Phone: 207-439-0452 ext 301
Email:kpa@kitteryme.org
http://www.kitteryme.gov/

KITTERY PORT AUTHORITY
TOWN HALL
200 ROGERS RD.
KITTERY, ME 03904

Meeting Agenda
July 7, 2022
6:00 P.M.

1. Call to Order / Attendance
2. Pledge of Allegiance
3. Agenda Amendments and Adoption
4. Acceptance of Previous Minutes: June 2, 2022
5. Harbormaster Report and Budget Report
6. All Items involving Town Officials or Invited Guests
7. Public Hearing
8. Piers, Wharves & Floats

   a. The Kittery Port Authority moves to accept an application from The Brewster Family Irrevocable Trust, 7 Bond Road, Kittery Point, ME 03905 (Map 25, Lot 1-A) for the construction of a 4’ x 24’ fixed wood pier, a 3’ x 30’ gangway and a 10’ x 20’ float secured by two helical moorings. Agent is Steve Riker, Ambit Engineering Inc.

   b. The Kittery Port Authority moves to accept an application from SHM Kittery Point, 48 Bowen Road, Kittery, ME 03904 (Map 17, Lot 10) for the conversion of 28 single point moorings in the Back Channel into twelve (12) 8’ x 80’ floats and one (1) 8’ x 160’ float. Agent is Sandra Guay, Archipelago Law, LLP.

9. Public Segment (Three Mins.)
10. Unfinished Business
11. New Business

    a. Workshop on Pier Regulations

12. Committee and Other Reports

a. Communications from the Chairperson

13. Board Member Issues or Comments
14. Executive Session
15. Adjournment

PORT AUTHORITY MEETING UNAPPROVED MINUTES

COUNCIL CHAMBERS JUNE 2, 2022

1. Call to Order / Attendance

Chair Philbrook called the meeting to order at 6:00 p.m.

Members present: Chair Philbrook, Vice Chair Patten, Steve Lawrence, John McCollett. Bryan Bush, and Niles Pinkham. Members absent: Alan Johnston.

2. Pledge of Allegiance

3. Agenda Amendments and Adoption

Added under New Business item b. The Kittery Port Authority moves to discuss extending the three-year rule for George Fox for not having a boat on a mooring.

4. Acceptance of Previous Minutes: May 5, 2022

Line 70 changed to, The KPA decided to postpone this item until the June 2, 2022 meeting, the application couldn't be accepted because of a name change due to a recent sell.

5. Harbormaster Report and Budget Report

Calendar Year to Date Statistics

Moorings relinquished:	19
Moorings revoked:	2
Moorings placed in Temporary Program:	32
Season Launch passes issued:	82
Season Facility Use passes issued:	6
Transient Slip rentals YTD (days):	8
Transient Mooring rentals YTD (days):	16
Kayak Rack assignments	8 (all resident so far)

2. The Deputy Harbormaster Chuck Moran reported on some items of interest 5/1 through 5/31/2022.

The Float In was at Pepperrell Cove on 5/2/2022. The Deputy Harbormaster wanted to thank all the volunteers that made this successful, and he stated Float In was delayed from 4/28/2022 due to excessive windy conditions.

The Deputy Harbormaster stated on 5/3/2022, they were called to be on scene for possible "jumper" on Piscataqua (95) Bridge. Deputy Moran and KPD Officer Valenti responded in the Harbormaster boat (15') and Harbormaster Brosnihan responded on shore. The individual was convinced by law enforcement to come back onto the

roadway after approx. 4 hours. The Deputy Harbormaster provided support and information relative to the individual's actions from the water under the bridge.

Deputy Moran reported he had been struck with a vehicle in Pepperrell Cove parking lot on 5/12/2022. Only minor injuries occurred.

The Harbormaster boat (21') was completely cleaned, surface buffed/waxed and new lettering applied, and the boat was launched on 5/14/2022.

The Deputy Harbormaster said subsequent to the launch of the Harbormaster 21, throttle cables were replaced due to sticking, the seat was reinstalled and the support brackets fabricated for Bimini top frame due to vibrations pulling the deck screws out of the deck. The top was installed without backing plates and was attached using screws. (Will be installed next week).

The derelict/abandoned float adjacent to Old Ferry Lane was removed on 5/16/2022.

The Deputy Harbormaster stated a sailboat broke loose on 5/17/2022 in Pepperrell Cove due to pennant line failure, the vessel ended up on the beach at Moore's Island. He also said they coordinated with the owner and a Tow Boat to have vessel floated and placed on Transient Dock/Mooring on the next high tide that night. There was only minor damage to the vessel.

The Deputy Harbormaster reported Sam Reid invited and took KPA members to Wood Island on 5/18/2022 for a tour.

Deputy Moran and KPD Officer Valenti also accompanied Sam Reid and the Traip "boat building class" to Wood Island on 5/20/2022 for the tour.

The Deputy Harbormaster stated a mooring chain broke on 5/25/2022 and a vessel drifted to transient docks, but no damage occurred.

The Deputy Harbormaster said a sailboat mooring failed in heavy wind/seas on 5/26/2022 and became entangled with another sailboat that was on a mooring. Harbormaster Brosnihan, Deputy Moran and Deputy Breton responded in the Harbormaster boat (21') but due to the severe conditions they needed to call for a Tow Boat for assistance (with boat owner's permission). The sailboat that went adrift was placed on one of the transient moorings, and he stated there was damage to both vessels.

The Deputy Harbormaster stated there was an abandoned floating canoe in Spruce Creek, and they responded to a boat in distress, near Whaleback Light on 5/29/2022. The USCG and Tow Boat US were tied-up, so they were requested to render assistance, and were able to help get the boat back underway under its own power, as well as escorting the boat back to the dock in Kittery.

The Deputy Harbormaster reported they responded to the area of the I-95 Bridge for a reported 55-gallon drum adrift, and discovered it was a log.

FY 2022 YTD EXPENSES

		6/1/2022			
OBJECT	ACCT DESCRIPTION	CURRENT YEAR BUDGET	CURRENT YEAR EXPENSE	CURRENT YEAR REMAINING	PERCENT USED
64010	HARBOR MASTER FULL TIME SALARI	$ 60,536.00	$ 56,252.19	$ 4,283.81	92.92
64020	PART TIME SALARIES	$ 19,042.00	$ 18,773.93	$ 268.07	98.59
65010	POSTAGE	$ 250.00	$ 170.28	$ 79.72	68.11
65020	TELEPHONE & INTERNET	$ 1,950.00	$ 1,807.86	$ 142.14	92.71
65080	LEGAL NOTICES/OTHER ADVERTISE	$ -	$ 88.21	$ (88.21)	0
65200	ELECTRICITY	$ 1,800.00	$ 1,548.01	$ 251.99	86
65220	WATER	$ 500.00	$ 175.20	$ 324.80	35.04
65240	DUMPSTERS/TRASH REMOVAL	$ 1,000.00	$ 684.00	$ 316.00	68.4
65305	BOAT EQUIPMENT MAINTENANCE	$ 3,500.00	$ 4,680.40	$ (1,180.40)	133.73
65310	VEHICLE MAINTENANCE	$ 1,500.00	$ 2,324.00	$ (824.00)	154.93
65311	GAS, GREASE, & OIL	$ 1,500.00	$ 823.84	$ 676.16	54.92
65462	RIGGING	$ 11,000.00	$ 11,054.19	$ (54.19)	100.49
65463	SANITATION	$ 2,500.00	$ 1,274.00	$ 1,226.00	50.96
65470	PROFESSIONAL DEVELOPMENT	$ 1,500.00	$ 1,060.87	$ 439.13	70.72
65480	OTHER PROFESSIONAL/CONTRACTED	$ 3,000.00	$ 645.54	$ 2,354.46	21.52
65500	MAIN BLDG/GROUNDS WHARVES/HARB	$ 5,000.00	$ 3,444.17	$ 1,555.83	68.88
65521	UNIFORMS	$ 1,000.00	$ 713.88	$ 286.12	71.39
66010	OFFICE SUPPLIES	$ 300.00	$ -	$ 300.00	0
66040	JANITORIAL SUPPLIES & SERVICES	$ 500.00	$ 441.69	$ 58.31	88.34
TOTAL		**$ 116,378.00**	**$105,962.26**	**$ 10,415.74**	**91.05%**

FY 2022 YTD REVENUE

		6/1/2022			
OBJECT	ACCT DESCRIPTION	CURRENT YEAR BUDGET	CURRENT YEAR REVENUE	CURRENT YEAR DIFFERENCE	PERCENT
43147	DINGHY FEES	$ (10,000.00)	$ (13,510.00)	$ 3,510.00	135.1
43148	TRANSIENT SLIP RENTAL	$ (7,000.00)	$ (16,266.00)	$ 9,266.00	232.37
43149	KPA APPLICATION FEES	$ (500.00)	$ (1,500.00)	$ 1,000.00	300
43150	MOORING FEES	$ (100,000.00)	$ (104,975.62)	$ 4,975.62	104.98
43151	LAUNCH FEE	$ (14,000.00)	$ (12,079.08)	$ (1,920.92)	86.28
43152	TRANSIENT MOORING	$ (4,000.00)	$ (13,262.00)	$ 9,262.00	331.55
43153	WAIT LIST FEE	$ (800.00)	$ (2,383.00)	$ 1,583.00	297.88
43156	PIER USAGE FEE	$ (2,400.00)	$ (3,182.00)	$ 782.00	132.58
43157	MOORING LATE FEE	$ -	$ (150.00)	$ 150.00	0
43159	KAYAK RACK RENTAL	$ -	$ (620.00)	$ 620.00	0
TOTAL		**$ (138,700.00)**	**$ (167,927.70)**	**$ 29,227.70**	**121.07%**

6. All Items involving Town Officials or Invited Guests - None

7. Public Hearing

a. The Kittery Port Authority moves to approve an application from Nicholas & Amy

Mercier, 134 Whipple Road, Kittery, ME 03904 (Map 10 Lot 6A) for the replacement of an existing seawall. Agent: Erik Saari, Altus Engineering Inc.

Erik Saari from Altus Engineering Inc. went over the changes he had discussed with the board at the site walk.

Chair Philbrook moved to approve the application from Nicholas & Amy Mercier, 134 Whipple Road, Kittery, ME 03904 (Map 10 Lot 6A) for the replacement of a seawall and a ramp, from the seawall to an existing structure not to exceed 20 ft., as well as the signoff from the abutters would need to be acquired, before a building permit could be issued, seconded by Mr. Lawrence.

Motion Carried 5-0-1

Mr. Bush abstained.

b. The Kittery Port Authority moves to approve an application from B.I.W. Group, LLC, 35 Badgers Island West, Kittery, ME 03904 (Map 1 Lot 32) for the replacement of stone rip rap along the shoreline. Agent: Steven Riker, Ambit Engineering, Inc.

Steven Riker, Ambit Engineering, Inc was representing B.I.W. Group, LLC.

Chair Philbrook moved to approve the application from B.I.W. Group, LLC, 35 Badgers Island West, Kittery, ME 03904 (Map 1 Lot 32) for the replacement of stone rip rap along the shoreline, seconded by Mr. Lawrence.

Motion Carried 5-0-1

Mr. Bush abstained.

8. Piers, Wharves & Floats - None

9. Public Segment (Three Mins.) - None

10. Unfinished Business - None

11. New Business

a. Workshop on Pier Regulations – postponed

b. The Kittery Port Authority moves to discuss extending the three-year rule for George Fox not having a boat on a mooring.

George Fox came before the board and asked the board to give him a year extension, as well as putting the mooring in the temporary mooring program due to not having a boat on his mooring for three years.

Chair Philbrook moved to allow George Fox not to put a boat on his mooring this year, seconded by Mr. Lawrence.

All were in favor.

12. Committee and Other Reports - None

a. Communications from the Chairperson

Chair Philbrook stated she approved a repair in-kind on Adams Drive for replacement for pilings.

Chair Philbrook spoke about the Traip boat building, and said how impressive it was.

Chair Philbrook stated she had received a call from Sarah Drummond from the Visual Arts Committee, and she wanted the board's permission to put up a picture from long ago at Pepperrell Cove on the Fisherman's Pier.

All were in favor.

13. Board Member Issues or Comments

Mr. Bush wanted to reiterate the importance of the students getting involved with the boat building at Traip.

14. Executive Session - None

15. Adjournment

Mr. Lawrence moved to adjourn at 6:34 p.m., seconded by Mr. Bush.

All were in favor.

Submitted by Kim Tackett

Disclaimer: The following minutes constitute the author's understanding of the meeting. Whilst every effort has been made to ensure the accuracy of the information, the minutes are not intended as a verbatim transcript of comments at the meeting, but a summary of the discussion and actions that took place. For complete details, please refer to the video of the meeting on the Town of Kittery website.

LETTER OF TRANSMITTAL

TO: **Town of Kittery**
Kittery Port Authority
200 Rogers Rd Ext.
Kittery, ME 03904

FROM:
AMBIT ENGINEERING, INC.
Civil Engineers and Land Surveyors
200 Griffin Road, Unit 3
Portsmouth, NH 03801
Phone (603) 430-9282 Fax 436-2315

DATE: 5/31/2022	JOB NO. 3402.02
ATTENTION: Kittery Port Authority	
RE: Application for Tidal Docking Structure	
7 Bond Road, Kittery, ME	

WE ARE SENDING YOU
- ☐ SHOP DRAWING
- ☒ PLANS
- ☐ SAMPLES

- ☐ ATTACHED
- ☒ COPY OF LETTER
- ☐ CHANGE ORDER
- ☐ OTHER

- ☐ UNDER SEPARATE COVER VIA
- ☐ PRINTS
- ☐ SPECIFICATIONS

COPIES	DATE	REVISION	DESCRIPTION
10	5/31/22		KPA Application
10	5/26/22		Maine DEP Application
10	5/22	5/4/22	Plan Set
1	5/20/22		Check for $125.00

THESE ARE TRANSMITTED AS CHECKED BELOW

- ☒ FOR YOUR APPROVAL
- ☐ FOR YOUR USE
- ☐ AS REQUESTED
- ☐ FOR BIDS DUE
- ☐ FOR REVIEW AND COMMENT
- ☐ RETURNED AFTER LOAN TO US

REMARKS

COPY TO File

If enclosures are not as noted, kindly notify us at once.

MISCELLANEOUS PAYMENT RECPT#: 712105
TOWN OF KITTERY - LIVE
200 ROGERS ROAD
KITTERY ME 03904

DATE: 06/01/22 TIME: 11:25
CLERK: 220codeca DEPT:
CUSTOMER#: 0

PARCEL: 7 BOND RD

CHG: 10 DESIGNATED ACCO 125.00

REVENUE:
1 1111 43149 125.00
   KPA APPLICATION FEES
   REF1: REF2:
CASH:
   1000 11011 125.00
   CHECKING

AMOUNT PAID: 125.00

PAID BY: RIVERSIDE & PICKERIN
PAYMENT METH: CHECK
4313
REFERENCE: CV

AMT TENDERED: 125.00
AMT APPLIED: 125.00
CHANGE: .00

Map: 25
Lot: 1-A
Date Submitted: June 1 2022

TOWN OF KITTERY
KITTERY PORT AUTHORITY

Application for

PIERS, WHARFS, FLOATS AND OTHER MARINE-RELATED STRUCTURES

Contact: kpa@kitteryme.org Website: kitteryme.gov

NOTE: Ten (10) sets of plans, applications, maps and other necessary information are required atsubmittal.

The following application is submitted for the construction, modification, reconstruction of a:

The project proposes the construction of a 4' x 18' accessway, a 4' x 24' fixed wood pier, a 3' x 30' gangway, and a 10' x 20' float secured by two (2) helical moorings and chains. The structure will be built over and utilize an existing stone crib located along the shoreline of the subject property.

1. This project is an in-kind repair/replacement, **which will not** expand, move, or modify the style of the existing structure:
   ☐ Yes, it is in-kind repair ☒ No, there will be modifications
2. Property Owner(s): The Brewster Family Irrevocable Trust of 2016
3. Property Address: 7 Bond Road, Kittery, ME 03905
4. Telephone Number: 603-748-0013 (REQUIRED) Email: rebeccadpt07@gmail.com (REQUIRED)
5. Property Size (Acres/SF): 1.66 ac / 72,198 sq. ft. Zoning District(s): Residential Kittery Point Village (R-KPV)
6. The shore frontage of this property is 204 feet, measured at the high water line in a straight line, stake to stake.
7. This is my first Kittery Port Authority application **for this property**: Yes ☒ No ☐
   If No, please explain:
8. LEGAL INTEREST: The applicant demonstrates a legal interest in the property by including a copy of the following: Deed, Purchase and Sale Agreement See attached deed
9. CONSTRUCTION PLAN: Provide a description of the property showing all proposed construction showing the lot lines and exact positions of the proposed structure with dimensions and elevations from readily identifiable reference points. See attached plans

Applicant Signature: _____ Date: _____

Property Owner Signature: _____ Date: _____

Agent Name: Steven D. Riker Agent Firm: Ambit Engineering, Inc.

Agent Phone: 603-430-9282 (REQUIRED) Agent Email: sdr@ambitengineering.com (REQUIRED)

APPLICATION FEE ($125). Include a check payable to the Town of Kittery. Additional fees may be charged for direct costs (i.e. legal notices, engineering review, etc.) necessary to complete the review of the application per Town Code, Title 3, Chapter 3.3

Fee Paid, Amount: $125.00 Date: May 31, 2022

AMBIT ENGINEERING,INC. Civil Engineers and Land Surveyors
200 Griffin Road, Unit 3, Portsmouth, NH 03801 Phone (603) 430-9282 Fax 436-2315

26 May 2022

Maine Department of Environmental Protection
312 Canco Road
Portland, ME 04103

Re: NRPA Individual Permit Application
Tax Map 25, Lot 1-A
7 Bond Road
Kittery, ME

To Whom it May Concern:

This letter transmits a Maine Department of Environmental Protection, Natural Resources Protection Act Individual Permit Application request to permit the construction of a tidal docking structure on the above referenced site along Barters Creek. The construction includes the installation of a 4' x 18' accessway, a 4' x 24' fixed wood pier, a 3' x 30' gangway, and a 10' x 20' float secured by two (2) helical moorings and chains. The structure will be built over and utilize an existing stone crib located along the shoreline of the subject property demonstrating the least impacting alternative to provide recreational boating access to Barter's Creek.

Attached to this application you will find a ME DEP Permit Plan-Sheet C2, a Dock Details Plan-Sheet D1 and a Details Plan-Sheet D2. The plan set depicts the existing lot, jurisdictional areas, abutting parcels, existing structures, proposed work, and impact areas. Also attached to this application you will find the following: USGS Project location map, tax map, recorded deed, certified mail receipts for abutter notification, a field survey checklist, a coastal wetland characterization, a photo log, project description worksheets for docks, and a notice of intent to file.

Lastly, in utilizing the Maine Office of GIS, the site is located directly adjacent to Tidal Wading Bird and Waterfowl Habitat and Shellfish Beds.

Please contact me if you have any questions or concerns regarding this application.

Respectfully submitted,

Steven D. Riker, CWS
NH Certified Wetland Scientist/Permitting Specialist
Ambit Engineering, Inc.

Cc: US Army Corp of Engineers, Maine Project Office
Maine Bureau of Lands
Kittery Town Clerk
Maine Historic Preservation Commission
Houlton Band of Maliseet Indians
Aroostook Band of Micmacs
Passamaquoddy Tribe of Indians-Indian Township Reservation
Passamaquoddy Tribe of Indians-Pleasant Point Reservation
Penobscot Nation

18 May, 2022

To Whom It May Concern:

RE: State of Maine Department of Environmental Protection Application for proposed docking structure within the previously developed 100' Tidal Buffer Zone and jurisdictional wetlands for *Brewster Family Irrevocable Trust 2016 of 7 Bond Rd Kittery, ME 03904*

This letter is to inform the State of Maine DEP the Town of *Kittery* in accordance with State Law that the following entity:

Ambit Engineering, Inc.
Riverside & Pickering Marine Contractors, Inc.

Is individually authorized to represent us as our agents in the approval process.

Please feel free to call me if there is any question regarding this authorization.

Sincerely,

Brewster Family Irrevocable Trust 2016
Henry J. Brewster Trustee
7 Bond Rd
Kittery, ME 03904

From: Maine Dept. of Environmental Protection
To: Steve Riker
Subject: Dept. of Environmental Protection Payment Portal
Date: Monday, May 16, 2022 3:46:17 PM

Thank you for submitting this payment to the Dept. of Environmental Protection. Below is a copy of the information and payment the agency will receive.

- Applicant Name: **Brewster Family Revocable Trust 2016**
- Activity Location: **7 Bond Rd Kittery Maine 03904**
- First Name: **Steve**
- Last Name: **Riker**
- Company Name: **Ambit Engineering, Inc**
- Street Address: **200 Griffin Road Unit #3**
- Town/City: **Portsmouth**
- State or Province: **New Hampshire**
- Country: **United States**
- Zip Code: **03801**
- Phone Number: **603-430-9282**
- Email Address: **sdr@ambitengineering.com**
- Fee Type: **Natural Resources Protection Act (Individual Permit)**
- Customer Number:
- Invoice Number:
- Spill Number:
- Payment Amount: **564.00**
- Additional Comments:

Your information will be reviewed and you may be contacted if more information is needed or if there are additional questions.

APPLICATION FOR A NATURAL RESOURCES PROTECTION ACT PERMIT

➔PLEASE TYPE OR PRINT IN *BLACK INK ONLY*

1. Name of Applicant:	The Brewster Family Irrevocable Trust of 2016	**5.Name of Agent:**	Steven D. Riker Ambit Engineering, Inc.
2. Applicant's Mailing Address:	46 S. Street N.W., Washington, D.C. 20051	**6. Agent's Mailing Address:**	200 Griffin Road, Unit 3, Portsmouth, NH 03801
3. Applicant's Daytime Phone #:	603-748-0013	**7. Agent's Daytime Phone #:**	603-430-9282
4. Applicant's Email Address (Required from *either* applicant or agent):	rebeccadpt07@gmail.com	**8. Agent's Email Address:**	sdr@ambitengineering.com

9. Location of Activity: (Nearest Road, Street, Rt.#)	7 Bond Road	**10. Town:**	Kittery	**11. County:**	York

12. Type of Resource: (Check all that apply)
- ☒ River, stream or brook
- ☐ Great Pond
- ☒ Coastal Wetland
- ☐ Freshwater Wetland
- ☐ Wetland Special Significance
- ☐ Significant Wildlife Habitat
- ☐ Fragile Mountain

13. Name of Resource: Barter's Creek

14. Amount of Impact: (Sq.Ft.)
154 sq. ft. direct above HAT for accessway

Fill: 386 sq. ft. indirect for shading

Dredging/Veg Removal/Other: 630 sq. ft. direct impact to existing stone crib

15. Type of Wetland: (Check all that apply)
- ☐ Forested
- ☐ Scrub Shrub
- ☐ Emergent
- ☐ Wet Meadow
- ☐ Peatland
- ☐ Open Water
- ☒ Other tidal wetland

FOR FRESHWATER WETLANDS

Tier 1	*Tier 2*	*Tier 3*
☐ 0 - 4,999 sq ft. ☐ 5,000-9,999 sq ft ☐ 10,000-14,999 sq ft	☐ 15,000 – 43,560 sq. ft.	☐ > 43,560 sq. ft. or ☐ smaller than 43,560 sq. ft., not eligible for Tier 1

16. Brief Activity Description: This project proposes the construction of a tidal docking structure on the above referenced site along Barters Creek. The construction includes the installation of a 4' x 18' accessway, a 4' x 24' fixed wood pier, a 3' x 30' gangway, and a 10' x 20' float secured by two (2) helical moorings and chains. The structure will be built over and utilize an existing stone crib located along the shoreline of the subject property demonstrating the least impacting alternative to provide recreational boating access to Barter's Creek.

17. Size of Lot or Parcel & UTM Locations: ☒ 72,198 square feet, or ☒ 1.66 acres UTM Northing: -70.71472 UTM Easting: 43.08555

18. Title, Right or Interest: ☒ own ☐ lease ☐ purchase option ☐ written agreement

19. Deed Reference Numbers:	Book#: 17358 Page: 768	**20. Map and Lot Numbers:**	Map #: 25	Lot #: 1-A	
21. DEP Staff Previously Contacted:	Alison Sirois	**22. Part of a larger project:**	☐ Yes ☒ No	**After-the-Fact:**	☐ Yes ☒ No
23. Resubmission of Application?:	☐ Yes➔ ☒ No	**If yes, previous application #**		**Previous project manager:**	
24. Written Notice of Violation?:	☐ Yes ➔ ☒ No	**If yes, name of DEP enforcement staff involved:**		**25. Previous Wetland Alteration:**	☒ Yes ☐ No

26. Detailed Directions to the Project Site:

27.

TIER 1
- ☒ Title, right or interest documentation
- ☒ Topographic Map
- ☒ Narrative Project Description
- ☒ Plan or Drawing (8 1/2" x 11")
- ☒ Photos of Area
- ☒ Statement of Avoidance & Minimization
- ☒ Statement/Copy of cover letter to MHPC

TIER 2/3 AND INDIVIDUAL PERMITS
- ☐ Title, right or interest documentation
- ☐ Topographic Map
- ☐ Copy of Public Notice/Public Information Meeting Documentation
- ☐ Wetlands Delineation Report (Attachment 1) that contains the Information listed under Site Conditions
- ☒ Alternatives Analysis (Attachment 2) including description of how wetland impacts were Avoided/Minimized
- ☒ Erosion Control/Construction Plan
- ☒ Functional Assessment (Attachment 3), if required
- ☐ Compensation Plan (Attachment 4), if required
- ☒ Appendix A and others, if required
- ☐ Statement/Copy of cover letter to MHPC
- ☐ Description of Previously Mined Peatland, if required

28. FEES Amount Enclosed: $564.00

CERTIFICATIONS AND SIGNATURES LOCATED ON PAGE 2

IMPORTANT: IF THE SIGNATURE BELOW IS NOT THE APPLICANT'S SIGNATURE, ATTACH LETTER OF AGENT AUTHORIZATION SIGNED BY THE APPLICANT.

By signing below the applicant (or authorized agent), certifies that he or she has read and understood the following :

DEP SIGNATORY REQUIREMENT

PRIVACY ACT STATEMENT

Authority: 33 USC 401, Section 10; 1413, Section 404. Principal Purpose: These laws require permits authorizing activities in or affecting navigable waters of the United States, the discharge of dredged or fill material into waters of the United States, and the transportation of dredged material for the purpose of dumping it into ocean waters. Disclosure: Disclosure of requested information is voluntary. If information is not provided, however, the permit application cannot be processed nor a permit be issued.

