Memo

Date:	Tuesday, June 23, 2015
Project:	NHDOT 16127 New Castle-Rye Bridge Project
To:	Mr. Chris Bisignano, P.E. Commander, First Coast Guard District First Coast Guard District Battery Park Building, Room 301 One South Street New York, NY 10004-1466
From:	L. Robert Landry, Jr., P.E. Chief of Consultant Section, Bureau of Bridge Design New Hampshire Department of Transportation
Subject:	Navigational Report

Applicant Information

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Background

This memorandum is intended to provide technical information regarding the navigation of vessels using the waterway at the bridge crossing of NH Route 1B over Little Harbor between Rye and New Castle, New Hampshire, and the justification of constructing a fixed bridge at this site as a replacement option for the existing bascule bridge.

Purpose

The purpose of this memorandum is to:

1. Provide a project overview.
2. Summarize the characteristics of the waterways upstream, downstream and within the project area.
3. Identify the users of the Little Harbor and the Back Channel, Northward, Channel and Sagamore Creek.
4. Discuss potential impacts and improvements to navigation (navigation needs assessment) at the proposed bridge.
5. Provide a draft Navigational Survey (see Appendix 1 for proposed recipients and Appendix 2 for proposed Survey) for comment.

A separate technical memorandum will be prepared with the analysis of the survey responses when received.

Project Overview

Purpose and Need

The purpose of this project is to provide a safe, functional and efficient crossing between New Castle, NH and Rye, NH, that serves the needs for highway, pedestrian and marine traffic. The need for this project is to replace the existing bridge carrying NH 1B/Wentworth Road between Rye, NH and New Castle, NH over the mouth of the Little Harbor. This existing structure is functionally obsolete due to the roadway geometry over the bridge and structurally deficient; it is also has significant deterioration throughout. Under condition ratings in the Federal Highway Administration Recording and Coding Guide for the Structure Inventory and Appraisal of the Nation's Bridges Report, both the superstructure and substructure have a condition rating of "Serious". A load rating of the structure performed in 2011 determined that the bridge requires a 15-ton posting, which is the current posting.

Description of Existing Bridge

The existing bridge carries two lanes, one in each direction, over a six-span structure consisting of five steel stringer approach spans and a single-leaf bascule-lift span. The bridge serves the towns of New Castle and Rye, and is one of only two roadways onto New Castle Island. The subject bridge is located at the southwest corner of New Castle. The other bridge servicing New Castle is located at the northwest corner of the island.

The navigable channel is perpendicular to the bridge piers and is located beneath the bascule span. The channel has documented clearances of 29 feet horizontally and 13 feet vertically with the bascule span closed. The vertical clearance is approximately 65 feet vertically when the bridge is in the open position. The clearance is restricted by overhead electric and fiber optic utility lines that run parallel to the bridge to the west, and are supported independent of the bridge on timber poles.

Project Description

The New Hampshire Department of Transportation performed an intensive alternatives analysis from 2012 through 2015. The process evaluated five alternatives: Major Bridge Rehabilitation, Replacement with 6'-3" Raised Profile Fixed Bridge, Replacement with Bascule Bridge, Replacement with a Fixed Bridge, and Replacement Off-Alignment with Bascule Bridge.

Two alternatives, Replacement with 6'-3" Raised Profile Fixed Bridge, Replacement Off-Alignment with Bascule Bridge, were dismissed due to unreasonable environmental impact, right-of-way impacts, and cost. Major Bridge Rehabilitation was dismissed because of the structural and functional obsolescence of the structure. The remaining options to consider were the Replacement with a Bascule Bridge and Replacement with a Fixed Bridge. These two options were compared in a Benefit-Cost Analysis (BCA) which is summarized below, along with the recommended alternative.

