became a problem. Early on, difficulties arose over questions of adequate water during summer drought periods, icing during the winter, and diversion of water, which affected mill power along the Blackstone River. Toll revenue made 1832 the most-profitable year for the Blackstone Canal, but fortunes began to ebb with diversion of Worcester-bound traffic over the Boston & Worcester Railroad. The completion of the Providence and Worcester Railroad in 1847 brought a virtual end to canal traffic. Rail service began on October 25, 1847, and the last canal toll was collected in 1848.

Once the connection between Providence and Worcester was established by rail, the canal could no longer compete for traffic, and service came to a close. The Blackstone Valley National Heritage Corridor now serves to remind visitors of the importance of the role of the canal in the growth of the mills, homes, and communities, and the transportation of goods.

03-05 AGE OF STEAMBOATS (1792-1942)

The first record of steam-powered vessels in Rhode Island is of an effort by Elijah Ormsbee in 1792, who crafted the vessel *The Experiment*. Described as a "canoe with a kettle in it raising

steam to propel the boat," the vessel was a longboat with a goosefoot paddle and a 150-gallon copper still. Ormsbee made several trips on the Seekonk River between Lower Wharf in Providence and Pawtucket, and then dismantled the craft, and returned the still to its ordinary place of business.

When the steam-powered sailing vessel *Firefly* arrived in Narragansett Bay on May 26, 1817, from New York, there were some who recalled the Ormsbee experiment. Slower than the sailing sloops, *Firefly* nonetheless was the center of great excitement. President Monroe was a visitor aboard, on a trip between Bristol and Providence. With fierce competition from skippers of the sailing packets, who lured passengers away from the steamboat, service lasted only four months.

After *Firefly*, the next reported steam-powered vessel was *Robert Fulton*, Figure 651-03(03). It arrived on a special expedition with great ceremony in 1821. The trip between New York and Providence took 24 hours, with the vessel making stops at Newport, Providence, and Bristol. Among its passengers was John Quincy Adams, who travelled on from Providence to Boston by stagecoach, a trip of six hours. Generally, the stagecoach trip to Boston took five to six hours, and involved three changes of horses.

Stagecoaches to Boston and other cities expanded to meet steamboat schedules, with lively competition, offering better fares, travel times, comfort, speed, and accommodation than their fellow providers of transport. In 1829, it was reported that there were 328 weekly stages to and from Providence.

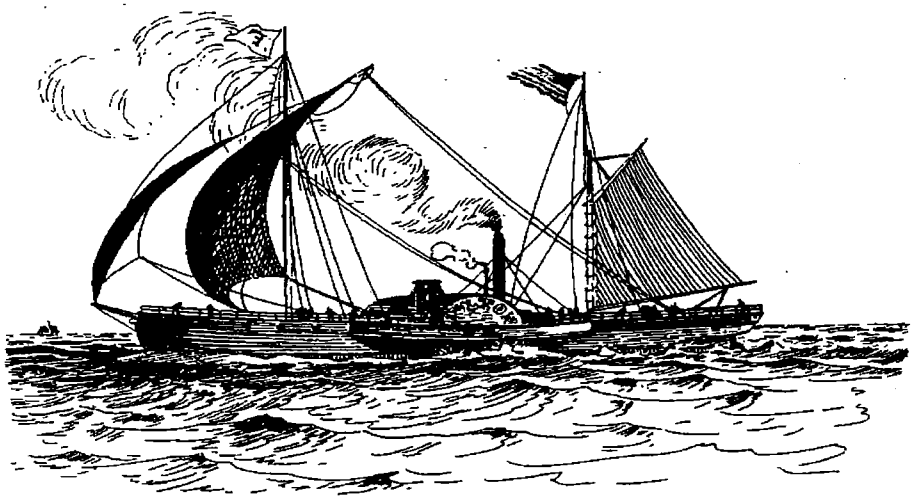


Figure 651-03(03) *Robert Fulton*[3]

From Narragansett Bay, steamboats provided links to New York and East Coast ports. Sail packet owners carried their opposition to the steamboats to the legislature, and attempted to discourage the competition by filing a tax bill that would levy 50 cents on each passenger to arrive in Rhode Island by steamboat, as well as the "Prohibitory Bill," designed to "restrict the landing of steamboat passengers on Rhode Island soil." The tax bill was declared to be unconstitutional, and the Prohibitory Bill didn't get far.

Steam-powered vessels made trans-Atlantic connections as well. Within the bay, a great array of excursion steamers came into being, as well as a cross-bay network of ferries, many following the earlier sailing and packet routes. Railroad companies competed with steamers, or owned them, and competed against one another with rail-steamer routes. Monopoly control by the New Haven Railroad occurred in the early years of the 1900s.

Table 651-03(01) lists some of the principal steamboat companies serving the Providence-New York route from 1817 to 1938 and illustrates the corporate competition, monopolies, and mergers that shaped the steamboat era. In 1845, five separate companies competed to provide steamboat service between New York and Providence. Volumes have been written about the boats of the Long Island Sound; this table presents some of the highlights of the connections to one Rhode Island city.

03-06 BOATS TO NEW YORK

Upon the development of the steamboat in the early 1800s, there was an "early discovery that the fastest and most convenient routes between New York and Boston, two of America's three leading ports, was by steamboat from New York to Providence and by stages from Providence to Boston." On July 12, 1822, the Rhode Island and New York Steamboat Company was organized to provide weekly trips between Providence and New York. Trips aboard *Fulton* and *Connecticut* took 18 to 32 hours. From this first regular service, expansion of routes and improvements in schedule grew.

Misfortunes and calamities marked steamboat travel, along with successes. An epidemic of cholera in 1832 practically stopped traffic to New York. Fires, gales, and shipwrecks made major impacts on the memories of those who knew the routes, and slowed progress. But the sensibilities of those who enjoyed steamboat travel were also engaged. In the 1870s, a Providence-New York trip by steamboat was described:

TABLE 1 -- STEAMBOAT CONNECTIONS TO PROVIDENCE

May, 1817. Steamboat "Firefly" arrived from New York via Newport.
June, 1822. Captain Elihu S. Bunker brought steamboat" Connecticut" from New York, Rhode Island and New York Steamboat Company; shortly began regular Providence-New York service with the "Fulton" and "Connecticut".
June, 1835. Commodore Vanderbilt opened competing Providence-New York "through by daylight" passenger service with fast "Lexington".
1837. Atlantic Steamboat Company in competition with Boston and Providence Railroad Line with fast steamer "John W. Richmond".
1845. Five competing lines operated Providence-New York.
1847. Railroad Line withdrew steamers from direct Providence-New York route. Boston and Providence connections made via Stonington.
1855. Commercial Steamboat Company began daily service Providence-New York.
1863. Neptune Line began service and shortly consolidated with Commerical Steamboat Company.
1866. Neptune Line and Stonington Line consolidated as Merchants Steamship Company. Merchants Steamship Company shortly failed with subsequent formation of three new companies -- Metropolitan Steamship (Boston-New York); Narragansett Steamship (Bristol - New York); Providence and New York Steamship (Providence - New York).
April 1875. Providence and New York Steamship Company and Stonington Steamship Company consolidated.
April, 1892. New York, Providence and Boston Railroad (Providence and Stonington Steamship Company) leased to New York, New Haven and Hartford Railroad Company.
April , 1899. Joy Steamship Company (F. M. Dunbaugh and others) began Providence-New York service in competition with New Haven Railroad.
May 1899. Narragansett Bay Line ("Chester W. Chapin") operated New Haven Steamboat Lines "Richard Peck" and new "Chester W. Chapin", Providence to New York with stops at New Haven, in opposition to New Haven Railroad.
April 1900. Narragansett Bay Line purchased by New Haven Railroad.
1907. Joy Steamship Company pirchased by New Haven Railroad-- reorganized as Bay State Line of New Haven Railroad's Hartford and New York Transportation Company.
June 1910. Colonial Navigation Company (F. M. Dunbaugh) began Providence-New York passenger service with steamers "Concord" and " Lexington".
September 1917. New England Steamship Company (New Haven Railroad) discontinued summer Providence-New York passenger service (Daily all year round freight service continued).
1928. New England Steamship Company began all year 'round Providence - New York passenger service with steamers "City of Lowell" and "Chester W. Chapin"
June, 1929. Colonial Navigation Company purchased Blackstone Valley Transportation Company (Pawtucket- New York freight service).
January, 1931. Bay State Line passenger and freight service abandoned by New Haven Railroad.
October, 1935. New Haven Railroad filed reoganization petition with Federal Court under Section 77 of Bankruptcy Court.
June, 1936. Colonial Navigation Company placed "triple screw express turbine steamers "Arrow " (ex-"Belfast") and "Comet" (ex-"Camden") in all year round Providence- New York passenger service.
May, 1937. New England Steamship Company (New Haven Railroad) abandoned Providence Line passenger and freight service.
May 1938, United States District Court at New Haven approved sale of New England Steamship Company's passenger steamer "Chester W. Chapin" to Colonial Navigation Company (renamed "Meteor")

Salts of the Sound, Roger Williams McAdam, Stephen Daye Press, Brattleboro VT, 1939, pp. 237-9.

Figure 651-03(01)
Principal Steamboat Companies

> The railroad ride will not begin until the cool of the day. At 7:15, the steamer will leave Fox Point, and, in the sunset, will sail down past green fields and cottage villages; past the terraced banks of Pawtuxet and the rocky bluffs at Silver Spring; past boat loads of joyous excursionists and beautiful Rocky Point; past Patience and Prudence and Beaver Tail; until, at length, the lights flash out from Narragansett Pier and Point Judith rises in the distance, while leftward, reaching almost to the morning, lie three thousand miles of sea. Presently the boat turns southward and we, her passengers, bid adieu to Narragansett Bay.

Stagecoaches and steamboats continued to compete over the packed pathways and navigational channels. Steamboat time between New York and Boston was cut to 12 hours. With the initiation of train service between Providence and Boston in 1835, a six-hour coach trip was cut to two hours. Over the years, times improved, and travel connections were made more efficient. A typical schedule is shown in Figure 651-03(04).

In 1900, steamboat passenger and freight service reached its peak between New England and New York. Intermodal connections were highly efficient. The Marine District of the New York, New Haven and Hartford Railroad included 16 passenger steamers and 7 freight steamers. The company operated the Providence Line, the 184-mile route between New York and Providence, using the steamers *Plymouth* and *Providence*, and the Fall River Line, the 177-mile route between New York and Fall River, using the steamers *Priscilla* and *Puritan*.

In a journal published by the line, schedules reflected the entertainment to be performed en route for the pleasure of the passengers, as well as the times and connections of ferries, express trains, electric cars, and parlor cars–the network that delivered passengers from point to point. Night boats were laid out to include cargo on the main deck, cabins for crew and passengers, a dining room, and a main saloon with a grand staircase. Fare structures varied, depending upon the level of accommodation and service.

A description of *Bristol* of the Fall River Line gives an excellent idea of the elegance of the service offered its passengers. Amenities included "a dining hall capable of seating 110," the saloon, "300 feet long and 30 feet wide, richly and elegantly furnished and carpeted in velvet pile in brilliant colors, and decorated in gold and white."

A businessman leaving the Worth Street textile area in New York to return to the mills in Rhode Island or Fall River could depart New York at 5:00 P.M. from Pier 18 in the North River, enjoy an evening dinner aboard the luxuriously appointed steamer, as well as a concert by Smythe's Orchestra, featuring five soloists and selections including opera and waltzes, and retire for sleep in a cabin. The vessel would arrive in Newport at 2:30 A.M., and at Fox Point Wharf in Providence at 5:00 A.M. The passenger could rest in his cabin until the express train to Boston

Fall River Line

between

New York and Boston

Via Newport and Fall River

Daily Service All Year Round — **Special Train Fall River and Boston**

Steamers Commonwealth, Priscilla, Providence and Plymouth

STEAMER SCHEDULES

EASTBOUND—Daily

	Runs June 20 to Sept. 7, inc.	Direct Steamer	Via Newport
Lv. New York, Pier 14, North River foot of Fulton St.		4 30 P.M.	4 30 P.M.
Due Newport		.....	2◆30 A.M.
Lv. Newport		.....	3 00 A.M.
Due Fall River		4 30 A.M.	4 30 A.M.
Lv. Fall River Wharf Special Boat Train		6 10 A.M.	6 10 A.M.
Due Back Bay Station, Boston		7 25 A.M.	7 25 A.M.
Due South Station, Boston		7 30 A.M.	7 30 A.M.

WESTBOUND—Daily

	Runs June 20 to Sept. 7, inc.	Direct Steamer	Via Newport
Lv. South Station, Boston Special Boat Train		5 00 P.M.	5 00 P.M.
Lv. Back Bay Station, Boston		5 06 P.M.	5 06 P.M.
Due Fall River Wharf		6 20 P.M.	6 20 P.M.
Lv. Fall River Steamer		6 30 P.M.	6 30 P.M.
Due Newport		8 a00 P.M.	7d50 P.M.
Lv. Newport		8 a15 P.M.	8d25 P.M.
Due New York, Pier 14, North River foot of Fulton St.		6 00 A.M.	6 00 A.M.

Time shown in this folder is

Eastern Standard Time

Daylight Saving Time is one hour in advance of Eastern Standard Time

Sailing Arrangement from New York

Steamer	June	July	Aug.	Sept.
Commonwealth	Odd Dates	Odd Dates	Even Dates	Odd Dates
Plymouth	Odd "	Odd "	Even "	Odd "
Priscilla	Even "	Even "	Odd "	Even "
Providence	Even "	Even "	Odd "	Even "

Sailing Arrangement from Fall River

Steamer	June	July	Aug.	Sept.
Commonwealth	Even Dates	Even Dates	Odd Dates	Even Dates
Plymouth	Even "	Even "	Odd "	Even "
Priscilla	Odd "	Odd "	Even "	Odd "
Providence	Odd "	Odd "	Even "	Odd "

Parlor Car Service—Boston and Fall River Wharf

From Fall River, Parlor Car is attached to the 6.10 A.M. train for Boston. Seats, 75 cents each, may be purchased at the New York Consolidated Ticket Offices, also at Ticket Office on Pier 14, North River, New York City, and at Purser's Office on Steamers.

From Boston, Parlor Car is attached to the 5.00 P.M. train for Fall River. Seats, 75 cents each, may be purchased at the Consolidated Ticket Office and at the South and Back Bay Stations, Boston.

Railroad Connections with the New York, New Haven & Hartford Railroad
FALL RIVER AND BOSTON VIA MANSFIELD OR RANDOLPH

STATIONS	Week-days							Sundays		
	AS	AS	AS	AS	AS	AS	AS	AS	AS	
Fall River Wharf..... Lv	4 45	4 45	5 18	6 10	6 15	6 35		5 40	6 10	
Fall River..... "	4 50	4 50	5 23	6 14	6 20	6 45		5 45	6 14	
Somerset..... Due	.....	.....	5 32	.....	6 28	.....		5 54	.....	
Dighton..... "	.....	.....	5 38	▲	6 34	.....		6 00	▲	
Segregansett..... "	.....	.....	5 f41	▲▲	6 f37	.....		6 f03	▲▲	
North Dighton..... "	.....	.....	5 f44	.....	6 40	.....		6 06	.....	
Weir Village..... "	5 09	5 09	5 49		6 45	.....		6 11	.....	
Taunton..... "	5 13	5 13	5 53		6 49	7 06		6 15	6 37	
Norton..... "	5 29	.....	6 13		.....	7 19		6 28		
Mansfield..... "	5 38	.....	6 22		.....	.....		6 38		
Sharon..... "	5 56	.....	6 38		.....	.....		6e53		
Easton..... "	.....	6e18	f6e17		.....	.....		.....		
North Easton..... "	.....	.....	6e29		.....	.....		.....		
Canton Junction..... "	6 08	.....	6 44		.....	.....		6e58		
Randolph..... "	.....	6e27	.....		.....	.....		.....		
South Braintree..... "	.....	6e45	.....		.....	.....		.....		
Braintree..... "	.....	6e50	.....		.....	.....		.....		
Quincy..... "	.....	7v08	.....		.....	.....		.....		
Back Bay..... "	6 33	.....	7 08	7 25	.....	8 00		7e20	7 25	
Boston..... Due	6 38	7e23	7 08	7 30	.....	8 05		7e25	7 30	
	AS	AS	AS	AS	AS	AS		AS	AS	

STATIONS	Week-days					Sundays		
	AS	AS	AS	AS	AS	AS	AS	
Boston..... Lv	3 28	4 02	4e06	5 00		3 28	5 00	
Back Bay..... "	3 31	4 05	4e11	5 03		3 31	5 03	
Quincy..... "	.....	.....	.....	▲		.....	▲	
Braintree..... "	.....	.....	.....	▲▲		.....	▲▲	
South Braintree..... "	.....	.....	.....			.....		
Randolph..... "	.....	.....	.....			.....		
Canton Junction..... "	.....	3e56	.....			.....		
North Easton..... "	.....	.....	.....			.....		
Easton..... "	.....	.....	.....			.....		
Sharon..... "	.....	4e03	.....			.....		
Mansfield..... "	.....	4 22	.....			.....		
Norton..... "	.....	4 36	.....			.....		
Taunton..... "	4 24	5 01	5 16			4 24		
Weir Village..... "	.....	.....	.....			.....		
North Dighton..... "	.....	.....	.....			.....		
Segregansett..... "	.....	.....	.....			.....		
Dighton..... "	.....	.....	.....			.....		
Somerset..... "	.....	.....	.....			.....		
Fall River..... "	4 48	5 25	5 41	6 16		4 48	6 16	
Fall River Wharf..... Due	4b52	5b58	5 45	6 20		4b52	6 20	
	PS	PS	PS	PS		PS	PS	

◆ To avoid early arising at Newport passengers may continue on the steamer to Fall River and use train leaving Fall River Wharf, at 7.40 A.M. week-days; 7.41 A.M. Sundays. The fare to Newport by this route is $4.72.

▲▲ Has Parlor Car.

▲ Solid Vestibuled Train: no extra seat fare except in Parlor Cars.

a Stops at Newport on Sundays only and on September 1.

b Fall River (Ferry Street Station).

c By connecting train.

d Beginning June 24. On Sundays due Newport 8.15 P.M., leave 9.00 P. M.

e By connecting train: change at Taunton.

f Stops on signal.

v Change at Braintree.

Figure 651-03(04)
Typical Schedule[4]

left Steamboat Wharf at 6:55 A.M., arriving in Boston at 8:21 A.M., or take any one of the departing electric cars that left Steamboat Wharf from 6:00 A.M. to 9:30 A.M. for connections to Union Station trains to Pawtucket, Woonsocket, Worcester, and other points north.

En route to Newport from New York via the Fall River Line, a passenger would leave New York at 6:00 P.M. and arrive at Fall River at 5:00 A.M. Rather than disembark at Newport in the middle of the night, the passenger could make a connection at Steamboat Wharf for Newport, the South Shore, Martha's Vineyard, or Boston. Boston's connecting train offered a "special vestibuled express train with parlor car."

Photographs of the Fall River Line's Steamboat Wharf demonstrate the simple but efficient intermodal system that was employed in the steamboat era. Early in the day, a freight train would pull into the Steamboat Wharf for unloading through adjacent doors onto a vessel. Once unloaded, the freight train would leave. Passengers leaving from Boston would board a train at South Station, and points further south, for connections to Steamboat Wharf. With the passenger train on the wharf, the train doors would open and passengers would make the connection of a few yards under cover to board the steamer.

The Providence River was the landing area for larger steamboats in Providence, including those traveling to New York, Bristol, and Newport. Before the construction of the hurricane barrier, vessels moored alongside Fox Point, and three could lay alongside the Providence River wharves up to the head of navigation.

In Newport, several piers were used as steamboat piers over the years, and a major repair facility was located in Newport as well, for the use of the Fall River Line.

03-07 COASTWISE AND TRANS-ATLANTIC CONNECTIONS

Records from the 1800s describe the more-distant passenger and cargo steam connections. As an example, a painting of Lonsdale Wharf in 1878 shows a train leaving the wharf, having made its connection with the steamer bound for destinations in Baltimore, Norfolk, and points south.

Paintings that are now historic treasures were the records of daily activity prior to the advent of photography. *Providence: A Pictorial History* illustrates the Merchants and Miners Transportation Company activity. Located at India Point, the company was engaged in coastwise cargo and passenger trade:

> This company's freight-carrying steamers left Providence three times weekly bound for Baltimore (a coastal voyage of 528 nautical miles) and Norfolk Virginia (404 nautical miles) with both passengers and cargo. Early in the twentieth century the line added other ports of call, including Boston, Philadelphia, Newport News, Savannah, Jacksonville, and Miami. (p.110)

Among items carried in the coastwise trade, mill owners in Fall River and Providence brought cotton from the South, and shipped textiles from Rhode Island.