CORPS SIGNATORY REQUIREMENT

USC Section 1001 provides that: Whoever, in any manner within the jurisdiction of any department or agency of the United States knowingly and willfully falsifies, conceals, or covers up any trick, scheme, or disguises a material fact or makes any false, fictitious or fraudulent statements or representations or makes or uses any false writing or document knowing same to contain any false, fictitious or fraudulent statements or entry shall be fines not more than $10,000 or imprisoned not more than five years or both. I authorize the Corps to enter the property that is subject to this application, at reasonable hours, including buildings, structures or conveyances on the property, to determine the accuracy of any information provided herein.

DEP SIGNATORY REQUIREMENT

"I certify under penalty of law that I have personally examined the information submitted in this document and all attachments thereto and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe the information is true, accurate, and complete. I authorize the Department to enter the property that is the subject of this application, at reasonable hours, including buildings, structures or conveyances on the property, to determine the accuracy of any information provided herein. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

Further, I hereby authorize the DEP to send me an electronically signed decision on the license I am applying for with this application by emailing the decision to the address located on the front page of this application (see #4 for the applicant and #8 for the agent)."

Steven Riker
SIGNATURE OF AGENT/APPLICANT

Date: May 19, 2022

NOTE: Any changes in activity plans must be submitted to the DEP and the Corps in writing and must be approved by both agencies prior to implementation. Failure to do so may result in enforcement action and/or the removal of the unapproved changes to the activity.

(pink)

08/08

PUBLIC NOTICE:
NOTICE OF INTENT TO FILE

Please take notice that

The Brewster Family Irrevocable Trust of 2026

46 S. Street N.W., Washington, D.C. 20051

(*Name, Address and Phone # of Applicant*)

is intending to file a Natural Resources Protection Act permit application with the Maine Department of Environmental Protection pursuant to the provisions of 38 M.R.S.A. §§ 480-A thru 480-BB on or about

May 26, 2022

(anticipated filing date)

The application is for

Construction of a tidal dock

(description of the project)

at the following location:

7 Bond Road, Kittery, Maine 03905

(*project location*)

A request for a public hearing or a request that the Board of Environmental Protection assume jurisdiction over this application must be received by the Department in writing, no later than 20 days after the application is found by the Department to be complete and is accepted for processing. A public hearing may or may not be held at the discretion of the Commissioner or Board of Environmental Protection. Public comment on the application will be accepted throughout the processing of the application.

For Federally licensed, permitted, or funded activities in the Coastal Zone, review of this application shall also constitute the State's consistency review in accordance with the Maine Coastal Program pursuant to Section 307 of the federal Coastal Zone Management Act, 16 U.S.C. § 1456. (Delete if not applicable.)

The application will be filed for public inspection at the Department of Environmental Protection's office in (*Portland, Augusta or Bangor*)(circle one) during normal working hours. A copy of the application may also be seen at the municipal offices in Kittery, Maine.

(*town*)

Written public comments may be sent to the regional office in Portland, Augusta, or Bangor where the application is filed for public inspection:

MDEP, Central Maine Regional Office, 17 State House Station, Augusta, Maine 04333
MDEP, Southern Maine Regional Office, 312 Canco Road, Portland, Maine 04103
MDEP, Eastern Maine Regional Office, 106 Hogan Road, Bangor, Maine 04401

(blue)

PUBLIC NOTICE FILING AND CERTIFICATION

Department Rules, Chapter 2, require an applicant to provide public notice for all Tier 2, Tier 3 and individual Natural Resources Protect Act projects. In the notice, the applicant must describe the proposed activity and where it is located. **"Abutter"** for the purposes of the notice provision means any person who owns property that is BOTH (1) adjoining and (2) within one mile of the delineated project boundary, including owners of property directly across a public or private right of way.

1. **Newspaper:** You must publish the Notice of Intent to File in a newspaper circulated in the area where the activity is located. The notice must appear in the newspaper within 30 days prior to the filing of the application with the Department. You may use the attached Notice of Intent to File form, or one containing identical information, for newspaper publication and certified mailing.

2. **Abutting Property Owners:** You must send a copy of the Notice of Intent to File by certified mail to the owners of the property abutting the activity. Their names and addresses can be obtained from the town tax maps or local officials. They must receive notice within 30 days prior to the filing of the application with the Department.

3. **Municipal Office:** You must send a copy of the Notice of Intent to File and a **duplicate of the entire application** to the Municipal Office.

   ATTACH a list of the names and addresses of the owners of abutting property.

CERTIFICATION

By signing below, the applicant or authorized agent certifies that:

1. A Notice of Intent to File was published in a newspaper circulated in the area where the project site is located within 30 days prior to filing the application;
2. A certified mailing of the Notice of Intent to File was sent to all abutters within 30 days of the filing of the application;
3. A certified mailing of the Notice of Intent to File, and a duplicate copy of the application was sent to the town office of the municipality in which the project is located; and
4. Provided notice of and held a public informational meeting, if required, in accordance with Chapter 2, Rules Concerning the Processing of Applications, Section 13, prior to filing the application. Notice of the meeting was sent by certified mail to abutters and to the town office of the municipality in which the project is located at least ten days prior to the meeting. Notice of the meeting was also published once in a newspaper circulated in the area where the project site is located at least seven days prior to the meeting.

The Public Informational Meeting was held on N/A.
Date

Approximately N/A members of the public attended the Public Informational Meeting.

Steven Riker
Signature of Applicant or authorized agent

May 19, 2022
Date

(blue)

APPENDIX A: MDEP VISUAL EVALUATION
FIELD SURVEY CHECKLIST
(Natural Resources Protection Act, 38 M.R.S.A. §§ 480 A - Z)

Name of applicant: The Brewster Family Irrevocable Trust of 2016 Phone: 603-748-0013

Application Type: Maine DEP NRPA Individual

Activity Type: (brief activity description) Construction of a tidal docking structure

Activity Location: Town: Kittery Court: York

GIS Coordinates, if known: Lat:-70.71472 Lon:43.08555

Date of Survey: December 4, 2021 Observer: Steven D. Riker Phone: 603-430-9282

1. Would the activity be visible from:	Distance Between the Proposed Activity and Resource (in Miles) 0-¼	¼-1	1+	
A. A National Natural Landmark or other outstanding natural feature?	☐	☐	☒	
B. A State or National Wildlife Refuge, Sanctuary, or Preserve or a State Game Refuge?	☐	☐	☒	
C. A state or federal trail?	☐	☐	☒	
D. A public site or structure listed on the National Register of Historic Places?	☐	☒	☐	Bray House
E. A National or State Park?	☐	☒	☐	Fort McClary
F. 1) A municipal park or public open space?	☐	☒	☐	Fort McClary
2) A publicly owned land visited, in part, for the use, observation, enjoyment and appreciation of natural or man-made visual qualities?	☐	☒	☐	Fort McClary
3) A public resource, such as the Atlantic Ocean, a great pond or a navigable river?	☒	☐	☐	
2. What is the closest estimated distance to a similar activity?	☒	☐	☐	
3. What is the closest distance to a public facility intended for a similar use?	☒	☐	☐	

4. Is the visibility of the activity seasonal? (i.e., screened by summer foliage, but visible during other seasons)	☒ Yes	☐ No
5. Are any of the resources checked in question 1 used by the public during the time of year during which the activity will be visible?	☒ Yes	☐ No

A listing of National Natural Landmarks and other outstanding natural features in the State of Maine can be found at: www.nature.nps.gov/nnl/Registry/USA_map/states/Maine/maine.htm . In addition, unique natural areas are listed in the Maine Atlas and Gazetteer published by DeLorme.

(pink)

APPENDIX B: MDEP COASTAL WETLAND CHARACTERIZATION: INTERTIDAL & SHALLOW SUBTIDAL FIELD SURVEY CHECKLIST

NAME OF APPLICANT: The Brewster Family Irrevocable Trust PHONE: 603-748-0013
APPLICATION TYPE: Maine DEP NRPA Individual
ACTIVITY LOCATION: TOWN: Kittery COUNTY: York

ACTIVITY DESCRIPTION: ☐ fill ☒ pier ☐ lobster pound ☐ shoreline stabilization
☐ dredge ☐ other: _____

DATE OF SURVEY: May 20, 2022 OBSERVER: Steven D. Riker

TIME OF SURVEY: 9:30 A.M. TIDE AT SURVEY: Low tide @ 9:30 AM Seavey Island

SIZE OF DIRECT IMPACT OR FOOTPRINT (square feet):
Intertidal area: 630 sq. ft. Subtidal area: None

SIZE OF INDIRECT IMPACT, if known (square feet): _____
Intertidal area: 386 sq. ft. Subtidal area: None

HABITAT TYPES PRESENT(check all that apply):
☐ sand beach ☒ boulder/cobble beach ☐ sand flat ☒mixed coarse & fines ☐salt marsh
☒ ledge ☐ rocky shore ☐ mudflat (sediment depth, if known:____)

ENERGY: ☒ protected ☐ semi-protected ☐ partially exposed ☐ exposed

DRAINAGE: ☐ drains completely ☐ standing water ☐ pools ☒stream or channel

SLOPE: ☐ >20% ☐ 10-20% ☐ 5-10% ☒ 0-5% ☐ variable

SHORELINE CHARACTER:
☒ bluff/bank (height from spring high tide: 19') ☐ beach ☐rocky ☒ vegetated

FRESHWATER SOURCES: ☐ stream ☒ river ☐ wetland ☒ stormwater

MARINE ORGANISMS PRESENT:

	absent	occasional	common	abundant
mussels	☐	☒	☐	☐
clams	☐	☒	☐	☐
marine worms	☐	☒	☐	☐
rockweed	☐	☐	☐	☒
eelgrass	☒	☐	☐	☐
lobsters	☒	☐	☐	☐
other Periwinkle Green crabs	☐	☐	☐	☒

SIGNS OF SHORELINE OR INTERTIDAL EROSION? ☐ yes ☒ no

PREVIOUS ALTERATIONS? ☒ yes ☐ no Existing stone crib

CURRENT USE OF SITE AND ADJACENT UPLAND:
☐ undeveloped ☒ residential ☐commercial ☐ degraded ☐ recreational

PLEASE SUBMIT THE FOLLOWING:
☒ Photographs ☒ Overhead drawing (pink)

Natural Resource Protection Act Application
APPENDIX D: Project Description Worksheet for a Dock, Pier or Wharf Application.

Help us process your application more efficiently by completing this worksheet, which is supplemental to a NRPA application for a dock, pier or wharf. A completed Appendix D may be substituted for Block 14 of the application page.

THIS IS AN APPLICATION FOR A.....

☐ Commercial wharf
If yes, indicate type of commercial activity: _____
License number: _____
Number of fishermen using this wharf: _____

☐ Public pier, dock or wharf

☐ Common or shared recreational pier, dock or wharf

☒ Private recreational pier, dock or wharf

☐ Expansion or modification of an existing structure

☐ Other, please indicate: _____

TELL US ABOUT YOUR BOAT.... 2013 Key West 17'

My boat(s) requires a draft of 1 feet.
My boat(s) is 17 feet long.

TELL US ABOUT YOUR PROJECT SITE.... For coastal piers and wharves, please complete Appendix B of the NRPA application. For freshwater docks, please describe the substrate and any vegetation: _____
Appendix B attached

SCENIC CONSIDERATIONS... Please complete Appendix A of the NRPA application.
Appendix A attached

WHAT FACILITIES ARE NEARBY?

The nearest public boat launch is located in Kittery (town) approximately 1 (distance) miles from the project location.

The nearest public, commercial, or private marina is located in Kittery (town) approximately 1 (distance) miles from the project location.

☒ I have inquired about slip or mooring availability at the nearest marina or public facility.

☐ Yes, a slip or mooring is available. ☒ No, a slip or mooring is not available.
Approximate expected time on waiting list: 95 on "Back Channel" wait list as of July 10, 2021

☒ I have contacted the local Harbor Master. Name: John Brosnihan
Phone: 207-451-0829

I currently use the following for my boat: ☐ Mooring ☐ Marina

TELL US ABOUT YOUR PROPOSED PIER, DOCK OR WHARF...

MATERIALS:

☒ The structure will be supported by pilings.
4 pilings of 12 inches in diameter

☐ The structure will be supported by stacked, flow-through granite cribs.
_____ blocks, measuring _____ feet by _____ feet

☐ The structure will be supported by solid fill.
_____ square feet of solid fill

☐ Other: _____

DIMENSIONS:

Length of fixed section: 24 feet
Width of fixed section: 4 feet
Length of ramp: 30 feet
Dimensions of float: 10 feet wide by 20 feet long
Distance the structure will extend below mean low water (MLW): 0 feet
Depth of water at the fixed end of the structure: 0 at low tide feet
Depth of water at the float at low tide: 0 at low tide feet
Depth of water at the float at high tide: 9 feet
Dimensions of any proposed buildings (e.g. bait shed):
____feet high by ____ feet wide by ____ feet long

ACCESS:

During construction, my project site will be accessed via:

☒ Land

☐ Beach/intertidal area

☒ Water/barge

ALTERNATIVES ANALYSIS

This project proposes the construction of a tidal docking structure on the above referenced site along Barters Creek. The construction includes the installation of a 4' x 18' accessway, a 4' x 24' fixed wood pier, a 3' x 30' gangway, and a 10' x 20' float secured by two (2) helical moorings and chains. The structure will be built over and utilize an existing stone crib located along the shoreline of the subject property demonstrating the least impacting alternative to provide recreational boating access to Barter's Creek.

Other alternatives to provide the same use and function include constructing a dock in another location along the properties shoreline which would not utilize the existing stone crib and the previously impacted area associted with the stone crib. Another alternative would involve entirely removing the stone crib and installing the dock in the footprint of the existing crib, however this alternative would require uneccesary impacts associated with removal of the stone crib since the dock can be constructed utilizing the stone crib with some modifications to support the piles for the fixed wood pier.

Project design alternatives have been explored to provide safe boating access/dockage, and safe foot access to the structure itself, while also minimizing impacts to the adjacent tidal resource to the greatest extent practicable. Due to the fact that the stone crib exists, installing a dock in this location represents the least impacting alternative.

The property owners require a tidal docking structure on their property as the public boat launch/marina is located 1 mile from the project site in Kittery, ME, and is very congested during the boating season. The Town of Kittery Harbormaster has 95 people on the "back channel" wait list as of July 10, 2021. Additionally, the nearest privately owned marina, Great Cove Boat Club, has waiting list over 1 year for a slip.

Lastly, the length of the structure will only provide partial use due to the tidal cycle as the proposed float will rest on the bottom substrate on an average tide. The proposed float skids will provide bottom protection for the float during low tide further reducing impact to the substrate.

The shoreline associcated with the site consists of a bluff that peaks at approximate elevation 19', with a slope leading to the tidal resource area with an average approximate grade of 18% that extends to the H.A.T. located at elevation 10.4'. The substrate below the H.A.T. is characterized as a combination of boulder/cobble beach and mixed coarse & fines which is occasionally vegetated with rockweed *(Ascophyllum* spp. and *Fucus* spp.).

In conclusion, the construction of the docking structure in the proposed location utilizing the existing stone crib, combined with the project design and components demonstrate that the project is the least impacting alternative while providing reasonable use for the property owners.

CONSTRUCTION DETAILS-SEQUENCE

This project proposes the construction of a tidal docking structure on the above referenced site along Barters Creek. The construction includes the installation of a 4' x 18' accessway, a 4' x 24' fixed wood pier, a 3' x 30' gangway, and a 10' x 20' float secured by two (2) helical moorings and chains. The structure will be built over and utilize an existing stone crib located along the shoreline of the subject property demonstrating the least impacting alternative to provide recreational boating access to Barter's Creek.

The fixed pier will be constructed of wood with an associated wooden railing for safety. The fixed pier will be supported by 4 piles. These piles will be anchored by two (2) 2' x 2' x 5' granite blocks that will be placed within the existing stone crib. The purpose of the blocks is to provide a flat stable surface in which to support the piles. Portions of the stone crib may need to be excavated and require the need for the re-arranging of stones to accomoate the granite blocks in order to provide a structurally stable foundation in which to anchor piles upon. The installation of the granite blocks and any needed work within the stone crib will be completed using a combination of a crane barge from the water and small construction equipment on the stone crib in the dry during low tide hours only. The piles will be CCA treated lumber which shall be cured on dry land in a manner that exposes all surfaces to the air for 21 days prior to the start of construction. Details for the fixed pier, gangway, and floats are provided in the plan set, located on "Dock Details-Sheet D1".

Construction of the dock is anticipated to take approximately 1 week. A crane barge will mobilize to the site with equipment and materials. The gangway and float are pre-fabricated off site and are mobilized to the site via crane barge. The crane barge is used to bring the pier superstructure, float and gangway into place for installation. A construction sequence is also provided in the plan set, located on "Details-Sheet D2".

The proposed float and gangway will be seasonal structures. The gangway will be stored on the fixed pier, and the float will be removed and towed from the site for winter storage.

No erosion control devices are required for the tidal docking component of the project. There will be no exposed soils or vegetation removal required to complete the installation of the float and gangway. Work performed within the stone crib to accommodate the granite blocks will be performed in the dry during low tide hours only eliminating the need for erosion and sediment controls. Foot traffic and trenching for standard silt fence installation would cause disturbance far in excess of those from the project itself. There is nothing in regards to the proposed modification that would provide an opportunity for erosion. Work on all portions of the structure located over wetland resource will be performed utilizing a crane barge at low tide eliminating erosion and potential for sedimentation.

WETLAND FUNCTIONS AND VALUES ASSESSMENT

INTRODUCTION

This report provides an assessment of the functions and values of the tidal wetland system located within a parcel of land located at 7 Bond Road, Kittery, Maine. The property is identified as Tax Map 25, Lot 1-A, is approximately 1.66 acres in size, and is located to the south of Bond Road and to the north of Barter's Creek. The lot is developed and contains a single family home with associated driveway. The surrounding land use is residential.

Wetlands on the project site were assessed by Steven D. Riker, New Hampshire Certified Wetland Scientist on December 4, 2021 in accordance with the 1987 United States Army Corps of Engineers' Wetlands Delineation Manual (Routine Delineation Method), and Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Northcentral and Northeast Region, Version 2.0, January 2012. The functions and values of these wetlands were assessed using the United States Army Corp of Engineers' Highway Methodology Workbook Supplement (ACOE, September 1999).

Thirteen functions/values were assessed and evaluated for the wetland area, which include groundwater recharge/discharge, floodflow alteration, fish/shellfish habitat, sediment/toxicant retention, nutrient removal, production export, sediment shoreline stabilization, wildlife habitat, endangered species habitat, visual quality aesthetics, educational/scientific value, recreation and uniqueness/heritage. Functions are considered "principal" if they are found to be an important or critical component of the wetland. Functions and values may also be "principal" if they provide a special or unique value to society.

DISCUSSION

For the purpose of this assessment, the tidal wetland directly associated with the subject parcel was evaluated. This tidal wetland is contiguous with other wetlands located along Barter's Creek, the Piscataqua River, and on a larger scale, the Atlantic Ocean. This assessment examines those functions and values of the tidal wetland area located directly adjacent to the subject parcel, and the proposed tidal docking structure. Also, for the purposes of the assessment, the freshwater wetland and tidal wetland will be referred to as Wetland A, as both systems are located directly adjacent to each other, and also provide similar functions and values.

As described above, the wetland, herein referred to as Wetland A, receives hydrology from the daily tide cycle, and surrounding upland runoff, to a lesser extent. Tidal flow associated with Barter's Creek and the Piscataqua River provides hydrology to Wetland A. During a dropping tide, water flows southwesterly within the Piscataqua River where it empties into the Atlantic Ocean.

There are 2 wetland classes associated with the wetland resources that exist on the subject parcel. According to the "Classification of Wetlands and Deepwater Habitats of the United States" (USFWS 1979). The tidal flat associated with the parcel would be classified as an estuarine intertidal unconsolidated shore cobble-gravel wetland system that is regularly flooded by the tides (E2US1N). The subtidal area associated with the parcel would be classified as a marine subtidal unconsolidated bottom mud wetland system (M2UB3L).

Wetland A performs sediment/toxicant retention, nutrient removal, floodflow alteration, sediment/shoreline stabilization and uniqueness/heritage as principal functions and values and is also capable of providing fish and shellfish habitat, production export, wildlife habitat, recreation, and educational/scientific value.

IMPACT ASSESSMENT

This project proposes the construction of a tidal docking structure on the above referenced site along Barters Creek. The construction includes the installation of a 4' x 18' accessway, a 4' x 24' fixed wood pier, a 3' x 30' gangway, and a 10' x 20' float secured by two (2) helical moorings and chains. The structure will be built over and utilize an existing stone crib located along the shoreline of the subject property demonstrating the least impacting alternative to provide recreational boating access to Barter's Creek.

Given the nature of the project, it is anticipated that there will be no affect on the wetland's ability to perform the above identified functions and values. The tidal docking structure will not impede tidal flow or alter hydrology, it will not deter use by wildlife species that currently use the wetland area, it will not impede any migrational fish movement, it will not contribute to pollution, degredation, or erosion, and it will not have a visual impact as the surrounding properties are previously developed and some already contain similar structures. Impacts associated with tidal docking structures are insignificant as tidal docks are designed to minimize impact, do not contribute to additional stormwater or pollution, and do not impede fish migration or deter use by wildlife species. Given that the tidal dock will be supported by piles it will therefore not impede tidal flow or alter hydrology, will not impact migrational movement of fish and wildlife, and will not provide a barrier or alter hydrology, therefore preserving the functionality of the adjacent wetland resources.

The tidal docking structure is comparable to others in the immediate area, therefore having no impact from an aesthetic or navigational standpoint.

Lastly, following construction, the wetland will still be able to perform its principal functions which are sediment/toxicant retention, nutrient removal, floodflow alteration, sediment/shoreline stabilization and uniqueness/heritage as the tidal docking structure will have no interference with the natural processes that are integral to these functions.

AMBIT ENGINEERING,INC. CIVIL ENGINEERS AND LAND SURVEYORS
200 Griffin Road, Unit 3, Portsmouth, NH 03801 Phone (603) 430-9282 Fax 436-2315

31 May 2022

Maine Bureau of Parks and Lands
Maine Department of Agriculture, Conservation & Forestry
22 State House Station
Augusta, ME 04333

Re: NRPA Individual Permit Application
Tax Map 25, Lot 1-A
7 Bond Road
Kittery, ME

To Whom it May Concern:

This letter transmits a request to review the attached Maine Department of Environmental Protection, Natural Resources Protection Act Individual Permit Application.

Please contact me if you have any questions or concerns regarding this application, or if you need any additional information to complete a review.

Respectfully submitted,

Steven D. Riker, CWS
NH Certified Wetland Scientist/Permitting Specialist
Ambit Engineering, Inc.

AMBIT ENGINEERING,INC. CIVIL ENGINEERS AND LAND SURVEYORS
200 Griffin Road, Unit 3, Portsmouth, NH 03801 Phone (603) 430-9282 Fax 436-2315

31 May 2022

Maine Historic Preservation Commission
55 Capitol Street
65 State House Station
Augusta, ME 04333

Re: NRPA Individual Permit Application
Tax Map 25, Lot 1-A
7 Bond Road
Kittery, ME

To Whom it May Concern:

This letter transmits a request to review the attached Maine Department of Environmental Protection, Natural Resources Protection Act Individual Permit Application, per Section 106 of the National Historic Preservation Act of 1996.

Please contact me if you have any questions or concerns regarding this application, or if you need any additional information to complete a review.

Respectfully submitted,

Steven D. Riker, CWS
NH Certified Wetland Scientist/Permitting Specialist
Ambit Engineering, Inc.

AMBIT ENGINEERING,INC. CIVIL ENGINEERS AND LAND SURVEYORS
200 Griffin Road, Unit 3, Portsmouth, NH 03801 Phone (603) 430-9282 Fax 436-2315

19 May 2022

Tribal Historic Preservation Officer
Penobscot Nation
Cultural and Historic Preservation Department
12 Wabanaki Way
Indian Island, ME 04468

Re: NRPA Individual Permit Application
Tax Map 25, Lot 1-A
7 Bond Road
Kittery, ME

To Whom it May Concern:

Enclosed for your use is a Maine Department of Environmental Protection, Natural Resources Protection Act Individual Permit Application request for the construction of a tidal docking structure on the above referenced site along Barter's Creek.

This project proposes a 4' x 18' accessway, a 4' x 24' fixed pier, a 3' x 30' gangway, and a 10' x 20' float located on the subject parcel. The float will be secured by two helical moorings and chain. The structure will be built over and utilize an existing stone crib located along the shoreline of the subject property demonstrating the least impacting alternative to provide recreational boating access to Barter's Creek.

Attached to this application you will find a "MEDEP Permit Plan- Sheet C2" which depicts the existing lot, jurisdictional areas, abutting parcels, existing structures, proposed work, and impact areas. Also attached to this application you will find the following: USGS Project location map, tax map, recorded deed, certified mail receipts for abutter notification, a field survey checklist, a coastal wetland characterization, a photo log, project description worksheets for docks, and a notice of intent to file.

Lastly, in utilizing the Maine Office of GIS, the site is located directly adjacent to Tidal Wading Bird and Waterfowl Habitat and Shellfish Beds.

Respectfully submitted,

Steven D. Riker, CWS
NH Certified Wetland Scientist/Permitting Specialist
Ambit Engineering, Inc.

Cc: US Army Corp of Engineers, Maine Project Office

AMBIT ENGINEERING,INC. CIVIL ENGINEERS AND LAND SURVEYORS
200 Griffin Road, Unit 3, Portsmouth, NH 03801 Phone (603) 430-9282 Fax 436-2315

31 May 2022

Tribal Historic Preservation Officer
Passamaquoddy Tribe of Indians
Pleasant Point Reservation
PO Box 343
Perry, ME 04667

Re: NRPA Individual Permit Application
Tax Map 25, Lot 1-A
7 Bond Road
Kittery, ME

To Whom it May Concern:

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Respectfully submitted,

Steven D. Riker, CWS
NH Certified Wetland Scientist/Permitting Specialist
Ambit Engineering, Inc.

Cc: US Army Corp of Engineers, Maine Project Office

AMBIT ENGINEERING,INC. CIVIL ENGINEERS AND LAND SURVEYORS
200 Griffin Road, Unit 3, Portsmouth, NH 03801 Phone (603) 430-9282 Fax 436-2315

31 May 2022

Tribal Historic Preservation Officer
Passamaquoddy Tribe of Indians
Indian Township Reservation
PO Box 301
Princeton, ME 04668

Re: NRPA Individual Permit Application
Tax Map 25, Lot 1-A
7 Bond Road
Kittery, ME

To Whom it May Concern:

Enclosed for your use is a Maine Department of Environmental Protection, Natural Resources Protection Act Individual Permit Application request for the construction of a tidal docking structure on the above referenced site along Barter's Creek.