Summary of the Benefit-Cost Analysis and Alternative Recommendation

The BCA examined in detail the costs and benefits of each of the two alternatives under consideration; replacement with a bascule bridge and replacement with a fixed bridge. Each of the two alternatives maintains the existing profile. See Appendix 6 for the full Benefit-Cost Analysis. Initial capital costs, as well as life-cycle maintenance costs, were analyzed for each alternative. The analysis documented that the bascule bridge would cost approximately $15.6 million to construct while the fixed bridge would cost approximately $7 million. The total life cycle costs associated with the bascule bridge would be approximately $17.6 million and the total life cycle costs associated with a fixed bridge would be approximately $7.7 million. Costs associated with the bascule span pier construction, mechanical and electrical systems, and the maintenance of the systems and operation costs, were the principal reasons for the $9.9 million difference in life cycle costs. The BCA also looked at such issues as property values, traffic impacts, safe harbor, commercial fishing, tourist revenue, boat-related economic activity, climate change resiliency, dredging costs, and noise. The study concluded that many of the potential benefits of the bascule bridge – including safe harbor, increased commercial fishing, tourist revenue, and boat-related economic activity – were not quantifiable. Due to the cost differential between the two alternatives, the fact that the benefits of the bascule bridge weren't quantifiable, and the fact that the existing bridge is only opened three times per year on average for boat traffic, the study recommended NHDOT carry forward the Fixed Bridge Alternative.

New Bridge Features

The proposed project includes the replacement of the existing movable bascule bridge with a fixed bridge structure. The new structure will be supported by abutments at each end and by three piers founded on six drilled shafts in the waterway (two drilled shafts per pier). In addition, a fender system will be installed under the bridge. The new bridge will have wider roadway with wider shoulders and an asphalt wearing surface. Both of these features will improve safety for pedestrians and motorists. In addition, the sidewalk on the proposed bridge will be located on the east side of the structure so that pedestrians will not have to cross the roadway to use the sidewalk on the bridge. See Appendix 5 for preliminary bridge plans.

The proposed fixed bridge increases horizontal clearances from the existing 29'-3" to 51'-6". The underclearance of the proposed bridge is 14'-0", which is greater than the 13'-0" on the existing bridge, when it was in the closed position. Because the existing bascule bridge lifted an average of only three times per year, these clearances will serve as an improvement for the majority of vessels that cross under the bridge.

The hydraulic opening of the proposed bridge is to be affected as minimally as is practical with the expected change in area anticipated to be within 1% of the current hydraulic opening. A change of 1% is likely to have a negligible impact on the hydraulic conditions at the bridge site. A hydraulic analysis will be performed in final design to confirm this assumption.

Existing and Proposed Vertical and Horizontal Clearances

Bridge Dimensions and Clearances

	Existing Bridge	**Proposed Bridge**
Bridge Location	43° 03' 30", 70° 43' 45"	-
Mean High Water (MHW)	EL 3.98	-
Mean Higher High Water (MHHW)	EL 4.41	-
Mean Low Water (MLW)	EL -4.65	-
Mean Lower Low Water (MLLW)	EL -4.99	-
Vertical Clearance (open)	-	N/A
Vertical Clearance (closed)	13 ft. at MHW	14 ft. at MHW
Horizontal Clearance Normal to Channel	29'-3"	51'-6"
Length of Bridge	253 feet	272 ft.
Width of Bridge (at Piers)	32'-10"	38' – 6" to 49' - 6"
Depth of Waterway at MHW	15 feet	-
Depth of Waterway at MLLW	6 feet	-
Federal Channel depth (relative to MLLW)	6 feet	-
Width of the River at this location	75 feet	-

*All elevations are relative to the NAVD 1988 datum.
**Channel depths from Surveys by the Army Corp of Engineers to 2012 as presented in NOAA Chart 13283.

Funding
The proposed bridge replacement project is slated to receive funds from the Federal Aid Transportation Funding Program.

Bridge Removal Limits

Superstructure
The existing superstructure will be completely removed. Demolition of the superstructure will be sequenced to occur after construction of the proposed drilled shaft foundations for the new bridge. The existing superstructure will be demolished piecemeal with equipment placed on barges and/or on land.

Substructure
The existing substructure will be partially removed. The north and south abutments will be removed to just below the ground line leaving the buried portion of the abutments in place. The

steel piers and bents will be demolished to 4 feet below the mudline, except for two piles. These piles will be removed completely, as they will conflict with the new fender system.

The removal of the substructure to 4 feet below the mudline will not restrict future navigation on the channel, unless the channel is to be significantly enlarged beyond its current dimensions. There are no economic interests that would require and promote such an undertaking and the feasibility of such a project has not been explored.