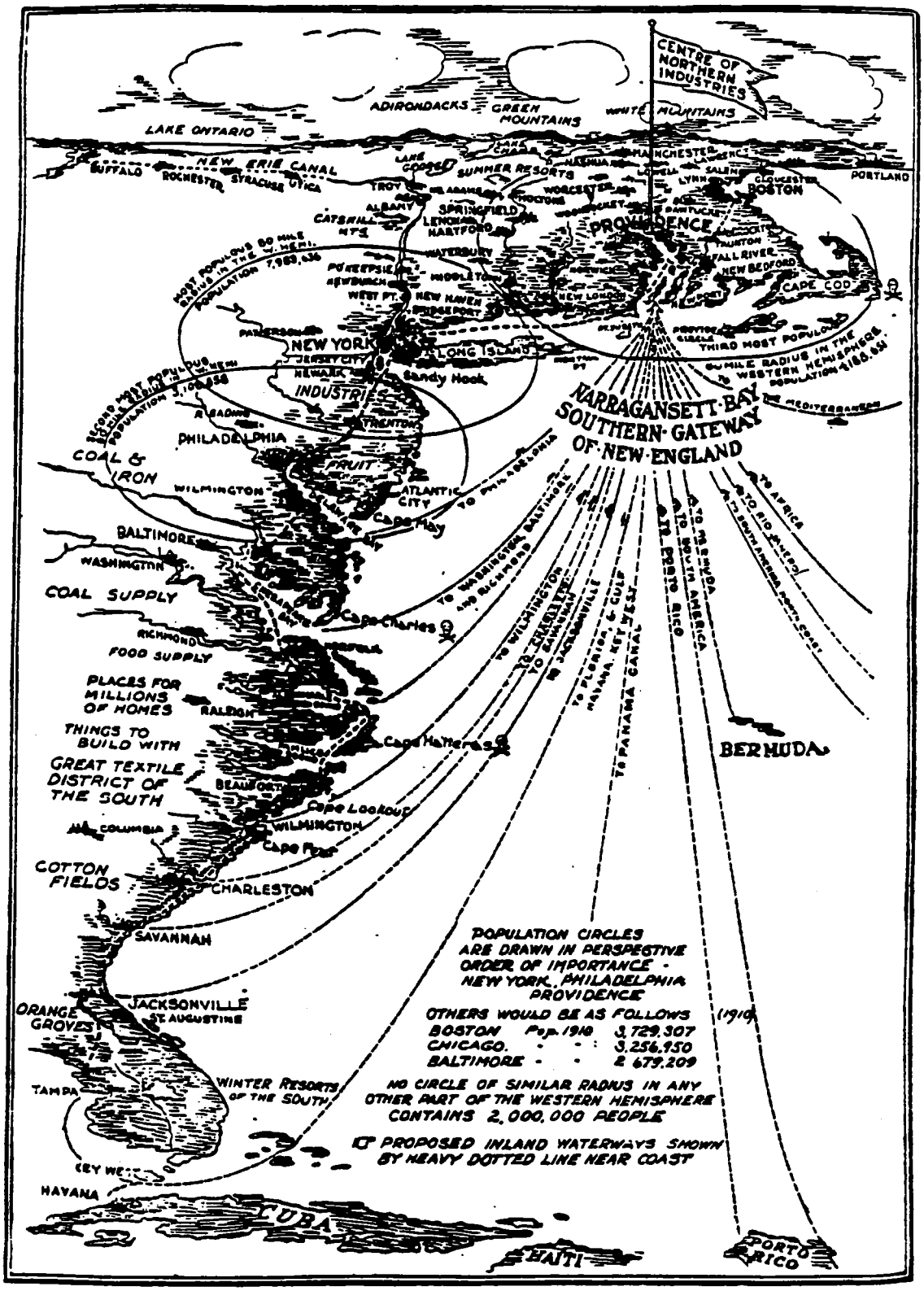
Rail and steamboat connections were gradually improved during the 1800s as Providence's waterfront grew. In the 1880s, the completion of Harbor Junction Wharf connected rail and shipping lines.

In 1910, promotional material, shown in Figure 651-03(05), demonstrated the advantage of linking maritime commercial connections to Narragansett Bay, and the bay's proximity to the markets of the Northeast as "The Southern Gateway of New England." New rail links to new ocean terminals were planned. Efforts were made to accommodate Providence Harbor for trans-Atlantic shipping, including dredging and new pier facilities. Fields Point Park fell victim to the construction of new port facilities. The Fabre Line decided to locate in Providence at about this time, away from New York's congested piers. Individuals associated with an effort entitled Atlantic Deeper Waterways Association planned to connect Narragansett Bay with Long Island Sound and Boston Harbor by the construction of two barge canals. A Grand Trunk rail connection to Canada and other cities was planned to compete with the New Haven rail monopoly.

The barge canals were never completed, and the prospect for rail expansion sank with its major sponsor aboard *Titanic*. Even so, the Fabre Line became active in the transport of immigrants from the Mediterranean and in trans-Atlantic freight shipments. According to *Providence: A Pictorial History*, almost 55,000 immigrants from Italy and 20,000 immigrants from Portugal came to Rhode Island from 1898 to 1932. The accessibility of the Fabre Line connections to Europe also encouraged emigrant departures, and an estimated 20,000 Italians and Portuguese returned to their home countries during the period from 1908 to 1932 using the Fabre ships. Freight was shipped to New York in the absence of adequate pier facilities in Providence.

03-08 NARRAGANSETT BAY FERRIES

Service on the earliest ferry connections in Narragansett Bay was either supplanted by bridges or continued to be provided by more-efficient steam-powered craft and sailing coastal packets through the 1800s. The first Tiverton-Aquidneck Island link by bridge was completed in 1794.



NEW ENGLAND'S SOUTHERN GATEWAY.

Providence is the nearest, the easiest, and the cheapest New England port to reach from Southern waters. It is also the most centrally located harbor with respect to the majority of the Population of New England.

Figure 651-03(05)
New England's Southern Gateway[5]

With the construction of the railroad bridge in 1865, New York boats could link with Newport and rail connections to Boston.

North-south ferry links continued between Portsmouth and Bristol, between Bristol and Prudence Island, between Point Judith and Block Island, and between Providence and Newport and Block Island. Principal east-west steam-powered ferry links across the bay connected Saunderstown to Jamestown (West Ferry), Jamestown to Newport (East Ferry), and Wickford to Newport. Others included Wickford-Little Compton and Narragansett to Jamestown.

03-09 EXCURSIONS

Narragansett Bay steamboats offered the most popular excursions for Rhode Island residents and visitors in the 1800s and early 1900s. Vessels from Providence would take tens of thousands each weekend to shore dinners and amusement parks down the bay, to Rocky Point, to Crescent Park, and as far as Fields Point. All that remains of the Crescent Park today is its carousel, now protected by National Register of Historic Places status, and still a popular destination. Narragansett Pier's shingled towers are the remnant of the great casino-hotel resort. In its heyday, Narrangansett Pier offered some 15 hotels and a beach, "considered to be one of the finest on the eastern seaboard, a factor which contributed greatly to the development of the Pier in the late nineteenth century." Train connections to Narragansett Pier and to Wickford opened access by rail to tourists from throughout the eastern United States.

Oakland Beach, located in Warwick, featured "a railroad and a hotel...one of the most beautiful resorts on the bay." Buttonwoods was described as attracting "a summer population of hundreds if not thousands." Other excursion sites included Bullock's Point, Riverside, Silver Spring, Ocean Cottage, and Halsey Farm. Fields Point Farm, at the southern tip of Providence, was well known as a shore-dinner destination as well. The trip from downtown Providence was three miles, and took 15 minutes.

With the construction of sheltered harbor facilities, Block Island set out to become a summer resort. Its first hotel opened in 1842. During the peak of Block Island's activity as a tourist destination in the early 1900s, there were 30 hotels accommodating 3,100 visitors, and almost 60,000 annual visitors. Maritime structures, including the harbor, lighthouses, and weather station, are today recognized as National Register historic sites.

Island picnics and outings were highly popular during this period. Dutch Island, Hog Island, and Prudence Island were among the favorite destinations. Excursions also went to Mount Hope, to Massachusetts, on fishing expeditions, and on Sunday-school picnics.

Even the New York boats promoted excursions to New England, using the steamboats as part of the excursion. One of these promotions, described in Figure 651-03(06), was a ski cruise to Rhode Island, offering transfers and passes to Diamond Hill in Cumberland, and skiing lessons aboard the vessel en route from New York. Connections with the White Mountains and other watering holes of New England were also promoted.

03-10 THE WANING DAYS OF STEAMBOATS

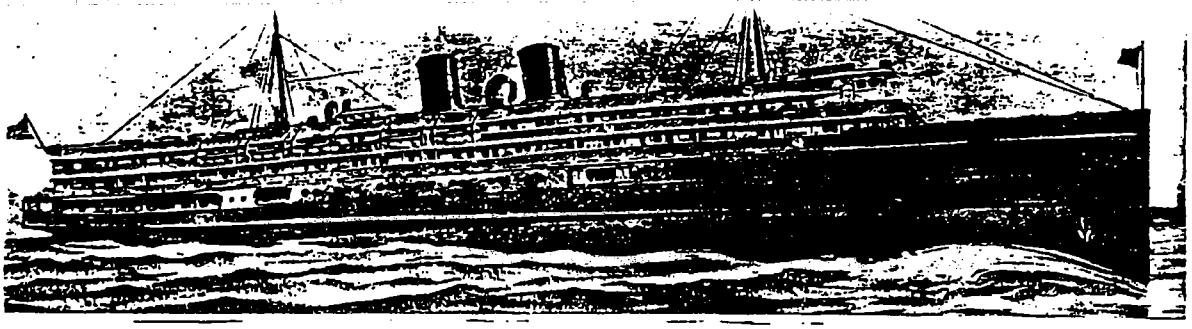
Night boats to New York, excursion steamers on Narragansett Bay, ferries throughout the bay to Wickford, Newport, Providence, Bristol, Portsmouth, Little Compton, Jamestown, Saunderstown, and Block Island–most of these are now described in books and memoirs, recalled in panel discussions, or recorded in photography and painting.

Competition from rail service and from highways and automobile traffic was key to the collapse of the great ferry network. But, over the centuries of maritime use in Narragansett Bay, there were other significant factors in transportation change as well. In the early days of settlement, plagues and pestilence decimated native American Indian populations; wars drew vessels into combat from King Philip's War through the Revolution, embargoes, wars of the 1800s, the Civil War, and the wars of the 20th century. Maritime disasters of the early 1900s, including the sinking of *Titanic* in 1912, discouraged steamboat and cruise passengers for a period. Federal legislation requiring costly crew complements added to financial burdens of steamboat and transportation companies. The last vessels to run as night boats to New York, *Arrow* and *Comet* of the Colonial Line, were taken by the U.S. Government as World War II approached, spelling the end of the night boats.

Great gales and hurricanes devastated piers and buildings, and had a special impact on the excursion markets. The Hurricane of 1938 was particularly devastating to Rhode Island piers and terminals. Coupled with the economic disaster of the Great Depression, the advent of World War II, and the requisition of available vessels for troop movements, the ferry network dwindled, leaving only the Jamestown ferries, the Prudence Island, Block Island, and Hog Island ferry links.

03-11 NEW FERRY TECHNOLOGY IN RHODE ISLAND

In recent years, a number of new ferry technologies have been used in Rhode Island. One was a hydrofoil that was used for passenger service on Rhode Island Sound during the summers of 1974 and 1975 and part of the summer of 1976. Interstate Navigation, operator of the Block



FROM THE OFFICE OF
JOHN W. BRADY
GENERAL PASSENGER AGENT
COLONIAL NAVIGATION COMPANY
PIER 11, NORTH RIVER
NEW YORK CITY
TEL. BARCLAY 7-1800

NEW YORK'S FIRST

SKI CRUISES

EVERY SATURDAY

Also Washington's Birthday
(SNOW CONDITIONS PERMITTING)

$14.50

EVERYTHING INCLUDED

To Cumberland, R. I. State Park, with 800 ft. trail for experts, gentler slopes for novices.

Board Luxury Liner, S.S. ARROW or S.S. COMET at Pier 11, North River, New York City at 6 P. M. Sat.

You're back in New York 7 A. M. Monday.

Passage ticket, Private Stateroom, Heated Motor Coach to and from State Park, four hearty meals aboard ship, luncheon at State Park, All For $14.50.

ON SHIPBOARD: Lecture by Ski Expert from Alex Taylor & Co., who will also arrange lessons if desired.

Feature Talkies and dancing.

When skiing's over you return to a steaming hot dinner and a warm stateroom.

PHONE FRED NELSON, BArclay 7-1800, for latest weather information.

A limited supply of articles such as skis, poles, boots, etc. is available for rental at low daily charge—such equipment can be fitted and rented at Alex Taylor & Company's New York store, 22 East 42nd Street, during the week prior to Ski Cruise sailings, and will be delivered to the skier aboard Colonial Line steamships.

COLONIAL LINE

OR TRAVEL AGENT

Figure 651-03(06)
Advertisement for Ski Excursion[6]

Island ferries, purchased the 49-passenger hydrofoil *Sealink*, which had been in use in California. The published 1974 ferry schedule notes, "There will be unscheduled 50 passenger commuter service from Pt. Judith to Block Island daily from June 15 to Sept. 8." The one-way fare was $5.00, compared to the $3.75 fare charged for the conventional ferry. The hydrofoil had a trip time of 25 minutes, one-third the time of the conventional ferry on the same route. The operator reports that the service was terminated because of small vessel capacity and frequent cancellations because of rough seas and bad weather that limited visibility. Advances in vessel technology over the two decades since this service was terminated would help to solve these problems. The newer vessel types described in Part 651.05 would have fewer weather-caused service disruptions because they are less affected than hydrofoils by rough seas. Service interruptions because of limited visibility would also occur less frequently because of improved radar technology, which has made radar both more effective and less expensive so that it is more widely used.

A contemporary newspaper account stated that the start-up of the service was delayed by mechanical and legal problems, including difficulties in meeting DEM requirements for access to the Galilee pier. Detailed ridership records do not exit, but the available information provides some insights into the market response to the service; the average daily August ridership fell from about 160 in 1974 to less than 100 in 1975. The service was canceled because of the small vessel capacity and frequent cancellations caused by rough seas and bad weather that limited visibility.

In 1983, Blount Marine in Warren, Rhode Island, developed a composite-hull technology using glass-reinforced plastic. A vessel built with this technology, the 149-passenger *Hi-Tech Express*, was the first of the current generation of high-speed ferries in the United States to use a bow-landing configuration. It was demonstrated in 1984 on Narragansett Bay and in Boston, and also ran several time trials from Warren to New York City, covering the 150-mile distance in five hours. The vessel later went into service on the East River as the first vessel of the NY Waterway trans-Hudson ferry fleet.

The bay has been the site for testing of a "wing-in-ground-effect" craft, a technology that has been developed primarily in other countries. Operating at 150 mph, these craft resemble airplanes more than boats, but they use the surface of the water for lift, operating up to two meters above the surface. These craft are expected to be used for air taxis and coastal patrols.

Finally, an electric-powered launch operating on the bay demonstrates the potential for this alternative power source. The launch was developed by a Rhode Island firm using its patented technology.

03-12 CONCLUSIONS—LESSONS FROM HISTORY

From precolonial times to today in Rhode Island, people have crossed the rivers and bays to reach their destinations using whatever technologies were available. Although most ferry routes have been replaced by highway and bridge connections, island communities have never discontinued ferry service. Waterborne services continue to be important components of the state's transportation system.

This discussion of history of the development and change in the cross-bay and regional ferry network yields several important lessons for contemporary planners and ferry operators:

- Ferries have operated in some locations in Rhode Island over long periods of time, indicating the persistence of markets for waterborne passenger transportation services.

- Older towns and cities were established in eras when ferries were more central to the transportation system. They may be among the best places to look for markets for present services because their development patterns are more oriented to the water than those of many newer communities.

- The types of technologies available for waterborne transportation in each era have been a factor in determining which services could be successful. New technologies can create new opportunities.

- The introduction of new technologies has not always gone smoothly. New technologies must be carefully matched to market opportunities, and start-up problems must be expected and anticipated.

- The system of highways and bridges is a powerful competitor to waterborne passenger transportation services. Where the creation of new roadway links has allowed faster and more convenient travel by car, ferry services have been discontinued.

- Throughout history, the public sector has been involved in decisions that affect the viability of waterborne passenger transportation services in Rhode Island.

- Conditions have changed over time, and will continue to do so. Present and future waterborne passenger transportation services can draw upon the past, but cannot be expected to recreate it.

[1] Balloon View of Narragansett Bay, J.C. Thompson, Providence, 1882, Rhode Island Historical Society.

[2] Mount Hope and Pocasset Map, diary of King Phillip's War, 1675-1675, Colonel Benjamin Church, Lockwood Publications, 1975.

[3] Drawing of *Robert Fulton*, by Samuel Ward Stanton, American Steam Vessels, 1895, Rhode Island Historical Society.

[4] Schedule of Daily Steamer Service, Fall River Line between New York and Boston, Fall River Marine Museum.

[5] New England's Southern Gateway, from "Rhode Island Businessman's Association," 1912, Reprinted in *Providence, A Pictorial History*, Patrick T. Conley and Paul R. Campbell, p. 149.

[6] Poster for Ski Cruises, Cumberland RI and Diamond Hill, Fall River Marine Museum.

PART 651.04 EXISTING CONDITIONS

04-01 EXISTING WATERBORNE PASSENGER TRANSPORTATION SERVICES

Several types of waterborne passenger transportation now serve Rhode Island. Figure 651-04(01) shows the present activity in Narragansett Bay and Rhode Island, with codes indicating the type of service provided:

- **E** – Existing Year-Round Routes
- **ES** – Existing Seasonal Routes
- **B** – Bay Islands Park Sites–Occasional Trips
- **EX** – Excursion Sites
- **CH** – Charter, Harbor Tour Locations
- **CR** – Coastal Cruise
- **WT** – Water Taxi

04-01-01 Existing Year-Round Routes (E)

Existing year-round routes are operated by Interstate Navigation between Point Judith and Block Island and by Prudence Ferry Co. Inc. between Bristol and Prudence Islands. These are private car-ferry operations.

Block Island ferry service from Galilee began in the 1930s. With vessels built in the 1970s and 1980s, Interstate Navigation now provides year-round ferry service for passengers, vehicles, and freight. A new vessel was added to the fleet in 1997. The Block Island ferry is itself a busy and successful destination for tourists, offering a pleasant trip to the island. Reservations for vehicles are made in advance, and automobiles must be dockside one-half hour before departure. The crossing time for the twelve-mile route from Galilee to Block Island is one hour and fifteen minutes. The rate schedule carries different fares for adults, one-way travel, children, same-day round-trip travel, passenger cars, trucks, motorcycles, and bicycles, and includes a Block Island landing fee of 50 cents per person. The ferry schedule changes seasonally, seven times a year, to accommodate demand. The busiest time periods are typically weekends from mid-June through Labor Day, when up to 10 round trips are scheduled each day. The only day when ferries do not run is Christmas Day.