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Respectfully submitted,

Steven D. Riker, CWS
NH Certified Wetland Scientist/Permitting Specialist
Ambit Engineering, Inc.

Cc: US Army Corp of Engineers, Maine Project Office

AMBIT ENGINEERING,INC. CIVIL ENGINEERS AND LAND SURVEYORS
200 Griffin Road, Unit 3, Portsmouth, NH 03801 Phone (603) 430-9282 Fax 436-2315

31 May 2022

Tribal Historic Preservation Officer
Aroostook Band of Micmacs
7 Northern Road
Presque Isle, ME 04769

Re: NRPA Individual Permit Application
Tax Map 25, Lot 1-A
7 Bond Road
Kittery, ME

To Whom it May Concern:

Enclosed for your use is a Maine Department of Environmental Protection, Natural Resources Protection Act Individual Permit Application request for the construction of a tidal docking structure on the above referenced site along Barter's Creek.

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AMBIT ENGINEERING,INC. CIVIL ENGINEERS AND LAND SURVEYORS
200 Griffin Road, Unit 3, Portsmouth, NH 03801 Phone (603) 430-9282 Fax 436-2315

31 May 2022

Tribal Historic Preservation Officer & Environmental Planner
Houlton Band of Maliseet Indians
88 Bell Road
Littleton, ME 04730

Re: NRPA Individual Permit Application
Tax Map 25, Lot 1-A
7 Bond Road
Kittery, ME

To Whom it May Concern:

Enclosed for your use is a Maine Department of Environmental Protection, Natural Resources Protection Act Individual Permit Application request for the construction of a tidal docking structure on the above referenced site along Barter's Creek.

This project proposes a 4' x 18' accessway, a 4' x 24' fixed pier, a 3' x 30' gangway, and a 10' x 20' float located on the subject parcel. The float will be secured by two helical moorings and chain. The structure will be built over and utilize an existing stone crib located along the shoreline of the subject property demonstrating the least impacting alternative to provide recreational boating access to Barter's Creek.

Attached to this application you will find a "MEDEP Permit Plan- Sheet C2" which depicts the existing lot, jurisdictional areas, abutting parcels, existing structures, proposed work, and impact areas. Also attached to this application you will find the following: USGS Project location map, tax map, recorded deed, certified mail receipts for abutter notification, a field survey checklist, a coastal wetland characterization, a photo log, project description worksheets for docks, and a notice of intent to file.

Lastly, in utilizing the Maine Office of GIS, the site is located directly adjacent to Tidal Wading Bird and Waterfowl Habitat and Shellfish Beds.

Please contact me if you have any questions or concerns regarding this application.

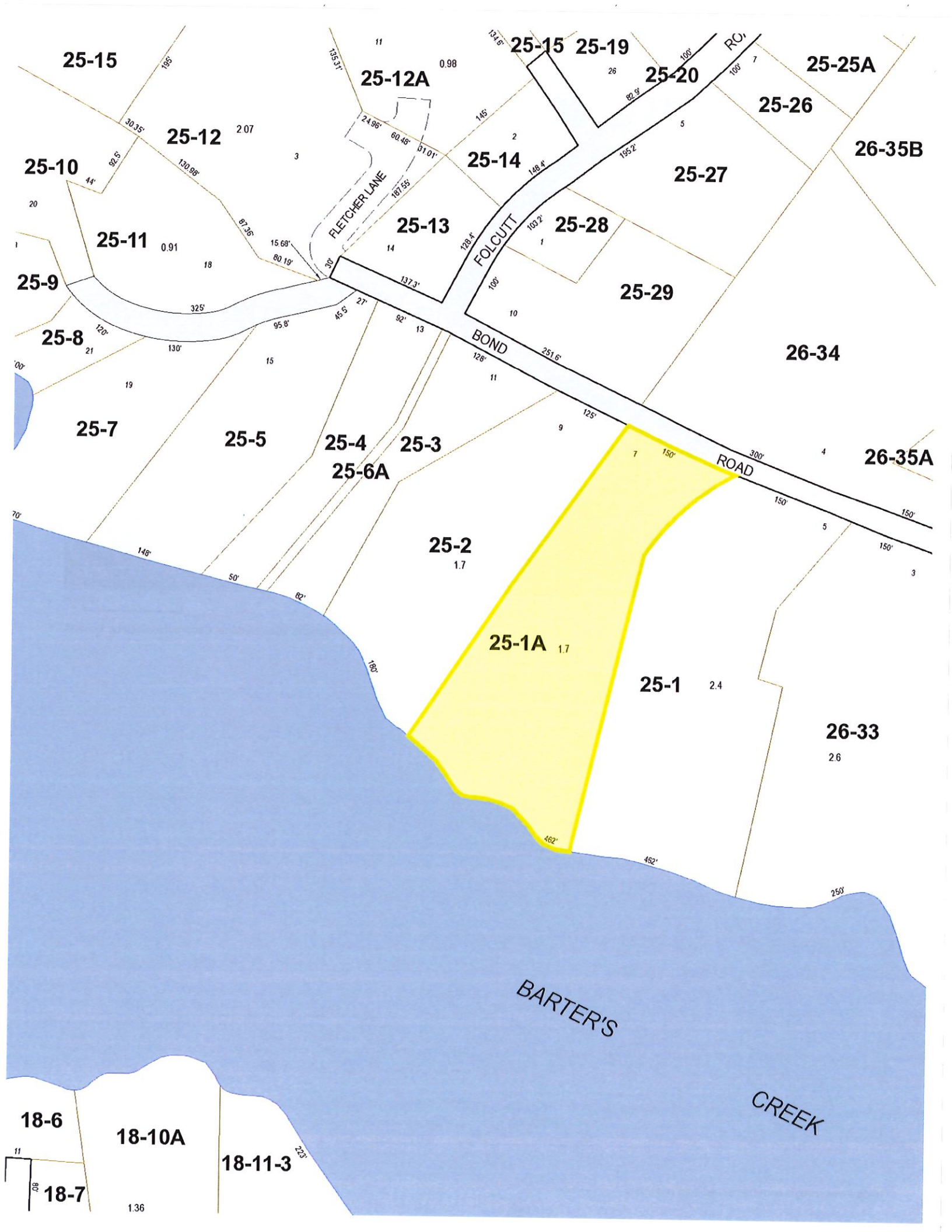
Respectfully submitted,

Steven D. Riker, CWS
NH Certified Wetland Scientist/Permitting Specialist
Ambit Engineering, Inc.

Cc: US Army Corp of Engineers, Maine Project Office

My Map

No legend


25-15
25-12A
0.98
25-15
25-19
25-20
25-25A
25-26
25-12
2.07
25-14
26-35B
25-10
25-27
25-11
0.91
FLETCHER LANE
25-13
25-28
FOLCUTT
25-9
25-29
BOND
25-8
26-34
25-7
25-5
25-4
25-3
25-6A
ROAD
26-35A
25-2
1.7
25-1A
1.7
25-1
2.4
26-33
2.6
BARTER'S
CREEK
18-6
18-10A
18-11-3
18-7
1.36

Ambit Engineering Abutter List

Brewster Family Irrevocable Trust of 2016
7 Bond Road
Kittery, ME

Job # 3402.02

Applicant/Owner(s)

Map	Lot	Deed	Owner (s) First/Trust	Owner(s) Last, Trustee	Mailing Address	City	State	Zip
25	1-A	17358/768	Brewster Family Irrevocable Trust of 2016	Henry J. Brewster	46 S. Street NW	Washington	DC	20001
	Engineer		Ambit Engineering Civil Engineers & Land Surveyors		200 Griffin Road, Unit #3	Portsmouth	NH	03801
	Other Consultants							
	Other Consultants							
	Other Consultants							

Job #	3402.02		Abutters					
Map	Lot	Deed	Owner(s) First/Trust	Owner(s) Last /Trustee	Mailing Address	City	State	Zip
25	1	18644/228	Cushing Family Rev. Trust 2021	Leonard & Wendy Cushing	5 Bond Road	Kittery	ME	03905
25	2	9550/234	Kevin B. & Karen E.	Routley	9 Bond Road	Kittery	ME	03905

AMBIT ENGINEERING,INC. CIVIL ENGINEERS AND LAND SURVEYORS
200 Griffin Road, Unit 3, Portsmouth, NH 03801 Phone (603) 430-9282 Fax 436-2315

31 May, 2022

Kevin B. & Karen E. Routley
9 Bond Road
Kittery, ME 03905

RE: Maine Department of Environmental Services, Natural Resources Protection Act Permit Application for construction of a tidal docking structure for the Brewster Family Irrevocable Trust, 7 Bond Road, Kittery, ME.

Dear Property Owner,

Under the Maine Department of Environmental Protection, this letter is to inform you in accordance with State Law that a Natural Resources Protection Act Permit Application will be filed with the Maine Department of Environmental Protection (DEP) for a permit to construct a tidal docking structure, **at the above mentioned property** on behalf of your abutter **the Brewster Family Irrevocable Trust.**

This letter is sent to inform you as an abutter to the above-referenced property (according to local Municipal records) that **the Brewster Family Irrevocable Trust** proposes a project that requires construction in areas under jurisdiction of the Maine DEP.

Plans are on file at this office, and once the application is filed, plans that show the proposed project will be available for viewing during normal business hours at the office of the **Kittery** clerk, **Kittery Town Offices**, or once received by Maine DEP, at the offices of the Maine DEP, 312 Canco Road, Portland, ME 04103, (207)822-6300. It is suggested that you call ahead to the appropriate office to ensure the application is available for review.

Please feel free to call if you have any questions or comments.

Sincerely,

Steven D. Riker
NH Certified Wetland Scientsist/Permitting Specialist

CERTIFIED MAIL/Return Receipt Requested

AMBIT ENGINEERING,INC. Civil Engineers and Land Surveyors
200 Griffin Road, Unit 3, Portsmouth, NH 03801 Phone (603) 430-9282 Fax 436-2315

31 May, 2022

Cushing Family Revocable Trust of 2021
Leonard & Wendy Cushing
5 Bond Road
Kittery, ME 03905

RE: Maine Department of Environmental Services, Natural Resources Protection Act Permit Application for construction of a tidal docking structure for the Brewster Family Irrevocable Trust, 7 Bond Road, Kittery, ME.

Dear Property Owner,

Under the Maine Department of Environmental Protection, this letter is to inform you in accordance with State Law that a Natural Resources Protection Act Permit Application will be filed with the Maine Department of Environmental Protection (DEP) for a permit to construct a tidal docking structure, **at the above mentioned property** on behalf of your abutter **the Brewster Family Irrevocable Trust.**

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Please feel free to call if you have any questions or comments.

Sincerely,

Steven D. Riker
NH Certified Wetland Scientsist/Permitting Specialist

CERTIFIED MAIL/Return Receipt Requested

7022 0410 0002 6198 5690

U.S. Postal Service™
CERTIFIED MAIL® RECEIPT
Domestic Mail Only

3402.02

For delivery information, visit our website at *www.usps.com®*.

OFFICIAL USE

Certified Mail Fee
$

Extra Services & Fees *(check box, add fee as appropriate)*
- ☐ Return Receipt (hardcopy) $
- ☐ Return Receipt (electronic) $
- ☐ Certified Mail Restricted Delivery $
- ☐ Adult Signature Required $
- ☐ Adult Signature Restricted Delivery $

Postage

USPS GREENLAND POST OFFICE 03840 MAY 31 2022 Postmark Here

Cushing Family Rev. Trust 2021
Leonard & Wendy Cushing
5 Bond Road
Kittery ME 03905

PS Form 3800, April 2015 PSN 7530-02-000-9047 See Reverse for Instructions

7022 0410 0002 6198 5683

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CERTIFIED MAIL® RECEIPT
Domestic Mail Only

3402.02

For delivery information, visit our website at *www.usps.com®*.

OFFICIAL USE

Certified Mail Fee
$

Extra Services & Fees *(check box, add fee as appropriate)*
- ☐ Return Receipt (hardcopy) $
- ☐ Return Receipt (electronic) $
- ☐ Certified Mail Restricted Delivery $
- ☐ Adult Signature Required $
- ☐ Adult Signature Restricted Delivery $

Postage

USPS GREENLAND POST OFFICE 03840 MAY 31 2022 Postmark Here

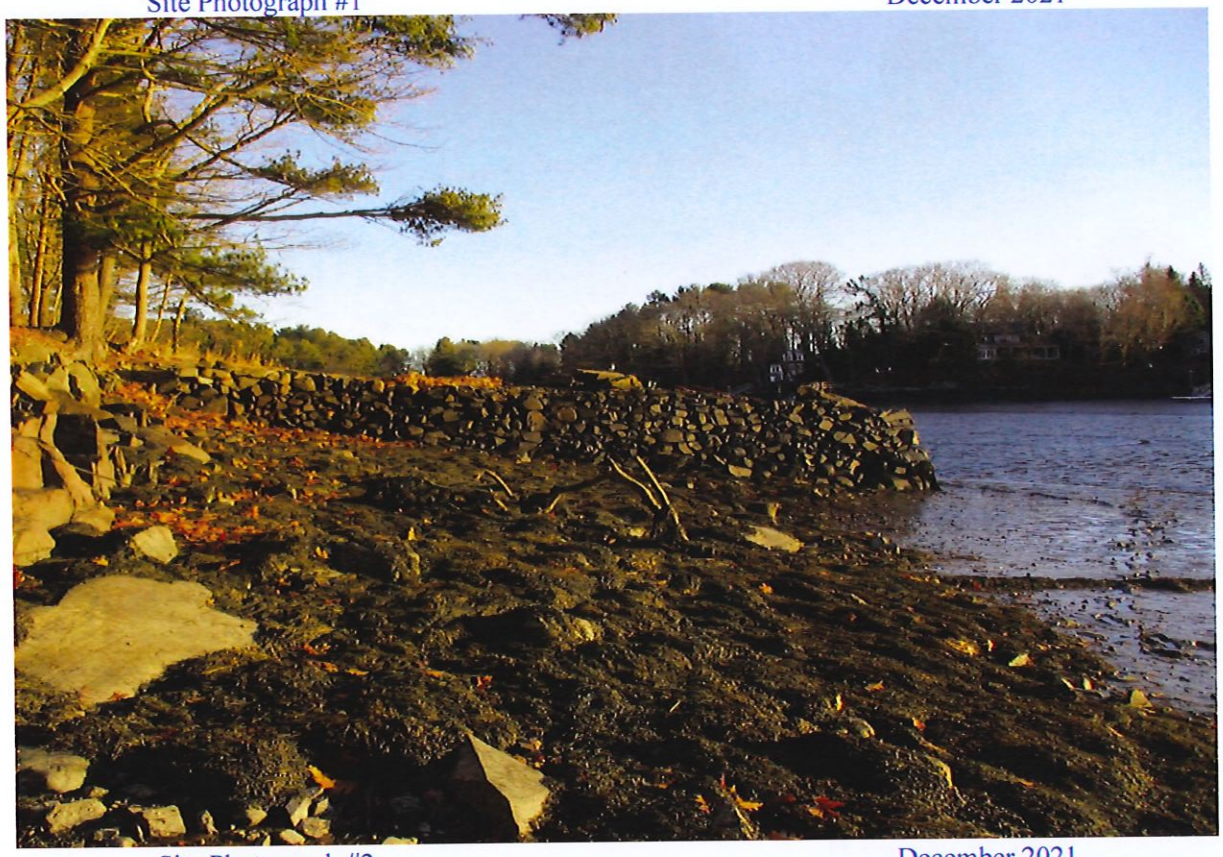
Kevin B. & Karen E. Routley
9 Bond Road
Kittery ME 03905

PS Form 3800, April 2015 PSN 7530-02-000-9047 See Reverse for Instructions

Maine DEP-NRPA Application
The Brewster Family Irrevocable Trust of 2016
Tidal Docking Structure

SITE PHOTOGRAPHS
Kittery Point, ME

Site Photograph #1 December 2021



Site Photograph #2 December 2021

Site Photograph #3

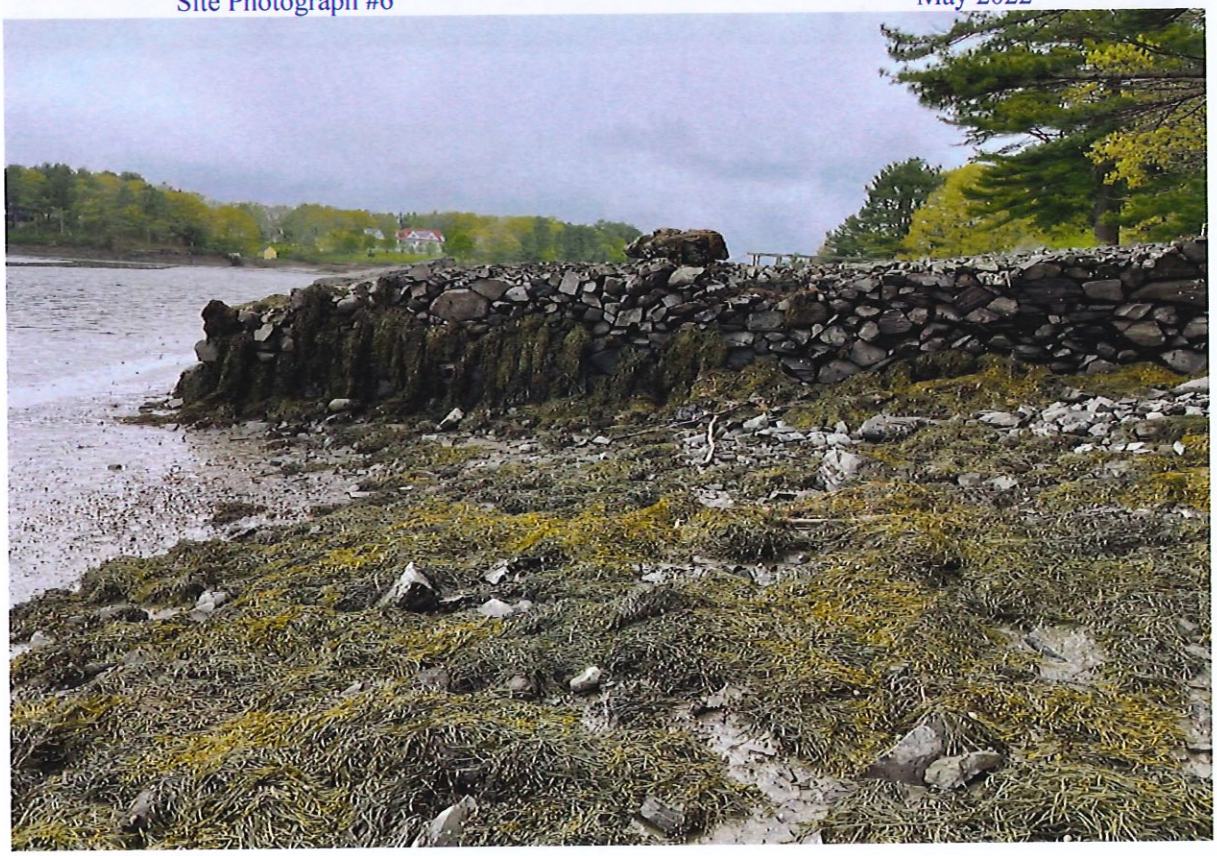
December 2021

Site Photograph #4

May 2022

Site Photograph #5 May 2022

Site Photograph #6 May 2022



Site Photograph #7

May 2022

BK17358 PGS 768 - 769 11/07/2016 09:15:32 AM
INSTR#: 2016048003 DEBRA ANDERSON
RECEIVED YORK SS REGISTER OF DEEDS
E-RECORDED

After recording, please return to:
Maine Center for Elder Law, LLC
3 Webhannet Place, Suite 1
Kennebunk, ME 04043

QUITCLAIM DEED WITH COVENANT

Maine Statutory Short Form

ARLENE B. BREWSTER of Kittery, County of York, State of Maine, for consideration paid, grants to

Henry J. Brewster, Trustee of the BREWSTER FAMILY IRREVOCABLE TRUST, dated September 16, 2016.

whose mailing address is 1429 Clifton St. NW, Washington, DC 20009 with **QUITCLAIM COVENANT** all of her interest in a certain lot or parcel of land and improvements thereon located at 7 Bond Road in the Town of Kittery Point, County of York and State of Maine, being further bounded and described as follows:

See SCHEDULE A attached hereto and made a part hereof

Being the same premises conveyed to Arlene B. Brewster by William Brewster by Quitclaim Deed with Covenant dated November 15, 2004 and recorded in the York County Registry of Deeds in Book14298, Page 0371.

NO REAL ESTATE TRANSFER TAX PAID

Witness my hand and seal this 21st day of October 2016.

Signed, Sealed and Delivered
in the presence of

Witness: Brian Nereson

Arlene B. Brewster

STATE OF MAINE
COUNTY OF YORK, ss. October 21, 2016

Then personally appeared before me the above-named **Arlene B. Brewster** who acknowledged the foregoing to be her free act and deed.

BRITTON RYAN GARON
Notary Public, State of Maine
My Commission Expires June 6, 2023

Britton Ryan Garon, Notary Public
My commission expires: June 6, 2023

After recording, please return to:
Maine Center for Elder Law, LLC
3 Webhannet Place, Suite 1
Kennebunk, ME 04043

SCHEDULE A

BEGINNING at a pipe on the southerly side of Bond Road at the northwesterly corner of the "First Lot" so-called as conveyed to Elizabeth B. Brewster by deed of M. Elizabeth Eastham, Executrix under the Will of Agnes Anderson dated May 24, 1972, hereinafter referred to;

thence turning and running S 54° 42' 00" W along land now or formerly of Louise Moulton, and formerly of Wallace and Esther Piche, one hundred fourteen and 61/100 (114.61) feet to a drill hole in a stone wall;

thence turning and running S 54° 42' 00" W along land now or formerly of said Moulton seventy and 47/100 (70.47) feet to a drill hole in a stone wall;

thence turning and running S 59° 12' 00" W along land now or formerly of said Moulton forty-three and 25/100 (43.25) feet to a drill hole in a stone wall;

thence turning and running S 46° 59' 00" W along land now or formerly of said Moulton one hundred seventeen and 19/100 (117.19) feet to a drill hole in a stone wall;

thence turning and running S 51° 51; 00" W along land now or formerly of said Moulton ninety-two and 41/100 (92.41) feet to a drill hole in a stone wall;

thence turning and running S 57° 08' 00" W along land now or formerly of said Moulton twenty-seven and 49/100 (27.49) feet to a pile at Barters (or Spruce) Creek;

thence in a general easterly course by said Spruce Creek two hundred fifty-seven (257) feet, more or less to a drill hole at other land now or formerly of Elizabeth B. Brewster;

thence turning and running N 37° 44' 12" E along land now or formerly of Elizabeth B. Brewster three hundred sixty-four and 18/100 (364.18) feet to a drill hole situated fifteen and 00/100 (15.00) feet easterly of the northeasterly corner of a cottage on the premises conveyed;

thence turning and running N 63° 21' 00" E along land now or formerly of Elizabeth B. Brewster ninety-eight and 01/100 (98.01) feet to a drill hole situated fifteen and 00/100 (15.00) feet westerly of the northwesterly corner of a house on the adjoining premises now or formerly of Elizabeth B. Brewster;

thence turning and running N 74° 59' 00" E along land now or formerly of Elizabeth B. Brewster fifty-three and 09/100 (53.09) feet to a set pipe at Bond Road;

thence turning and running N 46° 49' 00" W along the southerly side of Bond Road one hundred fifty and 00/100 (150.00) feet to the place of beginning. Containing 72,198 square feet, more or less.

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Maine Ecological Services Field Office
P. O. Box A
East Orland, ME 04431
Phone: (207) 469-7300 Fax: (207) 902-1588
http://www.fws.gov/mainefieldoffice/index.html

May 26, 2022

In Reply Refer To:
Project Code: 2022-0047866
Project Name: Brewster Tidal Dock

Subject: List of threatened and endangered species that may occur in your proposed project location or may be affected by your proposed project

To Whom It May Concern:

The enclosed species list identifies threatened, endangered, proposed and candidate species, as well as proposed and final designated critical habitat, that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*).

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the ECOS-IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the ECOS-IPaC system by completing the same process used to receive the enclosed list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 *et seq.*), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species and to determine whether projects may affect threatened and endangered species and/or designated critical habitat.

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2)

(c)). For projects other than major construction activities, the Service suggests that a biological evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

If a Federal agency determines, based on the Biological Assessment or biological evaluation, that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species, proposed species and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at:

http://www.fws.gov/endangered/esa-library/pdf/TOC-GLOS.PDF

Migratory Birds: In addition to responsibilities to protect threatened and endangered species under the Endangered Species Act (ESA), there are additional responsibilities under the Migratory Bird Treaty Act (MBTA) and the Bald and Golden Eagle Protection Act (BGEPA) to protect native birds from project-related impacts. Any activity, intentional or unintentional, resulting in take of migratory birds, including eagles, is prohibited unless otherwise permitted by the U.S. Fish and Wildlife Service (50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)). For more information regarding these Acts see https://www.fws.gov/birds/policies-and-regulations.php.

The MBTA has no provision for allowing take of migratory birds that may be unintentionally killed or injured by otherwise lawful activities. It is the responsibility of the project proponent to comply with these Acts by identifying potential impacts to migratory birds and eagles within applicable NEPA documents (when there is a federal nexus) or a Bird/Eagle Conservation Plan (when there is no federal nexus). Proponents should implement conservation measures to avoid or minimize the production of project-related stressors or minimize the exposure of birds and their resources to the project-related stressors. For more information on avian stressors and recommended conservation measures see https://www.fws.gov/birds/bird-enthusiasts/threats-to-birds.php.

In addition to MBTA and BGEPA, Executive Order 13186: *Responsibilities of Federal Agencies to Protect Migratory Birds*, obligates all Federal agencies that engage in or authorize activities that might affect migratory birds, to minimize those effects and encourage conservation measures that will improve bird populations. Executive Order 13186 provides for the protection of both migratory birds and migratory bird habitat. For information regarding the implementation of Executive Order 13186, please visit https://www.fws.gov/birds/policies-and-regulations/executive-orders/e0-13186.php.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Code in the header of this letter with any request for consultation or correspondence about your project that you submit to our office.