Construction Activities and Impacts

Construction of the replacement bridge between Rye and New Castle is scheduled to begin on November 15, 2017 and will begin with construction of the drilled shaft foundations for the piers, outside the footprint of the existing bridge. The bridge will remain open to traffic during this time and it is anticipated that work will be conducted from barges and temporary platforms. To construct the shafts and columns, one of two methods of construction may be utilized. The preferred method is to drive a temporary casing to keep the hole open and free of sea water, drill the shaft and rock socket, install the rebar cage, and pour the concrete for the shaft in a single pour. An alternative method is to use an 11 foot diameter steel casing for use as a cofferdam, around each shaft, dewater, and construct the shaft within the cofferdam. The proposed drilled shafts and columns will be installed outside of the existing navigable channel.

Beginning January 1, 2018 the bridge will closed to all traffic for a 3 month construction window ending on April 1, 2018. During this window, the exiting structure will be demolished and the bridge superstructure and substructure construction completed. Work will begin with demolition of the existing steel superstructure.

Once removed, the existing piers will be demolished, precast concrete caps will be placed on top of the completed drilled shaft and columns, and construction of the new abutments will commence. Each of these three activities may proceed at the same time, providing construction is coordinated. Piles for the exiting piers will be demolished to 4’ below the mudline by partially pulling, cutting, and re-driving the piles. Two piles will be removed completely, as they would conflict with the new fender system.

Following completion of substructure and foundation elements and demolition of the existing piers, superstructure construction will begin. Precast concrete NEXT beams will be lifted into place, one span at a time working from either abutment, so that each completed span can serve as a laydown area for the next span. Following placement of the NEXT beams, closure pours, end diaphragms, and deck closure pours will be made for continuity. After placement of the NEXT beams, precast curbs, sidewalk, bridge railings, expansion joints, waterproofing membrane, and hot mix asphalt wearing surface will need to be installed before the roadway can reopen.

The fender system and precast retaining walls along the west side of the roadway approaches would also be constructed during this period. After to the April 1, 2018 deadline, the roadway will reopen to traffic. Single lane closures with traffic control for alternating one-way traffic will be utilized to reconstruct the approach roadways, and to complete punch list items as necessary.

The proposed channel closure is similar to the roadway closure: January 1 to April 1 of 2018. Since access to the Back Channel can be gained through NH Route 1B/ New Castle Avenue Bridge between Shapleigh Island and Goat Island, this would not restrict access to Sagamore Creek nor the Back Channel, but it would require vessels to take an alternate route. The current bridge only lifts for vessels between April 1 and October 31, so construction will not impact lifting operations.

Environmental Summary

The lead federal agency for the National Environmental Policy Act (NEPA) compliance phase of the project is the Federal Highway Administration (FHWA), New Hampshire Division. The proposed bridge project will be reviewed with an Environmental Assessment (EA). A Wetland Delineation Report has been prepared, and a draft Biological Assessment and Essential Fish Habitat checklist are currently under review by the National Oceanic and Atmospheric Administration (NOAA). In addition, field surveys for eel grass beds and land-side listed species were conducted on the site. A draft Environmental Assessment is also under development. These documents will be finalized during the final design phase of the project.

Other federal agencies with jurisdiction over this project are the United States Army Corp of Engineers (USACE), NOAA, U.S. Environmental Protection Agency, and the U.S. Fish and Wildlife Service.

The types of permits and approvals required for this project are environmental review under NEPA, NH Wetlands Permit, NH Shoreland Permit, NH Section 401 Water Quality Certification, USACE Alteration of Terrain Permit, USACE Section 404 and 408 approvals, U.S. EPA 2012 Construction General Permit for Stormwater Discharges, Coastal Zone Management Consistency Certification, and Section 106 and Section 4(f) compliance. These permits and approvals will be completed during the final design phase of the project.

Waterway Characteristics

Summary of Waterway Characteristics

Near the mouth of the Piscataqua River, the river splits into two channels separated by New Castle Island. The main channel bends around New Castle Island to the north and serves as the deep water entrance into Portsmouth Harbor for freight and commercial traffic. To the south of New Castle Island, the waterway is comprised of Little Harbor, Back Channel, and Northward Channel. The bridge from New Castle into Rye crosses Back Channel, east of Blunts Island and upstream of the entrance Little Harbor. The channel is oriented northwest to southeast, bending northward upstream of the bridge eastward downstream.