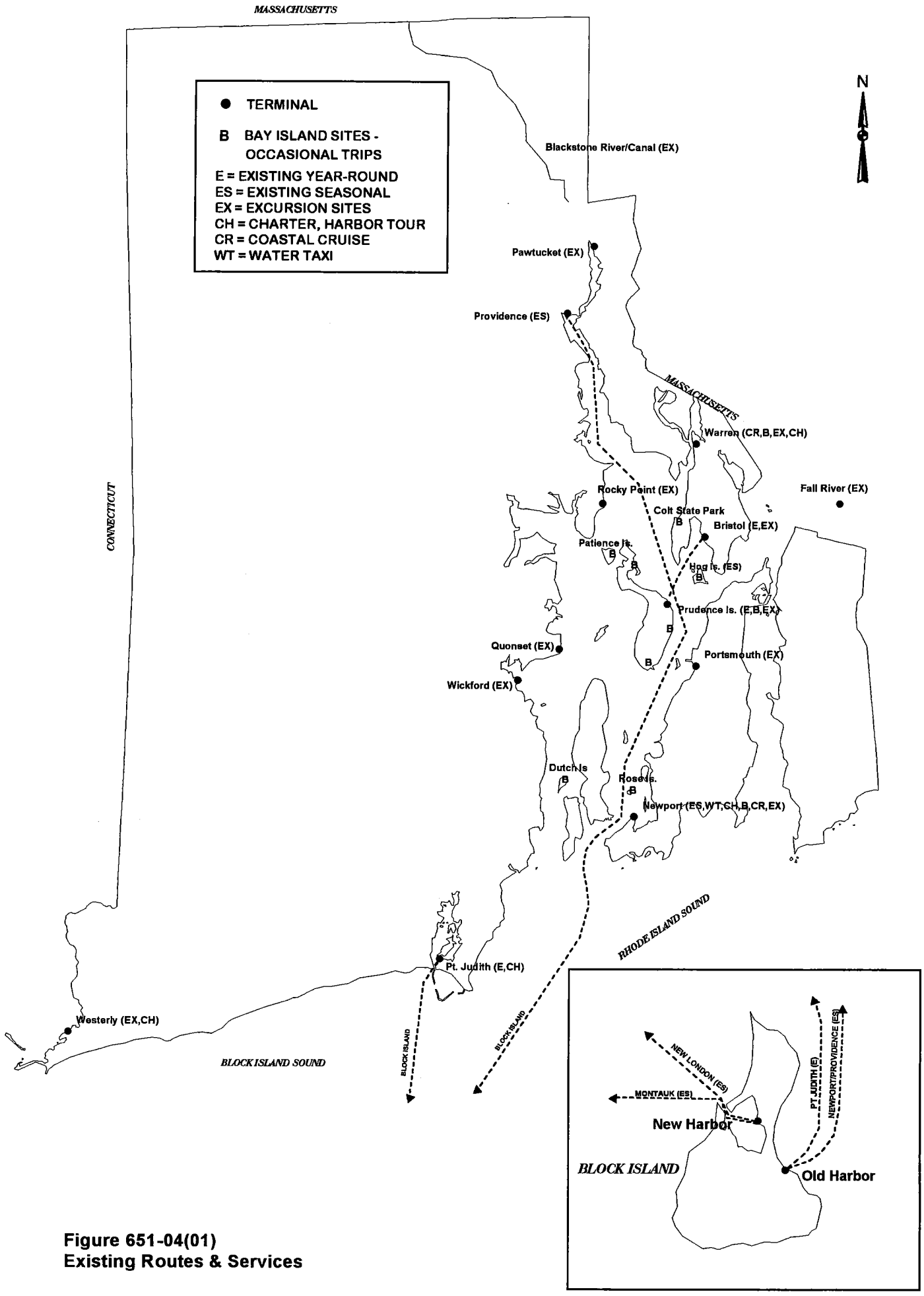


Figure 651-04(01)
Existing Routes & Services

Point Judith (Galilee) facilities include ferry slips, a queuing area, a ticketing and administration building, a small waiting area, and large amounts of parking operated by the Department of Environmental Management and private parking enterprises. Space is leased from the Department of Environmental Management.

While running an effective car-ferry system, Interstate Navigation could provide service improvements to expedite traffic. This may not be seen as a desirable objective by Block Island residents. There are no formal intermodal linkages between the ferry and other transportation services. RIPTA bus service and ferry schedules are not coordinated. There are problems with traffic congestion at the terminal, with parking, and with security in the parking lots. Since ferry terminal expansion or restructuring could conflict with the needs of the active fishing fleet, the Rhode Island Department of Transportation is working closely with the Department of Environmental Management and representatives of ferry and fishing interests to shape a future for the terminal site that is acceptable to all parties.

Prudence Island ferry service was established in about 1924, according to *Ferries of America*, and has been operated by Prudence Ferry, Inc. since 1986 with a ten-car, 149-passenger ferry. Service is provided to Homestead and Sandy Point on Prudence Island connecting to Bristol. Ferry service leaves Bristol from the Prudence Ferry Wharf on Church Street. Ticket facilities are located at the dock, and there is limited parking. Reservations are required for automobiles.

04-01-02 Existing Seasonal Ferry Routes (ES)

Existing seasonal ferry routes are provided by Nelseco Navigation Company, an Interstate Navigation subsidiary, between Providence, Newport (Ft. Adams), and Block Island, and from New London, Connecticut, to Block Island. Travel time from Providence to Newport is two hours, and from Newport to Block Island is two hours, via *Nelseco*. The trip duration from Providence to Block Island is 4 hours and 30 minutes. There is one round trip a day; ferry service is provided on this route from late June to early September, and carries passengers and cargo only.

New London-to-Block Island ferry service carries vehicles and passengers; reservations for automobiles are required. The duration of the trip is two hours. There is one round trip a day, except for Fridays, when an extra trip with an evening departure is scheduled from New London.

Block Island service is also provided from Montauk, Long Island, by two private operators, Captain Howard Carroll, and Captain Paul Fosberg, operating *Viking Starship* and *Jigger III*. *Jigger III* carries 75 passengers and provides a single round trip each day between mid-June and

late September. The vessel can be boarded at Christman's Dock in Montauk and Payne's Dock in New Harbor, Block Island. *Viking Starship* operates between the Viking Dock in Montauk and the Boat Basin on Block Island, with l-hour-30-minute service from June 1 to September 30, and a capacity of 300 passengers.

Seasonal summer service is provided by the Prudence Ferry Company from Bristol to Hog Island. Additional summer express shuttle service is available to Homestead and Hog Island as well.

04-01-03 Excursions and Other Services (EX, CH, CR, WT, B)

Some of the informal ferry excursion routes give an indication of where new recreational markets might develop. In an echo of the days of the great excursions down the bay for shore dinners, a pier at Rocky Point remains to accommodate the occasional shore-dinner excursion boat. Private boat owners are also able to tie up at the Rocky Point pier.

One of Rhode Island's boatbuilders has become well known for excursions and cruises that provide markets for its vessels. Within Narragansett Bay, Luther Blount's vessels carry passengers from Warren to Newport, Quonset, Wickford, Rocky Point, Pawtucket, Providence, and Dutch Island for special seasonal events, shore dinners, charter trips, and brunch tours of Narragansett Bay.

Blount Marine's enterprises also feature coastal cruises from Warren. Vessels embark from Warren on twelve-day cruises to New York, up the Hudson River and through the Erie Canal, down the St. Lawrence River and up the Saguenay River in Quebec. The first night of the cruise, leaving Warren at 3:00 P.M. and landing at the South Street Seaport in New York City the next morning, intentionally replicates the historic night-boat connections from Providence and Newport to New York.

Charter and harbor tour-boat traffic is particularly active in Newport and Galilee. Some of these vessels are designed exclusively as tour/charter vessels, and other tours are provided on fishing vessels that have been adapted for harbor tours and cruises. River tours on the Blackstone River are sponsored by the Blackstone Valley Tourism Council, in cooperation with the National Park Service and other interested agencies. These tours focus on special themes of environmental and historic interest.

Occasional service is available to several of the Bay Islands. This is only intermittent, but trips go to Prudence, Patience, Dutch, and Hope Islands from Providence, Bend Boat Basin, Colt

State Park, and N. Prudence. Occasional service from Newport to Rose Island is available. Connections between N. Prudence and S. Prudence are also occasionally available.

Finally, water taxis provide connecting links in Newport Harbor and Providence. One water taxi run by Oldport Marine links several destinations in Newport–Ft. Adams, Sayers Wharf, Ida Lewis Yacht Club, Newport Yacht Club, Goat Island–and provides yacht launch services. Additionally, Oldport Marine provides connecting water-taxi service to Rose Island.

04-02 EXISTING MARINE FACILITIES AT THE TIME OF THE STUDY

Existing marine facilities are an important consideration in planning future waterborne passenger transportation services, because their locations may offer opportunities for easier development of new facilities. An inventory of existing boatyards and marinas all across the state was prepared for use in the study. The inventory was prepared in fall, 1992. It is a snapshot in time; businesses change ownership, the names of the boatyards may be altered, or facilities could go out of business. With the exception of some major facilities such as Coddington Cove, which was still Derecktor's Shipyard in 1992, but which has been changed to read Coddington Cove in the inventory, this inventory represents the 1992 Rhode Island waterfront.

04-02-01 Sources of Information

The inventory of existing marine facilities was prepared from reference documents and field inspections, with telephone contacts to verify information. The following reference documents were used:

US Geological Survey Maps
NOAA Charts
Rhode Island Division of Tourism Visitors' Map
Rhode Island Division of Tourism Boating and Fishing Guide
Embassy-Complete Boating Guide to Rhode Island and Massachusetts 1989
Port Book-Newport Tourism Publication
Studies and reports prepared for the Rhode Island Department of Environmental Management, City of Providence, and Newport Planning Department
Access Guide

4-02-02 Format of the Inventory

The inventory is shown in text form in Table 651-04(01) and graphically in Figures 651-04(02) through 651-04(10). The table is organized by cities, towns, and places, and lists existing facilities in alphabetical order. The figures are a set of maps, each of which covers a significant feature on the coastline, such as a harbor. City, town, and place names are noted on the maps to allow cross-referencing with the table.

Not all existing marina locations would be suitable for ferry service because of inadequate space, so the inventory includes only those marinas with slips that will accommodate vessels larger than dinghies. Some other categories of existing facilities that appear to be suited to waterborne passenger transportation were not included in the inventory. Although they have convenient water access, harbor protection, and availability of land for support facilities, they were not included because the present use of the property would conflict with ferry operations for all vessels other than water taxis. Omitted from the inventory were:

Yacht clubs because the landside support facilities are typically too small to accommodate ferry service requirements.

Marine industrial facilities such as those serving the Port of Providence or power plants located along the waterfront because of the potential for conflict between cargo movement and ferry passengers.

U.S. Navy facilities because the U.S. Navy's operations render the sites inappropriate for public use. The exceptions are the Navy Yacht Club at Newport, which is open to the public; Coddington Cove, which is no longer an active Navy facility; and the Quonset Point/ Davisville Yacht Club at Allen Harbor, which was turned over to the town for recreational boating.

Public floats and ramps because these are generally too small to accommodate waterborne passenger transportation service.

Both marine industrial facilities and currently operating U.S. Navy facilities may, at some later date, change their operations or cease to perform their current functions. Should this be the case, they would become sites suitable for consideration for waterborne passenger transportation connections, especially given the docking facilities already in place at those sites. At such times as these become available, they should be evaluated for their potential as ferry docking locations.

Table 651-04(01) Inventory of Existing Marine Facilities as of 1992

City, Town, or Place	Marinas		Boatyards		Public Facilities	
Barrington	Striper Lavin's Cove Haven	245-8110 246-1180 246-1600	Stanley's	245-5090	Haines Memorial Park Bold Point	
Bristol	Bristol Boat Town Marina	254-1990 253-9847	Bristol Marine	253-2200	State Pier Town Dock Herreshoff Museum Dock	 253-1700 253-6660
Charlestown	Shady Harbor Docking Assn. Ocean House Shelter Cove	322-1675 364-6040 364-8891				
Cranston	Edgewood Marina Pawtuxet Yacht Club & Marina	467-4519 467-4510	Port Edgewood Ltd.	941-2000		
East Greenwich	Apponaug Harbor East Greenwich Marina Masthead Ponaug Greenwich Cove	739-5005 885-2911 884-1810 884-1976 885-6611	Norton's Shipyard Gull Marine Brewer's	884-8770 885-5317 884-0544		
East Providence	Bullock's Cove Marine	433-3010				
Galilee			Wilcox Marine Rhode Island Engine	789-1890 789-1021	State Pier	783-5551
Jamestown			Clark Conanicut Marine Service Jamestown Boatyard Dutch Harbor Boatyard	423-1545 423-1556 423-1706 423-0630		
Jerusalem	Jim's Dock Cap'n Jack Skip's Dock	783-2050 789-4556 783-5031			State Pier	783-5551
Little Compton	Sakonnet Point Marina	635-4753				
Middletown					Coddington Cove - Navy	
Narragansett	Middlebridge	783-2903				

City, Town, or Place	Marinas		Boatyards		Public Facilities	
Narragansett Pier					State Pier	783-4711
Newport	Bannister's Brown & Howard Goat Island Newport Yacht Center Long Wharf Christie's Landing Newport Onshore The Pier Sail Newport Newport Offshore	846-4500 274-6611 849-5655 847-9047 847-9000 849-6789 849-0480 847-3645 849-8355 846-6000	Brewer Street Boatworks Oldport Marine	847-0321 849-2111	State Pier #9 Fort Adams Dock Coast Guard NETC-Navy Ann St. Pier	783-4711 846-3676
New Shoreham/Block Island	Champlin's Marina Boat Basin Payne's Dock Smugglers' Cove Old Harbor Dock	466-2641 466-2631 466-5572 466-2828 466-2526			Coast Guard Station	466-2049
North Kingstown/Quonset-Davisville	Allen Harbor Marina	294-1212			Navy	
Point Judith					Coast Guard Station	789-0444
Portsmouth	East Passage Yacht Center Little Harbor Lighthouse Pirate Cove Stone Bridge	683-4000 683-5700 683-5663 683-3030 683-1011	Brewer's Sakonnet Bend Boat Basin Point Boatyard	683-3551 643-4000 683-0433		
Providence	Old Harbor Marina India Street Dock Maurania Co.	751-7547	Marine Machinery Service	238-9342	State Pier Municipal Wharf	
Prudence					T-dock (Navy) Homestead Wharf Sandy Point	

City, Town, or Place	Marinas		Boatyards		Public Facilities	
South Kingstown	Billington Cove	783-1266	Ocean State			
	Stone Cove	783-2313	Marine Railway	789-3023		
	Marina Bay	789-4050	Salt Pond			
	Kenport Marina	782-2863	Marine Railway	783-5310		
	Point Judith Marina	789-7189	Ram Point Boatyard	783-4535		
	Snug Harbor	783-7766	Silver Spring Boatyard	783-0783		
Tiverton	Anthony Point		Riverside Boatyard	625-5231		
			Shannon Boatyard	624-6195		
			Standish Boatyard	624-4075		
Warren	Touisset Pt.	245-2162	Speed's Marine	245-3132		
			Joe's Boatyard	245-4824		
			Blount's Marine	245-8300		
Warwick	Bay Marina	739-6435	Pettis Boatyard	781-2340		
	C-Lark	739-3871				
	RI Boat Movers	884-1976				
	Harbor Light	737-6353				
	Winstead's	737-8723				
	Pier 36	738-2194				
	Warwick Cove	737-2446				
	Nick's Dock	737-0228				
	Angel's	737-9805				
	Wharf Marina	739-8914				
	Carlson's	738-4278				
	Breezy Point	738-0357				
Watch Hill	Weekapaug Marina	322-0581	Watch Hill Boatyard	596-7807		
Westerly	Pier 65 Marina	596-6350	Cardone Marine	596-3408		
	Westerly Marina	596-1727	Frank Hall Boatyard	348-8005		
			River Bend Boatyard	596-0064		
			Avondale Boatyard	348-8187		
Wickford	Wickford Bait	295-8845	Wickford Shipyard	294-3361	Town Wharf	884-4337
	Brewer's Wickford Cove Marina	884-7014	Johnson's Boatyard	294-3700		
	Harbor Ready Marine	294-8711				
	Pleasant St. Wharf	294-2791				

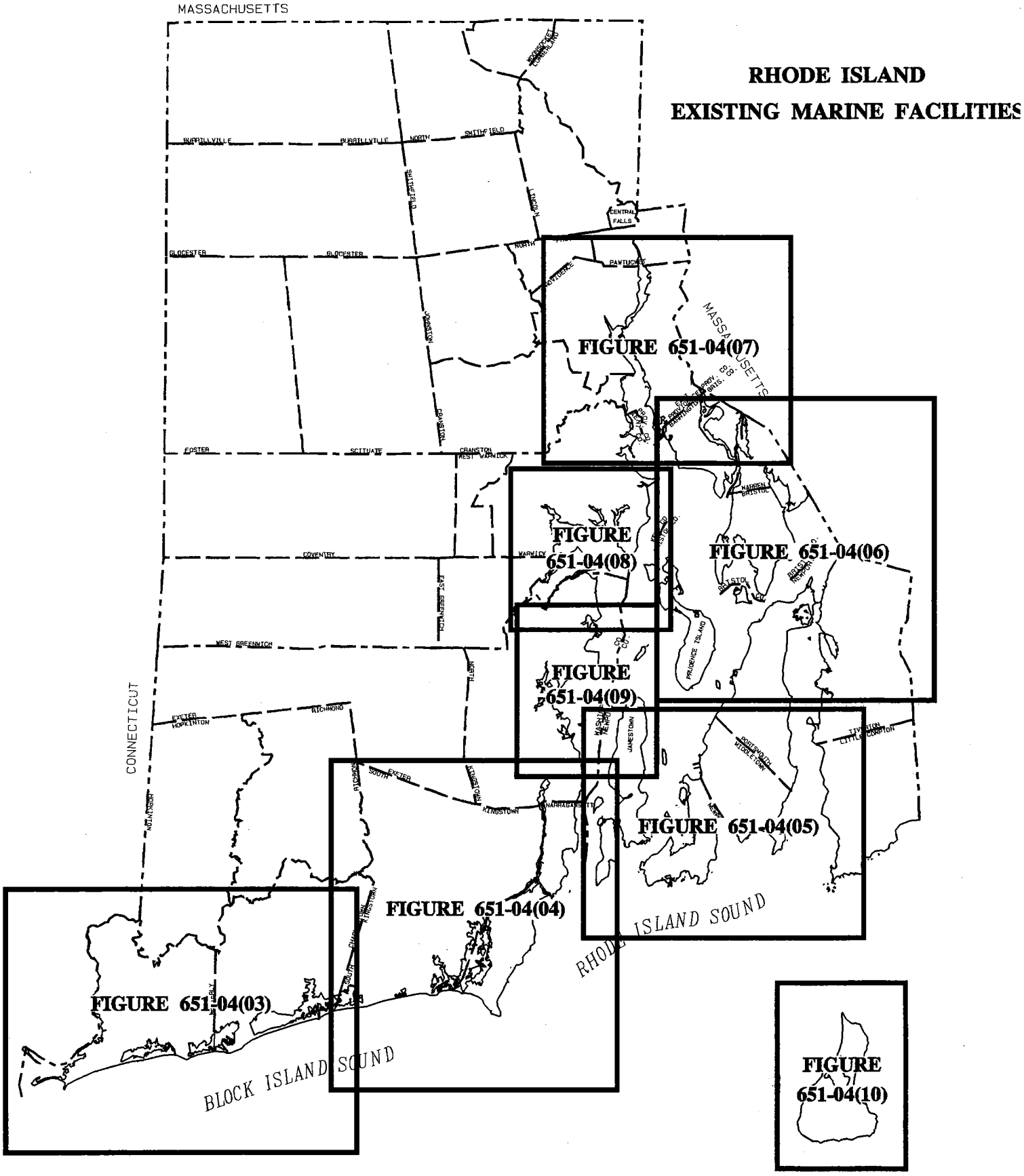
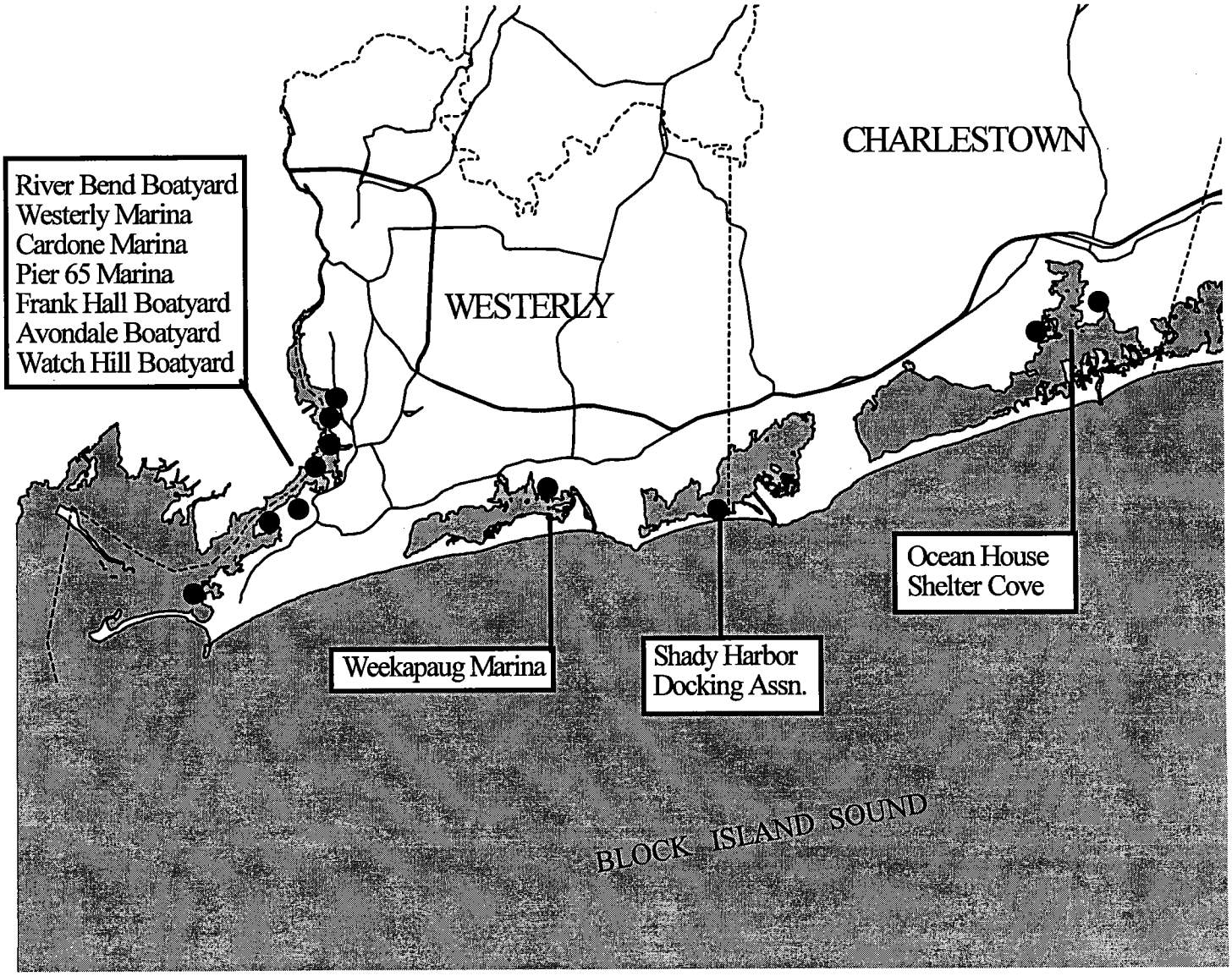