Attachment(s):

- Official Species List

Official Species List

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

Maine Ecological Services Field Office
P. O. Box A
East Orland, ME 04431
(207) 469-7300

Project Summary

Project Code: 2022-0047866
Event Code: None
Project Name: Brewster Tidal Dock
Project Type: Boatlift/Boathouse/Dock/Pier/Piles - New Construction
Project Description: The project proposes the construction of a tidal docking structure on the above referenced site along Barters Creek. The construction includes the installation of a 4' x 18' accessway, a 4' x 24' fixed wood pier, a 3' x 30' gangway, and a 10' x 20' float secured by two (2) helical moorings and chains. The structure will be built over and utilize an existing stone crib located along the shoreline of the subject property demonstrating the least impacting alternative to provide recreational boating access to Barter's Creek.

Project Location:

Approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/@43.08566615,-70.7154520073139,14z

Counties: York County, Maine

Endangered Species Act Species

There is a total of 2 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species.

IPaC does not display listed species or critical habitats under the sole jurisdiction of NOAA Fisheries[1], as USFWS does not have the authority to speak on behalf of NOAA and the Department of Commerce.

See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

1. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

Mammals

NAME	STATUS
Northern Long-eared Bat *Myotis septentrionalis* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/9045	Threatened

Birds

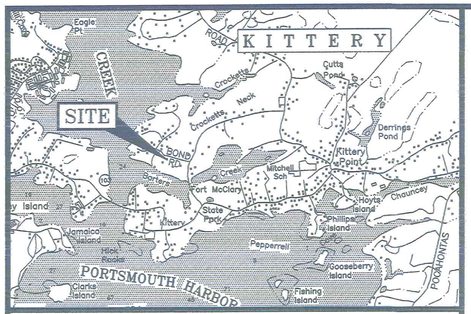
NAME	STATUS
Roseate Tern *Sterna dougallii dougallii* Population: Northeast U.S. nesting population No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/2083	Endangered

Critical habitats

THERE ARE NO CRITICAL HABITATS WITHIN YOUR PROJECT AREA UNDER THIS OFFICE'S JURISDICTION.

IPaC User Contact Information

Agency: Ambit Engineering, Inc.
Name: Steven Riker
Address: 200 Griffin Road, Unit 3
City: Portsmouth
State: NH
Zip: 03801
Email sdr@ambitengineering.com
Phone: 6034309282



LOCATION MAP SCALE 1"=2,000'

LEGEND:

N/F	NOW OR FORMERLY
RP	RECORD OF PROBATE
YCRD	YORK COUNTY REGISTRY OF DEEDS
11/21	MAP 11 / LOT 21
⊐	RAILROAD SPIKE FOUND
○	IRON ROD/IRON PIPE FOUND
◉	IRON PIPE FOUND
⊡	STONE/CONCRETE BOUND FOUND
▬	RAILROAD SPIKE SET
●	IRON ROD SET
⊙	DRILL HOLE SET
■	GRANITE BOUND SET
———	BOUNDARY
– – – –	BUILDING SETBACK
—·—·— MHW	MEAN HIGH WATER LINE
—·—·— MLW	MEAN LOW WATER LINE
—·—·— HAT	MAINE DEP HIGHEST ANNUAL TIDE LINE
—·—·—	FRESHWATER WETLAND LINE
—·—·— WB	WETLAND BUFFER LINE
100	CONTOUR
97x3	SPOT ELEVATION
	EDGE OF PAVEMENT (EP)
	WOODS / TREE LINE
Ø Ø	UTILITY POLE (w/ GUY)
G W E	METER (GAS, WATER, ELECTRIC)
W	WELL
6	PHOTO LOCATION/DIRECTION
AC	AIR CONDITIONER UNIT
EL.	ELEVATION
EP	EDGE OF PAVEMENT
FF	FINISHED FLOOR
INV.	INVERT
TBM	TEMPORARY BENCHMARK
TYP.	TYPICAL
LSA	LANDSCAPED AREA

PLAN REFERENCES:

1) SUBDIVISION OF LAND OF MRS. WILLIAM BREWSTER, KITTERY POINT, MAINE. PREPARED BY MOULTON ENGINEERING, INC. PLAN NO. 2874M-33-00, DATED 7-21-75, SCALE 1"=50'. Y.C.R.D. PLAN BOOK 83/6.

ADDITIONAL ABUTTER:

25/29
N/F
HOLLY B. BOWDOIN
10 BOND ROAD
KITTERY, ME 03905

26/34
N/F
STELLA B. HALL TRUST
STEPHEN F. HALL TRUST
4 BOND ROAD
KITTERY, ME 03905
16132/155

25/2
N/F
KEVIN B. & KAREN E. ROUTLEY
9 BOND ROAD
KITTERY, ME 03905
9550/234

25/1-A

1 STORY WOOD FRAME

25/1
N/F
CUSHING FAMILY REVOCABLE TRUST
LEONARD & WENDY CUSHING, TRUSTEES
5 BOND ROAD
KITTERY, ME 03905
18644/228

ME SPC NAD83(2011)
GRID NORTH
WEST ZONE

DRILL HOLE FOUND IN BASE STONE OF STONE WALL

STONE WALL

TBM B
NAIL SET
IN TREE ROOT
EL.=16.41

STONE & CONCRETE RETAINING WALL

WOOD PIER

PILE

GANGWAY

FLOAT

LEDGE

TBM A
NAIL SET
IN TREE ROOT
EL.=20.64

1" IRON PIPE w/CAP (ILLEGIBLE) FOUND, UP 8", LEANING, LOCATED AT BASE

APPROXIMATE BOUNDARY LINE

STONE BED

STONE RETAINING WHARF

RIPARIAN LINES AS DEFINED BY KITTERY PORT AUTHORITY AND DETERMINED BY REFERENCE PLANS.

BARTERS CREEK

0.77 0.82 0.84 0.64 0.56 0.55 0.39 0.44

GRAPHIC SCALE
30 0 50 100 120 FEET
10 5 0 10 20 30 METERS

PURSUANT TO CHAPTER 90 PARTS 1 AND 2 OF THE SURVEY STANDARDS OF PRACTICE AS ADOPTED BY THE MAINE BOARD OF LICENSURE FOR PROFESSIONAL LAND SURVEYORS, THE FOLLOWING EXCEPTIONS TO PART 2 ARE NOTED;

A) NO SURVEY REPORT HAS BEEN PREPARED.
B) NO LAND DESCRIPTION HAS BEEN PREPARED.
C) MONUMENTS HAVE NOT BEEN SET.

THIS SURVEY CONFORMS TO THE MAINE BOARD OF LICENSURE FOR PROFESSIONAL LAND SURVEYORS CHAPTER 90 STANDARDS OF PRACTICE, EFFECTIVE DATE APRIL 1, 2001 EXCEPT AS NOTED ON THIS PLAN.

STATE OF MAINE JOHN R. CHAGNON No. 2276 PROFESSIONAL LAND SURVEYOR

JOHN R. CHAGNON, PLS 2276

2.7.22
DATE

OWNER & APPLICANT:
BREWSTER FAMILY REVOCABLE TRUST
7 BOND ROAD
KITTERY, ME 03905

PREPARED BY:
AMBIT ENGINEERING
200 GRIFFIN ROAD UNIT 3
PORTSMOUTH, N.H. 03801

AMBIT ENGINEERING, INC.
Civil Engineers & Land Surveyors
200 Griffin Road – Unit 3
Portsmouth, N.H. 03801-7114
Tel (603) 430-9282
Fax (603) 436-2315

NOTES:

1) PARCEL IS SHOWN ON THE TOWN OF KITTERY ASSESSOR'S MAP 25 AS LOT 1-A.

2) OWNER OF RECORD:
BREWSTER FAMILY REVOCABLE TRUST 2016
46 S. STREET N.W.
WASHINGTON, D.C. 20051
17358/768

3) A PORTION OF THE PARCEL IS IN A SPECIAL FLOOD HAZARD AREA, ZONE A2 (ELEV. 9), AS SHOWN ON FIRM PANEL 2301710005D. EFFECTIVE DATE JULY 3, 1986.

4) EXISTING LOT AREA:
72,198 S.F. ± (PLAN REFERENCE 1)
1.66 ACRES ± (PLAN REFERENCE 1)

5) PARCEL IS LOCATED IN THE RESIDENTIAL-KITTERY POINT VILLAGE (R-KPV) ZONING DISTRICT AND IS SUBJECT TO SHORELAND-WATER BODY/WETLAND PROTECTION AREA (OZ-SL-250') OVERLAY DISTRICT.

6) DIMENSIONAL REQUIREMENTS:

MIN. LOT AREA:		40,000 S.F.
FRONTAGE:		150 FEET
SETBACKS:	FRONT	40 FEET
	SIDE	15 FEET
	REAR	15 FEET
MAXIMUM BUILDING HEIGHT:		35 FEET
MAXIMUM BUILDING COVERAGE:		20%

7) THE PURPOSE OF THIS PLAN IS TO SHOW THE EXISTING CONDITIONS ON A PORTION OF ASSESSOR'S MAP 25 LOT 1-A IN THE TOWN OF KITTERY.

8) VERTICAL DATUM IS MEAN LOWER LOW WATER (MLLW). MLLW REFERENCED TO NOAA STATION 8419870 SEAVEY ISLAND, PORTSMOUTH HARBOR MAINE, MLLW BEING 4.62 FEET LOWER THAN 0.00 NAVD88. BASIS OF VERTICAL DATUM IS REDUNDANT RTN GNSS OBSERVATIONS.

9) HIGHEST ANNUAL TIDE LINE SHOWN AT ELEVATION 10.4 PER LOCATION SEAVEY ISLAND IN MAINE DEP HIGHEST ANNUAL TIDE (HAT) LEVELS FOR YEAR 2018.

10) BOUNDARY LINES SHOWN HEREON ARE BASED ON BEST AVAILABLE EVIDENCE FOR THE PURPOSES OF PERMITTING. THIS PLAN DOES NOT REPRESENT AN OPINION AS TO THE LOCATION OF THE BOUNDARY LINES. EASEMENTS, RIGHTS OF OTHERS, ETC., HAVE NOT BEEN RESEARCHED OR NOTED HEREON. THIS IS NOT A BOUNDARY SURVEY.

TIDAL DOCK
BREWSTER RESIDENCE
7 BOND ROAD
KITTERY, ME

NO.	DESCRIPTION	DATE
0	ISSUED FOR COMMENT	2/7/22

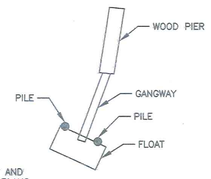
REVISIONS

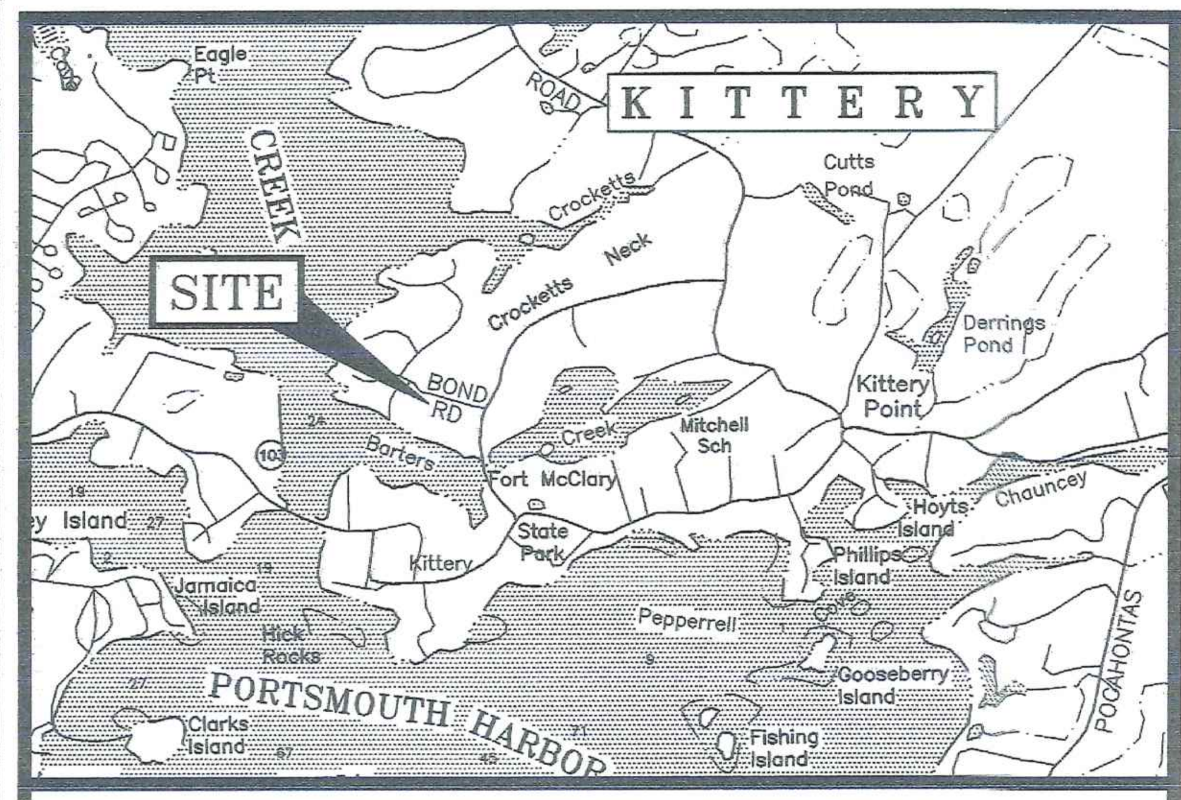
SCALE: 1" = 30' DECEMBER 2021

EXISTING CONDITIONS PLAN

C1

FB 431 PG 1 TAX MAP 25 LOT 1-A 3402.02





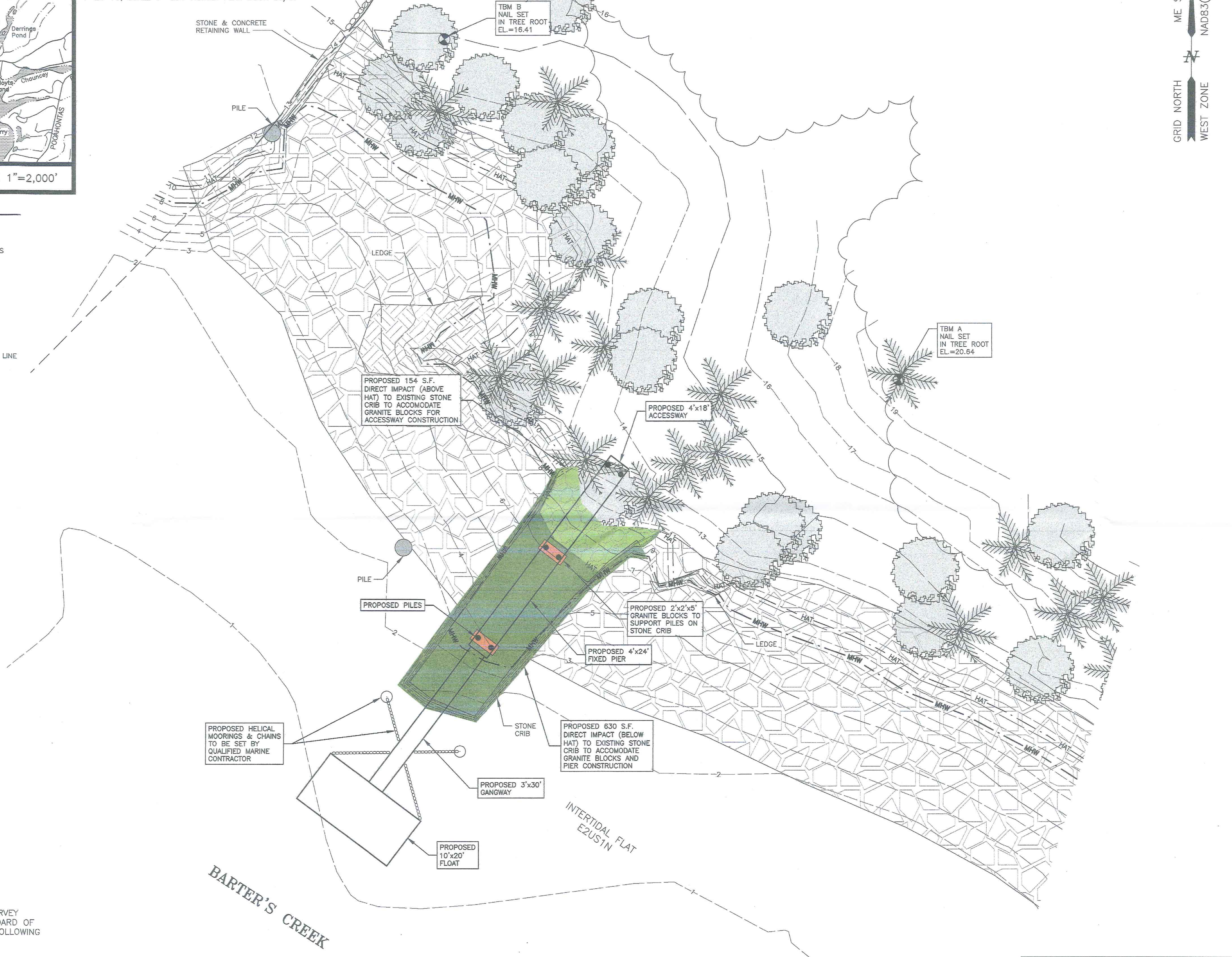
LOCATION MAP SCALE 1"=2,000'

LEGEND:

N/F	NOW OR FORMERLY
RP	RECORD OF PROBATE
YCRD	YORK COUNTY REGISTRY OF DEEDS
11/21	MAP 11 / LOT 21
○	IRON ROD/IRON PIPE FOUND
◉	IRON PIPE FOUND
	BOUNDARY
	BUILDING SETBACK
— MHW —	MEAN HIGH WATER LINE
— MLW —	MEAN LOW WATER LINE
— HAT —	MAINE DEP HIGHEST ANNUAL TIDE LINE
	FRESHWATER WETLAND LINE
— WB —	WETLAND BUFFER LINE
—100—	CONTOUR
97x3	SPOT ELEVATION
	WOODS / TREE LINE
EL.	ELEVATION
TBM	TEMPORARY BENCHMARK
TYP.	TYPICAL

PLAN REFERENCES:

1) SUBDIVISION OF LAND OF MRS. WILLIAM BREWSTER, KITTERY POINT, MAINE. PREPARED BY MOULTON ENGINEERING, INC. PLAN NO. 2874M-33-00, DATED 7-21-75, SCALE 1"=50'. Y.C.R.D. PLAN BOOK 83/6.



WETLAND IMPACT AREA:

TOTAL INDIRECT IMPACT: 386 S.F.
TOTAL DIRECT IMPACT: 630 S.F.
TOTAL DIRECT IMPACT ABOVE HAT: 154 S.F.

PURSUANT TO CHAPTER 90 PARTS 1 AND 2 OF THE SURVEY STANDARDS OF PRACTICE AS ADOPTED BY THE MAINE BOARD OF LICENSURE FOR PROFESSIONAL LAND SURVEYORS, THE FOLLOWING EXCEPTIONS TO PART 2 ARE NOTED;

A) NO SURVEY REPORT HAS BEEN PREPARED.
B) NO LAND DESCRIPTION HAS BEEN PREPARED.
C) MONUMENTS HAVE NOT BEEN SET.

THIS SURVEY CONFORMS TO THE MAINE BOARD OF LICENSURE FOR PROFESSIONAL LAND SURVEYORS CHAPTER 90 STANDARDS OF PRACTICE, EFFECTIVE DATE APRIL 1, 2001 EXCEPT AS NOTED ON THIS PLAN.

JOHN R. CHAGNON, PLS 2276 — DATE 5.4.22

STATE OF MAINE — JOHN R. CHAGNON — No. 2276 — PROFESSIONAL LAND SURVEYOR

GRAPHIC SCALE: 10 5 0 10 20 30 40 FEET; 3 0 5 10 METERS

OWNER & APPLICANT:
BREWSTER FAMILY REVOCABLE TRUST
7 BOND ROAD
KITTERY, ME 03905

PREPARED BY:
AMBIT ENGINEERING
200 GRIFFIN ROAD UNIT 3
PORTSMOUTH, N.H. 03801

AMBIT ENGINEERING, INC.
Civil Engineers & Land Surveyors
200 Griffin Road - Unit 3
Portsmouth, N.H. 03801-7114
Tel (603) 430-9282
Fax (603) 436-2315

NOTES:

1) PARCEL IS SHOWN ON THE TOWN OF KITTERY ASSESSOR'S MAP 25 AS LOT 1-A.

2) OWNER OF RECORD:
BREWSTER FAMILY IRREVOCABLE TRUST 2016
46 S. STREET N.W.
WASHINGTON, D.C. 20051
17358/768

3) A PORTION OF THE PARCEL IS IN A SPECIAL FLOOD HAZARD AREA, ZONE A2 (ELEV. 9), AS SHOWN ON FIRM PANEL 2301710005D. EFFECTIVE DATE JULY 3, 1986.

4) EXISTING LOT AREA:
72,198 S.F. ± (PLAN REFERENCE 1)
1.66 ACRES ± (PLAN REFERENCE 1)

5) PARCEL IS LOCATED IN THE RESIDENTIAL-KITTERY POINT VILLAGE (R-KPV) ZONING DISTRICT AND IS SUBJECT TO SHORELAND-WATER BODY/WETLAND PROTECTION AREA (OZ-SL-250') OVERLAY DISTRICT.

6) DIMENSIONAL REQUIREMENTS:

MIN. LOT AREA:		40,000 S.F.
FRONTAGE:		150 FEET
SETBACKS:	FRONT	40 FEET
	SIDE	15 FEET
	REAR	15 FEET
MAXIMUM BUILDING HEIGHT:		35 FEET
MAXIMUM BUILDING COVERAGE:		20%

7) THE PURPOSE OF THIS PLAN IS TO SHOW A PROPOSED DOCKING STRUCTURE ON A PORTION OF ASSESSOR'S MAP 25 LOT 1-A IN THE TOWN OF KITTERY.

8) VERTICAL DATUM IS MEAN LOWER LOW WATER (MLLW). MLLW REFERENCED TO NOAA STATION 8419870 SEAVEY ISLAND, PORTSMOUTH HARBOR MAINE, MLLW BEING 4.62 FEET LOWER THAN 0.00 NAVD88. BASIS OF VERTICAL DATUM IS REDUNDANT RTN GNSS OBSERVATIONS.

9) HIGHEST ANNUAL TIDE LINE SHOWN AT ELEVATION 10.4 PER LOCATION SEAVEY ISLAND IN MAINE DEP HIGHEST ANNUAL TIDE (HAT) LEVELS FOR YEAR 2018.

10) BOUNDARY LINES SHOWN HEREON ARE BASED ON BEST AVAILABLE EVIDENCE FOR THE PURPOSES OF PERMITTING. THIS PLAN DOES NOT REPRESENT AN OPINION AS TO THE LOCATION OF THE BOUNDARY LINES. EASEMENTS, RIGHTS OF OTHERS, ETC., HAVE NOT BEEN RESEARCHED OR NOTED HEREON. THIS IS NOT A BOUNDARY SURVEY.

TIDAL DOCK BREWSTER RESIDENCE 7 BOND ROAD KITTERY, ME

NO.	DESCRIPTION	DATE
0	ISSUED FOR COMMENT	5/4/22

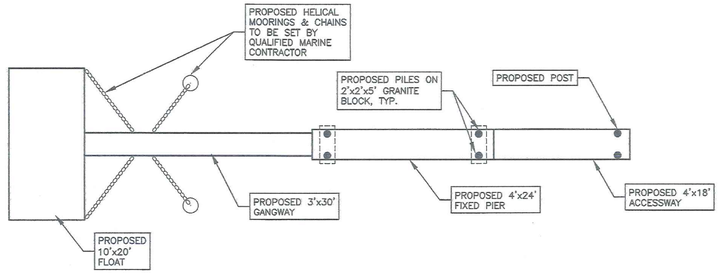
REVISIONS

STATE OF MAINE — JOHN R. CHAGNON — No. 6950 — LICENSED — PROFESSIONAL ENGINEER

SCALE: 1" = 10' MAY 2022

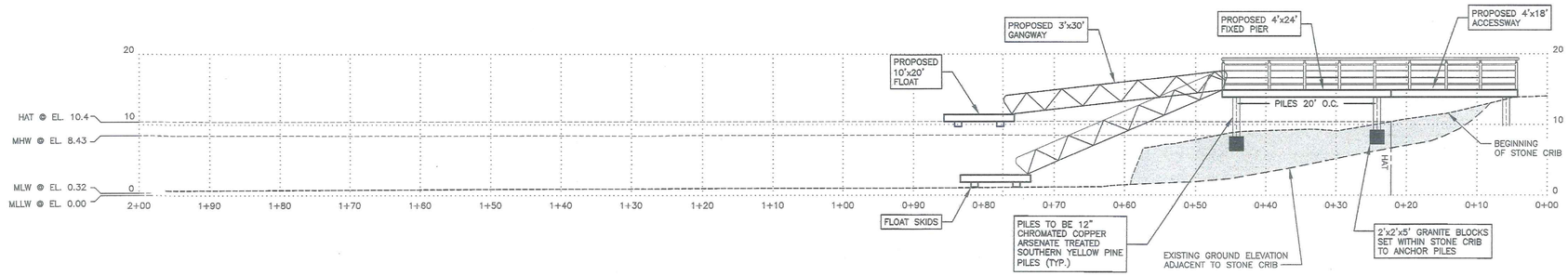
ME DEP PERMIT PLAN — C2

FB 431 PG 1 TAX MAP 25 LOT 1-A 3402.02



PLAN VIEW

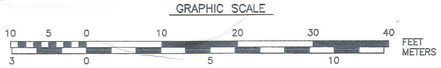
PROPOSED PIER, GANGWAY & FLOAT



DOCK ELEVATION

PROPOSED PIER, GANGWAY & FLOAT

GRAPHIC SCALE



SEQUENCE OF CONSTRUCTION

1) MOBILIZATION OF A CRANE BARGE, PUSH BOAT, WORK SKIFF, MATERIALS AND PREFABRICATED COMPONENTS SUCH AS THE GANGWAY AND FLOAT TO THE SITE VIA AVAILABLE ACCESS.
2) MOBILIZATION OF EQUIPMENT TRUCKS TO THE SITE.
3) THE BARGE WILL BE POSITIONED ALONGSIDE THE PROPOSED LOCATION OF THE NEW DOCK AND WATERWARD OF ANY EMERGENT VEGETATION TO MINIMIZE IMPACTS
4) INSTALLATION OF THE SUB STRUCTURE WILL BE PERFORMED FROM A CRANE BARGE OR SKIFF TO REDUCE THE AMOUNT OF FOOT TRAFFIC IN THE INTERTIDAL AREA.
5) ALL WORK WILL BE PERFORMED AT LOW TIDE TO MINIMIZE SEDIMENTATION.
6) SUPER STRUCTURE OF THE PIER IS BUILT. MATERIALS ARE LIFTED FROM THE BARGE AND SET INTO POSITION BY THE CRANE.
7) ONCE THE PIER IS COMPLETE, THE GANGWAY AND FLOAT ARE BROUGHT INTO POSITION AND INSTALLED.