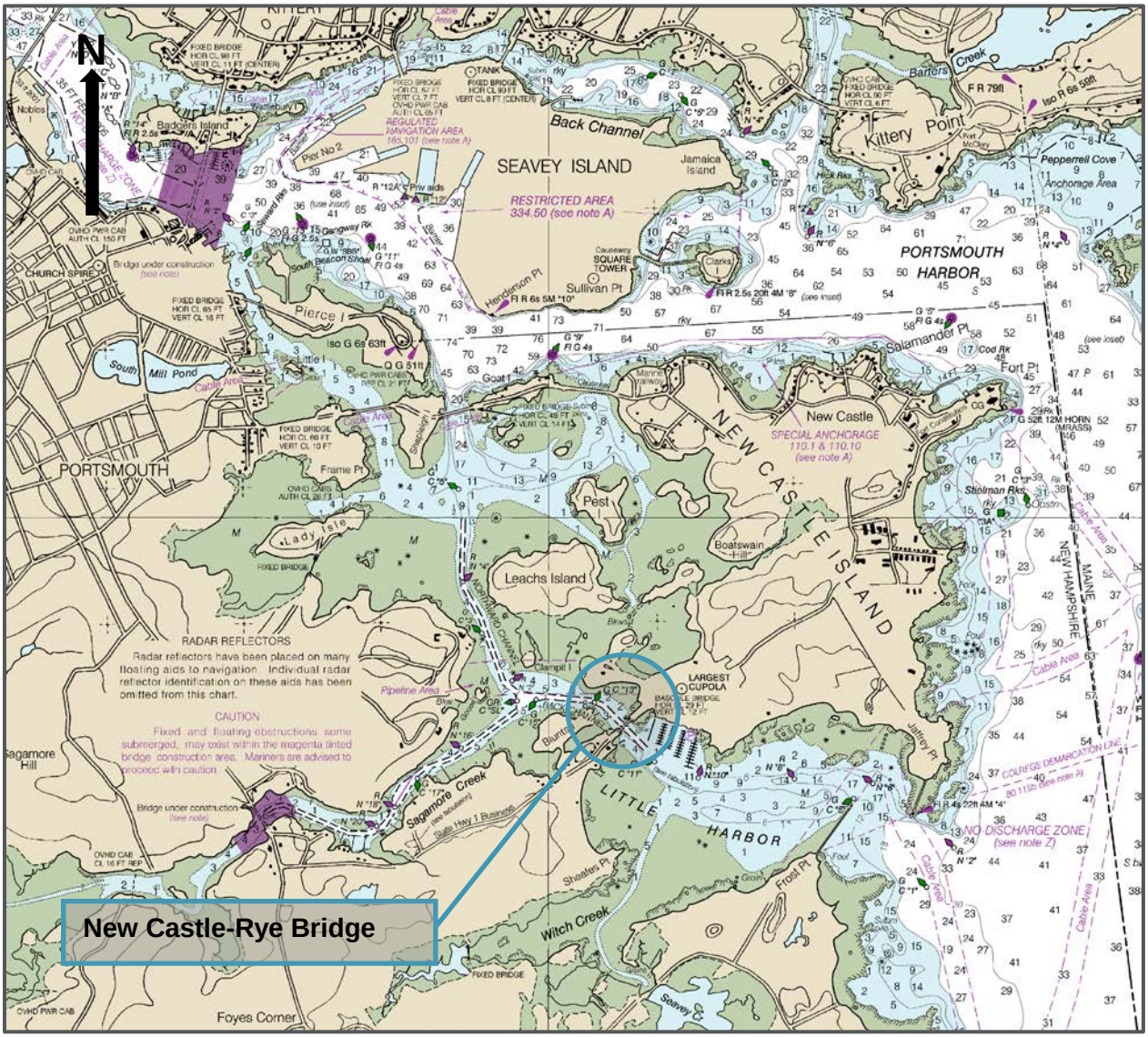
The entrance to little harbor has a charted depth of 17 feet at Mean Lower Low Water (MLLW) at its entrance between Jaffrey Point and Frost Point. Jetties extending from each point serve as breakwaters to the entrance of Little Harbor. Little Harbor consist of a narrow channel that bends slightly in a reverse curve as winds upstream toward the bridge. This bend is located within one half mile of the bridge site. On the New Castle shore is Wentworth by the Sea Marina. To the south is Witch Creek flows into Little Harbor and has a charted depth of 1 foot at MLLW.