FIGURE 651-04(02)



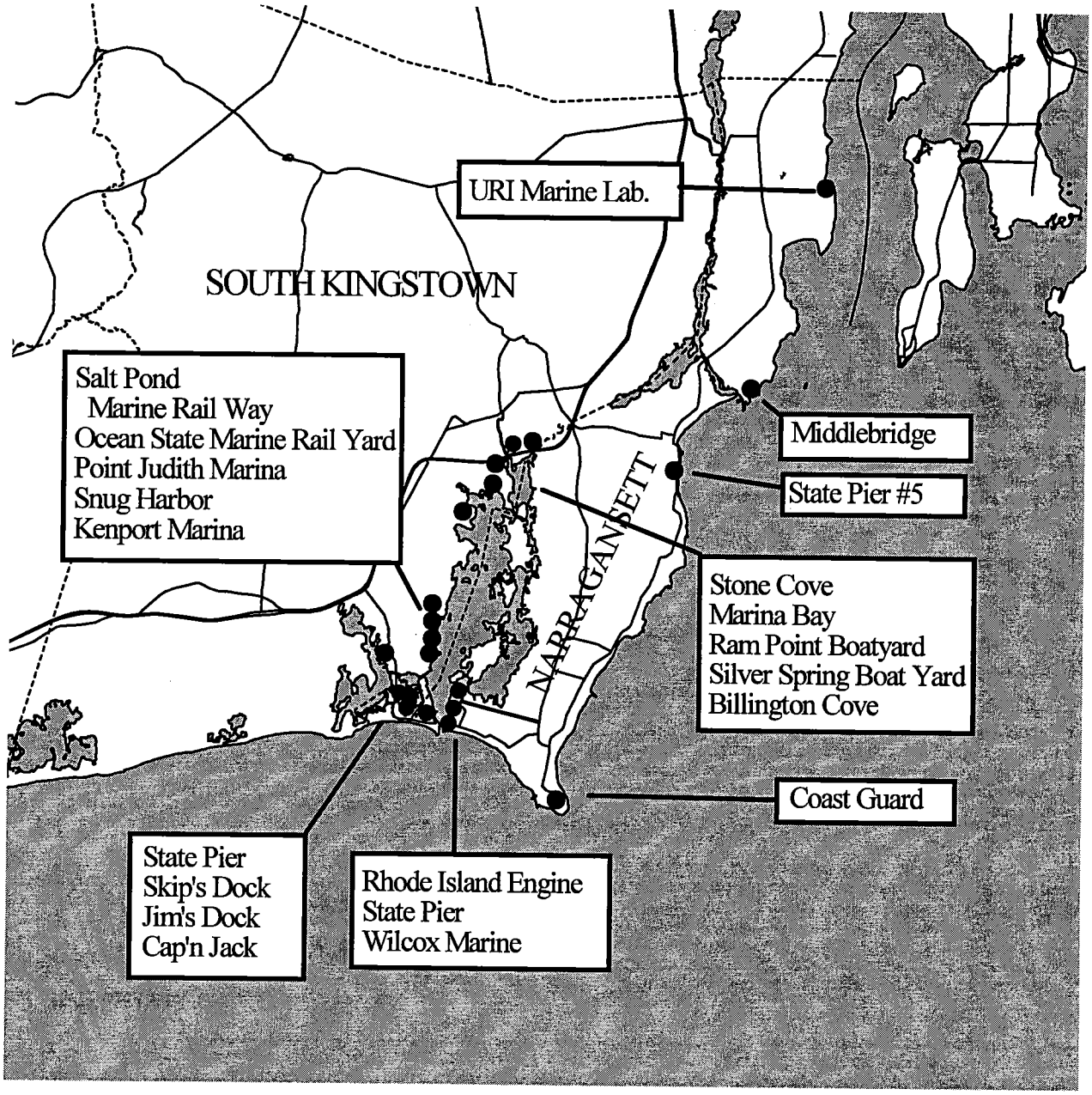
RHODE ISLAND COASTAL FACILITIES

FIGURE 651-04(03)

N

EFFECTIVE : 1993

NOT TO SCALE



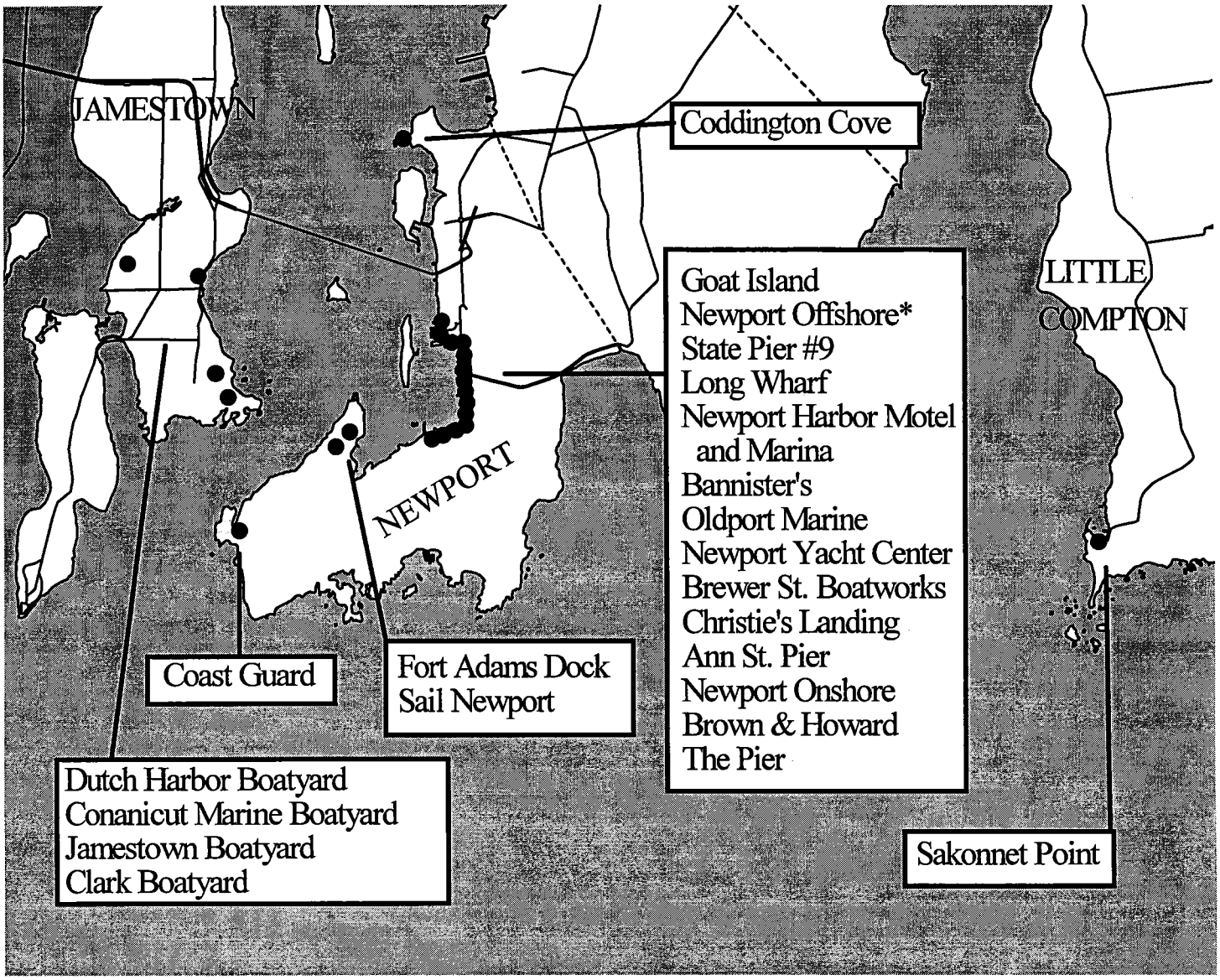
RHODE ISLAND COASTAL FACILITIES

FIGURE 651-04(04)

N

EFFECTIVE : 1993

NOT TO SCALE



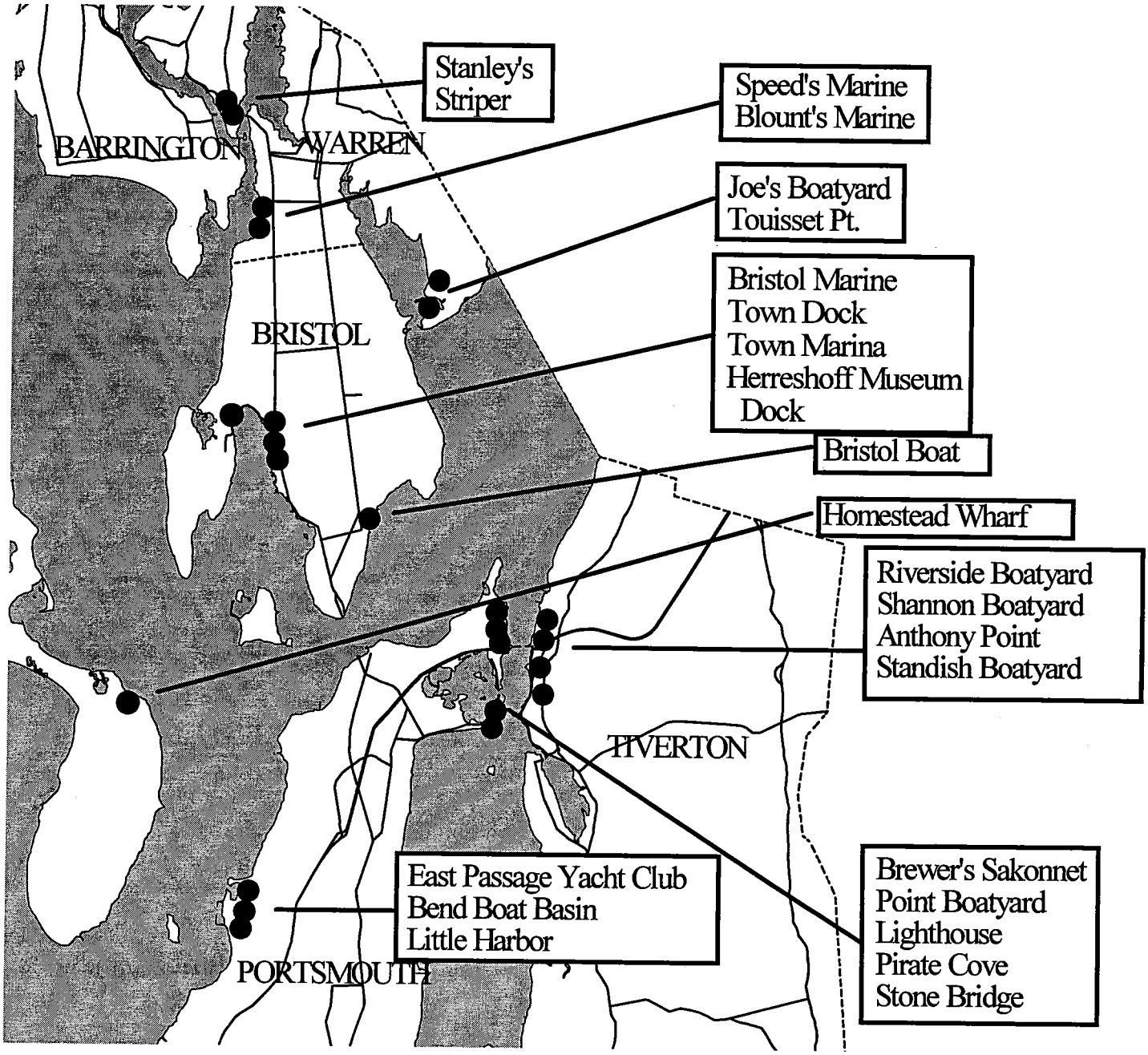
* Presently Renamed American Shipyard

RHODE ISLAND COASTAL FACILITIES

FIGURE 651-04(05)

N

EFFECTIVE : 1993
NOT TO SCALE



RHODE ISLAND COASTAL FACILITIES

FIGURE 651-04(06)

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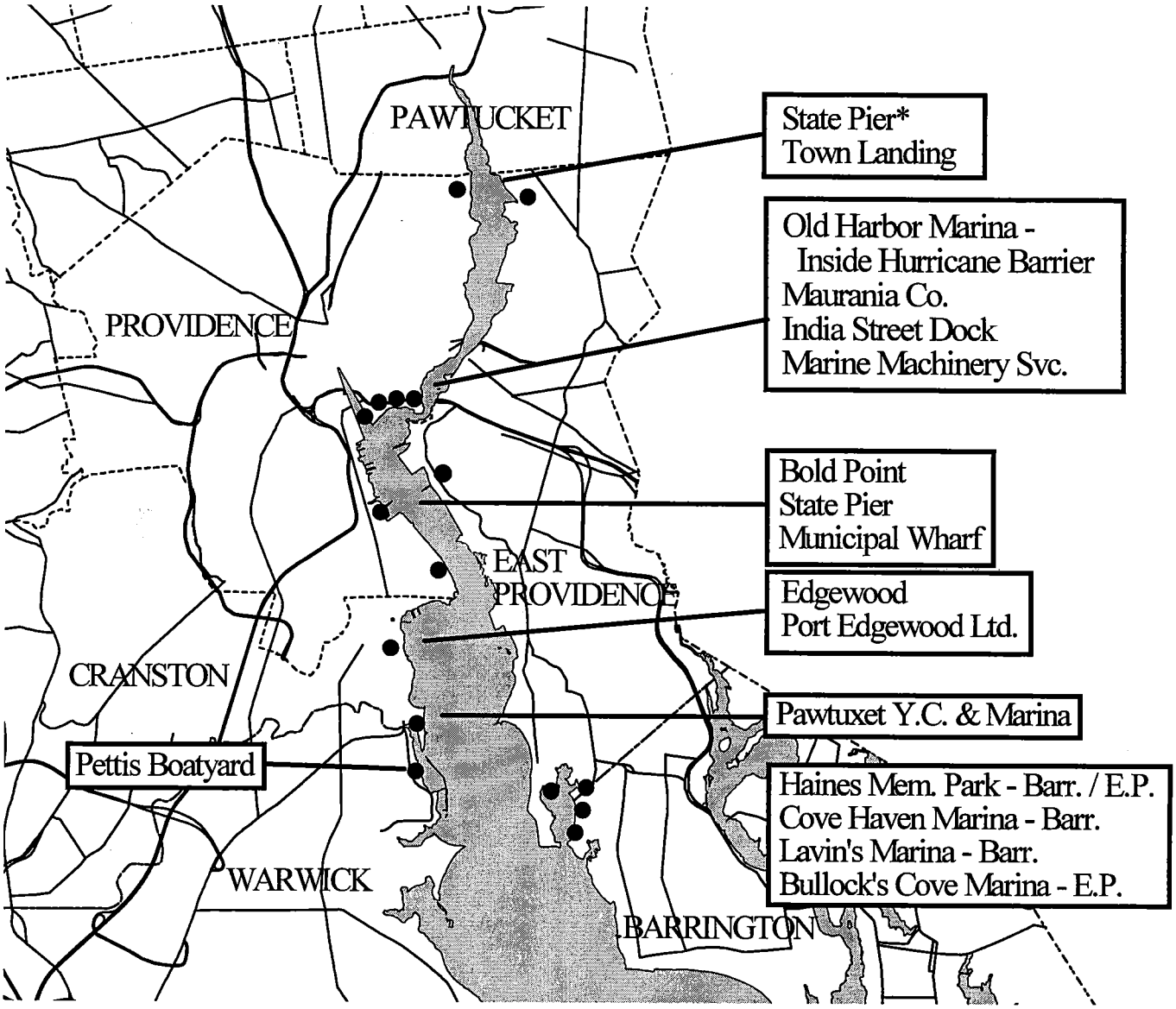
EFFECTIVE : 1993
NOT TO SCALE



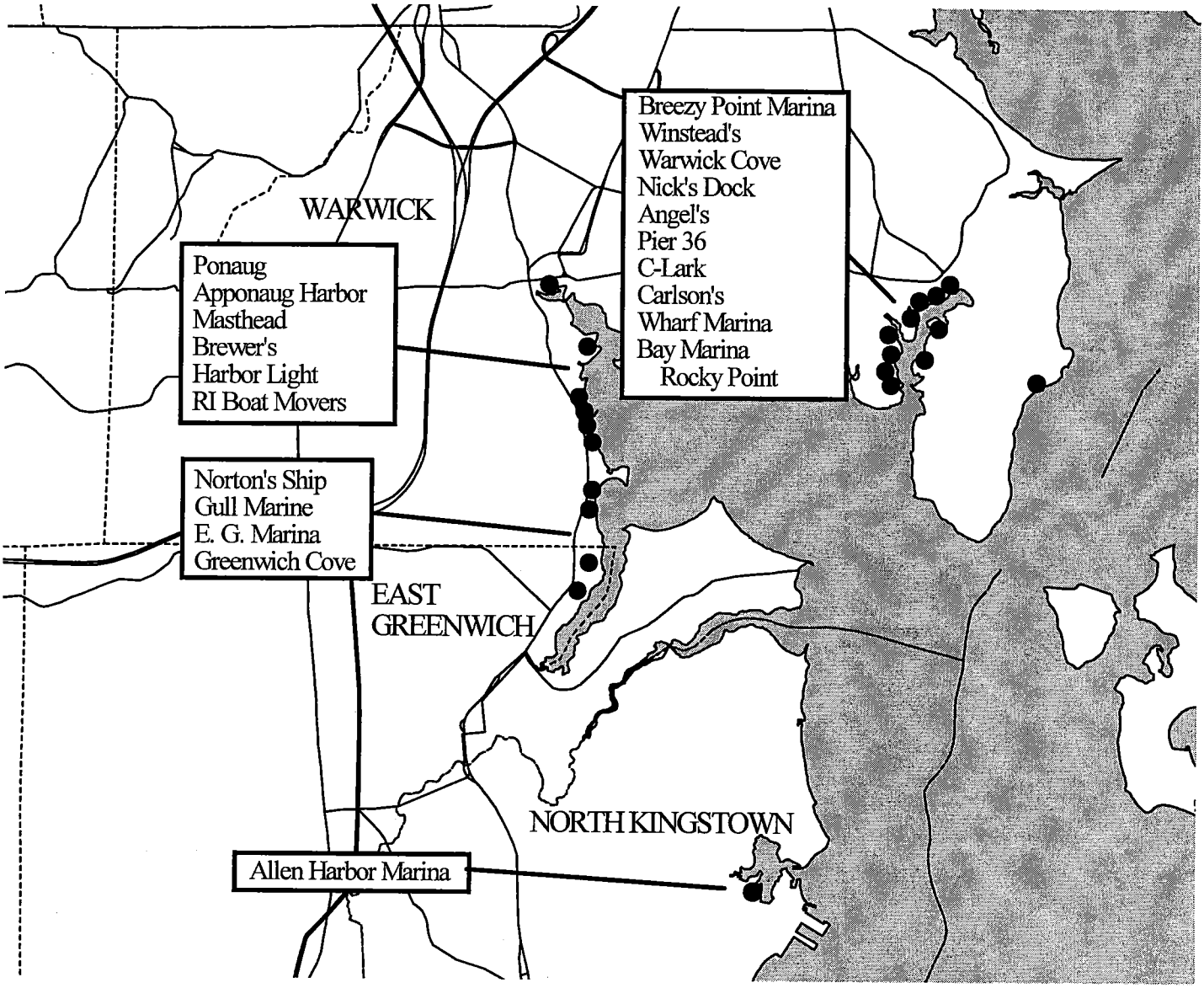
*Presently Called School Street Pier

RHODE ISLAND COASTAL FACILITIES

FIGURE 651-04(07)