HEAVY EQUIPMENT IN WETLANDS OR MUDFLATS

OPERATING HEAVY EQUIPMENT OTHER THAN FIXED EQUIPMENT (DRILL RIGS, FIXED CRANES, ETC.) WITHIN WETLANDS SHALL BE MINIMIZED, AND SUCH EQUIPMENT SHALL NOT BE STORED, MAINTAINED OR REPAIRED IN WETLANDS, TO THE MAXIMUM EXTENT PRACTICABLE. WHERE CONSTRUCTION REQUIRES HEAVY EQUIPMENT OPERATION IN WETLANDS, THE EQUIPMENT SHALL EITHER HAVE LOW GROUND PRESSURE (TYPICALLY <3 PSI), OR IT SHALL BE PLACED ON SWAMP/CONSTRUCTION/TIMBER MATS (HEREIN REFERRED TO AS "CONSTRUCTION MATS" AND DEFINED AT APPENDIX A, ENDNOTE 4) THAT ARE ADEQUATE TO SUPPORT THE EQUIPMENT IN SUCH A WAY AS TO MINIMIZE DISTURBANCE OF WETLAND SOIL AND VEGETATION. CONSTRUCTION MATS ARE TO BE PLACED IN THE WETLAND FROM THE UPLAND OR FROM EQUIPMENT POSITIONED ON SWAMP MATS IF WORKING WITHIN A WETLAND. DRAGGING CONSTRUCTION MATS INTO POSITION IS PROHIBITED. OTHER SUPPORT STRUCTURES THAT ARE CAPABLE OF SAFELY SUPPORTING EQUIPMENT MAY BE USED WITH WRITTEN CORPS AUTHORIZATION (CATEGORY 2 AUTHORIZATION OR INDIVIDUAL PERMIT). SIMILARLY, THE PERMITTEE MAY REQUEST WRITTEN AUTHORIZATION FROM THE CORPS TO WAIVE USE OF MATS DURING FROZEN, DRY OR OTHER CONDITIONS. AN ADEQUATE SUPPLY OF SPILL CONTAINMENT EQUIPMENT SHALL BE MAINTAINED ON SITE. CONSTRUCTION MATS SHOULD BE MANAGED IN ACCORDANCE WITH THE CONSTRUCTION MAT BMPS AT WWW.NAE.USACE.ARMY.MIL/MISSIONS/REGULATORY

FLOODPLAINS AND FLOODWAYS

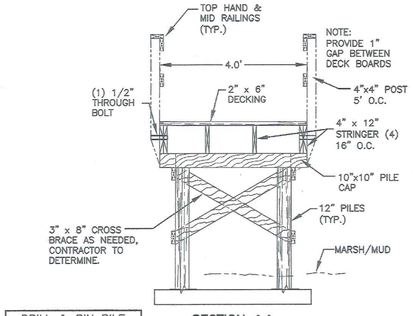
A. APPROPRIATE MEASURES MUST BE TAKEN TO MINIMIZE FLOODING TO THE MAXIMUM EXTENT PRACTICABLE.
B. ACTIVITIES WITHIN 100-YEAR FLOODPLAINS MUST COMPLY WITH APPLICABLE FEDERAL EMERGENCY MANAGEMENT AGENCY (FEMA)-APPROVED STATE AND/OR LOCAL FLOODPLAIN MANAGEMENT PERMITTING REQUIREMENTS. PROPONENTS MAY NEED TO COORDINATE WITH FEMA AND APPLY FOR A FORMAL CHANGE TO THE FLOOD INSURANCE STUDY PRODUCTS OR FORWARD A SET OF PROJECT PLANS AND RELEVANT TECHNICAL DOCUMENTATION IN A DIGITAL FORMAT TO THE RISK ANALYSIS BRANCH CHIEF, MITIGATION DIVISION, FEMA, REGION 1, 99 HIGH STREET, BOSTON, MASSACHUSETTS 02110. APPLICANTS SHOULD PROVIDE A COPY OF ANY DOCUMENTATION TO THE CORPS ALONG WITH THE PCN.
C. PROPONENTS MAY HAVE TO OBTAIN A FLOOD HAZARD DEVELOPMENT PERMIT ISSUED BY THE TOWN. INQUIRIES MAY BE DIRECTED TO THE MUNICIPALITY OR TO THE MAINE FLOODPLAIN MANAGEMENT COORDINATOR AT (207) 287-8063. SEE HTTP://WWW.MAINE.GOV/DACF/FLOOD/

STORAGE OF SEASONAL STRUCTURES.

SEASONAL OR RECREATIONAL STRUCTURES SUCH AS PIER SECTIONS, FLOATS, AQUACULTURE STRUCTURES, ETC. THAT ARE REMOVED FROM THE WATERWAY FOR A PORTION OF THE YEAR (OFTEN REFERRED TO AS SEASONAL STRUCTURES) SHALL BE STORED IN AN UPLAND LOCATION LANDWARD OF HIGHEST ANNUAL TIDE (H.A.T.) OR ORDINARY HIGH WATER (OHW) AND NOT IN WETLANDS, TIDAL WETLANDS, THEIR SUBSTRATE OR ON MUDFLATS. THESE SEASONAL STRUCTURES MAY BE STORED ON THE FIXED, PILE-SUPPORTED PORTION OF THE STRUCTURE THAT IS WATERWARD OF H.A.T. OR OHW. SEASONAL STORAGE OF STRUCTURES IN NAVIGABLE WATERS, E.G., IN A PROTECTED COVE ON A MOORING, REQUIRES CORPS APPROVAL AND LOCAL HARBORMASTER APPROVAL.

SPAWNING, BREEDING, AND MIGRATORY AREAS.

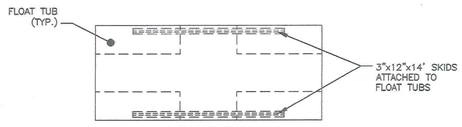
A. JURISDICTIONAL ACTIVITIES AND IMPACTS SUCH AS EXCAVATIONS, DISCHARGES OF DREDGED OR FILL MATERIAL, AND/OR SUSPENDED SEDIMENT PRODUCING ACTIVITIES IN JURISDICTIONAL WATERS THAT PROVIDE VALUE AS FISH MIGRATORY AREAS, FISH AND SHELLFISH SPAWNING OR NURSERY AREAS, OR AMPHIBIAN AND MIGRATORY BIRD BREEDING AREAS, DURING SPAWNING OR BREEDING SEASONS SHALL BE AVOIDED AND MINIMIZED TO THE MAXIMUM EXTENT PRACTICABLE .
B. JURISDICTIONAL ACTIVITIES IN WATERS OF THE UNITED STATES THAT PROVIDE VALUE AS BREEDING AREAS FOR MIGRATORY BIRDS MUST BE AVOIDED TO THE MAXIMUM EXTENT PRACTICABLE. THE PERMITTEE IS RESPONSIBLE FOR OBTAINING ANY "TAKE" PERMITS REQUIRED UNDER THE USFWS'S REGULATIONS GOVERNING COMPLIANCE WITH THE MIGRATORY BIRD TREATY ACT OR THE BALD AND GOLDEN EAGLE PROTECTION ACT. THE PERMITTEE SHOULD CONTACT THE APPROPRIATE LOCAL OFFICE OF THE USFWS TO DETERMINE IF SUCH "TAKE" PERMITS ARE REQUIRED FOR A PARTICULAR ACTIVITY.



DRILL & PIN PILE TO GRANITE BLOCK

SECTION A-A (THROUGH PIER)
NTS

PROPOSED PIER DETAIL
NTS



PROPOSED FLOAT SKIDS
NTS

OWNER & APPLICANT:
BREWSTER FAMILY REVOCABLE TRUST
7 BOND ROAD
KITTERY, ME 03905

PREPARED BY:
AMBIT ENGINEERING
200 GRIFFIN ROAD UNIT 3
PORTSMOUTH, N.H. 03801

AMBIT ENGINEERING, INC.
Civil Engineers & Land Surveyors
200 Griffin Road - Unit 3
Portsmouth, N.H. 03801-7114
Tel (603) 430-9282
Fax (603) 436-2315

NOTES:

1) THE CONTRACTOR SHALL NOTIFY DIG SAFE AT 1-888-DIG-SAFE (1-888-344-7233) AT LEAST 72 HOURS PRIOR TO COMMENCING ANY EXCAVATION ON PUBLIC OR PRIVATE PROPERTY.

2) UNDERGROUND UTILITY LOCATIONS ARE BASED UPON BEST AVAILABLE EVIDENCE AND ARE NOT FIELD VERIFIED. LOCATING AND PROTECTING ANY ABOVEGROUND OR UNDERGROUND UTILITIES IS THE SOLE RESPONSIBILITY OF THE CONTRACTOR AND/OR THE OWNER. UTILITY CONFLICTS SHOULD BE REPORTED AT ONCE TO THE DESIGN ENGINEER.

3) EROSION CONTROL MEASURES SHALL BE IN ACCORDANCE WITH MAINE EROSION AND SEDIMENT CONTROL PRACTICES FIELD GUIDE FOR CONTRACTORS, MARCH 2015.

4) VERTICAL DATUM IS MEAN LOWER LOW WATER (MLLW). MLLW REFERENCED TO NOAA STATION 8419870 SEAVEY ISLAND, PORTSMOUTH HARBOR MAINE, MLLW BEING 4.62 FEET LOWER THAN 0.00 NAVD88. BASIS OF VERTICAL DATUM IS REDUNDANT RTN GNSS OBSERVATIONS.

TIDAL DOCK
BREWSTER RESIDENCE
7 BOND ROAD
KITTERY, ME

NO.	DESCRIPTION	DATE
0	ISSUED FOR COMMENT	5/4/22

REVISIONS

STATE OF MAINE
JOHN R. CRIGNON
No. 9350
LICENSED
PROFESSIONAL ENGINEER
5.4.22

SCALE: AS SHOWN — MAY 2022

ME DEP PERMIT PLAN

D1

FB 431 PG 1 — TAX MAP 25 LOT 1-A — 3402.02

TOWN OF KITTERY

APPLICATION FOR PIERS, WHARFS, FLOATS AND OTHER MARINE-RELATED STRUCTURES

Applicant: SHM Kittery Point, LLC

Property: 48 Bowen Road
Kittery, Maine

Agent: Sandra L. Guay, Esq.
Benjamin E. Ford, Esq.
Archipelago
22 Free Street, Suite 403
Portland, ME 04101

DATE: June 15, 2022

Index

Map: 17
Lot: 10
Date Submitted: June 15, 2022

TOWN OF KITTERY
KITTERY PORT AUTHORITY

Application for

PIERS, WHARFS, FLOATS AND OTHER MARINE-RELATED STRUCTURES

Contact: kpa@kitteryme.org Website: kitteryme.gov

NOTE: Ten (10) sets of plans, applications, maps and other necessary information are required atsubmittal.

The following application is submitted for the construction, modification, reconstruction of a:

Conversion of 28 single point moorings in the Back Channel operated by Safe Harbors Kittery Point into 13 floating docks configured as (12) 80'x8' long floats and (1) 160'x8' long float along the narrower part of the BC.

1. This project is an in-kind repair/replacement, **which will not** expand, move, or modify the style of the existing structure:
   ☐ Yes, it is in-kind repair ☒ No, there will be modifications
2. Property Owner(s): SHM Kittery Point LLC.
3. Property Address: 48 Bowen Road, Kittery, ME 03904
4. Telephone Number: 207-439-9582 (REQUIRED) Email: toallen@shmarinas.com (REQUIRED)
5. Property Size (Acres/SF): +/-1.3acres/ 57,500s.f. Zoning District(s): R/U Maritime Overlay
6. The shore frontage of this property is +/-500' feet, measured at the high water line in a straight line, stake to stake.
7. This is my first Kittery Port Authority application **for this property**: Yes ☐ No ☒
   If No, please explain: (See attached narrative)
8. LEGAL INTEREST: The applicant demonstrates a legal interest in the property by including a copy of the following: Deed, Purchase and Sale Agreement
   (See Recorded Deed attached as Exhibit 1)
9. CONSTRUCTION PLAN: Provide a description of the property showing all proposed construction showing the lot lines and exact positions of the proposed structure with dimensions and elevations from readily identifiable reference points. (See Site Plan attached Exhibit 2)

Applicant Signature: _____ Date: 6/14/2022
GENERAL MANAGER

Property Owner Signature: _____ Date: 6/14/2022
GENERAL MANAGER

Agent Name: Sandra Guay Agent Firm: Archipelago Law, LLP

Agent Phone: 207-558-0102 (REQUIRED) Agent Email: sguay@archipelagona.com (REQUIRED)

APPLICATION FEE ($125). Include a check payable to the Town of Kittery. Additional fees may be charged for direct costs (i.e. legal notices, engineering review, etc.) necessary to complete the review of the application per Town Code, Title 3, Chapter 3.3

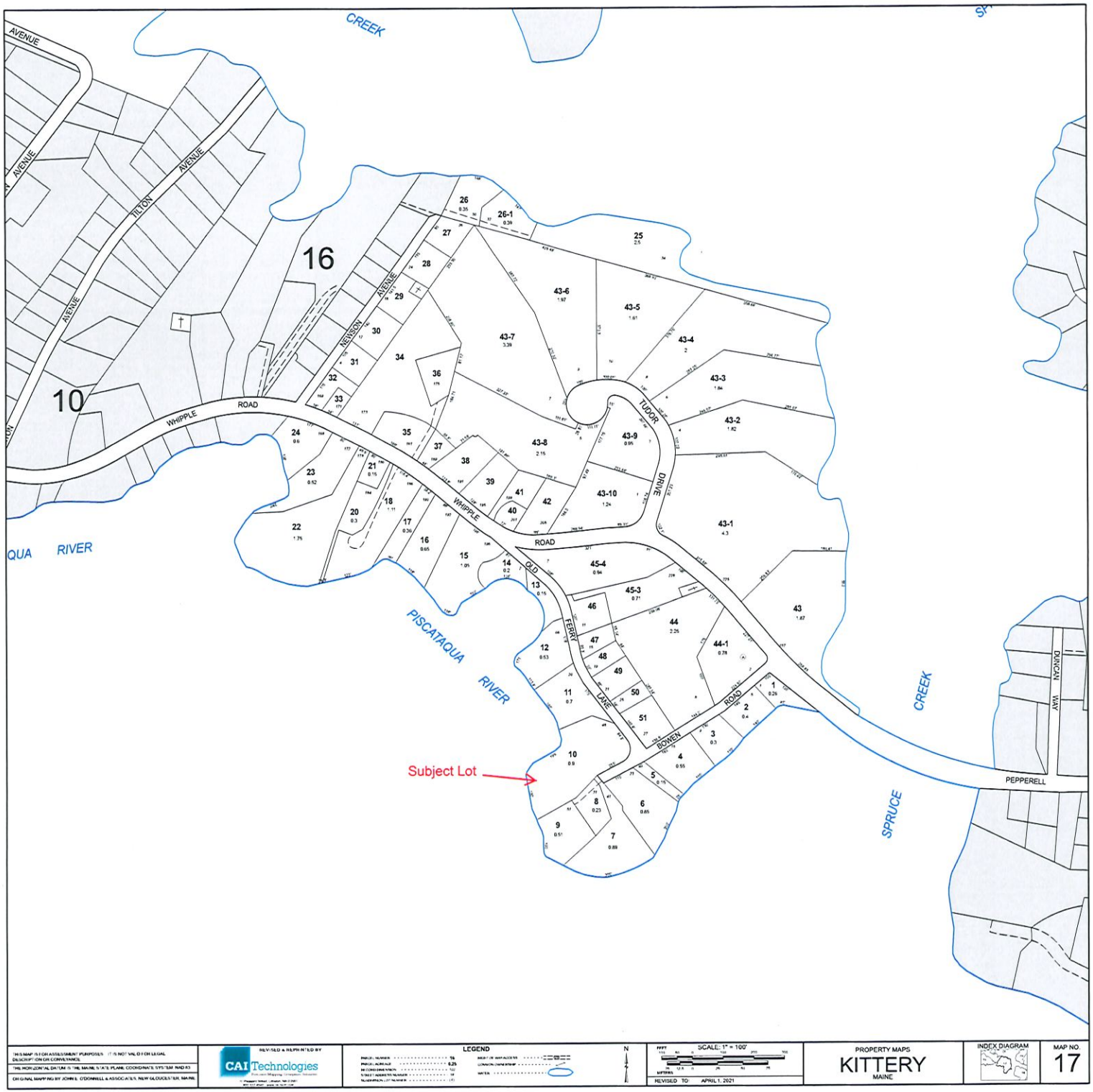
Fee Paid, Amount: _____ Date: _____

AUTHORIZATION

I, Thomas J. Allen, as General Manager of SHM Kittery Point, LLC, hereby authorize Sandra Guay and Benjamin Ford of firm of Archipelago in Portland, Maine, to sign any and all State of Maine or Town of Kittery permit and appeal applications on our behalf with regard to our property located at 48 Bowen Road, Kittery, Maine (Tax Map 17 Lot 10). We further authorize any member of that firm to appear on our behalf and to represent us before any department, board, committee, or agency of said State or town, including, but not limited to, the Kittery Port Authority, the Kittery Planning Board, and the Kittery Board of Appeals.

DATED: June 14, 2022

Thomas J. Allen
General Manager
SHM Kittery Point, LLC



THIS MAP IS FOR ASSESSMENT PURPOSES. IT IS NOT VALID FOR LEGAL DESCRIPTION OR CONVEYANCE.

THE HORIZONTAL DATUM IS THE MAINE STATE PLANE COORDINATE SYSTEM NAD 83

ORIGINAL MAPPING BY JOHN E. O'DONNELL & ASSOCIATES, NEW GLOUCESTER, MAINE

REVISED & REPRINTED BY CAI Technologies

LEGEND

N

SCALE: 1" = 100'

REVISED TO: APRIL 1, 2021

PROPERTY MAPS

KITTERY

MAINE

INDEX DIAGRAM

MAP NO. 17

Abutter's List

(150 ft from Applicant's shorefront property line)

Abutter	Mailing Address	Lot Address	Map	Lot
Sanidas, John & Carol	7 Amberwood Ln Boxford, MA 01921	20 Old Ferry Lane	17	11
Hall, Michael & Rebecca	140 State Rd Kittery, ME 03904	51 Bowen Road	17	9
Anderson, Lee Richards	6029 E Old West Way Scottsdale, AZ 85262	31 Bowen Road	17	8

INTRODUCTION

SHM Kittery Point, LLC (the "Applicant") is a marina operating in the Back Channel. The Applicant currently leases and maintains 41moorings and two existing 28' x 6' floating docks in the harbor that it then leases out to its customers. In the summer, the Applicant's service customers are a mix or recreational and commercial boaters. In the winter, the Applicant's on-the-water customers are almost exclusively commercial. The Applicant is proposing to replace 28 of their single-point moorings with 13 fixed-position floating docks. Most docks will consist of two 40' X 8' floating platforms joined end to end. One dock will consist of four 40' x 8' platforms. See **Exhibit 2**.

For several years, members of the Kittery Port Authority have discussed replacing some moorings in the Back Channel with fixed floating docks. Compared to single-point moorings, fixed floating docks provide enhancements to safety, environmental impacts, and public access to the waterway. In the Back Channel, the proposed floating dock arrangement would better define the center channel and allow boats to navigate the harbor more easily, especially in conditions with low visibility.

While a floating dock arrangement provides many benefits over single point moorings, those benefits come with capital costs associated with building the docks and installing the anchors, chain, and tackle. This proposal would offset the increased capital costs by granting the Applicant a waiver to build floating platforms larger than the maximum size specified in the Kittery Port Authority Rules. The increased size would allow the Applicant to recoup its investment by slightly increasing the number of boats moored in the same space. This proposal would not increase the size of the space currently allocated to the Applicant; it would only increase the size of the floats and allow the Applicant to slightly increase the number of boats moored in the same space.

LEGAL STANDARD

The Kittery Port Authority has the authority to permit the installation of floating docks and to grant waivers to permit the construction of floats exceeding the maximum size defined by the rules. Kittery Port Authority Rules state that:

> No wharf, pier, float, or any other marine-related structure may be erected, moved, or otherwise altered without a Building Permit therefor, issued by the Code Enforcement Officer after plan approval is obtained from the Port Authority and in compliance with all requirements of the applicable local, State and Federal requirements.

Port Authority Rules and Regulations Pertaining to Harbor, Port, and Channels, Within the Town of Kittery, Maine, Amended January 2, 2020 (the "Rules") § 4.2.1. The Rules further state that:

> Moored floats are authorized only with the expressed permission of the Port Authority and only after receiving an Army Corps of Engineers Permit. Permits are issues in accordance with Section 4 of these rules.
> …

> Float size may not exceed 10' X 24' dimensions for commercial uses and 8' 24' dimensions for recreational uses, unless otherwise permitted by the Port Authority.

Rules § 3.12.1 (A, C). The Rules also specify minimum standards for floats specifically requiring the floats to have "a minimum of two (2) moorings," that each float be identified with registration numbers, and that each float use the proper chain size and include "hot dopped galvanized steel for all shackles and fasteners." *Id.* (D-F).

The Port Authority may grant a waiver from the specifications defined by the regulations provided that "the Port Authority finds that due to special circumstances of the specific application, the granting of a waiver will not adversely impair the public health, safety and general welfare, the use of public waters, navigation, or harm the environment." Rules § 4.3.3.

The proposed installation includes four granite anchors, each weighing at least 4,000 pounds, 5/8" chain, sentinel weights to maintain chain tension, and ¾" hot dipped galvanized steel shackles. **Exhibit 3**; see also Rules § 3.12.1 (D-F). Each float will be identified with an assigned registration number on both ends of the float, in contrasting colors, and with numbers that are at least three inches high. *Id.* The proposed installation is already approved by the Army Corp of Engineers. *Id.* (A); see **Exhibit 4**. The only waiver the Applicant is requesting is to the maximum size requirements found in section 3.12.1 (C). As discussed below, the waiver should be granted because the installation of floating docks will enhance, rather than impair each of criteria specified in the Rules.

1. **Enhancements to Public Health**

The proposed floating docks will float lower in the water compared to most of the vessels tied to them. To access the vessel, boaters will transfer first from the dingy or launch to the float, and then from the float to the boat itself. The lower float makes it easier and safer for people to transfer between vessels since they will not need to scale the freeboard of a larger boat or manage stability issues with a smaller boat. This benefit is especially pronounced for the elderly and boaters with mobility issues.

2. **Enhancements to Public Safety**

Floating docks allow vessels to remain in a fixed location. This prevents the vessels from oscillating horizontally in the wind and current and lessens the risk of dangerous collisions between dinghies or launches, and their intended vessels. The fixed location also provides a safer platform for workers as they commission, de-commission, and prepare vessel for adverse weather such as hurricanes.

In the winter, the use of floats will allow increased capacity for the Back Channel to serve as a safe harbor for the in-water commercial fleet during storms.

While experienced operators pride themselves on their ability to land on small docks in tight locations, a larger float will allow a new boater more room to make mistakes thereby lessening the chance of dangerous collisions between boats, docks, and people.

Unlike single point moorings, floating docks allow multiple points of attachment between the vessel and the float and between the float and the anchors. This eliminates the danger of a single point failure and makes it significantly less likely an equipment failure will allow boats to break free in adverse weather.

3. Enhanced Access to the Public Waters

The proposed improvements will increase access for the local boating community by allowing approximately 20-25 additional vessels to moor in the same amount of space. Because the proposed installation will not take up more space in the harbor, the waitlist for moorings will not be lengthened and may even be reduced as some of the additional spaces may be used by those already on the list.

Because the floats are easier to use and access, the use of floats will also allow elderly boaters to use their vessel later in life and the larger landing space will allow for new boaters to use their vessels in a greater range of weather conditions.

4. Enhanced Navigation

Unlike most harbors, the Back Channel currently lacks a clearly defined navigation channel. As vessels are free to swing around their moorings in the wind and current, the navigable channel can be obscured which greatly increases the risks of collisions, especially at night and in low visibility conditions. As the plan shows, most of the single-point moorings on the west side of the center channel will be removed and replaced with floats. See **Exhibit 2**. The floats and the vessels tied to them will be fixed thereby clearly defining the center channel and easing navigation for vessels entering and leaving the harbor.

By eliminating the swing associated with single point moorings, the use of floats will have a significantly smaller impact on the harbor surface. With the swing associated with single-point moorings, the current area of impact is estimated at 170,000 square feet based on an average vessel length of 38' LOA. The proposed converson to fixed floats would reduce that impact to an estimated 26,000 square feet.[1]

While each float will have four anchors as opposed to a single anchor in a traditional system, if four boats are tied to one float, there will not be any additional ground tackle per boat. In other words, under a traditional system, four boats would require four anchors and four chains. In the proposed system, those same four boats will still only require four anchors and four chains. The advantage of the proposed system is that the chains and the boats do not move, thereby allowing people to fish in very close proximity to the floats.

---

[1] 88' diameter= 44' radius squared x 3.14 x 28 moorings= 170,213sf versus float and additional boat area of ((12) x 80 x 8) + (1) x 160 x 8)) x 3 = 26,880sf].

5. Enhanced Environmental Benefits

Eelgrass provides critical habitat for many spawning and juvenile fish species. In 2001, a study by the University of New Hampshire showed that adolescent lobsters in the vicinity of Seavey Island burrow into the eelgrass beds and use those eelgrass beds to overwinter. See **Exhibit 5**. In 1997 and again in 2010, the Maine Department of Marine Resource documented the presence of eelgrass habitat in the Back Channel. See **Exhibit 6**. Researchers have documented negative environmental effects from single point moorings. See **Exhibit 7**. As the chain between anchor and the mooring ball is allowed to rest on the harbor floor, it scours the bottom as the vessel swings in the changing wind a current. *Id.* Researchers have noted a significant environmental benefit when mooring chains are lifted off the bottom thereby eliminating bottom scouring. See **Exhibit 8**.