From the bridge site northwest through the Back Channel, the channel remains narrow and shallow. Within one half mile upstream of the bridge site the channel bends as it rounds the northeast side of Blunts Island. North of Blunts Island the Back Channel ends at the convergence of the Northward Channel and Sagamore Creek. Sagamore Creek flows from the southwest and hosts The Freedom Boat Club, Witch Cove Marina, as well as number of private docks and public moorings. The Northward Channel is oriented north to south and provides access the waters surrounding Leach's Island, Pest Island, Goat Island, Shapleigh Island, Frame Point, and Lady Isle. Public moorings are located to the south of Goat Island (Goat Back) and south of Pierce Island. The water depths surrounding the islands vary from intertidal zones to a charted depth of 13 feet at MLLW. Sagamore Creek, Back Channel, and Northward Channel, are all waterways that are maintained by the US Army Core of Engineers and have been periodically dredged to maintain the channel.

From the Northward Channel, passage to the main channel of the Piscataqua River can be made by either passing beneath a bridge between Shapleigh and Goat Islands or by passing beneath two bridges and navigating the channel to the west of Pierce Island. Both channels are narrow and shallow and are traversed by fixed span bridges with charted clearances summarized in Table 2.

Dredging of the Back Channel is planned as part of the congressionally authorized Federal Navigation Project, but funding has not yet been authorized. The 2013 Annual Dredge Report by the Pease Development Authority Division of Ports & Harbors states that the USACE estimates the dredging would cost approximately $750,000. This estimate assumes the current bridge will be in place. Correspondence with the USACE indicates that both a fixed and bascule bridge would improve access for dredging, as both alternatives widen the horizontal clearances of the waterway.

Figure 1: Bridge Location and Surrounding Waterways



*Information presented above in Figure 1 is from NOAA Chart No. 13283, Portsmouth Harbor – Cape Neddick to Isles of Shoals (3/30/2015).

Table 1: U.S. Army Corps of Engineers Maintained Channels
Back Channel, Northward Channel, and Sagamore Creek

Name of Channel	**Depth at MLLW** (feet)	**Date of Survey**	**Project Dimensions**		
			Width (feet)	Length (NM)	Depth (feet)
Portsmouth Harbor					
Back Channel	6.0	12/12	75	0.30	6
Confluence Area	2.0 (See Note A)	12/12	Area = 1.63 Acres		6
Northward Channel – Confluence to Buoy 4	4.7 (See Note B)	12/12	75-60	0.16	
Northward Channel – Buoy 4 to End of Channel	6.0	12/12	60	0.15	6
Sagamore Creek					
Confluence Area to Buoy 16	3.9	12/12	60	0.16	6
Buoy 20 to End of Channel	5.0 (See Note C)	12/12	60-80	0.30	6
Anchorage	6.0	12/12	Area = 1.63 Acres		6

Note A: Shoaling located 280 ft. west of Buoy 15 in southern half portion of confluence limit; 6.0 ft. available in the northern portion.
Note B: Shoaling within 5 feet along the north limit between Buoy RN-18 and RN-20; Six feet available elsewhere.
Note C: Encroachment by floats and piles of Witch Cove Marina.

*Information presented above in Table 1 is from NOAA Chart No. 13283, Portsmouth Harbor – Cape Neddick to Isles of Shoals (3/30/2015).

Table 2: Bridge Clearances Upstream of New Castle-Rye Bridge

Bridge	**Connecting**	**Controlling Channel Depth (at MLLW)**	**Vertical Clearance**	**Horizontal Clearance**
Pierce Island Rd.	Portsmouth to Pierce I.	7 ft.	16 ft.	65 ft.
NH Route 1B (New Castle Ave.)	Portsmouth to Shapleigh I.	4 ft.	10 ft.	60 ft.
NH Route 1B (New Castle Ave.)	Shapleigh I. to Goat I.	15 ft.	14 ft.	48 ft.