N

EFFECTIVE : 1993
NOT TO SCALE

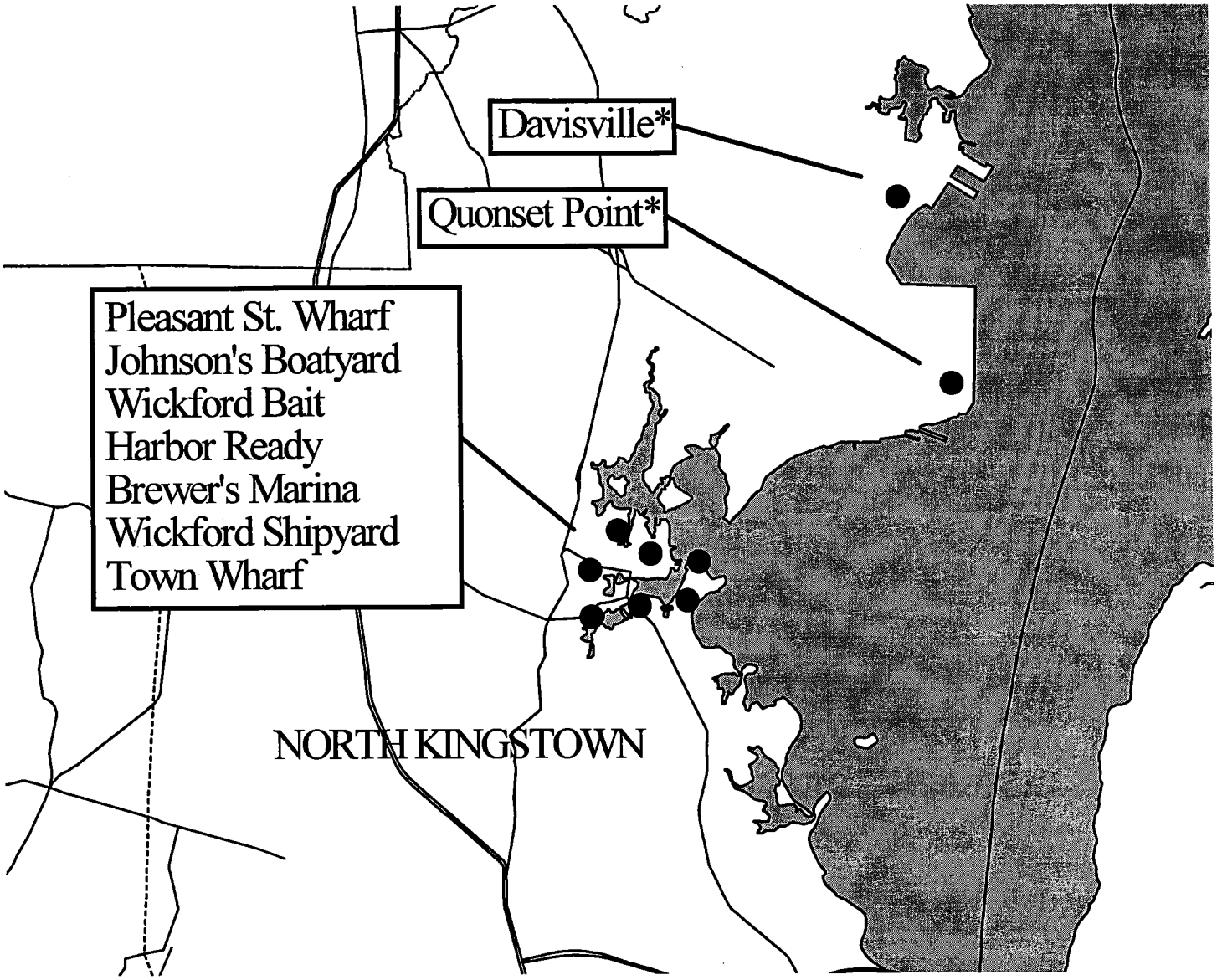


RHODE ISLAND COASTAL FACILITIES

FIGURE 651-04(08)

N

EFFECTIVE : 1993
NOT TO SCALE



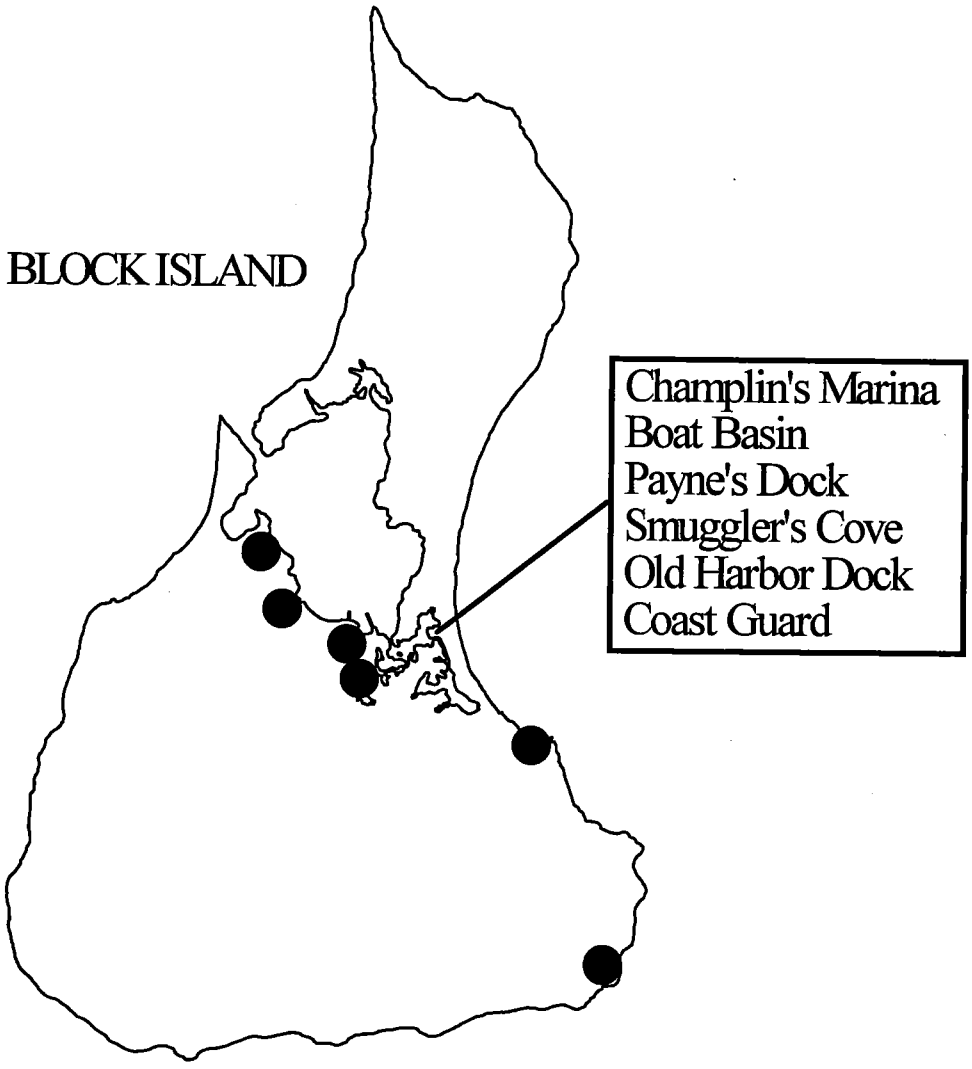
*Quonset Point/Davisville Are Being Analyzed for a Master Plan as QP/D

RHODE ISLAND COASTAL FACILITIES

FIGURE 651-04(09)

N

EFFECTIVE : 1993
NOT TO SCALE



RHODE ISLAND COASTAL FACILITIES

FIGURE 651-04(10)

N

EFFECTIVE : 1993
NOT TO SCALE

04-02-03 Harbor Management Plans

The Rhode Island Coastal Resources Management Council, in cooperation with the Marine Advisory Service at the Coastal Resources Center of University of Rhode Island, has developed a "Guide to the Harbor Management Planning Process." The document provides guidelines to facilitate the preparation of harbor management plans by coastal communities in the state.

The topics that the guidelines suggest should be covered in the harbor management plans include:

- Public access
- Water quality
- Boating safety and navigation
- Commercial fishing and shellfishing
- Moorings and marinas
- Historic resources
- Waterfront district overlay zoning
- State and local consistency
- Coordination with neighboring towns and state agencies

As of June 1993, seven harbor management plans had been submitted for approval. Those communities with completed plans include Barrington, Bristol, East Greenwich, East Providence, Jamestown, Portsmouth, and Warren. These seven plans were reviewed in this study to ensure consistency between any state initiative or a private effort regarding waterborne passenger transportation and the communities' plans.

The review revealed that the plans contain little or no specific discussion of ferries, especially for commuter transport. The lack of mention is probably not a rejection of the concept of waterborne transportation connections between coastal communities. Rather, it reflects the small amount of waterborne transportation service that exists at present in the state. The harbor management plans did acknowledge the need to facilitate access for recreational boating and the provision of boat ramps for this purpose. Some plans suggested waterborne passenger transportation be provided to facilitate public access to waterfront parks such as Goddard and Bold Point. Most of the plans were more concerned with preservation of local fishing through the maintenance of shellfish beds and through the provision of facilities to support the local industry.

As the harbor management plans are updated over time, the Rhode Island Department of Transportation will be a resource available to communities wanting to facilitate ferry service.

04-03 WATER ACCESS TO MARINE FACILITIES

Marine navigation and water access to terminals must also be considered in evaluating opportunities for future waterborne passenger transportation services. This includes such characteristics as channel length, depth, markings and lighting, tidal currents, visibility, obstructions, speed restrictions, turning basins, and potential for marine traffic conflicts that might interfere with schedules or dictate low-wake vessel design. Clearances were considered because some vessels may be too tall, be too wide, or have too deep a draft to navigate over, under, or through obstructions. Those characteristics were identified as a part of the inventory of existing conditions. Because marine facilities that are located within the same harbor typically have the same or similar water-side characteristics, this information was collected harbor by harbor for Providence Harbor, Pawtucket, the West Bay, the East Bay, Conanicut Island, Prudence Island, the Sakonnet River, Point Judith Pond, the Pawcatuck River, and Block Island.

04-03-01 Providence Harbor

Providence harbor was once an active maritime trading center, but as cars and trucks took the place of ferries and ships, the upper part of the Providence River was abandoned and a road network was constructed over the once-vital waterfront. The hurricanes of 1938 and 1954 reinforced public opinion of the waterfront as a liability rather than an asset. The hurricane barrier, which was constructed to protect Providence from hurricane flooding, also had the effect of closing off more of the inner harbor to large vessels.

a. Harbor Configuration

Providence inner harbor is a long narrow basin consisting of about 40 acres of open water. Its southern boundary is defined by Fox Point on the east and Collier Point on the west. Its limits to the east and west are the riverwalls on the banks of the Providence River. On the east side, these are vertical walls, mostly linked remnants of the stone wharves that once were the center of the city's shipping trade. On the west side, they are rip-rap slopes built when route I-195 was constructed. The northern limit of the inner harbor is the Crawford Street Bridge, the first of the new arched bridges designed to accommodate river ferries. Above Crawford Street Bridge, the river can still be navigated northward for approximately a half mile to a circular basin at Waterplace Park. Above Waterplace Park, railroad bridges with very low vertical clearance block further river access.

There are at present 56 slips inside the hurricane barrier that can accommodate boats up to 40 feet long. Wharves and bulkheads outside the barrier accommodate pilot boats, tug boats, and larger vessels.

Harbor conditions inside the barrier provide optimum conditions for navigation throughout the year. The harbor does not normally freeze over and the hurricane barrier provides protection from wind and weather. The inner harbor connects directly with the Port of Providence and with the Seekonk River. Navigating into or out of the inner harbor requires negotiating cross currents at the confluence of the Providence and Seekonk Rivers but currents usually are not a problem at the hurricane barrier.

The main navigation channel into Providence Harbor is a dredged channel about 14 miles long. Dredging in the Providence River channels is planned for 1997. The main channel starts about halfway up the bay along the east shore of Prudence Island. It has a design depth of 40 feet, is typically about 600 feet wide, and is divided into seven reaches. Heading into Providence, these are the Entrance Channel, Rumstick Neck, Conimicut Point, Bullock Point, Sabin Point, Fuller Rock and Fox Point reaches. Pilots of most small craft can largely ignore the southern reaches, entering the Upper Bay by any convenient route and picking up the channel at the mouth of the Providence River east of Conimicut Point.

The channel is an intensively used commercial shipping corridor. The port is a distribution center for petroleum products, and a terminal for such cargoes as scrap iron, lumber, chemicals, cement, asphalt and steel. Mariners must use caution to avoid tankers, freighters, barges and other heavy vessels, but the channel is sufficiently wide to safely pass approaching vessels. Recreational boating traffic is common, and there are occasional conflicts between commercial vessels and recreational craft, particularly near the junctions of the main channel and the entrance channels to Bullocks Cove, Pawtuxet Cove, and Edgewood.

Tidal currents flow north and south in the Providence River at speeds generally less than one knot. Besides the north-south movements of the tide and the river flow, the harbor has a slight easterly current caused by the discharge from the Narragansett Electric Company's cooling canals on the western shore. There is no particular tidal constraint to navigating in the channel. Figure 651-04(11) shows the inner harbor. The channel is well marked and lighted and there is ample turning basin available at the northern end in the Fox Point Reach. The Fox Point Reach is about 1.5 miles long and has a maximum width of 1,700 feet.

The nominal depth between the hurricane barrier and Crawford Street varies from zero along the riverwall to 24 feet just north of the Point Street Bridge. Recent surveys of the channel indicate that there has been considerable siltation since publication of the chart. Some parts of the channel bottom are exposed at extreme low tides. Dredging, scheduled for 1997, will address this problem. At any time other than high tide, navigation within the basin is therefore limited to a relatively narrow channel area where depth is sufficient. This severely constrains opportunities for landing or berthing vessels along the riverbanks.

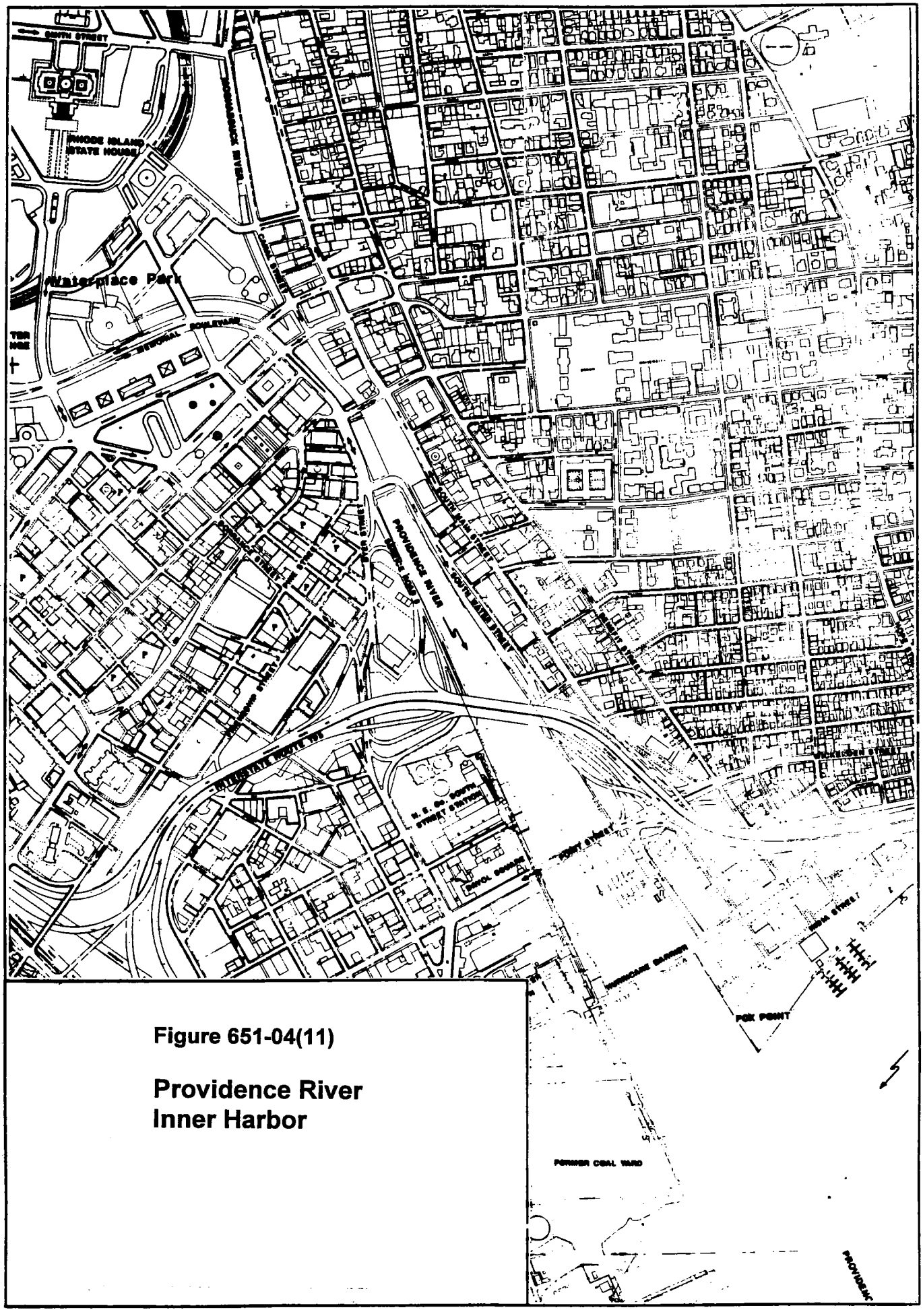


Figure 651-04(11)

Providence River
Inner Harbor

Two projects are underway that involve dredging of the river channel north of the hurricane barrier. The channel of the Woonasquatucket River, from Waterplace Park to the confluence with the Providence River, was dredged as part of Contract 5 for the construction of Memorial Boulevard. The Providence River, from the confluence to the Crawford Street Bridge, was dredged as part of Contract 6. Both of these contracts provide for dredging to a depth of eight feet at mean high water.

Dredging plans are also under consideration as part of the study of the relocation of Route I-195, which is underway. The basin between the Point Street Bridge and the Crawford Street Bridge will also be dredged to a minimum depth of eight feet at mean high water and the riverwalls would be reconstructed to permit vessel landing and berthing. In the meantime, the channel can be navigated, but the number of available landing sites with adequate draft to accommodate ferry traffic is limited.

One of the sites, Old Harbor Marina, is located inside the Providence hurricane barrier. Navigation through and north of the hurricane barrier is described below.

Maurania Company, also known as Providence Steamship, is located on the eastern shore of the inner harbor outside the hurricane barrier. It is one of the main berthing points for tugs and pilot boats in Providence. As a result, it is intensively used and space there is at a premium. It is a natural deep-water area with a depth of about 20 feet and is reasonably well protected. Being open to the south, it can be affected by strong southerly winds blowing up the channel.

The India Street Dock and the State Pier are located on the Fox Point shoreline. Though also somewhat open to the south, these sites are more protected by the high berms of South Quay, the Wilkes-Barre Pier, and Green Jacket Shoals than is Maurania. Tidal turbulence at the mouth of the Seekonk River can affect navigation in the area. These sites are located in an area where tidal currents from the Seekonk River introduce an east-west movement into prevailing north-south tidal flow. Ebb flow tidal currents in the Seekonk River on the east side of Fox Point (at the India Point railroad bridge) average 1.4 knots.

One additional site located in this area is Bold Point. There is no permanent berthing facility at Bold Point, but there is a launch ramp and a small float is available there in season. The float is reached by navigating from the Providence River into the Seekonk River around Bold Point, a maneuver which requires a 180-degree turn in a relatively narrow channel with turbulent currents. The Seekonk River channel is about 20 feet deep.

The State Pier and the Municipal Wharf are located in the heart of the industrial Port of Providence at Fields Point. This is the most active area of the port. Berthing is parallel to the

channel and is routinely occupied by very large vessels carrying scrap iron, lumber, and oil. There is no particular constraint to navigating into and out of these sites, but conflict with heavy commercial shipping is a distinct possibility.

b. Barriers to Navigation

The inner harbor is crossed by the three major structures. From south to north these are:

- The Fox Point Hurricane Barrier,
- The Point Street Bridge, and
- Route I-195.