This proposal would eliminate bottom scouring thereby promoting a healthier ecosystem in the Back Channel. The float, mooring tackle, and anchor will remain in a fixed single line should any chain contact the bottom, it would do so in only one direction. However, because the anchors are offset, the mooring tackle will remain under tension with each sentinel weight pulling against its opposite anchor. Because of this arrangement, the mooring chains will remain suspended and will not touch the bottom.

CONCLUSION

The Applicant is a historic boatyard that provides incomes for 22 local families and has been part of this community for 60 years. Past investments in infrastructure to control runoff and mitigate other negative environmental effects demonstrate the Applicant's sincere commitment as a steward of this important public resource.

From increased tax revenue from visitors to increased quality of life for residents, the Town of Kittery has much to gain from expanded use of the Back Channel. This proposal will allow the town to realize those benefits while at the same time making the Back Channel a safer and more welcoming harbor.

NANCY E HAMMOND, REGISTER OF DEEDS
E-RECORDED **Bk 19017 PG 753**
Instr # 2022019520
05/04/2022 02:23:05 PM
Pages 6 YORK CO

DLN: 1002240192344

After recording return to:
SHM Kittery Point, LLC
c/o Safe Harbor Marinas
14785 Preston Road, Suite 975
Dallas, TX 75254
Attn: John Ray

Space Above This Line For Recording Data

WARRANTY DEED

Maine R.E. Transfer Tax Paid

KNOW ALL MEN BY THESE PRESENTS that **MGX, LLC,** a Maine limited liability company with a principal place of business in Kittery, County of York and State of Maine, in consideration of one dollar and other valuable consideration, grants to **SHM KITTERY POINT, LLC**, a Delaware limited liability company with a place of business in Dallas, County of Dallas, and State of Texas, whose mailing address is 14785 Preston Road, Suite 975, Dallas, TX 75254, with WARRANTY COVENANTS, a certain lot or parcel of land, together with any improvements thereon, situated in the Town of Kittery, County of York and State of Maine, and described on the attached **Exhibit A**, which is made a part hereof for all purposes, together with all and singular the rights, benefits, privileges, easements, tenements, hereditaments and appurtenances thereon or in anywise appertaining thereto, and together with all improvements located thereon and any right, title and interest of Grantors in and to adjacent streets, alleys and rights-of-way (said land, rights, benefits, privileges, easements, tenements, hereditaments, appurtenances, improvements and interests being hereinafter referred to as the "**Property**").

This conveyance is made and accepted subject to those certain matters all as more particularly described on **Exhibit B** attached hereto and incorporated herein by this reference (the "**Permitted Exceptions**"); provided, however, that the reference to the Permitted Exceptions shall not be deemed to reimpose same.

TO HAVE AND TO HOLD the Property, subject to the Permitted Exceptions, as aforesaid, unto the Grantees, and the Grantees' legal representatives, successors and assigns forever; and Grantors do hereby bind themselves and their heirs, executors, legal representatives, successors and assigns, to WARRANT AND FOREVER DEFEND all and singular the Property unto Grantees and Grantees' legal representatives, successors and assigns against every person whomsoever lawfully claiming or to claim the same, or any part thereof.

[*Signature page follows*]

IN WITNESS WHEREOF the said MGX, LLC has caused this instrument to be executed by Thomas Allen, its Manager, duly authorized, this 2nd day of May, 2022.

MGX, LLC

WITNESS

By: _____
Thomas Allen, its Manager

STATE OF MAINE
York, ss.

May 2nd, 2022

Then personally appeared the above-named Thomas Allen, Manager of MGX, LLC and acknowledged the foregoing instrument to be his free act and deed in his said capacity, and the free act and deed of said limited liability company,

Before me,

_____
~~Notary Public~~ / Attorney at Law

Print Name: Benjamin E. Ford Benjamin E. Ford

My Commission Expires: Bar No. 4528 Bar No. 4528

EXHIBIT A

A certain lot or parcel of land, together with any buildings or improvements located thereon, situated on Old Ferry Lane and at 48 Bowen Road in the Town of Kittery, County of York and State of Maine, and being more specifically bounded and described as follows:

Beginning at a rebar found flush with the ground on the southwesterly side of said Old Ferry Lane at the intersection with Bowen Road, and thence proceeding South 52° 13' 55" West a distance of 260.59 feet along said Bowen Road and land now or formerly of Milton E. Hall to a one and one-half (1 ½) inch iron pipe found 6 inches high; thence proceeding South 61° 10' 14" West a distance of 114.46 feet along a chain link fence and land now or formerly of said Milton E. Hall to a one (1) inch iron pipe found 3 inches high; thence proceeding South 61° 39' 55" West a distance of 11.00 feet, more or less, to the mean high water mark of the Piscataqua River, and thence proceeding in the same direction to the low water mark; thence proceeding in a generally northeasterly, westerly, northwesterly and northeasterly direction along the Piscataqua River to a point at the low water mark found by extending the line shown on the plan hereafter referenced as the "Proposed Property Line" between other land now or formerly of Elmer L.J. Dion and Shirley I. Dion and the parcel herein conveyed to the low water mark of the Piscataqua River; thence turning and proceeding along said extended boundary line North 59° 06' 41" East to the high water mark, and thence continuing in the same direction a distance of 20.00 feet to a one-half (1/2) iron rod; thence North 59° 06' 41" East along the southerly boundary of other land now or formerly of said Elmer L.J. Dion and Shirley I. Dion fifty (50) feet to a two (2) inch iron pipe; thence proceeding North 76° 09' 26" East a distance of 50.73 feet still along other property now or formerly of Elmer L.J. Dion and Shirley I. Dion; thence turning and proceeding South 55° 01' 55" East a distance of 67.07 feet to a point in the southwesterly sideline of said Old Ferry Lane; thence proceeding South 27° 11' 00" East a distance of 12.81 feet along the sideline of said Old Ferry Lane to a point; thence proceeding South 30° 38' 00" East a distance of 60.09 feet still along said Old Ferry Lane to a point; thence proceeding South 33° 25' 00" East a distance of 20.64 feet along said Old Ferry Lane to a rebar found flush with the ground, and being the place of beginning.

Meaning and intending to convey the premises shown as "Tax Map 17 Lot 10" on a plan entitled "Lot Line Revision & Driveway Easement Plan for Property Off Old Ferry Lane, York County, Kitty, Maine for Elmer L.J. Dion & Shirley Dion", dated November 16, 1999 and last revised November 18, 1999, by Easterly Surveying, Inc., and recorded in Plan Book 251, Page 42 with the York County Registry of Deeds.

Also conveying at all the grantor's right, title and interest in and to the right of way for access and utility services along the southeasterly sideline of the property hereinabove conveyed over land shown on said plan as land of Milton E. Hall and shown as Tax Map 17, Lot 9 on the aforementioned plan. Also conveying all the grantor's right, title and interest in an easement from Milton E. Hall to Elmer L.J. Dion and Shirley I. Dion dated November 19, 1999 and recorded at said Registry of Deeds at Book 9788, Page 306, for maintenance of an existing overhead transmission line, underground water line and other utilities and access to the driveway to the premises conveyed above as shown on the aforementioned plan.

The premises are conveyed subject to an easement for access, ingress and egress from Old Ferry Lane for the benefit of other land of Elmer L.J. Dion and Shirley I. Dion shown as Tax Map 17, Lot 11 on the aforementioned plan over the following described property:

The starting point for the easement may be found by beginning at a rebar found flush with the ground on the northwesterly side of said Old Ferry Lane at its intersection with Bowen Road, and thence proceeding on the following courses and distances: North 33° 25' 00" West a distance of 20.64 feet, North 30° 38' 00" West a distance of 60.09 feet, and North 27° 11' 00" West a distance of 12.81 feet to a point and being the starting point for the easement reserved herein; thence proceeding North 59° 14' 08" West a distance of 71.87 feet to point at land of Elmer L.J. Dion and Shirley I. Dion; thence turning and proceeding North 76° 09' 26" East a distance of 7.0 feet to a point; thence turning and proceeding South 55° 01' 55" East a distance of 67.07 feet along said land of Elmer L.J. Dion and Shirley I. Dion to a point in the sideline of said Old Ferry Lane, and being the place of beginning.

The reserved easement is shown on the foregoing plan as "Driveway Easement Inset".

Meaning and intending to convey the same premises conveyed to MGX, LLC by deed of Dion's Yacht Yard Corp., dated June 17, 2004, and recorded in the York County Registry of Deeds in Book 14127, Page 576.

EXHIBIT B

Permitted Exceptions

1. Taxes and assessments for the year 2022 and subsequent years, a lien not yet due and payable.

2. Subject to the State of Maine Submerged Land Lease between the Bureau of Public Lands, State of Maine Department of Conservation, and Dion's Yacht Yard, Inc. dated July 24, 1986.

3. Such state of facts as set forth on a plan entitled "Lot Line Revision & Driveway Easement Plan for Property of Off Old Ferry Land, York County, Kittery, Maine for Elmer L. J. & Shirley Dion" dated November 15, 1999, prepared by Northeasterly Surveying, Inc. and recorded in Plan Book 251, Page 42.

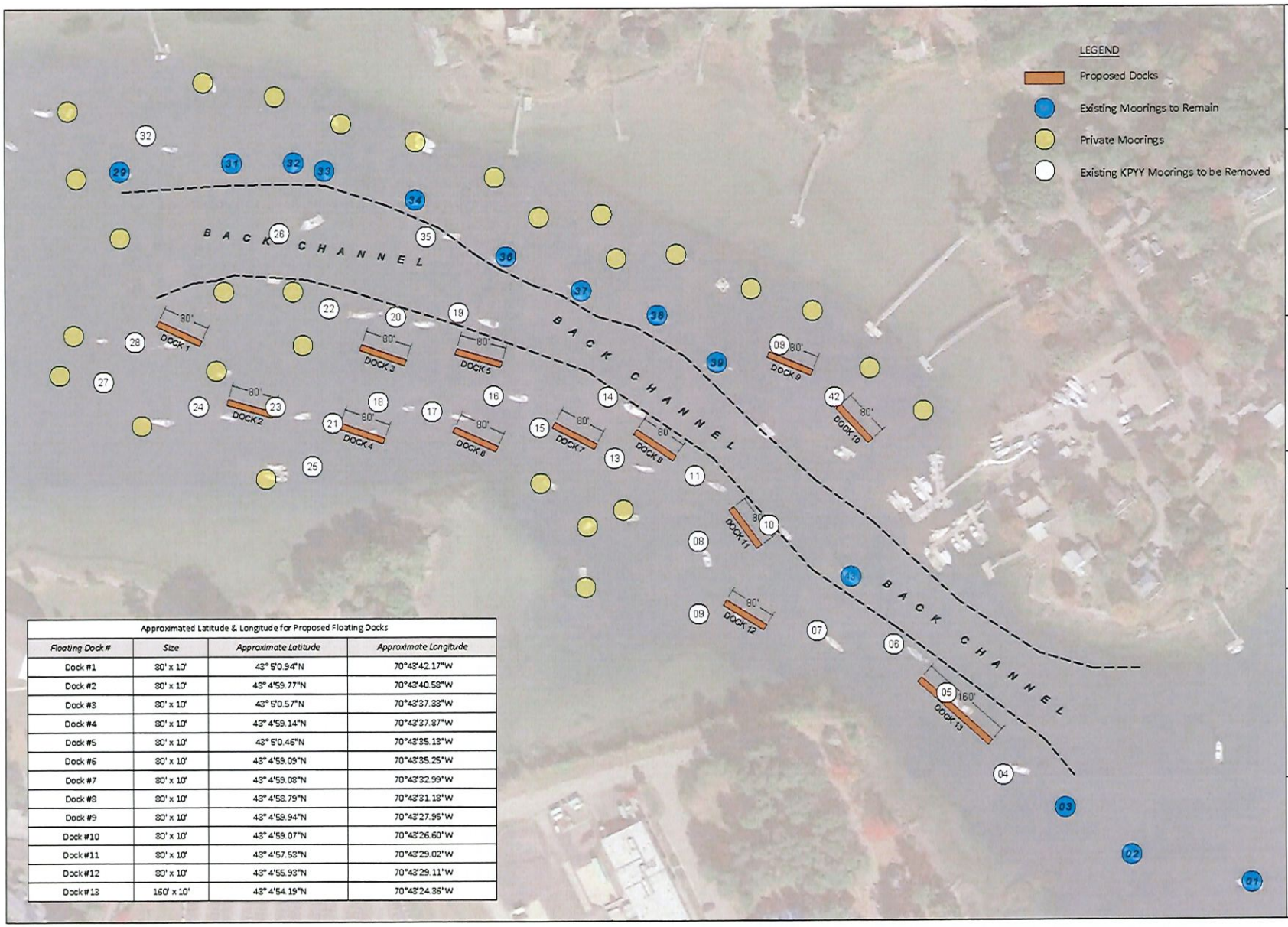
4. Conditions and restriction relative to an appurtenant easement from Milton E. Hall to Elmer L.J. Dion and Shirley I. Dion dated November 19, 1999 and recorded in Book 9788, Page 306, and as shown on the ALTA/NSPS survey of the property prepared by Earl N. Strom, PLS 2224, last revised February 18, 2022 , Surveyor Drawing No. 21-09-026 (the "Survey").

5. Easements and rights as reserved in Warranty Deed from Dion's Yacht Yard Corp. to MGX, LLC dated June 17, 2004 and recorded in Book 14127, Page 576, and as shown on the Survey.

6. Such state of facts as set forth on a plan entitled "Site Plan Showing Activity & Use Restriction Area for Property at 48 Bowen Road, Kittery, York County, Maine Owned by: MGX, LLC" dated September 29, 2005, prepared by Northeasterly Surveying, Inc. and recorded in Plan Book 312, Page 30.

7. Such state of facts as set forth in a Department Order from the State of Maine Department of Environmental Protection in the Matter of Dion's Yacht Yard Corporation dated June 5, 2006 and recorded in Book 14895, Page 216.

8. Such state of facts as set forth in a Declaration of Environmental Covenant by MGX, LLC (successor in interest to Dion's Yacht Yard Corporation) and the Maine Department of Environmental Protection dated June 28, 2006 and recorded in Book 14895, Page 220.



Approximated Latitude & Longitude for Proposed Floating Docks			
Floating Dock #	*Size*	*Approximate Latitude*	*Approximate Longitude*
Dock #1	80' x 10'	43° 5'0.94"N	70°43'42.17"W
Dock #2	80' x 10'	43° 4'59.77"N	70°43'40.58"W
Dock #3	80' x 10'	43° 5'0.57"N	70°43'37.33"W
Dock #4	80' x 10'	43° 4'59.14"N	70°43'37.87"W
Dock #5	80' x 10'	43° 5'0.46"N	70°43'35.13"W
Dock #6	80' x 10'	43° 4'59.09"N	70°43'35.25"W
Dock #7	80' x 10'	43° 4'59.08"N	70°43'32.99"W
Dock #8	80' x 10'	43° 4'58.79"N	70°43'31.18"W
Dock #9	80' x 10'	43° 4'59.94"N	70°43'27.95"W
Dock #10	80' x 10'	43° 4'59.07"N	70°43'26.60"W
Dock #11	80' x 10'	43° 4'57.53"N	70°43'29.02"W
Dock #12	80' x 10'	43° 4'55.93"N	70°43'29.11"W
Dock #13	160' x 10'	43° 4'54.19"N	70°43'24.36"W

[redacted]

KITTERY POINT

Eliot, Maine

DRAWING TITLE:

Kittery Point

DRAWING INDEX:

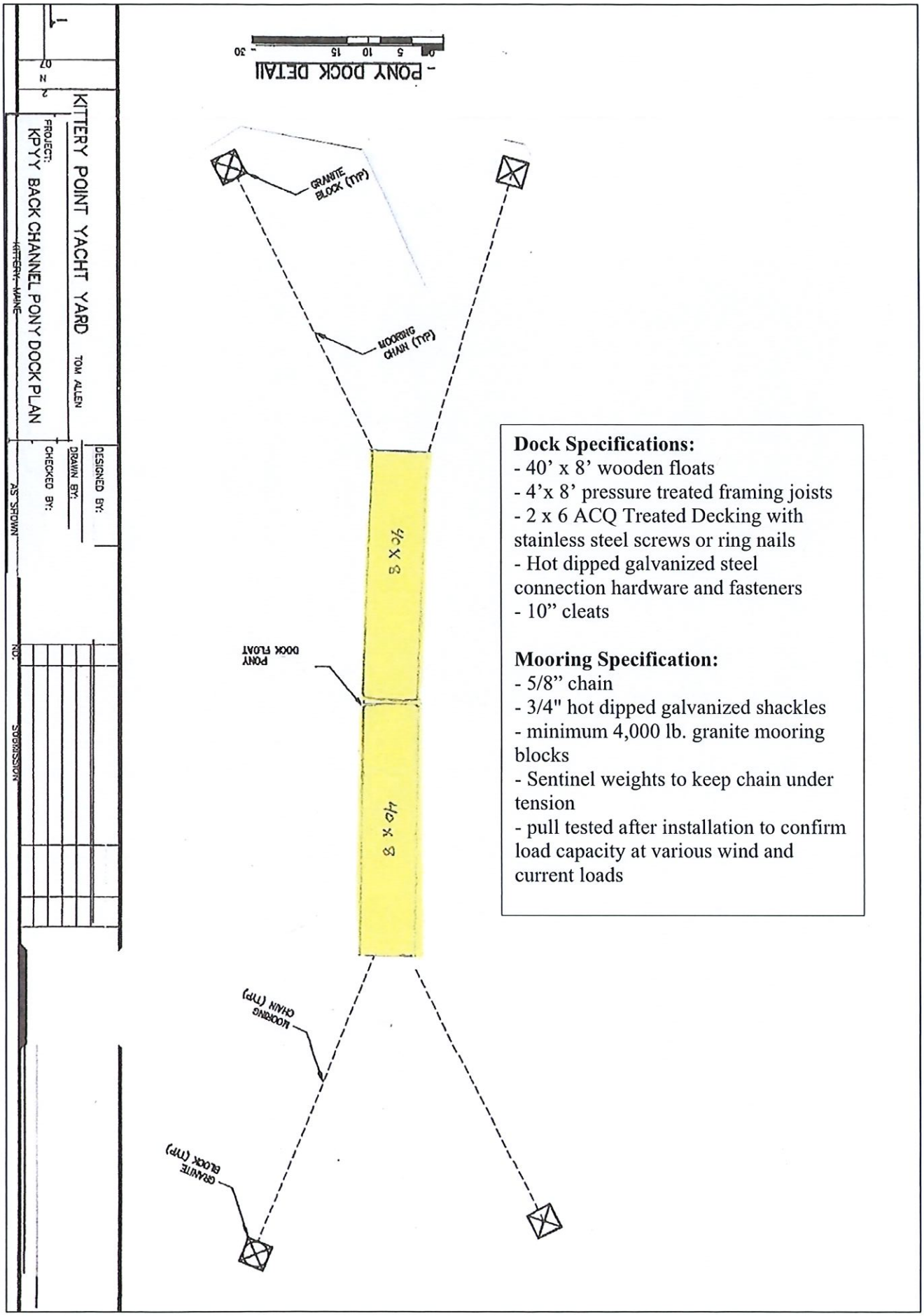
X1 : Proposed

SCALE

0' 150'

N

X1



Dock Specifications:
- 40' x 8' wooden floats
- 4'x 8' pressure treated framing joists
- 2 x 6 ACQ Treated Decking with stainless steel screws or ring nails
- Hot dipped galvanized steel connection hardware and fasteners
- 10" cleats

Mooring Specification:
- 5/8" chain
- 3/4" hot dipped galvanized shackles
- minimum 4,000 lb. granite mooring blocks
- Sentinel weights to keep chain under tension
- pull tested after installation to confirm load capacity at various wind and current loads

DEPARTMENT OF THE ARMY
NEW ENGLAND DISTRICT, CORPS OF ENGINEERS
696 VIRGINIA ROAD
CONCORD, MASSACHUSETTS 01742-2751

REPLY TO ATTENTION OF

MAINE GENERAL PERMITS (GPs)
AUTHORIZATION LETTER AND SCREENING SUMMARY

THOMAS ALLEN
KITTERY POINT YACHT YARD CORP.
48 BOWEN ROAD
KITTERY, MAINE 03904

CORPS PERMIT # NAE-2015-01134-MOD
CORPS GP# 3
STATE ID# exempt

DESCRIPTION OF WORK:
Install and maintain 13 floats below the mean high water mark of the Piscataqua River (Back Channel) at Kittery, Maine. Each of twelve 8-ft. wide x 80-ft. long floats will be comprised of twin 8-ft. wide x 40-ft. long floats and one 8-ft. wide x 160-ft. long float will be comprised of quadruple 8-ft. wide x 40-ft. long floats. Each float will be moored with four, 4,000-lb. granite blocks or equivalent. Approximately 26 commercial single-boat moorings will be removed upon installation of floats. This work is shown on the attached plans entitled "Approximated Latitude & Longitude for Proposed Floating Docks" and "PONY DOCK DETAIL" in two sheets undated. ***See GENERAL CONDITIONS attached.***

LAT/LONG COORDINATES: 43.082801° N -70.724969° W USGS QUAD: KITTERY, ME

I. CORPS DETERMINATION:
Based on our review of the information you provided, we have determined that your project will have only minimal individual and cumulative impacts on waters and wetlands of the United States. **Your work is therefore authorized by the U.S. Army Corps of Engineers under the Federal Permit, the Maine General Permits (GPs) which can be found at:** https://www.nae.usace.army.mil/Missions/Regulatory/State-General-Permits/Maine-General-Permit/ Accordingly, we do not plan to take any further action on this project.

You must perform the activity authorized herein in compliance with all the terms and conditions of the GP [including any attached Special Conditions and any conditions placed on the State 401 Water Quality Certification including any required mitigation]. Please review the GPs, including the GPs conditions beginning on page 5, to familiarize yourself with its contents. You are responsible for complying with all of the GPs requirements; therefore you should be certain that whoever does the work fully understands all of the conditions. You may wish to discuss the conditions of this authorization with your contractor to ensure the contractor can accomplish the work in a manner that conforms to all requirements.

If you change the plans or construction methods for work within our jurisdiction, please contact us immediately to discuss modification of this authorization. This office must approve any changes before you undertake them.

Condition 45 of the GPs (page 19) provides one year for completion of work that has commenced or is under contract to commence prior to the expiration of the GPs on October 14, 2025. You will need to apply for reauthorization for any work within Corps jurisdiction that is not completed by October 14, 2026.

This authorization presumes the work shown on your plans noted above is in waters of the U.S. Should you desire to appeal our jurisdiction, please submit a request for an approved jurisdictional determination in writing to the undersigned.

No work may be started unless and until all other required local, State and Federal licenses and permits have been obtained. This includes but is not limited to a Flood Hazard Development Permit issued by the town if necessary.

II. STATE ACTIONS: PENDING [ ], ISSUED [ ], DENIED [ ] DATE_____

APPLICATION TYPE: PBR:___, TIER 1:____, TIER 2:____, TIER 3:____, LURC: ____ DMR LEASE: ____ NA: X

III. FEDERAL ACTIONS:

JOINT PROCESSING MEETING: 18JUN2015 LEVEL OF REVIEW: SELF-VERIFICATION:___ PRE-CONSTRUCTION NOTIFICATION: X

AUTHORITY (Based on a review of plans and/or State/Federal applications): SEC 10 X, 404_____ 10/404_____, 103_____

EXCLUSIONS: The exclusionary criteria identified in the general permit do not apply to this project.

FEDERAL RESOURCE AGENCY OBJECTIONS: EPA NO, USF&WS NO, NMFS NO

If you have any questions on this matter, please contact my staff at 978-318-8676 at our Augusta, Maine Project Office. In order for us to better serve you, we would appreciate your completing our Customer Service Survey located at: http://corpsmapu.usace.army.mil/cm_apex/f?p=136:4:0

COLIN M. GREENAN
PROJECT MANAGER
MAINE PROJECT OFFICE

Richard Kristoff Jr.
Digitally signed by Richard Kristoff Jr.
Date: 2022.04.07 08:42:54 -04'00'

FOR FRANK J. DEL GIUDICE
CHIEF, PERMITS & ENFORCEMENT BRANCH
REGULATORY DIVISION

US Army Corps
of Engineers ®
New England District

PLEASE NOTE THE FOLLOWING GENERAL CONDITIONS FOR
DEPARTMENT OF THE ARMY
MAINE GENERAL PERMIT 3
PERMIT NO. NAE-2015-01134-MOD

GENERAL CONDITIONS

11. Navigation. a. There shall be no unreasonable interference with general navigation by the existence or use of the activity authorized herein, and no attempt shall be made by the permittee to prevent the full and free use by the public of all navigable waters at or adjacent to the activity authorized herein. b. Work in, over, under, or within a distance of three times the authorized depth of an FNP shall specifically comply with GC 10. c. Any safety lights and/or signals prescribed by the U.S. Coast Guard, State of Maine or municipality, through regulations or otherwise, shall be installed and maintained at the permittee's expense on authorized facilities in navigable waters of the U.S. d. The permittee understands and agrees that, if future operations by the U.S. require the removal, relocation, or other alteration, of the structure or work herein authorized, or if, in the opinion of the Secretary of the Army or his authorized representative, said structure or work shall cause unreasonable obstruction to the free navigation of the navigable waters, the permittee will be required, upon due notice from the Corps, to remove, relocate, or alter the structural work or obstructions caused thereby, without expense to the U.S. No claim shall be made against the U.S. on account of any such removal or alteration.

31. Storage of Seasonal Structures. Seasonal or recreational structures such as pier sections, floats, aquaculture structures, etc. that are removed from the waterway for a portion of the year shall be stored in an upland location and not in wetlands, tidal wetlands, their substrate, or on mudflats. These seasonal structures may be stored on the fixed, pile-supported portion of a structure that is waterward of the mean high water mark or the ordinary high water mark, e.g. the storage of a ramp or gangway on the pile-supported pier. Seasonal storage of structures in navigable waters, e.g., in a protected cove, requires prior Corps approval and local harbormaster approval.

33. Permit(s)/Authorization Letter On-Site. The permittee shall ensure that a copy of the terms and conditions of these GPs and any accompanying authorization letter with attached plans are at the site of the work authorized by these GPs whenever work is being performed and that all construction personnel performing work which may affect waters of the U.S. are fully aware of the accompanying terms and conditions. The entire permit authorization shall be made a part of any and all contracts and subcontracts for work that affects areas of Corps jurisdiction at the site of the work authorized by these GPs. This shall be achieved by including the entire permit authorization in the specifications for work. The term "entire permit authorization" means all terms and conditions of the GPs, the GPs, and the authorization letter (including its drawings, plans, appendices and other attachments) and subsequent permit modifications as applicable. If the authorization letter is issued after the construction specifications, but before receipt of bids or quotes, the entire permit authorization shall be included as an addendum to the specifications. If the authorization letter is issued after receipt of bids or quotes, the entire permit authorization shall be included in the contract or subcontract. Although the permittee may assign various aspects of the work to different contractors or subcontractors, all contractors and subcontractors shall be obligated by contract to comply with all environmental protection provisions contained within the entire GP authorization, and no contract or subcontract shall require or allow unauthorized work in areas of Corps jurisdiction.