*Vertical Clearance is measured relative to Mean High Water (MHW)
**Information presented above in Table 2 is from NOAA Chart No. 13283, Portsmouth Harbor – Cape Neddick to Isles of Shoals (3/30/2015).

Waterway Users

Analysis of Bridge Lift Logs

From to the beginning of 2010 through May of 2015, the bridge lift logs indicate that the bridge bascule span has been opened sixteen times; six times for buoy maintenance by the United States Coast Guard (USCG) and ten times for private vessels. During the same period the structure had been lifted thirty times for bridge maintenance, inspection and for operator training. Bridge lifts are infrequent and some vessels appear to travel in only one direction. This may be because they can pass under the bridge while closed, or because they are passing through the bridge to be hauled out and transported over land. Based on the bridge lift logs, none of the commercial fishing and lobster fishing vessels moored in the Back Channel requires bridge lifts. Currently, the bridge requires a 4-hour notice for openings, and it is unknown whether this inconvenience deters more vessels from using the Back Channel. For present vessel traffic however, there does not appear to be a great demand for bridge lifts. See Appendix 3 for the bridge's lift log for the years of 2010 to 2015.

Table 3: Non-USCG Vessels Requiring Bridge Lifts

January 2010 to May 2015

Vessel Name	Class	Date	Time (Open-Close)	Direction	Tide
Captain John Adams	Gundalow	08/03/2010	16:52 – 17:00	Out	Flood/ High
Magic Frog	Sailboat	07/06/2012	8:51 – 8:59	Out	Ebb
Magic Frog	Sailboat	07/08/2012	10:55 – 10:59	Out	Ebb
Easterly	Sailboat	06/28/2013	10:35 – 10:45	In	Low
Bufflehead	Sailboat	08/07/2013	3:00 – 3:10	In	Ebb
Bufflehead	Sailboat	08/09/2013	12:10 – 12:20	Out	Flood
Peter Nerbonne	Sailboat	09/30/2013	14:45 – 14:50	Out	Ebb
Black Finn	Cabin Cruiser	08/27/2014	10:00 – 10:08	In	Flood
Black Finn	Tuna Boat	04/30/2014	2:00 – 2:10	Out	¾ High
Black Finn	Tuna Boat	05/07/2015	6:35 – 6:30	In	Ebb

Waterway Users – Present and Prospective

Little Harbor is home to a small fleet of commercial lobstermen and fishermen as well as recreational sailboats and motorboats. The Back Channel allows access to moorings, marinas, private docks and safe harbor for vessels making passage. A list of waterway users is in development and a list of all maritime facilities within in a 3 mile radius is attached under Appendix 1. The list of waterway users includes the owners of vessels utilizing the moorings at Goat Back and Sagamore Creek. A navigation survey has been prepared, and will be sent to marine facilities within a three mile radius of the project, individuals and businesses that moor vessels in the Back Channel and Sagamore Creek, and land property owners along or near the coastline of the Back Channel and Sagamore Creek. The survey will serve to obtain vessel

descriptions and gather information on the current and expected future use of waterway beneath the bridge. The proposed navigational survey form is attached under Appendix 2.

Present recreation traffic includes both motor boats and sailboats, of which only a handful have requested bridge lifts. According to the lift log, replacement of the bascule bridge with a fixed bridge alternative will prevent at least some of the 6 vessels that have requested lifts since January 2010 from using the waterway (see lift logs in Appendix 3 and Table 3). Some of these vessels have requested lifts only in one direction of travel, possibly indicating that the vessel clears the existing bridge at low tide or that perhaps the boat is being hauled out of the water. For the majority of vessels, which do not require lifts, the proposed bridge will improve the navigational clearances compared to the existing bridge when in the closed position. This will provide a benefit to the majority of vessels using the waterway. More information regarding the vessels currently using the waterway will become available upon return of the navigational surveys.

There are several underutilized parcels along the waterway upstream of the project area that may theoretically be able to benefit from a bascule bridge by allowing the parcel to be developed to allow recreational boating access. No information was found during research for this document, nor for the Benefit-Cost Analysis, that would indicate that there are currently plans for such development. Improvements could reflect a change in land uses and value of developments associated with increased attention to the area.