Both the hurricane barrier and the Point Street Bridge were examined in detail because of their potential limitations on navigation into the inner harbor. I-195 received less attention; it does not significantly impede navigation because of its height and the spacing between piers. According to the navigation chart, the I-195 bridge provides 26 feet of vertical clearance at mean high water. The bridge columns stand on six piers placed in the river bottom. Maximum horizontal clearance between the piers is 52 feet. The present bridge is to be removed and a new bridge with similar clearances is to be built outside the hurricane barrier as part of the relocation of Route I-195 through the city.

b-1. Hurricane Barrier

The hurricane barrier is a large dam-like structure of concrete near the harbor mouth. It has three large gates that can be rotated downward to close off the harbor mouth in the event of flooding. It is connected to a rip-rapped berm that extends along the shore to provide flood protection. Gates that can be closed and sandbagged provide access through the barrier where it is crossed by city streets. There are about 20 acres of the inner harbor located above the hurricane barrier.

Each portal of the barrier is equipped with a gate that can be closed in the event of tidal flooding. Called tainter gates, these gates are arched metal plates, each supported by a framework and connected to a central axle by three spokes. Figure 651-04(12) includes a detailed drawing of the clearances at a typical gate. The gates are normally in the open position. They are closed only in the event of major storms or for periodic testing. Testing is conducted biannually; each gate is closed separately and then all gates are closed and the pumps are activated. The pumps are designed to pump river water out of the basin while the barrier prevents the tidal surge from entering the basin. Routine barrier testing has a negligible effect on navigation in the basin. However, even when open, the gates limit the size of vessels that can

safely traverse the barrier. Three limitations are imposed by the size of the gates–draft, vertical clearance, and horizontal clearance.

Draft through the hurricane barrier is set by the gate sills. The design drawings show that the sill of each gate is placed at elevation -15, mean sea level. The navigation charts indicate that the depth over the sill at the gates is 12.9 feet mean low water. Since the navigation charts also indicate that the difference between mean low water and mean tide level is 2.3 feet in Providence, when corrected for the tidal base these two reported depths are still a few tenths of a foot apart. Both seem to generally agree, however, that the available depth of water over the sill is slightly less than 13 feet at mean low water. Extreme low water, according to the chart, is 3.5 feet below mean low. Therefore the depth over the sill of the barrier at extreme low water could be less than 9.5 feet (9.4 feet using navigation chart data). Mean high water is 2.3 feet higher than mean tide, so the typical depth of water over the sill at high tide would be about 17.3 feet. Vessel draft at extreme high tides is not likely to be relevant since the types of events that bring extreme high tides are also the types of events that lead to closure of the barrier.

Water over the sill should therefore be sufficient for boats drawing less than 9.4 feet at almost any time. Boats drawing more than 9.4 feet must check the state of the tide and ensure sufficient draft before attempting to negotiate the gate. Vessels drawing more than 17 feet should not attempt to negotiate the barrier at any time.

Vertical clearance at the hurricane barrier, according to the navigation chart, is 21 feet at MHW. The drawing in Figure 651-04(12), taken from the design plans for the barrier, indicate a "maximum opening" to elevation 25.0 at mean sea level. Here, too, the elevations reported by the navigation chart do not match those in the design drawings, even if the base elevation is corrected. For purposes of this analysis, the "normal" opening of the gate (somewhat smaller than the "maximum") was assumed to provide 21 feet of vertical clearance at mean high water. This equates to 23.3 feet of clearance at mean tide and 25.6 feet of clearance at mean low water. The maximum vertical clearance would be 29.1 feet, available only at extreme low water (3.5 feet below mean tide).

Vertical clearance under the tainter gates should therefore be sufficient for vessels requiring less than 21 feet of vertical clearance at any time. Vessels requiring 21 to 25.6 feet of vertical clearance would be required to check the tide to confirm acceptable clearances before attempting to negotiate the barrier. Vessels requiring from 25.6 to 29.1 feet of vertical clearance may be able to negotiate the barrier, but only during extreme low tides. Vessels requiring more than 29.1 feet of vertical clearance cannot pass beneath the tainter gate at any time.

Each gate has a nominal horizontal clearance of 40 feet. However, because of the rotating mechanism that supports the tainter gates, the full 40 feet of clearance is not actually available. The axles on which the gates rotate protrude from the gate wall slightly more than two feet on each side. This reduces effective horizontal clearance to about 35.5 feet at the axle point. Further, the spokes that support the gate are attached to the gate itself about 7 feet inward from its edge. The spokes therefore pitch inward as well as upward when the gate is open. This restricts horizontal clearance to only about 26 feet at the top of the gate opening.

Vessels that require less than 26 feet of horizontal clearance can therefore negotiate the barrier without clearance constraints, assuming that they meet the draft and vertical-clearance restrictions. Vessels requiring more than 26 feet but less than 35.5 feet of horizontal clearance may be able to negotiate the barrier depending upon their overall shape. The ability to pass the barrier is best for those vessels with their maximum width near the waterline. Vessels requiring from 35.5 to less than 40 feet of horizontal clearance may be able to negotiate the barrier only under special tide conditions and vessels requiring more than 40 feet of horizontal clearance cannot pass through the barrier.

Modifications to the barrier gates have been considered by the City of Providence to make them more conducive to navigation. Some of the options that have been suggested are:

- replacing one or more of the gates with gates that are hinged vertically,
- replacing one or more of the gates with a sliding gate,
- replacing one or more of the gates with a submerged lift gate, and
- replacing the gates with a lock.

To date, none of these options has been developed sufficiently to enable an assessment of feasibility.

b-2. Point Street Bridge

Above the hurricane barrier is the Point Street Bridge. This bridge is a metal framework structure that carries Point Street across the harbor. About 11 acres of the inner harbor lie between the Point Street Bridge and the hurricane barrier. Another 19 acres lie between the Point Street Bridge and Crawford Street.

Although there are about 20 acres of the inner harbor above the hurricane barrier, only about 11 of these are located between the hurricane barrier and the Point Street Bridge. A marina, a navigation channel, and the utility cooling canals leave less than two acres for boating between the barrier and the bridge. Most of the inner harbor, and the entire navigable section of the

Woonasquatucket and Mosshasuck Rivers, are located above the Point Street Bridge. The bridge is a large metal framework structure that was originally designed to rotate, providing access to the navigation channel in the inner harbor. Badly damaged in 1938 and then again in 1954, the bridge is no longer operable. In 1996, the old power plant at Manchester Street was demolished and a new plant constructed. As part of the construction, a new water transportation area was designed.

The bridge presently poses a much more serious constraint to navigation than does the hurricane barrier. In its present fixed state, the bridge provides only limited vertical clearance. The navigation chart reports that the bridge provides 9 feet of vertical clearance at mean high water. However, the nominal 9-foot clearance is actually not available. The bridge is arched slightly and the peak of the arch, at the 9-foot clearance, is located over cribwork designed to protect the bridge when it is in the open position. Actual maximum vertical clearance under the bridge is only 7.92 feet (7 feet 11 inches) at Providence mean high water (2.35 NGVD). This equates to 12.5 feet at mean low water and 16.1 feet at extreme low water. This clearance is not located in the center of the channel under the bridge, but is located adjacent to the cribwork. The bridge slopes downward from this point, reducing the maximum vertical clearance over the channel to about 7 feet. The bridge offers 98 feet of horizontal clearance, more than sufficient for any vessel capable of navigating the hurricane barrier, as shown in Figure 651-04(12).

RIDOT has completed studies of the alternatives for rehabilitation of the bridge, including the alternative of restoring the swing-bridge function. The study (Parsons DeLeuw, January 1993) concluded that restoration of the swing function is not cost-effective at this time. RIDOTs current plans call for rehabilitation of the structure as a fixed bridge without restoration of the swing function.

b-3. Other River Bridges

When the bridges over the Providence River were reconstructed, they were designed to facilitate navigation. Figure 651-04(12) shows the clearances of the newly reconstructed bridges. Vertical and horizontal clearances are shown in this figure relative to Providence mean high water. As shown, the typical bridge arch provides clearances of at least eight feet vertically over a minimum distance of 14 feet horizontally. Only vessels that can fit within these height and width limitations can navigate up-river to Waterplace Park.

All the clearances specified here are referenced to the Providence mean high water datum as surveyed and monumented in 1929 (PMHW 1929). Sea levels have risen slightly since 1929. Information provided by the U.S. Department of Commerce National Ocean Service Tidal Datums Applications Unit references tidal data on the Providence River (at the State Pier, 242

Allens Avenue) based on the 19-year Metonic Cycle (National Tidal Datum Epoch) from 1960 through 1978. These data indicate that mean high water in Providence has risen to an elevation of 2.85 NGVD rather than the 2.35 NGVD of the 1929 datum. Therefore actual clearance available at mean high water in Providence is likely to be at least one-half foot less than indicated by the PMHW datum.

04-03-02 Pawtucket

Navigating into Pawtucket requires navigating up the Providence River to the Seekonk River. Vessels must round Bold Point, making the 180-degree turn described above, then navigate up the Seekonk River to Pawtucket. This requires another 180-degree turn around India Point and passage through the narrow 40-foot-wide opening of the India Point railroad bridge. It is a swing bridge that is kept in the open position. It has been declared a hazard to navigation and there is an order to remove it.

From the India Point railroad bridge, the channel continues northward under the Washington Bridge. This bridge is configured in a series of high arches. North of the Washington Bridge the channel widens. There are two boathouses along the west side near the river's mouth; one is the Brown University Boathouse and the other is a private rowing club. The Seekonk River between India Point and Pawtucket is extensively used for rowing and shell racing. Conflicts between ferry traffic and rowing boats are a distinct possibility in this part of the Seekonk.

Northward, the channel passes through the 92-foot-wide opening of the railroad lift bridge. This bascule bridge is no longer in railroad service and is secured in the open position; it may be rehabilitated or replaced for rail-transit use in the future. It may have been struck by a barge, however, its disuse is the result of lack of freight demand. When closed, it had a verticle clearance of 17 feet. From the bascule bridge north, the channel is relatively unobstructed. The west shore is forested and the east shore is an area of moribund heavy-industrial use. There are oil-loading piers protruding from the eastern shore. They are now used only rarely and do not pose a hazard for vessels that keep to the channel.

There are two possible landing sites in Pawtucket, located on opposite sides of the river. Navigation beyond these sites is limited by the dam and falls in downtown Pawtucket. Both sites have 15 to 20 feet of water and, though tide-influenced, are not subject to any tidal currents that could interfere with navigation. The dominant current at both sites is southward with the flow of the Seekonk River toward the Providence River and Narragansett Bay.

04-03-03 West Bay

a. Edgewood

The harbor at Edgewood is accessed from the Sabin Point Reach of the Providence channel via a long, narrow north-south channel. The channel is about one mile long and had a reported depth of 12 feet in 1959. It is well marked, but not lighted. Currents are generally less than one knot and are not likely to affect navigation.

The harbor entrance is clearly visible from the Sabin Point Reach of the Providence channel. It is also clearly visible from the Fuller Rock Reach of the channel, but has no entrance channel there. The proximity of Edgewood to the Fuller Rock Reach can tempt boaters to approach Edgewood (from Providence) by rounding Fields Point, a move that requires careful navigation because of limited water depths and unmarked obstructions. Proper passage to Edgewood from Providence requires navigating southward for about 1.5 miles along the Fuller Rock Reach and Sabin Point Reach to the south end of the Sabin Point Reach. From here a vessel may enter the Edgewood channel and proceed back northward for about a mile into Edgewood.

There is a turning basin at the head of the Edgewood Channel that is about 600 feet square, adequate for most smaller vessels. Because the channel is relatively narrow, there is a potential for conflicts between ferry traffic and recreational boating.

b. Pawtuxet Cove

Pawtuxet Cove is located on the western shore of the Providence River at the mouth of the Pawtuxet River. It is a long, narrow harbor protected by Pawtuxet Neck and by man-made breakwaters. It is accessed from the Bullock Point Reach of the Providence Channel via a short (±0.3 miles) and narrow dredged channel with a reported depth of 12 feet. The channel is well marked but not lighted. A pair of flashing red range beacons have been placed on the shore inside the harbor entrance. They are privately maintained and have been placed so that they appear one above the other to vessels within the entrance channel. The channel entrance and the beacons are clearly visible from the Bullock Point Reach.

There is no significant obstruction within the harbor, but both the entrance channel and the harbor itself are very narrow. There is very little maneuvering room in the harbor and the only turning basin is to the south of the entrance where water depth is limited. The harbor is a crowded recreational harbor with significant potential for conflicts between ferries and recreational boats.

c. Rocky Point

Rocky Point is located in Warwick, on the east shore of Warwick Neck, on the west side of the upper bay. It has been a terminal for water transportation in Narragansett Bay since the 1800s, when excursion boats brought tourists to its amusement park and shore dinner hall. It is well protected from the west, but is otherwise exposed. Fronting directly on the relatively deep water of the upper bay, it does not have an actual entrance channel but is approached from any part of the Rumstick Reach of the Providence harbor channel. The point is not marked or lighted, but the towers and lights of the amusement park form prominent landmarks easily visible by day year round and brightly lighted at night during the summer season.

Tidal currents off the point are generally less than one knot and are not a serious concern for navigation. The rocky point from which the park takes its name is clearly visible from almost anywhere in the upper bay. It is surrounded by rocks that break the surface at low tide, but depths are typically about 10 feet at mean low water and the approach is not seriously obstructed. The open approach provides ample turning room for any vessel and, though the upper bay is popular with recreational boaters, it is rarely crowded and the potential for marine traffic conflicts is minimal.

d. Greenwich Bay

Greenwich Bay is a large, relatively shallow embayment on the west shore of Narragansett Bay, about halfway between Providence and the entrance to Narragansett Bay. It is entered from the east passage of Narragansett Bay via a wide and well marked natural channel beginning between the lighthouse on the south point of Warwick Neck and Round Rock off Potowamut. Maximum channel depth is 42 feet off Warwick Neck, generally shoaling to eight to ten feet inside Greenwich Bay. The estuaries around the bay provide safe haven for boaters at a number of locations, especially at Warwick Cove, Apponaug Harbor, and Greenwich Cove. Breakwaters have also been installed to protect marinas along the west shore of the bay at Cowesett. A more detailed description of each of these harbors follows.

d-1. Warwick Cove

Warwick Cove is a long, narrow harbor in the northeastern part of Greenwich Bay. Securely nestled between Warwick Neck and Oakland Beach, the harbor is well protected although the approach is narrow and can be subject to storm surges from the south. Breezy Point Marina, Winstead's, Warwick Cove, Nick's Dock, Angel's, Pier 36, C-Lark, Carlson's, Wharf Marina, and Bay Marina are located within Warwick Cove.

The channel is about 100 to 150 feet wide and had a reported depth of five feet when last dredged in 1973. It is well marked, though none of the marks is lighted. Tidal currents flow generally north and south into and out of the cove and are not a significant impediment to navigation in the harbor. The channel entrance is clearly visible from the entrance to Greenwich Bay. Care must be taken when entering the harbor to avoid shallow water off Oakland Beach to the west and obstructions along the south and west shore of Warwick Neck to the east. About one mile of the route within the harbor is under speed restrictions to control wakes.

Within the harbor there is very little turning room. The channel is narrow and is normally crowded with recreational boats during the summer season. There is a high potential for conflicts between recreational boats and ferry traffic in the harbor, especially on summer weekends.

d-2. Apponaug Harbor

Apponaug Harbor is smaller than Warwick Cove, but is otherwise similar. It also is a narrow cove on the north shore of Greenwich Bay, is well protected, and is accessible via a long, narrow and relatively shallow navigation channel. Existing sites in Apponaug Harbor include Ponaug Marina, Apponaug Harbor, Harbor Light, RI Boat Movers, and Pettis Boatyard.

The channel into Apponaug Harbor is 75 to 100 feet wide and about 0.7 miles long. Like the channel into Warwick Cove, it has a reported depth at mean low water of five feet. It is reasonably well marked but not lighted. Tidal currents flow generally north to south and are not a significant impediment to navigation. Care must be taken when entering the channel to avoid obstructions off Cedar Tree Point to the east and Arnold Neck to the west. The channel entrance is obscured from the main channel into Greenwich Bay, but is clearly visible from the northwest part of the bay. The entire channel is subject to speed restrictions to reduce wakes.

Like the channel into Warwick Cove, the channel into Apponaug Cove is narrow and occasionally crowded with recreational boats. There is little turning room available within the harbor and there is a significant potential for conflicts between recreational and ferry traffic.

d-3. Cowesett

Two large breakwaters have been constructed along the west shore of Greenwich Bay north of Chepiwanoxet Point. These protect Masthead Marine and Brewer's Shipyard on the Cowesett Shore. Both sites are accessed directly from Greenwich Bay and are not served by separate dredged channels. The depth of the bay proximate to Cowesett is about eight to nine feet at mean low water. The entrances to both marinas can be clearly seen from Greenwich Bay and

tidal currents are not a factor in navigating into either site. The only obstructions to entering these sites are the breakwaters themselves. There are no speed restrictions outside the breakwaters. Ample turning room is available outside, but space within the breakwaters is at a premium and often very crowded. There is a high potential for conflicts between recreational boating and ferries inside the breakwater but not as much potential outside.

d-4. Greenwich Cove

Greenwich Cove is in the southwest part of Greenwich Bay, between East Greenwich and Potowamut. Though it is entirely within the City of Warwick, the cove is managed and regulated by East Greenwich, which controls the approaches along the western shore. The eastern shore, on Potowamut Neck, is within the Goddard State Park and is undeveloped, forested land.

Greenwich Cove is naturally eight to ten feet deep at mean low water. There is a loosely defined navigation channel between the marinas on the west shore and the moorings off the east shore. Channel markers are provided only at the harbor entrance, off Chepiwanoxet Point and Long Point. The harbor marks are not lighted, but the lights from the urbanized west shore make positioning within the cove relatively simple. Tidal currents are slight and do not interfere with navigation. The channel entrance is clearly visible from most of Greenwich Bay.

Care must be taken on entering the cove as sand bars extend from both Chipewanoxet Point and Long Point. Depth over the bars can be as little as one foot at mean low water, making it essential to stay in the channel at the entrance to the cove. Once inside the cove, there is no obstruction to navigation and adequate turning room is available for most vessels. The harbor is packed with moorings and is normally crowded in the summer season so that there is a potential for conflicts between ferry and recreational traffic inside.

e. Allens Harbor

Allens Harbor is a small cove on the west shore of Narragansett Bay between Greenwich Bay and Wickford Cove. Formerly part of the Construction Battalion installation at Davisville, this harbor is well protected behind Calf Pasture Point and Spink Neck. It is reached from the west passage of Narragansett Bay via a narrow channel, about a half mile in length with a depth of about eight feet at mean low water. Only the channel entrance is marked, but one of the entrance markers is lighted. Tidal currents run up to about one knot, flowing generally east and west into and out of the harbor.

Because the entrance to the harbor is narrow, it can be difficult to see from the west passage. Care must be taken to avoid shoals off both Calf Pasture Point and Spink Neck when entering the

harbor, as the entrance is extremely narrow. Speed restrictions apply inside the harbor, but the harbor is loosely regulated at present as it is in the process of being transferred from the Navy to the state. Ample turning room is available within the harbor for most vessels. There are moorings and docks within the harbor, but federal controls have prevented extensive private development for recreational use. There is only a slight potential for conflicts between ferry traffic and recreational boating.

f. Quonset Point/Davisville

Quonset Point/Davisville (QP/D), located on the west shore of Narragansett Bay in the Town of North Kingstown, is a former military installation that has been converted to industrial use. Major port facilities at Quonset, which once provided berthing space for aircraft carriers and other navy warships, now provide a deep-water commercial and industrial port that supports much of the waterborne commerce in the state. The carrier pier at Quonset Point is reached from the east passage of Narragansett Bay via a well marked and lighted navigation channel north of Conanicut Island. The channel has been dredged to provide a depth of 34 feet (MLW) at a design width of 300 yards. The piers at Davisville are reached from Quonset Point via another channel, north-south along the shore, with a width of 500 feet and a design depth of 31 feet. This channel is also well marked and lighted. The carrier pier at Quonset has a dredge depth of 34-35 feet and the pier at Davisville a depth of 29½ feet.

Current velocities in the area are generally under one knot and are not likely to interfere with navigation. The port at QP/D is prominently visible and easily accessible from almost anywhere in the lower bay. There are large turning basins at both Quonset and Davisville. There are no major obstructions on the approach to either facility although larger vessels drawing more than 20 feet must take care to remain within the marked channel. The port at Davisville is very well protected from the north and west, and open to the south and east. There are many recreational boats in the vicinity during the summer season, but there is ample room for them to maneuver to avoid shipping traffic, so conflicts between ferries and recreational boats are unlikely. QP/D is a busy port facility that accommodates many large cargo vessels and so there is some potential for conflicts between ferry traffic and shipping at the port. The new master plan for QP/D makes note of ferry accommodation in areas not in conflict with commercial shipping. As planning progresses, multi-use of the facilities continues as a goal.

g. Wickford Harbor

Wickford Harbor is located on the western shore of Narragansett Bay south of Quonset Point. It is a well protected harbor behind two man-made breakwaters, one extending northward from Poplar Point and the other southward from Sauga Point. The entrance to the harbor is obtained

directly from the west passage through these breakwaters. The entrance can be clearly seen from the west passage and lights on the ends of both breakwaters make it stand out at night.