34. Inspections. The permittee shall allow the Corps to make periodic inspections at any time deemed necessary in order to ensure that the work is eligible for authorization under these GPs, is being, or has been performed in accordance with the terms and conditions of these GPs.

Lobster Use of Eelgrass Habitat in the Piscataqua River on the New Hampshire/Maine Border, USA

Article *in* Estuaries and Coasts · April 2001

DOI: 10.2307/1352951

6 authors, including:

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University of New Hampshire
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University of New Hampshire
85 PUBLICATIONS **3,685** CITATIONS
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Estuaries Vol. 24, No. 2, p. 249–256 April 2001

Lobster Use of Eelgrass Habitat in the Piscataqua River on the New Hampshire/Maine Border, USA

F. T. SHORT[1,*], K. MATSO[1], H. M. HOVEN[2], J. WHITTEN[1], D. M. BURDICK[1], and C. A. SHORT[1]

[1] *Department of Natural Resources, Jackson Estuarine Laboratory, University of New Hampshire, 85 Adams Point Road, Durham, New Hampshire 03824*
[2] *SWCA, Inc. Environmental Consultants, 230 South 500 East, Suite 230, Salt Lake City, Utah 84102*

ABSTRACT: The relationship between lobsters and eelgrass beds was investigated in the Piscataqua River, which constitutes the lower portion of the Great Bay Estuary, New Hampshire and Maine. The goals of the study were to assess the numbers, size distribution, and sex distribution of lobsters in eelgrass beds, to determine whether lobsters in the eelgrass beds were transients or residents, and to investigate eelgrass density preferences among adolescent lobsters. Eighty percent of the lobsters collected from eelgrass beds were adolescents, measuring > 40 to 70 mm carapace length (CL). Of the 295 lobsters collected at four different eelgrass beds, we found an average male-to-female ratio of 1.2. Tag/recapture efforts in eelgrass beds (1.5 to 4 mo interim period) yielded an average recapture of 5.5%. Twenty transects, each 10 m in length, sampled at two eelgrass sites revealed a lobster density of 0.1 m^{-2}. In mesocosm experiments, lobsters (53–73 mm CL) showed a clear preference for eelgrass over bare mud. Our investigations showed that adolescent lobsters burrow in eelgrass beds, utilize eelgrass as an overwintering habitat, and prefer eelgrass to bare mud.

Introduction

The underwater habitat created by the seagrass *Zostera marina* L. (eelgrass) has been identified as critical for the reproduction and development of commercially, recreationally, and ecologically important shellfish and finfish species (see reviews by Thayer et al. 1984; Heck et al. 1989). The importance of other seagrass habitats to epibenthic shellfish has been documented in Florida Bay, with observations of commercially important pink and brown shrimp populations congregating within seagrass beds (Stoner 1980; Lewis and Stoner 1983). Working in Australia, O'Brien (1994) and Loneragan et al. (1994) demonstrated that seagrass provides critical nursery grounds for tiger prawns (*Penaeus esculentus*). Specifically regarding eelgrass, researchers working in the Chesapeake Bay have shown that the commercially important blue crab (*Callinectes sapidus*) is more abundant in eelgrass habitats than in adjacent unvegetated areas and that eelgrass is an important settlement habitat for post-larval blue crabs (Penry 1982; Montane et al. 1995).

The commercially important American lobster (*Homarus americanus* Milne Edwards) is known to be dependent on shelter for its survival during its early benthic life (Wahle and Steneck 1991). Wahle and Steneck (1991) designated the term early benthic phase (EBP) to describe the developmental stage of lobsters 25–40 mm CL. During this period, lobsters are known to inhabit areas that provide shelter, such as cobble (Wahle and Steneck 1991, 1992; Wahle 1993) or salt-marsh peat reefs (Able et al. 1988). As a lobster matures, however, it exhibits an ontogenetic shift from a post-settlement, shelter-based state to a more mobile existence. According to Wahle and Steneck (1991), the adolescent stage includes lobsters that are greater than 40 mm CL but not yet reproductive.

The onset of the reproductive phase in lobsters differs between males and females and also varies according to water temperature (Aiken and Waddy 1980). Female lobsters south of Cape Cod become reproductive at approximately 65 mm CL, whereas females in the Bay of Fundy become reproductive at 110 mm CL (Wahle and Steneck 1991). For the purposes of this paper, we will use the term adolescent to refer to lobsters > 40 to 70 mm CL. We assume that most lobsters in the Piscataqua River larger than 70 mm CL are either reproductive or nearly reproductive and therefore behaviorally distinguishable from smaller lobsters.

Studying substratum constraints on lobster recruitment, Wahle and Steneck (1991) censused adolescent lobsters in Pemaquid, Maine, and found 0.2 lobsters m^{-2} in eelgrass and 3.8 m^{-2} in cobble. Also in mid-coast Maine, it was shown that cobble habitat was used by adolescent lobsters at densities of 0.3–0.4 m^{-2} as well as EBP lobsters (Wahle and

* Corresponding author: tele: 603/862-2175; fax: 603/862-1101; e-mail: fred.short@unh.edu.

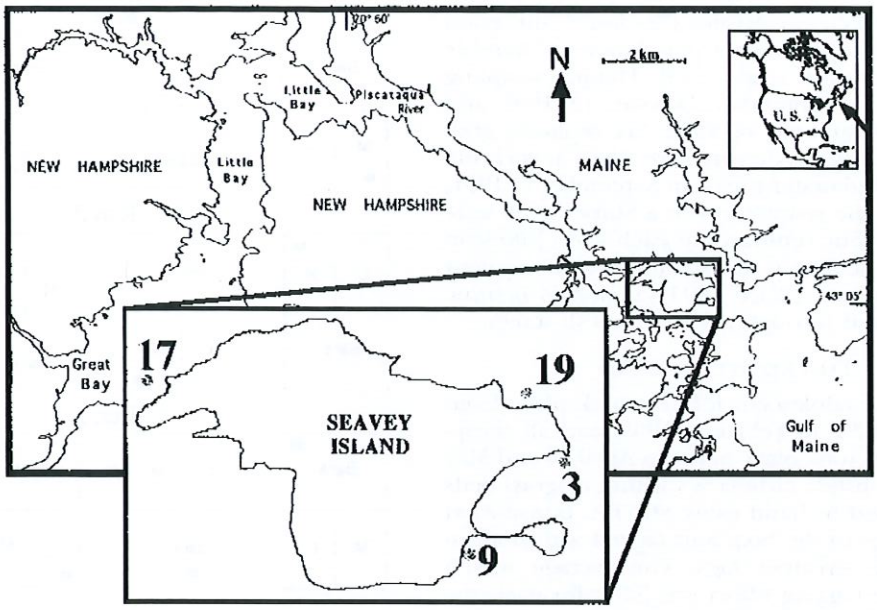


Fig. 1. Location of the lobster collection sites in eelgrass beds around Seavey Island (zoom) in Portsmouth Harbor, lower Piscataqua River, New Hampshire/Maine.

Incze 1997). Karnofsky et al. (1989) found transient and resident lobsters (mostly adolescent) in eelgrass beds in a shallow cove near Woods Hole, Massachusetts, with half the lobsters measuring 50–59 mm CL and the largest lobster measuring 92 mm CL; lobsters smaller than 50 mm CL were not recorded. In the Gulf of St. Lawrence, Hudon and Lamarche (1989) found fewer lobsters in eelgrass beds than in rocky areas, but the eelgrass beds contained more lobsters than adjacent areas of bare sediment. The lobsters they found in the eelgrass were all between 31.2 and 92.3 mm CL, predominantly adolescents.

Barshaw and Bryant-Rich (1988) found that EBP lobsters in eelgrass had a lower mortality rate than those in rock and mud when studied for an 8-mo period in 0.03 m^2 (surface area) aquaria. The authors attributed the lower mortality rate to the higher food resources and increased physical structure associated with eelgrass beds. They reported that lobsters in eelgrass spent much less time maintaining their burrows than lobsters in bare mud. Barshaw and Lavalli (1988), working with 0.33 m^2 (surface area) seawater tables, noted that when preying upon EBP lobsters, cunner (*Tautogolabrus adspersus*) were able to collapse lobster burrows made in bare mud by fanning their tails over the substrate, but in eelgrass this tactic was less successful.

While sampling eelgrass biomass around Seavey Island (Fig. 1) as part of the Portsmouth Naval Shipyard Ecological Risk Assessment (Short 1994), we were surprised to find many lobsters, mostly adolescent, in the eelgrass root-rhizome mass brought up by our modified oyster tong samplers. The present study investigates the population structure of lobsters in these eelgrass beds. We also sought to determine if lobsters were remaining in eelgrass beds for more than 1 mo in winter. Finally, using mesocosm experiments, we examined whether lobsters preferred eelgrass to bare fine-grained substratum and whether lobsters differentiated between low and moderate density eelgrass.

Study Location

Four sites located around Seavey Island (43°05′N, 70°44′W) in Portsmouth Harbor were examined for this study; stations 3, 9, 17, and 19. Portsmouth Harbor is located at the mouth of the Piscataqua River, which forms the border between New Hampshire and Maine along the lower portion of the Great Bay Estuary (Fig. 1). The main navigation channel passes south of Seavey Island. The Piscataqua drains the Salmon Falls and Cocheco Rivers as well as Little Bay, a fairly narrow L-shaped bay connecting to Great Bay. Lobsters have been documented moving in a seasonal migratory pattern into and out of this well-mixed macrotidal estuary (Watson and Howell 1991).

Materials and Methods

As part of the Ecological Risk Assessment, we studied habitat parameters including eelgrass den-

sity, sediment characteristics (% clay, % silt, grain size, and % organic), and populations of benthic infauna (Johnston et al. 1994). Habitat sampling took place in September/October of 1991 and again in the summer of 1992. Six replicate grab samples for eelgrass density were made at each site using modified oyster tongs. In September of 1991, we sampled the sediment with a Shipek grab sampler, taking four replicates at each site (Johnston et al. 1994); sediment texture and organic content were determined (Ward 1994) as well as benthic infauna, sieved through a 0.5-mm mesh screen.

Tag/Recapture Study

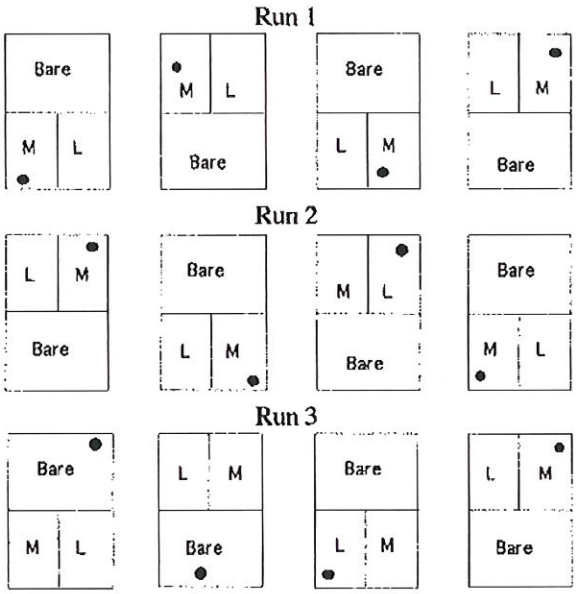
Tagging of adolescent lobsters took place from December 1992 to February 1993, and all recapturing efforts took place between April 16 and May 18, 1993. Lobsters in burrows within eelgrass beds were collected by hand using SCUBA, transported in mesh bags to the boat and tagged with fluorescent orange streamer tags. The average search time for the tagging effort was 5.3 h for each station. Tagging was accomplished by inserting the plastic streamer tag into the lobster flesh between the carapace and the tail so that the lobsters would retain the tags through the molting process (Landsburg 1991). A minimum of 60 lobsters were collected and tagged at each station. Lobsters were returned to the stations where they were initially collected (although not to their specific burrows), and these stations were surveyed again after a range of 1.5 to 4 mo. The recapture period was sufficient to visit each of the sites several times; once a given site yielded no new recaptures, we did not visit the site again. All recaptured lobsters were sexed and measured for carapace length. The search time for the recapture effort was 1.8, 3.3, 1.8, and 1.6 h for stations 3, 9, 17, and 19, respectively. Lobsters were considered to be residents if they were recaptured at the same station after a period of one month or more.

SCUBA Transect Surveys

Transect surveys of lobsters at station 9 on April 19, 1993 and at station 17 on March 29, 1993 were conducted by SCUBA. Transects 10 m long (10 per station) were laid out using line on the bottom within existing eelgrass beds of various plant densities; divers then swam the length of the transect line, recording observations of lobster burrows and lobsters within 1 m on either side of the line. All transects were located in water depths 1–2 m below mean low water.

Habitat Preference Mesocosm Study

Outdoor mesocosm experiments at the Jackson Estuarine Laboratory were conducted during the fall of 1992 to determine if adolescent lobsters preferentially selected eelgrass habitats over unvegetated mud bottom, and if they preferentially selected certain densities of eelgrass. Four mesocosm tanks of 1.5 m^2 surface area each were set up with three different regions: an unvegetated region, a region with low eelgrass density (37 shoots m^{-2}), and a region with moderate eelgrass density (287 shoots m^{-2}). In each mesocosm, the unvegetated zone occupied 50% of the total area; the low and moderately vegetated zones each occupied 25% of the total area. Four replicate tanks were set up with the location of the three habitat types randomly distributed within the replicates (Fig. 2). Each flow-through tank (800-l volume) received 1,000 l



Chi-square Comparison

Lobster Burrow Location (Count)	Chi-square	Confidence Interval (P < 0.05)
Vegetated vs. Bare (10 vs. 2)	4.1	(0.05 > P > 0.025)
Moderate vs. Low (8 vs. 2)	2.5	(0.25 > P > 0.10)

Fig. 2. Diagrammatic design of three runs of the habitat preference mesocosm study with Chi-square comparison. Moderate (M) indicates an eelgrass density of 287 shoots m^{-2}. Low (L) indicates an eelgrass density of 37 shoots m^{-2}. (Bare) indicates unvegetated mud substrate. Lobsters were introduced into the tanks, and the locations of their burrows (denoted by black dot) were recorded.

of ambient sea water d^{-1}, and all tanks were covered with screening to prevent disturbance by birds and to keep the tanks cool. Sixty percent ambient sunlight reached the water surface.

Lobsters for the mesocosm experiments were collected using SCUBA in Portsmouth Harbor, transported to the Jackson Estuarine Laboratory, and maintained in the flowing seawater system for at least 24 h prior to the experiment. Lobsters ranging in size from 53–73 mm CL were selected at random from the holding facility and one was introduced into each tank. Lobsters were placed into the tanks at night to avoid phototactic bias. After 2 wk, we recorded the area in which the burrow was located. The lobsters were then removed from the tanks and returned to the holding facility. The burrows were filled, the bottom surface restored to its original condition, and the tanks allowed to sit for 5 d to let the system stabilize before repeating the experiment. Two experiments were run with the first set of lobsters, and a third experiment was run with a second set of lobsters for a total of three experimental runs.

Chi-square tests were performed for the habitat preference mesocosm experiments and significance levels were set at 0.05. Vegetated habitat (low density and moderate density combined) was compared with bare substrate, and low density eelgrass was compared with moderate density eelgrass. Thus, the expected ratio for any comparison was 1:1, testing the null hypothesis that lobsters had equal preference for constructing burrows in either habitat treatment. Since v = 1 in these tests, we used the Yates Correction for Continuity.

Results

Population Assessment

Of the lobsters inhabiting the eelgrass beds around Seavey Island in Portsmouth Harbor, 11.5% were EBP (between 25 and 40 mm CL), 80% were adolescents (> 40 to 70 mm CL), and 8.5% were adults (> 70 mm CL). Size distributions for all stations were similar (Fig. 3). Station 17 had the highest collection rate, and stations 9 and 17, both close to the main channel, had more adult lobsters than stations 3 and 19 (Fig. 3). The mean CL at each of the four stations ranged from 51 to 56 mm. The average male-to-female ratio of all four stations was 1.2 (Table 1). Of the 25 lobsters over 70 mm CL, only 8 were female (male-to-female ratio = 2.1). Stations 9, 17, and 19 had 26%, 18%, and 15% injured lobsters (missing a claw), respectively, while at station 3, 49% were injured (Table 1).

Tag/Recapture Study

We measured and sexed 295 lobsters during the tag phase of the study. During the recapture phase, we counted 380 lobsters and measured and sexed 9 lobsters at each station. Recapture of the tagged lobsters between April 16 and May 18, 1993, showed resident populations at 3 out of the 4 stations. The average time between tagging and recapture was 95 d (Table 2). Of the 295 lobsters tagged, 15 lobsters were recaptured, with an average size of 57.3 mm CL (Table 1). Recapture was over 9% at stations 3 and 19, 3.4% at station 17, and no lobsters were recaptured at station 9 for an average recapture of 5.5% (Table 1). Of the 15 recaptured lobsters (Fig. 4), 10 were male and 5 were female (Table 2). All the lobsters that were recaptured were found in the beds where they were originally marked; no cross-bed movement of adolescent lobsters was seen.

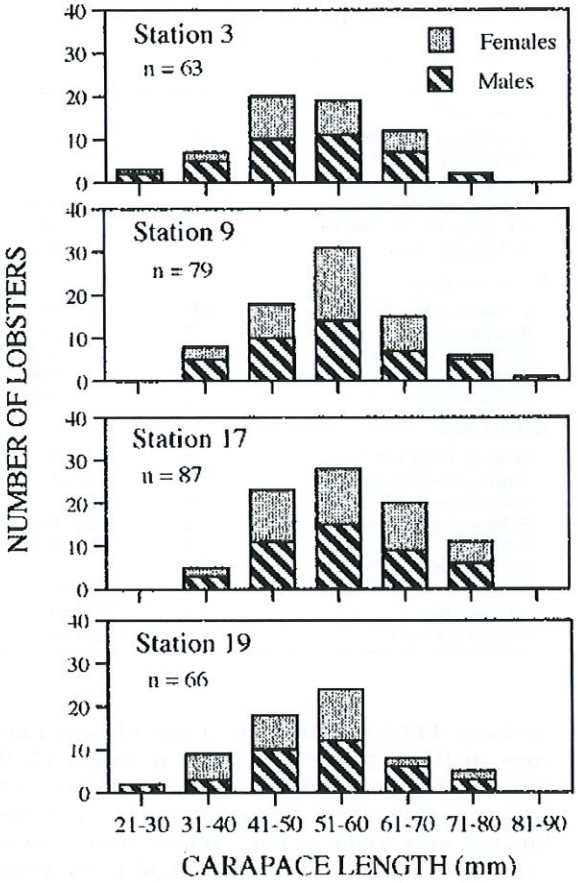


Fig. 3. Lobster size and sex distributions at the four stations around Seavey Island, Portsmouth Harbor. Lobsters were collected between December 1992 and March 1993.

SCUBA Transect Surveys

Ten transects (10 × 2 m, for a total area of 200 m^2) were searched at both stations 9 and 17. At

TABLE 1. Lobster capture/recapture and habitat data for stations sampled in Portsmouth Harbor. Means (SE) included where relevant.

	n	Station 3	Station 9	Station 17	Station 19	Study Average
Lobster data						
Lobsters tagged (#)	295	63	79	87	66	—
Collection rate (# h^{-1})	—	11.5	14.4	15.5	14.3	13.9
Carapace length (mm)	—	51 (1)	55 (1)	56 (1)	51 (1)	53
Male-to-female ratio	—	1.4	1.1	1.0	1.2	1.2
# Lobsters > 70 mm CL	25	2	7	11	5	—
% Missing claws	—	49.2	25.7	17.7	14.9	—
Recapture data						
Lobsters collected (#)	380	183	81	39	77	—
Recaptures	15	6	0	3	6	—
Recapture rate (# h^{-1})	—	3.3	0	1.6	3.8	2.2
Recapture CL, mean (mm)	—	62.0	—	53.8	54.3	57.3
% Recapture	—	9.5	0	3.4	9.1	5.5
Habitat data						
Eelgrass (shoot m^{-2})	6	401 (27)	237 (41)	341 (70)	285 (36)	316
Sediment—% clay	4	17 (1)	16 (2)	20 (2)	20 (2)	18.3
Sediment—% silt	4	35 (3)	18 (2)	30 (1)	39 (3)	31
Sediment grain size (phi)	4	5.23 (0.13)	4.28 (0.24)	5.23 (0.19)	5.58 (0.25)	5.08
Sediment—% organic	4	4.9 (0.3)	4.2 (0.4)	4.3 (0.2)	5.9 (0.7)	4.8
Benthic infauna (# spp.)	4	58	73	69	62	66
Benthic infauna (# $grab^{-1}$)	4	17,438	15,075	71,181	67,181	42,719
Salinity (‰)	2	26.4 (0.2)	28.1 0.3	28.1 (0.3)	26.5 (0.2)	27.3
Temperature (°C)	2	2.6 (0.2)	0.95 0.0	1.2 (0.1)	1.8 (0.1)	1.6

station 9, 14 lobsters (0.07 m^{-2}) and 42 lobster burrows (0.21 m^{-2}) were observed. At station 17, 28 lobsters (0.14 m^{-2}) and 74 lobster burrows (0.37 m^{-2}) were observed. On some transects, lobster burrows were found to have subterranean connections, but counts did not distinguish individual burrows from burrows with such connections. In some instances, more than one lobster was observed in a connected burrow.

Habitat Preference Mesocosm Study

In the mesocosm study (Fig. 2), lobsters showed a clear preference for creating burrows in vegetated habitat over unvegetated habitat (10 choices for eelgrass, 2 for bare substrate; $0.05 > p > 0.025$). Lobsters chose moderate-density eelgrass more often than low-density eelgrass, but the difference was not statistically significant (8 choices for moderate, 2 for low; $0.25 > p > 0.10$).

TABLE 2. Profiles of recaptured lobsters. No lobsters were recaptured at station 9.

Date Tagged	Initial CL (mm)	Date Recaptured	Second CL (mm)	Tag to Recapture (d)	Sex
Station 3					
30Dec92	64	18Apr93	64.1	109	M
30Dec92	58	18Apr93	57.1	109	F
5Feb93	59.7	18Apr93	60.3	72	F
19Feb93	58.6	18Apr93	58.8	58	M
30Dec92	61.1	30Apr98	61.3	121	M
30Dec92	70.1	18May93	70.1	139	M
Station 17					
11Feb93	40	21Apr93	38.3	69	M
30Dec92	70.5	21Apr93	70.7	112	M
4Mar93	52.8	21Apr93	52.3	48	M
Station 19					
30Dec92	51.1	16Apr93	51.2	107	M
30Dec92	52.5	16Apr93	52.8	107	F
30Dec92	58.7	5May93	59.2	126	F
30Dec92	50	5May93	50.3	26	M
26Feb93	62.8	5May93	62.6	68	F
26Feb93	50	5May93	49.7	68	M

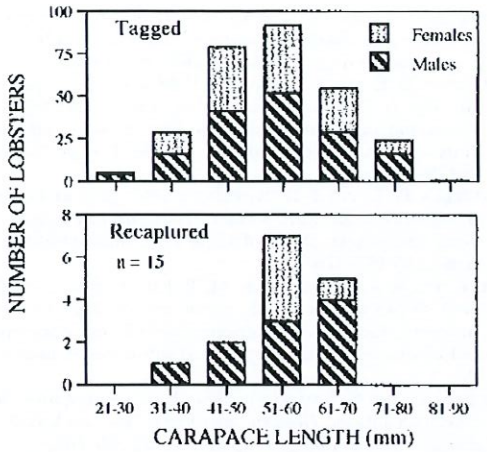


Fig. 4. Size and sex distributions for tagged and recaptured lobsters. Lobsters were tagged between December 5, 1992 and March 4, 1993, and recaptured between April 16 and May 18, 1993. Total SCUBA search time for the recapture effort was 8.5 h.

Discussion

Most of the lobsters inhabiting eelgrass beds around Seavey Island were adolescents. Only 34 of the 295 lobsters collected during the tag phase were less than 40 mm CL, and only 25 lobsters were over 70 mm CL with one lobster, a male found at station 9, greater than 80 mm CL. Our population assessment reinforces the previously observed pattern of primarily adolescent lobsters residing in eelgrass beds (Hudon and Lamarche 1989; Karnofsky et al. 1989). Karnofsky et al. (1989) suggested that the vegetated shallow cove (0.3–1.5 m MLW) studied in Woods Hole served as a lobster refuge, especially for injured males. This was based on a male-to-female ratio of lobsters > 50 mm CL of 1.8 and a high occurrence (26%) of resident males with missing claws. Sampling the eelgrass beds of the Piscataqua River, we also found that 26% of the lobsters we captured were missing claws, with 43% of the injured lobsters female and 57% male. In our sampling, we pulled lobsters from their burrows, which could have caused some of the observed injuries. Injury rates varied widely between sampling locations, ranging from 15% to 49%.

For the lobsters we collected around Seavey Island, the male-to-female ratio was 1.2; this number is consistent whether looking at all the lobsters in our study or just at those lobsters > 50 mm CL. However, when we looked at only those lobsters > 70 mm CL, the male-to-female ratio increased to 2.1. Others (Atema and Cobb 1980; Karnofsky et al. 1989; Estrella and Morrissey 1997) have noted that the onset of sexual maturity occurs in male and female lobsters at different sizes. Aiken and Waddy (1980) stated that females between 58 and 70 mm CL are in a transitional state where reproduction is only sometimes successful. Males, on the other hand, are physiologically mature as small as 45 mm CL. However, since males usually have to be larger than their chosen females for successful mating, they are not functionally mature until much later. Males must also be large enough to defend their mates and their shelters from other males. Females, in comparison, have the advantage of being protected by males when they mate and while they are vulnerable due to molting (Aiken and Waddy 1980). We conclude that the majority of the lobsters we collected were immature females and functionally immature males.

Our stations closer to the main channel of the Piscataqua River (stations 9 and 17) were slightly colder and more saline, had more lobsters > 70 mm CL, had no lobsters < 30 mm CL, and had fewer recaptures overall than the other two stations (Table 1 and Fig. 4). Not one of the 79 lobsters tagged at station 9 was recaptured. At the shallower eelgrass sites more distant from the main channel (stations 3 and 19), the lobsters were smaller and more were recaptured.