The Back Channel area is currently home to multiple small commercial lobstermen and fishermen. The boats that currently fish there do not require the existing bridge to be lifted for access to the Back Channel. Currently, only boats under a certain height can access the Back Channel area without at least 4-hours notice required for a bridge lift. There are currently only thirteen commercial vessels moored inside of the Back Channel; a bascule alternative allows for the possibility of increasing the number of commercial vessels through increased access, since it does not restrict vertical underclearance. Thus a fixed bridge may restrict potential growth in the commercial fishing fleet.

Several government agencies operate emergency response, national defense, and maintenance operations in the vicinity of Portsmouth Harbor and the Project Area. These organizations include the USCG, the Navy, the USACE, and the Portsmouth Harbor Master. Correspondence has been made with each of these organizations and will continue as the permitting process progresses. A navigational survey will be mailed to each of these organizations to determine potential impacts to their current and future operations and to obtain a description of the vessels that may be engaged in operations passing beneath the bridge. As mentioned previously, dredging of the Back Channel, Northward Channel, and Sagamore Creek is proposed by the USACE. Correspondence with the USACE indicates that both a fixed and bascule bridge would improve access for dredging, as both alternatives widen the horizontal clearances of the waterway.

Buoy maintenance is performed by the USCG. Bridge lifts were required for Buoy maintenance in 2010; however correspondence with the USCG indicated that the USCG currently utilizes a smaller vessel for Buoy maintenance. This vessel was chosen because it is smaller, more

maneuverable, and has a lesser draft and is thus better suited for maintenance work in the Back Channel, Northward Channel, and Sagamore Creek waterways. This vessel has lower vertical clearance requirements and removable antennae that allow the boat to pass beneath the existing bridge in the closed position. Because the choice of maintenance vessel is governed by the channel and not the vertical clearance of the bridge, it is not likely the fixed bridge alternative will limit the ability of the USCG to perform Buoy maintenance in the future.

The US Navy operates a base in Portsmouth Harbor on Seavey Island, which is primarily accessed through the harbors deep water channel to the north of New Castle Island. Correspondence has been made with the Navy regarding the importance to them of a Bascule bridge to their present or prospective operations in the Little Harbor and Back Channel Areas. Initial correspondences indicate that a bascule bridge is not necessary for their present and prospective operations.

Portsmouth Harbor is home to a deep water port which is accessed by navigating the Piscataqua River to the north of New Castle Island. The depth and width of the Back and Northward Channels are unsuitable for the tug boats, ships and barges using the port. There are no known commercial shipping operations passing through Little Harbor and the project site. In addition, no commercial freight vessels are documented on the bridge lift logs. If freight has passed through the Back Channel into Little Harbor since January 2010, the vessels did not require bridge lifts. More information will be available upon the return of the navigational surveys, however the discovery of commercial freight operations is unlikely due to the depth and width of the Back Channel. The American Association of State Highway Transportation Officials (AASHTO) Bridge Design Specifications require bridges be designed for a minimum of a barge with dimensions of 195 in length, 35 feet in width an empty displacement of 200 tons. Bridge owners may waive this requirement if they deem it prudent. Based on review of the lift logs, the vessels utilizing the Back Channel are significantly smaller and have less displacement than that AASHTO minimum design barge. The navigational survey will review vessels that utilize the Back Channel, and the New Hampshire Department of Transportation will determine the design vessel. The preliminary bridge plans provide a conceptual fender system that would be required if the impact vessel is the AASHTO minimum design barge. Should the NHDOT determine that the design vessel may be a smaller vessel, a fender system may not be required.

There are several boat tours that leave downtown Portsmouth near the Market Street Marine Terminal and tour the Portsmouth Harbor and the area around New Castle. Based on review of the lift logs, vessels that would require the bridge to lift do not currently enter the Back Channel. The proposed fixed bridge would reduce the vertical clearance for access into the Back Channel area and would limit the opportunity for expanded tours. Expanded tours in this area would only be possible if dredging of the Back Channel was completed, for which there is no funding currently planned.