The harbor inside the breakwaters is variously 10 to 15 feet deep. The outer harbor forms a broad channel that narrows with distance into the harbor and then forks into two reaches. One reach extends southward and westward into Wickford Cove while the other extends northward and westward into Mill Cove.

g-1. Wickford Cove

Wickford Cove is a narrow estuary in the southwestern part of Wickford Harbor. It includes five sites, Harbor Ready, Wickford Bait, Wickford Cove Marina, the Town Dock and the Wickford Shipyard. The cove is entered from the outer harbor via a channel between Poplar Point and the Town Dock. The channel is narrow, but is clearly marked by marinas and by lines of pilings between which boats are moored. It is a dredged channel about three-quarters of a mile long, which has a depth of eight to ten feet at mean low water.

The full channel length is under speed restrictions to prevent wakes. There is no noteworthy obstruction within the channel and tidal currents are not a significant factor in navigating it. There is limited turning room within the cove, and the channel is frequently crowded with recreational craft. There is a high potential for conflicts between ferry and recreational boats using the channel.

g-2. Mill Cove

Mill Cove is located in the northwestern part of Wickford Harbor; it includes two sites, Pleasant Street and Johnson's Boatyard. Access to Mill Cove is obtained from the outer harbor via a narrow channel between Cornelius Island and Pleasant Street. Tidal velocities in the narrow gut frequently exceed one knot and can affect navigation into and out of Mill Cove. Care must be taken on entering to navigate between the shoals off Cornelius Island and the docks at Pleasant Street.

The channel is reasonably well marked and, though the marks are not lighted, the lights from the shore illuminate the entrance. The entrance is clearly visible from the outer harbor and there is no significant obstruction to navigation. Mill Cove is subject to speed restrictions to control wakes. Ample turning room is available within the cove, although it is crowded with pleasure craft during the summer season. Conflicts between recreational boating and ferry traffic are possible here, especially in the narrow gut at the entrance to the cove.

h. South Ferry

South Ferry is located on the west shore of Narragansett Bay in the Town of Narragansett. It is the site of the University of Rhode Island Marine Campus and the EPA Marine Ecological Laboratory. It is locally known as South Ferry because, prior to construction of the Jamestown Bridge, it was one terminus of the ferry service between Narragansett and Jamestown. It is a natural deep-water area protected by groins. As such, it has no entrance channel per se, but is very exposed and subject to storm surge. Tides routinely run at velocities under one knot and are not a significant influence on navigation.

i. Middlebridge

Middlebridge is located on the Pettaquamscutt (Narrow) River. Access is obtained via a narrow channel at the river's mouth. Known as the narrows, the river entrance is not marked or lighted. It is not well protected, and is subject to large swells and breakers. Tidal currents are swift and variable. Navigating the channel requires both local knowledge and some degree of skill as there are a number of rocks and obstructions all around the channel entrance, including Clump Rocks, Cormorant Rock, River Rock, and Bass Rock. A sand spit at the north end of Narragansett Beach has been extending northward and threatening to close off the harbor mouth. Only the velocity of flow from the river has kept the harbor open.

The entrance is visible from the southwest, but obscured by rock ledge from most other directions. Navigating it requires approaching from the south, turning west around the sand spit, then turning northwest into the narrows, a route that can be navigated only in favorable weather conditions.

The narrows provide access to Pettaquamscutt Cove and the Pettaquamscutt River. Middlebridge is located part way up the river near where Middle Bridge Road crosses. It is principally a location for local, shallow-draft, recreational and fishing vessels. The bridge imposes vertical limitations and, although approach depths are up to 20 feet, depths at the marina itself are generally less than six feet.

j. Narragansett Pier

Narragansett Pier is on the shore of Rhode Island Sound south of Narragansett Beach. Since it fronts directly on the sound, it has natural access to deep water and does not need an entrance channel. It is clearly visible from the sound and the lights of the commercial and residential developments in Narragansett indicate its location at night.

Tidal currents are generally less than one knot and are not likely to interfere with navigation but the location is not well protected. It is subject to severe swells even in moderate weather and to large breakers in storms. The north side of the pier can be approached from the north without encountering obstructions but the south side is rocky and frequently pounded by surf so that it is not safe for berthing except in calm weather.

The pier is used principally for transient stops. Because it is subject to swell, it is not considered a suitable area for long-term berthing. Potential for conflicts between ferries and commercial fishing vessels and recreational boats is minimal.

04-03-04 East Bay

a. Barrington/East Providence–Bullocks Cove

Bullocks Cove is a well protected inlet on the east shore of the Providence River. It is accessed by a long, narrow channel dredged from the Bullock Point Reach of the Providence River Channel. The Bullocks Cove channel is about one mile long, eight to ten feet deep, and about 100 feet wide. It passes through a narrow gut between Bullock Point and Bay Spring where ebb-tide velocities average about 1.5 knots. Though the tide can be a factor in entering Bullocks Cove, the channel is well marked and can generally be navigated without difficulty. Bullocks Cove is a very popular and busy recreational area, crowded with moorings and often with anchored pleasure and fishing craft. These craft crowd the long, narrow channel outbound early in the day and inbound late in the day, especially during the summer months. There is some potential for conflicts between passenger service and pleasure craft.

Three sites are within Bullocks Cove–Cove Haven, Lavin's, and Bullock's Cove Marina. These locations are within the cove where they are well protected from storms. Lavin's and Cove Haven are on the east shore of the cove in Barrington; Bullocks Cove is on the west shore. All have reported channel depths of about ten feet at mean low water.

b. Warren River

The Warren River is a small harbor on the east shore of Narragansett Bay. It is approached from the Rumstick Neck reach of the Providence River channel. The approach channel into the Warren River is about 50 feet wide and approximately 4.5 miles long. Depth ranges from about 18 feet near the Providence River channel to about 10 feet in the northern limits of the Warren River. The harbor is long and narrow. Tidal currents near the river entrance flow at about 0.3 to 0.4 knot, while, in the river itself, they approach one knot.

Warren Harbor is crowded with pleasure boats during the summer so that conflicts between ferry service and recreational boating are possible. The river channel is lined on both sides for much of the way with moorings. In general, however, the channel is well marked and lighted and reasonably accessible. Navigating into the Warren River from the Providence shipping channel requires traversing or avoiding Rumstick Shoal (eight feet MLW) and navigating into a relatively constricted passage between Jacobs Point and Allen Rock. These latter two are close together, but are well marked and lit. About one mile of the channel within the harbor is posted for restricted speed limits to prevent wakes.

There are five sites within the Warren River. Three of them, Stanleys, Striper, and the State Pier, are in Barrington on the west shore of the river. The other two, Speeds Marina and Blount's Marina, are in Warren on the river's east shore. All have reported approach channel depths of eight to ten feet.

c. Colt State Park

Colt State Park is located in Bristol, on the northwest shore of Popasquash Neck, on the east side of the upper bay. It is well protected from the southeast, but exposed on all other sides. It fronts directly on the Providence harbor entrance channel and is approached directly from it. It is not marked or lighted although its location is obvious during the daytime because of the broad expanses of green lawn in the park. It can be difficult to locate at night, however, and there are a few rocks off the shore that must be avoided on approach.

Tidal currents adjacent to the park are typically less than one knot and do not interfere seriously with navigation. Care must be taken when landing, however, to avoid a cross current that can sometimes result from flow into and out of Mill Gut near the park entrance. The bottom at the park slopes gently toward the northwest, with depths of 20 to 25 feet near the shipping channel, 10 to 15 feet off shore, and three feet or less along the beach. The broad embayment provides ample turning room for most vessels. There is a launching ramp and landing at the north end of the park that is popular with recreational boaters, but the area is rarely crowded and the potential for traffic conflicts at the park is minimal.

d. Bristol Harbor

Bristol Harbor is a broad A-shaped embayment between Bristol Neck and Popasquash Neck. With a depth of 10 to 15 feet throughout at mean low water, it is a natural deepwater harbor. It is protected from the west by Popasquash Neck, on the east by Bristol Neck, and to the south by Hog Island. Sites within Bristol Harbor include Bristol Marine, the Town Dock, Town Marina,

and the Herreshoff Museum. There are two channels into Bristol Harbor, one to the west of Hog Island and the other to the east.

The west approach fronts on the Providence shipping channel and is used principally for access into the east passage of Narragansett Bay. It is well marked and lighted with depths of 20 to 25 feet. It is nearly half a mile wide at its entrance, narrowing to about 500 yards within the harbor. The east approach fronts on the channel under the Mount Hope Bridge and is principally used for access into Mount Hope Bay. This channel is also consistently greater than 20 feet in depth and about 500 yards wide. It is reasonably well marked but sparsely lighted.

The velocity of tidal currents in the harbor is typically under one knot and not likely to interfere with navigation. The harbor is clearly visible and easily accessible from either the Providence or Mount Hope channel. Obstructions in the west channel include shoals and rocks off the southwest point of Hog Island, shoals and rocks off Popasquash Neck, Castle Island north of Hog Island, and the rocks and shoals north of Castle Island. Obstructions in the east channel include the Hog Island Shoals, Walker Island shoals, and the shoals north of Castle Island. All of these are well marked and easily avoided.

The harbor is about one mile long and nearly half a mile wide, providing ample turning basin for most craft. Speeds are not limited in the channel, but are restricted to five miles per hour within the harbor to control wakes. The harbor is a very busy recreational harbor but the channel is wide enough so that conflicts between ferry traffic and pleasure boats are unlikely.

e. Church Cove

Church Cove is located on the east shore of Bristol between Mount Hope and the Mount Hope Bridge. One site, Bristol Boat, is in this area. With direct access to deep water, this site does not have an entrance channel per se. Accessed directly from the channel into Mount Hope Bay, it requires no lighting or marking. It is clearly visible from the bay channel. Tidal current velocities near the cove are normally less than one knot and are not likely to interfere with navigation. Currents under the Mount Hope Bridge approach 1.4 knots on the ebb tide and are a consideration when navigating through the Mount Hope channel. The site is protected from the north and west by Bristol Neck, but is not well protected from the south and east.

No speed restrictions are applicable in the area. There are numerous obstructions in the form of rocks in the shoals along shoreline, but these are easily avoided by staying clear of the shore. This port has limited berthing space and conflicts between pleasure boaters and ferry service are unlikely.

f. Kickamuit River

The mouth of the Kickamuit River provides entrance into a broad estuary between Touisset Highlands and Bristol Neck. Sites in the river include Joe's Boatyard and Touisset Point. Access is obtained through the Bristol Narrows. As its name implies, the narrows is a constricted passage between Coggeshall Point and Bristol Neck. Shifting sand on both sides of the channel restrict navigation to a very narrow area. The channel is well marked, but not lighted. Navigation through the narrows is further complicated by ebb-tide currents, which reach velocities of 1.7 knots and must be considered when entering the harbor. The harbor entrance can be seen from the southeast, but is obscured from view by Coggeshall Point over much of Mount Hope Bay.

There are no formal speed restrictions applicable in the channel, but slow speeds must be maintained inside near the marinas to reduce wakes. Once through the narrows, the Kickamuit opens into a broad estuary that is about one mile long and half a mile wide. The basin is bowl-shaped with a maximum depth of about 16 feet (MLW) in the center and shoals around the outside. Adequate turning room is available in the basin, but turning space is very limited in the entrance channel. Though the marinas are relatively small, the narrowness of the entrance channel may lead to conflicts between pleasure boats and ferry service at the harbor entrance.

g. Melville

Melville is on the west shore of Middletown near the entrance to the Providence Shipping Channel. It is a broad embayment protected from the south and east by Aquidneck Island and from the west by Dyer Island. With depths of 40 to 50 feet, it is a natural deepwater port without a dredged channel. There are three sites in Melville–East Passage Yacht Club, Bend Boat Basin, and Little Harbor. These are located within small, dredged basins in the northeast part of the bay. They are protected by a combination of man-made breakwaters and surrounding landforms.

Access to the cove can be obtained via two routes, one north of and the other south of Dyer Island. The approach from the north is more direct and deeper and is therefore more commonly used. It is well marked and more than 40 feet deep, passing between the shoals north of Dyer Island and into the harbor. The approach from the south is shallower, requiring passage over water from 14 to 16 feet deep between Carr Point and Dyer Island.

Tidal current velocity ranges from 0.6 to 0.8 knot and is not a significant concern for navigation into and out of the harbor. The harbor entrance is clearly visible from the north and northwest, but is obscured from the west and southwest by Dyer Island. Obstructions on approach include rocky shoals to the north and to the south of Dyer Island. These shoals are well marked,

however, and the natural deep-water channel is sufficiently wide so that these can be avoided without difficulty.

The protected basins within which boats are berthed are both very small and very crowded. Both have extremely narrow entrances. As a result, there is a high potential for conflicts between ferries and pleasure boats at these sites.

h. Coddington Cove

Coddington Cove is located on the Middletown shore north of the Newport Bridge and Coasters Harbor Island. Originally used as a military port, the cove has been dredged out to a uniform depth reported at 33 feet when last dredged in 1968. The site was leased to the Direcktor Shipyard by the U.S. Navy.

The port is protected from the east and south by Aquidneck Island, from the southwest by Coddington Point and from the north by a long, man-made breakwater. It is open to the west. Access is obtained directly from the east passage of Narragansett Bay by passage between the end of the breakwater and Coddington Point. The entrance is well marked and lighted. It is also marked by a bell buoy off the spit at Coddington Point and a horn on the end of the breakwater. It is clearly visible from the east passage north of the Newport Bridge.

There is ample turning basin available for large vessels within the cove as it is about half a mile wide and almost three-quarters of a mile long. There is no speed restriction posted for the entrance channel or in the basin, as recreational boat wakes are not normally a problem for the large vessels typically berthed in the cove. The cove is home to a number of large military vessels but not to an extensive fleet of pleasure boats. Ferry traffic is not likely to conflict seriously with other traffic in the cove.

i. Coasters Harbor-NETC

Coasters Harbor is a very small but well protected harbor at the Naval Education Training Center (NETC) just north of the Newport Bridge. It is accessed from the east passage via a narrow channel between the Newport Bridge and Coasters Harbor Island. It is protected from the east by Aquidneck Island, from the north and west by Coasters Harbor Island, and from the south by the causeway to the Newport Bridge.

The entrance channel is well marked and roughly parallels the Newport Bridge. Depths in the channel start at 35 to 40 feet, shoaling within the basin to nine feet. Although there are no lighted navigation marks, the lights on the bridge and on Coasters Harbor Island provide ample

illumination for navigation. The channel entrance can clearly be seen from the east passage north of the bridge. South of the bridge it is partially obscured by the bridge causeway.

Tidal currents approach 1.1 knots under the bridge northeast of Rose Island and must be considered when navigating the narrow passage between the south end of Coasters Harbor Island and the bridge. Obstructions in the channel entrance include rocky shoals to the north and a rocky reef to the northeast of Rose Island. The harbor entrance is partially visible from the east passage south of the Newport Bridge, but it cannot be approached from there because of these shoals. Proper entrance requires passage northward under the bridge and then a turn eastward around these shoals.

Speed within the harbor is restricted to five miles per hour to control wakes. The harbor is very small and packed with moored boats so that very little turning room is available. It is a crowded harbor that is home to the Navy's fleet of recreational sailing vessels, indicating a high potential for conflicts between ferry traffic and recreational boats.

j. Newport Harbor

Newport Harbor is a large, well protected, natural deep-water port on the southwestern part of Aquidneck Island. Long the location of the America's Cup races, a terminus of the single-handed transatlantic ocean race, and location of the start of the Newport-to-Bermuda races, it is an internationally known center for yacht racing.

The harbor is protected from the north and east by Aquidneck Island, from the south and west by Newport and from the northwest by Goat Island. It is accessed from the east passage of Narragansett Bay via a wide, well marked channel between Fort Adams and Goat Island. Depths in the channel are consistently greater than ten feet at mean low water. The harbor bottom slopes generally east to west, with depths of 20 to 22 feet along the western side near Goat Island and eight to ten feet along the Newport shoreline. The only concentration of shallow water in the harbor is in the southeast corner where depth is only two feet at mean low water.

The harbor entrance is clearly visible from the east passage of Narragansett Bay. The channel is both well marked and lighted, and a horn and bell indicate the north tip of Fort Adams and the south end of Goat Island respectively. Tidal currents are generally weak and variable and are not a significant concern for navigation. There are no significant obstructions in the harbor channel. Speeds are limited to five miles per hour throughout the harbor to control wakes.

The harbor is large enough to provide ample turning room for large vessels, but it is extremely crowded during the summer season. Berthing space is at a premium and it is often difficult to

find a place even for short-term berthing. The harbor is so crowded that, during special events like the tall-ships celebration, a one-way counter-clockwise circulation is imposed on boat traffic in the harbor. There is therefore a very high potential for conflicts between ferry traffic and other traffic in the harbor. If, however, the harbormaster were located at Long Wharf with the planned marine terminal, conflicts would be minimized by serious enforcement.

k. Brenton Cove

Brenton Cove is a southern extension of Newport Harbor between Fort Adams and Newport Neck. It is well protected from the west, south, and east, but is somewhat open to the north. It is a natural deep-water embayment with depths of 14 to 16 feet at mean low water. Two of the Newport Harbor sites, Fort Adams dock and Sail Newport, are located on Brenton Cove.

The entrance to Brenton Cove is the same as the entrance to Newport Harbor, but access to the cove is obtained by rounding Fort Adams and proceeding southward instead of eastward into Newport Harbor. The channel is marked for entrance into Newport Harbor instead of the cove and there are no navigation marks at the cove.

Most of the cove is occupied by moorings, but dockage is available along the west shore at Fort Adams. Abutting state-owned parkland, the cove is home to many of Newport's in-the-water boat shows and is a popular anchorage during music festivals held at Fort Adams. It is subject to five-mile-per-hour speed restrictions to control wakes. Though the cove is large enough to provide ample turning room for large vessels, crowding is a problem and there is a high potential for conflicts between ferry traffic and recreational boating in the cove. Water-taxi traffic, however, is very well tolerated.

l. Castle Hill

Castle Hill is a massive rock outcrop on the southeastern tip of Newport Neck. A narrow notch between the rock and Newport Neck provides a tiny harbor, which is home to the Castle Hill Coast Guard station. About 200 yards long and 50 to 100 yards wide, this harbor fronts directly on the east passage. It is extremely well protected from the east, south, and west by high, steep walls of natural rock and is open only to the north. There is no entrance channel per se, but the entrance can be seen from the east passage as a cleft in the rocky shoreline.

Depths outside the harbor are typically greater than 150 feet at mean low water and depth inside the harbor is about 20 feet. Ebb-tide currents outside the harbor run at velocities up to 1.4 knots and must be considered when navigating into or out of the harbor. There is no particular obstruction in the entrance or the harbor. Speed restrictions are not necessary in the harbor as it

is too small for high speeds. Little turning room is available as the harbor is so small and narrow. The harbor is not crowded, but there is a potential for conflict between ferry traffic and the Coast Guard enforcement and emergency-response operations in the cove.

04-03-05 Conanicut Island

Conanicut Island, or Jamestown as it is commonly known, is the second-largest of the islands in the bay after Aquidneck Island. Lying between the east and west passages, Conanicut has a shoreline on both. Sites are located in two harbors, Conanicut on the east and Dutch Harbor on the west.

a. Conanicut

Conanicut harbor is a broad crescent-shaped embayment on the eastern shore of Conanicut Island. Three sites there are Conanicut Marine, Jamestown Boatyard, and Clark's. It is reasonably well protected from the southwest, west, and northwest by the island, but is open to all other sides. Fronting directly on the deep water of the east passage, it does not have an actual entrance channel. It is not marked or lighted, but the lights of the Jamestown commercial center on the shoreline provide ample beacons for navigation in the area.

Tidal currents are generally less than one knot and are not a serious concern for navigation in the harbor. All of the harbor is clearly visible from the east passage anywhere north of Bull Point. The harbor bottom generally slopes from west to east, with depths of six to ten feet along the shoreline and 25 to 30 feet offshore. There are no particular obstructions to entering the harbor and no posted speed restrictions except immediately proximate to the docks, wharves, and piers along the shore.

The broad embayment provides ample turning room for almost any size vessel. In fact, Conanicut was one terminus of the Jamestown-Newport ferry service prior to construction of the Newport Bridge. The harbor is a popular mooring and anchorage and, though not as crowded as Newport, supports a large number of recreational and fishing craft. Conflicts between ferry traffic and recreational boats are unlikely, however, because of the broad and open nature of the harbor.

b. Dutch Harbor

Dutch Harbor is a large embayment on the west shore of Conanicut Island, between Conanicut Island and Dutch Island. Over a mile long and about half a mile wide, the harbor is a natural

deep-water port. Depths range from 35 to 40 feet along the Dutch Island shore to 10 to 15 feet along the Conanicut Shore. The harbor is protected from the west by Conanicut, from the south by Beaver Head and Fox Hill, and from the west by Dutch Island. It is open to the northwest and moderately exposed to the southwest.

Fronting directly on the west passage of Narragansett Bay, it is easily accessible either north of or south of Dutch Island. The northern approach is unmarked, but is over half a mile wide and typically 20 feet deep at mean low water so that it is easily navigated. The southern approach is only about 0.3 mile wide and is reasonably well marked by navigation bouys, a light, and a gong. The south channel is much deeper than the north channel, with depths ranging from 30 to 45 feet at mean low water.

Maximum tidal current velocities through the south approach are 1.2 to 1.4 knots but, because of the width of the channel, they are not a significant concern for navigation into and out of the harbor. There are no posted speed restrictions in the harbor except in immediate proximity to the moorings and piers along the eastern shore. Obstructions are limited to rocks along the shoreline and a wreck in the southeast corner of the harbor, all of which are easily avoided.

The wide, broad harbor provides ample turning room for most vessels. Berthing space is limited to the Dutch Harbor Boatyard, but the harbor is a very popular day anchorage in the summer. It is frequently crowded with recreational boats at anchor during daylight hours. This may lead to conflicts between ferry traffic and recreational boats.

04-03-06 Prudence Island

Prudence Island is the bay's third largest island, after Aquidneck Island and Conanicut Island. Inaccessible except by water, the island is reached by ferries that run between Bristol Harbor and Homestead and between Sandy Point and Portsmouth. There are three sites on the island–Homestead, Sandy Point, and the Navy Pier.

a. Homestead

Homestead is located on the northeastern shore of the largest part of Prudence Island. As its name implies, it is home to the largest concentration of residential development on the island. There is really no harbor at Homestead, which fronts directly on the east passage just north of the start of the Providence entrance channel. The landing there is exposed to the weather from all directions except the southeast and is sometimes inaccessible in bad weather.

It is reached directly from the east passage where water depths are 40 to 45 feet at mean low water. It is a prominent location on the island and is clearly visible from the east passage. Shoals northeast of Homestead and numerous rocks along the shoreline are the only obstructions to safe passage. No speed restrictions are applicable in the area.

Lacking any enclosed harbor, Homestead provides ample turning room for most large vessels. Berthing space is very limited but, because it is so open and unprotected, the landing is not particularly crowded. Local boaters are accustomed to ferry and heavy-ship traffic using the Providence entrance channel so that the potential for conflicts between ferries and recreational boats is limited. Ferries approaching Homestead from the east must cross the Providence shipping channel, so that there could be some conflict between ferries and channel shipping.

b. Sandy Point

Sandy Point is on the east shore of Prudence Island south of Homestead. It is one terminus of the ferry between Portsmouth and Prudence Island. It shares many of the characteristics of Homestead as described above, in that it is poorly protected and fronts directly on the Providence entrance channel. It is marked by a lighthouse with a flashing green light and a fog horn. Tidal currents are generally less than one knot and do not significantly affect navigation in the area.

The point is a prominent sand spit projecting from the island's eastern shore so that it is a recognizable landmark from the shipping channel. Care must be taken when approaching the landing to avoid shifting sand and shoals around Sandy Point. There are no speed restrictions applicable, turning room is adequate for most vessels, and the potential for marine conflicts is the same as that described for Homestead above.

c. Navy Pier

The Navy Pier is located on the southeastern tip of Prudence Island. It is a vestige of the days when Prudence Island was used for ammunition storage by the U.S. Navy. It is T-shaped and extends about 300 yards out from the shore into the east passage. It is exposed to the south but the north branch of the T forms a small, well protected harbor to the north. This harbor is only a few hundred yards square and fronts directly on the east passage.

Access is therefore easily obtained directly from the east passage. The pier is a prominent landmark and can be seen from a considerable distance. Shoals north and south of it are marked but not lighted. Tidal currents are generally less than one knot and do not interfere with navigation at the pier. Maximum water depth at the pier end is about 35 feet, shoaling to 25 feet

behind the pier. The bottom of the small, protected cove slopes away from shore steeply from shoals along the stony beach to 25 feet of water just a few hundred feet from shore.

The only obstruction at the pier site is a rock north of the pier near the shore. This rock is marked by a can and entrance to the protected anchorage is obtained by passing between the can and the pier. No speed restrictions are applicable in the vicinity of the pier. Ample turning room is available at the pier end, but the small cove north of the pier provides only limited turning room. The pier is a popular landing spot for fisherman and for tourists visiting the island and is also directly proximate to the main shipping channel. There is some potential for conflicts between ferry traffic, recreational boats, and heavy shipping at the site.

04-03-07 Sakonnet River

The Sakonnet River, between Aquidneck Island and Tiverton/Little Compton, is a third passage into Narragansett Bay. Its name is misleading as it is not a typical river, but a tidal passage between Aquidneck Island and the mainland to the east. Its northern end opens into Mount Hope Bay and its southern end into Rhode Island Sound. Over most of its length (about ten miles), it is more than a mile wide. However, the northernmost two miles are only about 500 to 700 feet wide and are further constricted by bridge piers and causeways. Sites are located at the northern end of the river (upper Sakonnet) in Portsmouth and Tiverton and at the southern end of the river (lower Sakonnet) at Sakonnet Point.

a. Upper Sakonnet

The upper Sakonnet River is a relatively narrow channel between Portsmouth and Tiverton. Sites in the upper river include marinas at Brewers, Lighthouse, Pirate Cove, and Stone Bridge in Portsmouth and Riverside, Shannon, Anthony Point, and Standish Boatyards on the Tiverton Shore. Bridge piers at the northern and southern end of the upper river form a well protected harbor between Almy Point, Hummock Point, and the Tiverton shore.

Constricted by the bridge piers and causeways, the upper Sakonnet is subject to swift tidal currents with velocities up to 2.7 knots. These currents are an important consideration when navigating through the channel and into any of the sites under consideration. The channel can be entered from either the north or south. From either direction it is necessary to pass through the bridge openings to enter the harbor itself.

From the north, passage must be made through a railroad swing bridge and a highway bridge that carries Route 138/24 across the river. The railroad swing bridge has a vertical clearance of only

12 feet when closed, but is no longer used and is kept in the open position. It has a horizontal clearance of 99 feet in the open position. The highway bridge is a fixed bridge with a vertical clearance of 65 feet for a center span width of 172 feet. Of the two, the railroad bridge is the more difficult to navigate because of its smaller clearances. There is a Coast Guard order to remove the bridge because of its effects upon navigation.

From the south, passage must be made between the approach causeways of the Old Stone Bridge, remnants of a bridge that once connected Portsmouth and Tiverton. The bridge was destroyed in the 1938 hurricane and not replaced, but the causeways remain, constricting the channel to a width of only a few hundred yards.

The river passage is well marked and there is a light and bell at the north entrance. Tidal scouring has resulted in depths ranging from 30 to 40 feet at mean low water though the river shoals to about 25 feet in the vicinity of the bridges. The entrance is easily visible from most of Mount Hope Bay and from the lower Sakonnet. There are no applicable speed restrictions except close to the wharves and piers along the shoreline. There is adequate turning room available within the basin, but tidal currents must be considered when planning turning moves in the channel. The basin is crowded with recreational craft and, because it is so narrow and its tidal currents so swift, there is a high potential for conflicts between ferries and recreational boating in the basin.

b. Sakonnet Harbor

At the south end of the Sakonnet River, the river is over two miles wide and fronts directly on Rhode Island Sound. Sakonnet Harbor is located just north of the southern tip of Sakonnet Point. It is a small harbor, only a few hundred feet square. It is protected from the south by Sakonnet Point, from the east by the mainland of Little Compton and from the west by a man-made breakwater. It is open to the north.

Fronting onto the lower Sakonnet River, it is the only safe harbor on the eastern shore of the river south of Tiverton. It has been dredged to a uniform depth of seven feet at mean low water. The entrance is marked by a flashing light on the end of the breakwater and is easily visible from Rhode Island Sound and from the river. There are numerous obstructions south of the harbor along Sakonnet Point. The point ends in a broad shoal studded with rocks. These rocks are routinely pounded by heavy surf so that navigation around the point is dangerous. As a result, most pilots avoid the area, giving a wide berth to the bell and lighthouse that mark the shoals.

Speeds within the harbor are limited to five miles per hour to control wakes. The harbor is small and crowded and provides little turning room but the entrance is wide enough so that there is a low potential for conflicts between ferry traffic and other boats in the harbor.

04-03-08 Point Judith Pond

Point Judith Pond is a very large salt pond between Narragansett and South Kingstown. About six miles long north to south and typically about two miles wide east to west, it is well protected behind Point Judith Neck to the east and the beaches to the south. Because it is so well protected with excellent access to deep water, it is the center of Rhode Island's commercial and recreational fishing industry.

Entrance to the pond is obtained from the Point Judith Harbor of Refuge via a narrow breachway through the beaches between Jerusalem and Galilee. Tidal current velocity in the breachway routinely exceeds two knots and must be considered in entering the pond. Once within the pond, the channel divides into an east fork and west fork. The east fork provides access to the Port of Galilee. The west fork provides access to the rest of the pond.

Some segments of the channel are dredged and some are naturally deep enough for navigation. Depths in the dredged channel at mean low water range from about 11 feet at the entrance channel and east fork, and eight to ten in the west fork, to five or six feet at the north end of the pond. The dredged channel is well marked and the natural channel is easy to navigate as it more or less parallels the west shore of the pond. The channel entrance is marked in the Harbor of Refuge by a light and horn on the end of the man-made breakwater that protects the harbor.

Point Judith Pond contains a number of small harbors and basins. These include sites in the port of Galilee in Narragansett, Jerusalem, and Snug Harbor in South Kingstown and the upper pond in Wakefield.

a. Galilee

Galilee is the largest fishing port in Rhode Island and is one terminus of the ferry route to Block Island. It is located immediately inside the breachway on the east shore of the pond. It is accessed via the breachway and east branch channel. The east branch ranges from 150 to 250 feet wide. It provides access to a large number of piers and wharves, including Rhode Island Engine, the State Pier, and Wilcox Marine.

Speed within the east fork is restricted to five miles per hour to control wakes. The channel width provides adequate-but-not-ample turning room for most vessels. Galilee is a crowded commercial and recreational fishing port accessible only by a narrow channel so that there is a significant potential for conflicts between ferry service and fishing vessels.

b. Jerusalem

Jerusalem is located immediately inside the breachway on the west shore of the pond. It is smaller than the port of Galilee, but is also a crowded fishing port. The State Pier, Skip's Dock, Jim's Dock, and Cap'n Jack are sites in Jerusalem. Accessed from the west fork of the channel, Jerusalem has less berthing space than Galilee. It fronts directly on the west fork of the channel. The channel is only about 100 feet wide at Jerusalem and provides little turning area and limited room for vessels to maneuver. There is a high potential for conflicts between ferries and other traffic in the breachway and west fork of the channel at Jerusalem.

c. Snug Harbor

Snug Harbor is located north of Jerusalem on the west shore of the pond. The channel between Jerusalem and Snug Harbor is 200 to 300 feet wide and is naturally eight to ten feet deep at mean low water. Sites in Snug Harbor include the Salt Pond Marine Railway, Ocean State Marine Railway, Point Judith Marine, Snug Harbor Marine, and Kenport Marine.

Snug Harbor, like Jerusalem and Galilee, is a busy fishing port. It is about half a mile from the breachway in a well protected area. Speed is restricted to control wakes. The natural channel provides ample turning room for vessels drawing less than eight feet. Because the channel is wider, there is less potential for conflict between ferry traffic and other boats except, of course, at the breachway where traffic congestion is common to all sites on Point Judith Pond.

d. Upper Pond

The upper pond is just south of Route 1 in Wakefield. Accessing it requires navigating the full length of the pond. Sites in the upper pond include Stone Cove, Marina Bay, Ram Point Boatyard, Silver Spring Boatyard, and Billington Cove. The entrance to the northern end of the upper pond is obtained through a ╝-shaped passage between Short Point off the mainland and Betty Hull Point on Foddering Place. This passage is known as the narrows. As the name implies, the channel there narrows to under 100 yards and turns sharply at the entrance to the upper pond.

The channel is well marked but not lighted. The entrance is visible from the north end of Point Judith Pond and tidal currents are light and variable. Obstructions are numerous and larger vessels must stay within the marked channel to avoid shoals and rocks around the narrows. Speed is restricted to five miles per hour to control wakes.

There is a turning basin, about 400 feet square, which has been dredged to a depth of five feet at the head of the harbor. This provides adequate-if-not-ample turning room for most vessels. Because the channel is narrow and the turning basin is small, there is a potential for conflicts between ferries and other traffic in the upper pond.

04-03-10 Pawcatuck River

The Pawcatuck River forms the boundary between Rhode Island and Connecticut. In the extreme southwest corner of Rhode Island, it is a tidal water body fronting on Little Narragansett Bay. It is separated from Block Island Sound by Napatree Beach, Napatree Point, and Sandy Point. Entrance to the river channel is obtained northwest of Sandy Point through Stonington, Connecticut. The trip from Watch Hill Point on Block Island Sound around Napatree Point and Sandy Point to the entrance to the Pawcatuck is a full five miles, three northwestward to Stonington and another two back to Westerly.

Currents through the passage between Napatree Point and Fishers Island can exceed three knots and must be considered when navigating outside of Little Narragansett Bay. Shifting sand banks around Napatree Point and Sandy Point are also obstacles to be considered in entering the river. The river entrance can clearly be seen from Fishers Island Sound between the two points, but is not accessible by that route.

The channel from Stonington up into the Pawcatuck River is about 100 feet wide, ten feet deep, and five miles long. Sites along the Pawcatuck include River Bend Boatyard, Westerly Marina, Cardone Marine, Pier 65 Marina, Frank Hall Boatyard, Avondale Boatyard, and Watch Hill Boatyard. All these sites are located along the river's east shore in Westerly.

Speed restrictions apply only in the immediate vicinity of the wharves and piers along the shoreline. Though the channel is narrow, there is adequate turning room in the river for most small craft. The river is often crowded with recreational boaters and, because of the long and narrow access channel, there is a potential for conflicts between ferry traffic and recreational boating in the channel.

04-03-11 Block Island (New Shoreham)

Located about 12 miles off shore, Block Island is accessible only by boat or airplane. It has about 800 year-round residents according to the 1990 census, but it is one of Rhode Island's major tourist attractions. Tourist trips account for most of the ferry traffic to and from the island. There are two harbors on Block Island that are suitable for ferry service, Old Harborer and New Harbor.

a. Old Harbor

Old Harbor is located on the east shore of the island near the commercial center of New Shoreham. It is a natural indentation on the rocky shore that has been dredged out and protected by two long breakwaters. The harbor supports the only year-round ferry service to the island. It is reached directly from Rhode Island Sound by passage between the two breakwaters. Lights on the ends of the breakwaters are clearly visible from Rhode Island Sound anywhere east of the island. There are no obstructions to the harbor entrance but the shoreline north and south of the harbor is strewn with boulders and cannot be safely approached from the water. The harbor is well protected by the breakwaters except in severe northeast gales.

Old Harbor is a tiny, protected area, only about a thousand square feet, which is crowded with moorings, making it essential for ferries to remain within the internal navigation channel and severely constraining turning and maneuvering room. Speed within the harbor is restricted to 5 miles per hour to control wakes. The small size, combined with heavy traffic in the harbor, leads to a high potential for conflicts between ferries and recreational and fishing craft.

b. New Harbor

Built in large part to help the island overcome the limitations of Old Harbor, New Harbor was constructed by dredging a breachway through the barrier beach at Harbor Neck and into the Great Salt Pond. Located at about the middle of the west shore of the island, the breachway is about 300 feet wide, 2,000 feet long, and 20 feet deep. It is well lighted and marked and is readily visible from Block Island Sound. Great Salt Pond is well protected coastal estuary with a surface area of about one square mile and depths of up to 51 feet. Possible ferry landing sites within the pond include the boat basin, Champlain's Marina, Payne's Dock, Smuggler's Cove, and the Coast Guard station. All of these are easily accessible from within Great Salt Pond. New Harbor presently accommodates seasonal ferry service from New London, Connecticut and from Point Judith, Rhode Island. While the harbor has ample turning and maneuvering room, it is seasonally crowded with recreational and fishing vessel and there is a high potential for conflicts between ferries and other vessels.

04-04 WEATHER CONDITIONS

Weather has several effects on waterborne transportation, including influences on navigation, berthing, loading and unloading of passengers, passenger comfort, and ridership. To be competitive, waterborne passenger transportation must be able to provide reliable, year-round service in all kinds of weather. There are three types of weather conditions that have the potential to influence ferry operations–fog, freezing temperatures, and wind/sea state.

04-04-01 Fog

Fog is formed by water droplets that condense as air is cooled to temperatures approaching the dew point. Fog is common in Narragansett Bay and Rhode Island Sound when water temperatures are cool, the relative humidity is high, nights are long, and winds are light. Fog that is light and patchy does not significantly impede the operation of modern ferries equipped with radar. However, vessel safety and headway requirements can be influenced by heavy fog, resulting in lower operating speeds and longer travel times.

National Weather Service records indicate that heavy fog, defined as fog resulting in visibility of one-quarter mile or less, occurs in Narragansett Bay an average of about two to three days per month. It is therefore reasonable to assume that heavy fog will affect waterborne passenger transportation service by lowering vehicle speeds and increasing travel times a few times each month during the year. In essence, heavy fog will affect ferry service in much the same way as it affects air traffic–it will cause occasional delays and some inconvenience to riders.

04-04-02 Freezing Temperatures

Freezing temperatures, by themselves, are not an impediment to waterborne transportation. However, icing of channels, harbors, and berthing areas caused by freezing temperatures can have adverse impacts on waterborne transportation. Modern passenger ferries built for speed tend to be relatively light craft that are not well suited to operation in ice. National Weather Service records indicate that freezing temperatures, less than 32°F, occur on about 100 days per year in Rhode Island. But one day of such temperatures is normally not sufficient to lead to significant icing in Narragansett Bay channels and harbors. Freezing salt water requires temperatures colder than 32°F or several consecutive days of below-freezing temperatures. Temperatures less than 0°F occur in Rhode Island on an average of less than one day per year. Even when channels and harbors become frozen, reinforced-hull vessels (ice breakers) can

normally be used to open passages along critical routes. Experience in Narragansett Bay and Rhode Island Sound suggests that freezing may interfere with ferry operations once or twice a year on the average.

04-04-03 Wind and Sea States

High wind velocities can make navigation difficult by roiling the surface of the water, contributing to passenger discomfort, causing motion sickness, and necessitating reduced operating speeds. Wind speed and sea states are characterized by the U.S. Coast Guard on the basis of potential to disrupt boating activities. Wind and resulting sea states are likely to affect waterborne passenger transportation operations in Rhode Island as follows:

Small Craft Advisories are issued for wind speeds in excess of 22 knots. These are not likely to interfere with operations of most vessels, though smaller vessels may require reduced operating speeds on occasion, and some increased passenger discomfort may result. Most operators are likely to continue service in small-craft-advisory winds. These winds occur frequently in Rhode Island, but are more of an inconvenience than an impediment.

Gale Warnings are issued for wind speeds in excess of 33 knots. These winds can interfere with operations of smaller vessels as described above and will cause interruptions in service for most smaller vessels, especially water taxis. Services that continue operations in gale-force winds can expect longer travel times, lower levels of ridership, and high levels of passenger discomfort.

Storm Warnings are issued for wind speeds in excess of 55 knots. Storm winds are likely to cause interruption of service for most vessel types, compelling riders to seek alternate transportation. Few services will continue operations in storm-force winds.

Hurricane Warnings, issued for winds over 64 knots, are likely to result in curtailment of all service and, in many instances, result in business closings and other more serious disruptions unrelated to waterborne transportation.

04-04-04 Summary of Constraints created by Weather Conditions

Weather conditions in Narragansett Bay and Rhode Island Sound are such that there will be periodic inconvenience of passengers and occasional interruptions in service due to freezing or high wind and sea states and occasional delays as a result of fog. The frequency of occurance is likely to be about the same for passenger ferries as for aircraft operation in the state. Bad

weather is not likely to threaten the viability of waterborne passenger transportation on the routes under consideration in this plan.