Navigation Needs Assessment

Discussion of Navigational Constraints

Under current conditions, tall boats can access the Back Channel area, but require a 4-hour notice to open the bridge. Due to the infrequent nature of lifts as indicated by the bridge lift log, a majority of the vessels passing through the bridge site do not require a movable bridge. Though construction of a fixed bridge at this location would limit the height of vessels accessing the Back Channel, there are also other navigational constraints on the channels themselves that limit the size of vessels that can safety and efficiently move through the affected waterway.

Vessels operating in the Back Channel are limited by the draft of the vessel and by their ability to maneuver in the narrow Back and North Channels. The ebb and flood tides are of considerable strength, velocity, and tidal range and also impact a vessels ability to move safety and efficiently. Each of these factors affects the size and type of vessels that can currently and potentially in the future access the waters upstream of the proposed bridge. Theoretically the channel could be dredged deeper and wider to allow access for larger vessels. However at this time the proposed dredging by the USACE has been approved to maintain the original dimensions of the Back Channel and mitigate shoaling that is currently occurring.

The vertical clearance at the existing bridge is approximately 65 feet vertically when the bridge is in the open position. The clearance is restricted by overhead utility lines that run parallel to the bridge and are supported independent of the bridge on timber poles. This feature controls the vertical clearance for vessels entering the Back Channel from Little Harbor.

There are three bridges on two waterways that limit the vertical clearances for vessels passing between the Northward Channel and the Piscataqua River upstream of the project area. The clearances of these bridges are summarized in Table 3. The proposed fixed bridge between Rye and New Castle will have a greater vertical clearance than all three (See Tables 1 and 3) and thus will not restrict ocean bound vessels heading from the Piscataqua River via Little Harbor. Though these channels can serve as an alternate route to access the waters upstream of the bridge site, they do not provide an alternate means of access for bridges that will not fit beneath the proposed bridge.

Atmospheric conditions such as fog could affect the safe and efficient movement of vessels at the bridge location. However the proposed bridge is not anticipated to significantly impact or mitigate navigational difficulties due to poor visibility. In some respects, the condition will improve as there will be fewer piers which have greater horizontal clearances between them, thus reducing the chance for vessel-pier collisions.

Under current conditions, the Back Channel area is considered a safe harbor that can be used for refuge during extreme weather events. Any restriction to the vertical clearance under the bridge has the potential to limit this access for future use as a safe harbor.

The proposed fixed bridge is not expected to negatively impact the maintenance of other public infrastructure. There are no levies located along the waterway upstream of the bridge to the Piscataqua River.

Though there are no consensus predictions regarding timing of climate change, rising sea levels have been an issue of importance in coastal areas. The timing of this climate change is unclear, and thus creates difficulty in attempting to measure benefits associated with its impacts. However, in this instance, the assumption is that the bridge will exist for 75 years. During this time, reasonable expectations include a rising sea level. While direct impacts associated with changes in coast line and reduction in land masses will not be affected by bridge type, the alternatives differ in how navigational clearances will be affected. The vertical clearance under a fixed bridge alternative would be reduced as sea levels rise, where a movable bridge can lift, maintaining accessibility for vessels even with rises in sea levels. The potential change in vertical clearance from the water should be considered due to its impact on existing private and commercial vessels.

In summary, the proposed fixed bridge would improve horizontal clearances beneath the structure and improve the vertical clearances beneath the bridge compared to the bascule span when in the closed position. Though the proposed fixed bridge will restrict the vertical clearance of boats passing beneath it, vessels seldom require lifts and thus the impact to navigation is minimal. In addition, the removal of several piers will decrease the chance of collision with a vessel and a fender system along the sides of the main channel will help guide wayward vessels.

Additional Benefits of the Fixed Bridge Alternative

Utilities

The City of Portsmouth Public Works Department is currently reviewing alternatives to improve water service to New Castle. One alternative under consideration calls for the installation of a new water line running across the Back Channel at the location of the New Castle-Rye Bridge. With a bascule bridge, this potential scenario would require the water line to run under the channel at the bridge location, installed by directional drilling. Under a fixed bridge alternative, the water line would be affixed to the bridge. The 2013 Portsmouth Master Plan programs the total cost of this new water line at $1.1 million. The City of Portsmouth Water Division has estimated that the ability to connect the water line to a fixed bridge would cost approximately $600,000 less than running the water line under the channel with a bascule bridge. This water line project is in the design phase, and commenced in the summer of 2014.