None of the recaptured lobsters molted between tagging and recapture; the small size differences are attributed to variation in measurement (Table 2). Aiken (1980) noted that lobsters do not normally molt while overwintering (~ 180 d), and that the molting cycle does not begin until the water temperature reaches approximately 10°C. Studies in Nova Scotia and Prince Edward Island, Canada, found that the molting cycle began in late May or June and ended between September and October (Landsburg 1991; Maynard 1991; Tremblay and Eagles 1997). Based on the time of year and the water temperature during our recapture effort (April 16 to May 18; 6.4°C to 11.0°C), it seems that our sampling took place just prior to the molting season.

The recapture of 15 of the 295 tagged lobsters demonstrates that lobsters do overwinter in eelgrass beds. Most recaptured lobsters were adolescents; all but 3 measured in the 40 to 70 mm CL range, with 2 of those 3 less than 71 mm CL (Table 2). The transect surveys indicated that lobster density was 0.1 m^{-2} in the eelgrass beds. Also, approximately one third of the identified burrows in eelgrass beds were occupied, with lobster-to-burrow ratios of 38% and 33% for stations 17 and 9, respectively. The pattern noted in this limited sampling is that lobster and burrow densities were proportional in eelgrass beds.

Our mesocosm experiments agree with results from previous studies comparing eelgrass to other

substrata as lobster habitat. Working in the field, Hudon and Lamarche (1989) found more lobsters in eelgrass beds than in nearby unvegetated mud. In aquaria, Barshaw and Bryant-Rich (1988) found that eelgrass offered EBP lobsters increased physical structure and food resources compared to unvegetated mud. In our mesocosm study, with no difference in food resources between eelgrass of two densities and unvegetated mud, adolescent lobsters still preferred eelgrass, indicating a response to structure. Also, lobsters in the mesocosm experiments exhibited a strong, though not statistically significant, preference for burrowing in moderate-density eelgrass (8 burrows) over low-density eelgrass (2 burrows).

The experimental mesocosm results, coupled with our findings that the lobsters with an average CL of 53 mm resided in eelgrass beds at a density of 0.1 m^{-2}, indicate that the eelgrass habitat surrounding Seavey Island in the Piscataqua River serves as a significant refuge for adolescent lobsters. Based on our studies to date, it is impossible to assess the overall importance of eelgrass beds to adolescent lobster populations in the region. We do know that eelgrass in the U.S. Gulf of Maine covers an area of 20,000 hectares (Barker, Costello, Short unpublished data), providing a substantial potential habitat resource. Studies of the habitat requirements of early benthic phase and adolescent lobsters have demonstrated the importance of cobble (Wahle and Steneck 1991; Wahle 1993; Wahle and Incze 1997). For the adolescent lobsters we studied, habitat preferences are not fully known but do include eelgrass.

Acknowledgments

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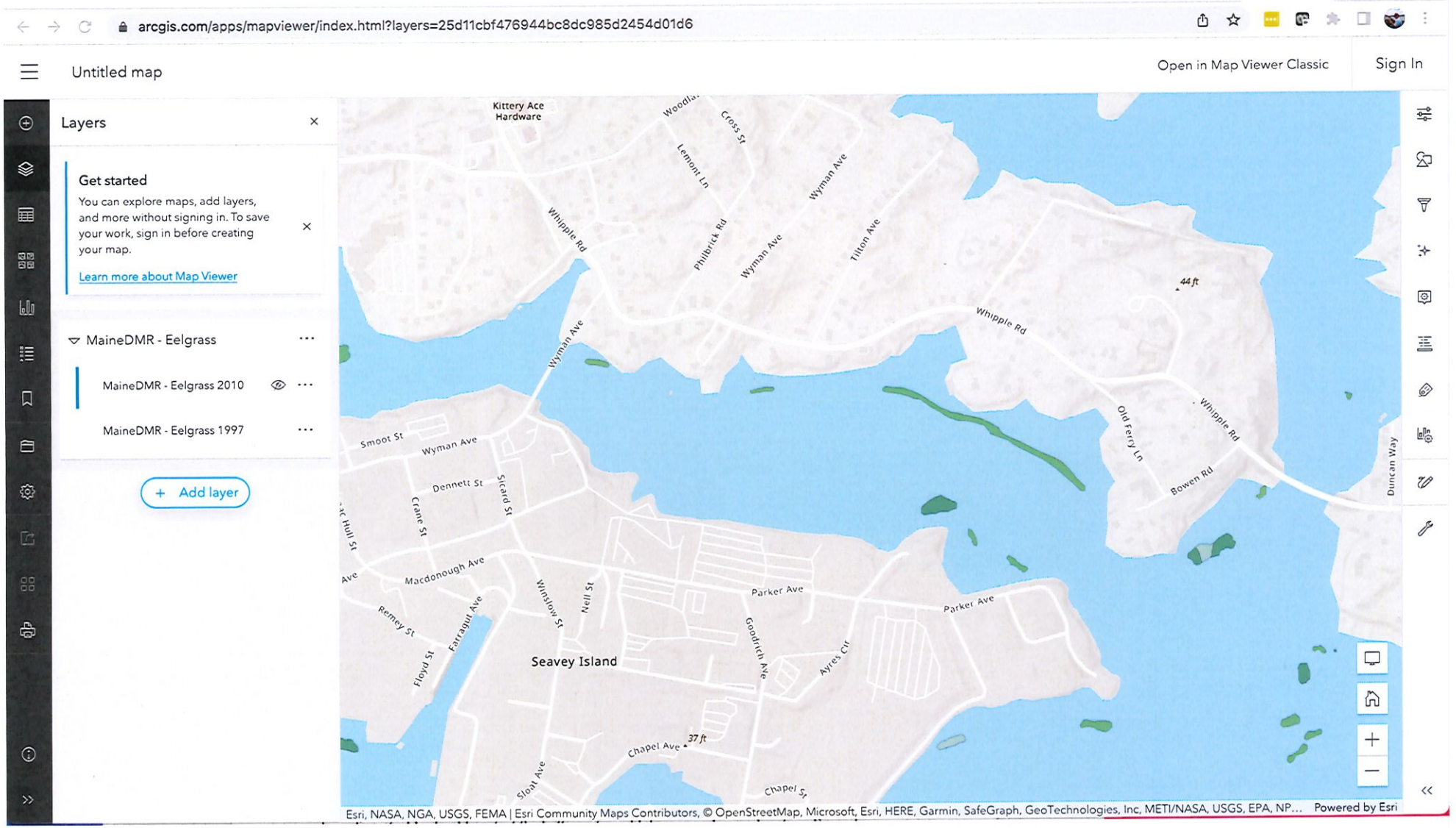
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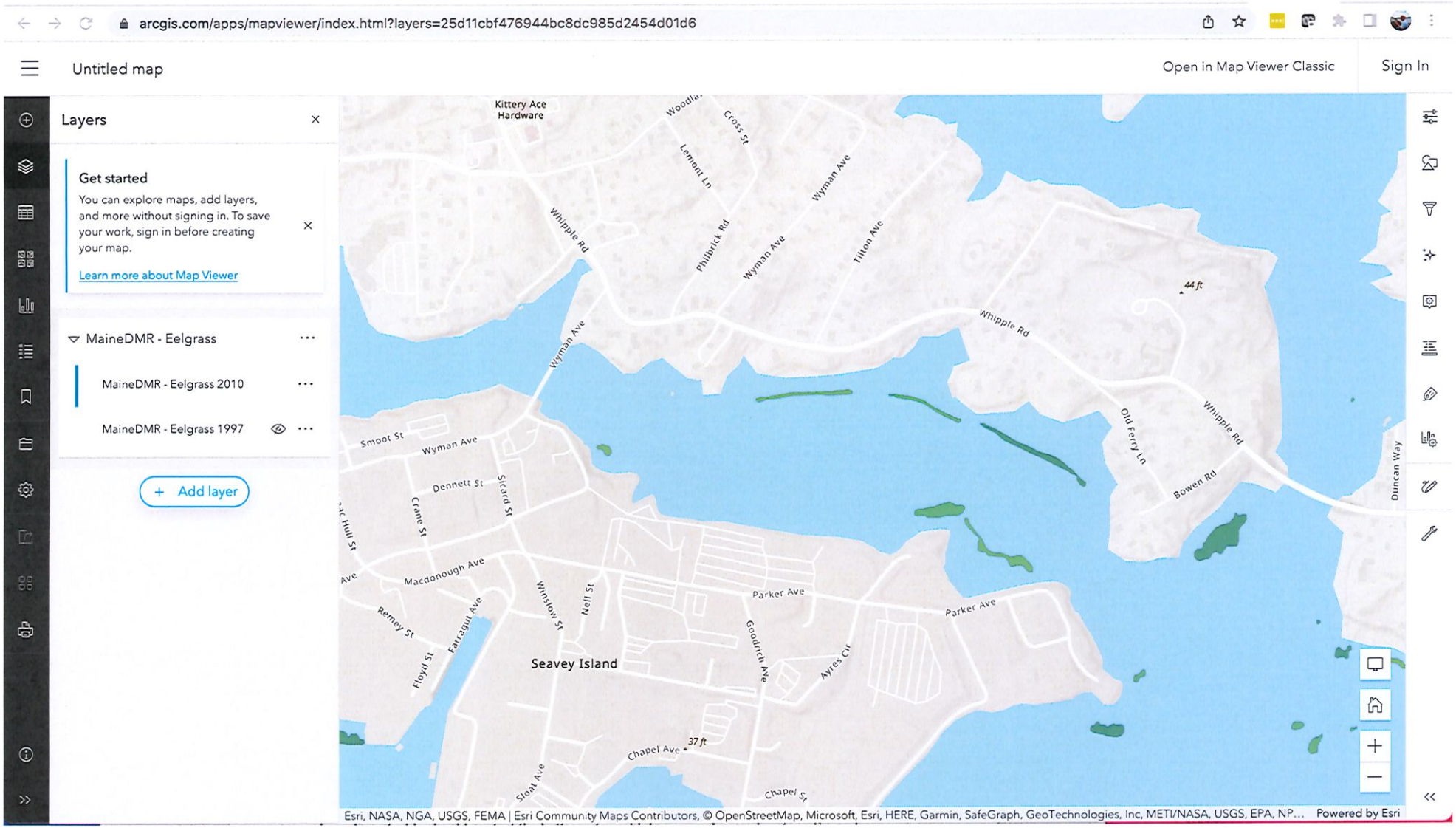
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PRIMARY RESEARCH PAPER

Disturbance of intertidal soft sediment assemblages caused by swinging boat moorings

R. J. H. Herbert · T. P. Crowe · S. Bray · M. Sheader

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Abstract The impact of swinging boat moorings on intertidal benthic assemblages was investigated in a small estuary on the south coast of England. Mooring buoys fixed near low water mark on a muddy shore were attached to 5 m of galvanised steel chain and had not been let for 12 months. Core samples for macro-invertebrates and sediments were taken both within and outside the chain radius of each buoy. The assemblage structure, biomass and abundance of selected bird prey species were examined at a range of scales. The study revealed variation in the impact of mooring buoys relative to control areas at two different times of sampling. Prior to the removal of buoys, the assemblage structure within areas affected by the buoys was found to be significantly different from unaffected areas. The abundance of the amphipod *Corophium volutator*, an important bird prey species, was significantly less in the areas affected by the buoys. In the second sampling programme (15 months after removal of buoys), the impact of extant buoys remaining in commission was not detectable. Assemblage structure in areas from which buoys had been removed was distinct from control areas which had never had buoys. The removal of mooring buoys clearly affected the assemblage, yet convergence with control areas, indicative of recovery, was not complete after 15 months. It is suggested that the effect of swinging mooring chains scraping over the mud surface may modify sediments favouring the greater prominence of larger particles such as gravel and shell fragments. The ecological impact of swinging moorings on estuarine benthic assemblages in designated protected areas is discussed in the context of other spatial and temporal disturbances.

Keywords Disturbance · Estuaries · Boating · Intertidal macrofauna · Recreation · Coastal management

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Introduction

Recreational boating is increasing worldwide (Cicin-Sain et al., 1998; Widmer & Underwood, 2004). The disturbance it may cause to aquatic habitats is perceived to be of conservation concern (Davenport & Davenport, 2006). Research has focussed on issues concerned with marina developments (Turner et al., 1997), water quality (Langston et al., 1994; Matthiessen et al., 1999), disturbance to benthic habitats and sea grass meadows by permanent subtidal moorings and anchoring (Walker et al., 1989; Creed & Amado, 1999; Francour et al., 1999; Backhurst & Cole, 2000; Milazzo et al., 2004), propellers (Uhrin & Holmquist, 2003) and disturbances caused by boat movements (Eriksson et al., 2004). In Europe, much boating activity falls within marine protected areas, yet there have been few ecological studies that have investigated this impact, especially upon intertidal estuarine habitats. Understanding the responses of marine ecosystems to disturbance is a key to predicting their spatial and temporal dynamics (Pickett & White, 1985). The extent of disturbance is known to influence the diversity and composition of benthic assemblages (Connell, 1978; Probert, 1984; Hall et al., 1994; Hall 1994).

The Solent, on the south coast of England, is one of the most popular sailing areas in the world and has seen a growth in moorings of 27% in the past 30 years to currently stand at approximately 24,000 (Solent Forum, 2008). While many vessels are harboured in marinas or deep-water moorings, a large number of boats on swinging moorings 'dry-out' at low tide in estuaries. Boats aground on intertidal mud and sand flats occupy potential bird feeding areas, and in some harbours and estuaries this collective footprint may be large. Moreover, moored boats and associated chains may cause scour and mechanical damage to the mud surfaces as they swing around their anchor point, and potentially impact upon the size and composition of invertebrate populations and assemblages that form important bird prey resources.

Although boats could be attached to moorings for considerable time, most swinging moorings will be subject to periods when boats have left the mooring and are out sailing. In the UK, many leisure craft are lifted out for 4–6 months during the winter, and numerous un-let or visitor moorings can normally be found in harbours and estuaries. Additionally, moored navigation marks may cause similar disturbances. The unseen, yet permanent, impact of the mooring is not the boat attached, which may be away for long periods, but the ground tackle and chain that moves over the sea bed in response to changes in wind and tide.

The aims of this investigation were to determine the extent to which swinging moorings impact upon estuarine soft sediment assemblages and to assess recovery following the removal of the moorings. In addressing these aims, we focussed on variation at a range of scales in assemblage structure, total biomass and the abundance of selected species considered important as food for birds.

Materials and methods

Study area

The Medina is a narrow, linear estuary 7.5 km in length with an intertidal area of 66 ha. It is a component of the Solent European Marine Site (European Habitats Directive 92/43/EEC and EU Birds Directive 79/409/EEC) and a Ramsar Site. Tides are semi-diurnal and the mean spring tide range is 3.6 m. The study area known as the 'Folly' (Fig. 1) is approximately halfway along the estuary where it is at its widest (0.5 km). Peak ebb currents here are 0.4 m s^{-1}. Surface salinity is 31–34 and there is seasonal dilution to 26 (Withers, 1979). Salinity at the water–sediment interface at High Water is 33–34. The surface water temperature range is between 6 and 20°C.

At the mouth of the Medina is the internationally famous yachting town of Cowes where there are large marinas and deep-water swinging moorings. Pile moorings, whereby boats are tied between posts, and pontoons for local and visiting craft occupy each side of the narrow channel along the lower 4 km of the estuary. In July 2004, 44 boats of between 5.5 and 8.0 m occupied swinging moorings between mean tide level (MTL) and low water spring tide level (LWS). Collectively, these craft, with an average of 6 m of chain attached, are estimated to scour 3% of the mudflat area as they swing with tide and wind. The duration of scour is dependent on mooring height above low tide and the length of chain. It is estimated that over a 12-h tidal cycle during a spring tide, these chains could scrape the mud surface for 7 h. At high tide, relatively little chain would be on the bottom,

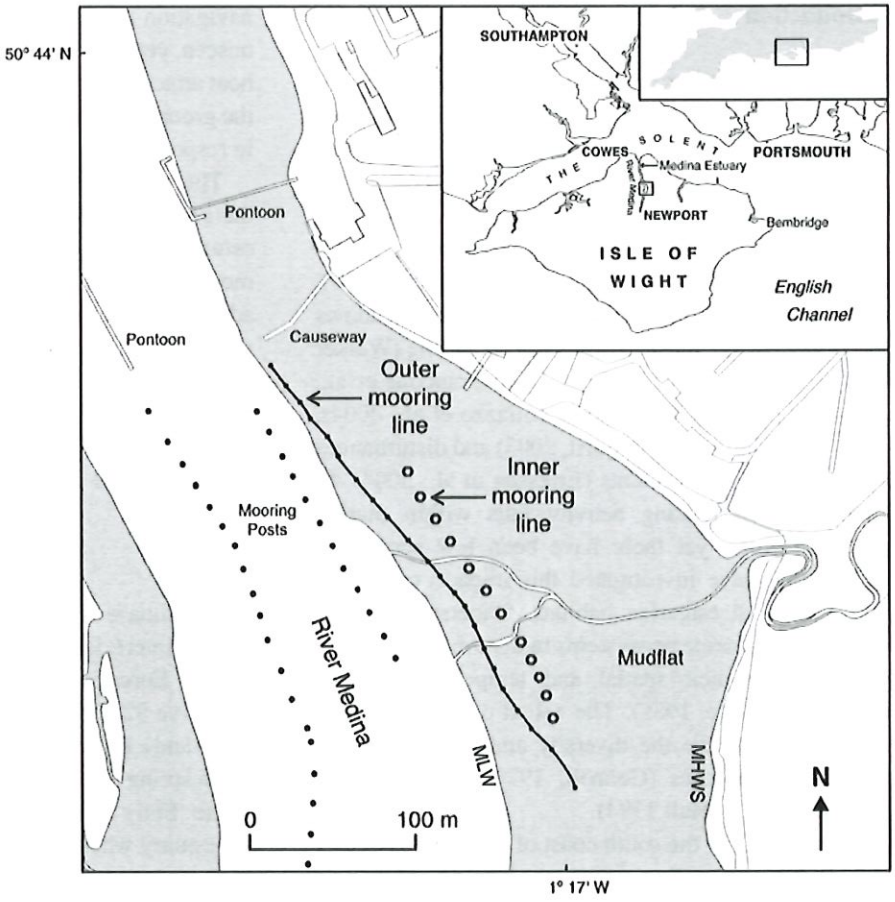

Fig. 1 Location of study area on the Medina Estuary, Isle of Wight. Samples were taken from two buoys along the 'inner mooring line'

whereas just prior to the buoy grounding as the tide recedes, most chain could be scraping over the mud.

Other potential disturbances from bait digging and clam collecting were not observed to occur in the immediate vicinity of the study area, although do occur on the estuary.

Fieldwork and sample processing

Two buoys were selected from an 'inner mooring line' of 12 small-craft (<6 m length) moorings that dried out between MTL and mean low water neap tide level in the Medina Estuary (Fig. 1). The buoys, 70 m apart, were attached to 2 m of rope (15 mm) and approximately 5 m of galvanised 8 mm steel chain that was attached to concrete blocks buried in the mud. The moorings had not been let during the year immediately prior to the fieldwork but had continued to swing around their anchor point with changes in tide and wind direction.

In September 2000, two separate random patches of five core samples were taken within the chain radius of each buoy and also within a control area 3–4 m beyond the chain radius of each buoy. Patch diameter was 1.5 m; core diameter was 10 cm and sampling depth 15 cm. The distance between patches was at least 3 m. This hierarchical sampling design was chosen so that any difference found between areas with and without buoys could be more confidently attributed to the buoys rather than small-scale variation in assemblage structure (Thrush, 1991; Winer et al., 1991; Underwood, 1997). Samples were processed using a 0.5-mm sieve and the animals preserved in 5% formaldehyde in seawater. Prior to sorting, samples were stained with Rose Bengal and macrofauna were identified to species where possible. Bryozoans were not identified to species level and, being colonial, were not easy to quantify. Where present in a core, usually on the shell of a bivalve, they were given an abundance of 1 for that core. Sub-

sampling was carried out for abundant species such as small oligochaete worms.

Following removal of the mooring buoys and ground tackle in July 2001, the sites were revisited in October 2002 utilising the same procedures to determine whether changes consistent with 'recovery' (convergence of the benthic assemblages) had taken place. In addition, to ensure that any evidence for recovery was due to decommissioning and not a reflection of temporary changes in assemblage structure, samples were also obtained from two moorings that had remained in commission. Finding that decommissioned sites were similar to unimpacted control sites yet different from sites subject to ongoing impact would provide clearer evidence for recovery (Chapman, 1998).

Estimation of sample biomass

A contractual requirement to preserve specimens necessitated a non-destructive estimation of sample biomass utilising mean dry-weight values for taxa held on a database (Medina Valley Field Centre, Isle of Wight). These measurements were obtained from material dried at 80°C for 48 h.

Sediment analysis

A core of 10 cm diameter was used to obtain samples for particle size analysis from each of the two 'Buoy sites' and two 'Control sites'. Samples were sieved wet over a stack of Wentworth sieves. The finer clay fractions (below 0.063 mm diameter) were not quantified. The organic content of the sediments was determined by placing 10 g sub-samples in a muffle furnace at 450°C for 8 h and measuring loss in mass on ignition. This was the most practical method available to help avoid overestimation of organic content due to loss of structural water in clays (Schulte & Hopkins, 1996; Cambardella et al., 2001).

Statistical analysis of biological data

Differences in assemblage structure

Non-metric mulitdimensional scaling (MDS) was used to produce a graphical representation of the data using the software package PRIMER (Clarke and Warwick, 1994). MDS plots were based on Bray–Curtis similarity measures calculated using square-root transformed data. Permutational multivariate analysis of variance (PERMANOVA) was used to test hypotheses of difference in community structure among groups of samples from different patches, sites and treatments (Anderson, 2001, 2005; McArdle and Anderson, 2001). Two analyses were done: one for data collected prior to removal of moorings and the other for data collected after removal. Prior to removal of moorings, the factors were: Treatment (fixed, 2 levels: buoy versus control); Site (random, 2 levels, nested in Treatment) and Patch (random, 2 levels, nested in the Treatment × Site interaction). After removal of moorings, the factors were the same, but there was an additional level for the factor Treatment (see above).

The PRIMER routine similarity of percentages (SIMPER) was used to identify which species were important in discriminating among samples from the different treatments.

Differences in abundance of individual taxa and total biomass

Variation in sample biomass and abundance of the more common invertebrate species (*Tubificoides* spp. *Cirriformia* and *Corophium*) known to be important prey items for birds (Prater, 1981) was tested separately using hierarchical ANOVA. A separate analysis was done for each variable. Two sets of analyses were done: one for data collected prior to removal of moorings and the other for data collected after removal. The factors involved were the same as those described above for multivariate analyses. There were five replicates. Heterogeneity of variance was tested using Cochran's test and where necessary, data were transformed.

Results

Prior to removal of moorings

A visual assessment of the mudflats in the vicinity of the moorings showed no obvious evidence of disturbance of the mud surface within the chain radius of each buoy. All samples contained coarser sediments, including small gravel, within a matrix of fine silt and clay. Below the top 10 mm sediments were anoxic.

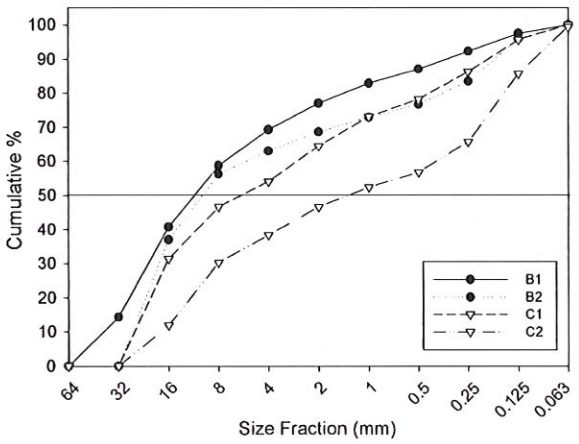

Fig. 2 Cumulative percentage weight of each sediment size class for samples from within the chain radius of buoys 1 & 2 and the two control sites. Samples sieved over a Wentworth sieve stack; largest diameter (64 mm). The median sediment size class (D^{50}) is indicated by *horizontal line*. See text for further details

Particles included shells of cockles and other molluscs. The median sediment size class (D^{50}) and interquartile range (IQR) were determined for each sample (Fig. 2). These were larger from samples affected by the buoys (D^{50} 11.2 and 10.1 mm; IQR 21.7 and 19.3 mm) than the unaffected control areas (D^{50} 5.84 and 1.34 mm; IQR 17.64 and 9.76 mm). The mean organic content of samples obtained from buoys was 2.85% (SE ± 0.05) and 2.65% (SE ± 0.35) from control areas.

The fauna was typical of that found previously at lower tidal levels within this part of the Medina Estuary (Withers, 1979). A total of 21 taxa were identified in the samples; 19 species occurred in the areas scraped by buoy chains and 15 occurred in the control areas (Table 1a). Epifaunal species attached to stones and shells including the barnacle *Elminius modestus* and chiton *Lepidochitona cinereus* were found only in the areas affected by the buoys.

Prior to removal of buoys, samples from different patches within a site and different sites within a treatment (i.e. buoy versus control) were intermingled, indicating no strong spatial patterns of community structure at either of those scales (Fig. 3, Table 3a). There was, however, a significant separation ($P < 0.024$) between samples from areas with buoy chains and samples from control areas (Fig. 3, Table 2a). It should be noted, however, that the stress value associated with this 2D representation is >0.2. Care should therefore be taken interpreting the figure (Clarke, 1993).

SIMPER analysis revealed 90% of variation among groups of samples collected near buoys and from control areas were caused by differences in abundance of *Tubificoides* sp., *Tubificoides benedii*, *Cirriformia tentaculata*, *Elminius modestus*, *Neanthes virens*, *Macoma balthica* and *Cerastoderma edule* which occurred in greater abundance among buoys than in control areas and by *Corophium volutator* and *Anaitides mucosa* which occurred in greater abundance in control areas than among buoys.

There were no significant differences between patches, sites or treatments for total biomass or densities of *Cirriformia tentaculata* or *Tubificoides* spp. (Fig. 4a, b, d; Table 3a, b, d). However, *Corophium volutator* was significantly more abundant at control sites than at sites with buoys (Fig. 4c, Table 3c; Student–Newman–Kuels (SNK) procedure, $P < 0.05$). The mean density of *Corophium* was reduced by 40% from 4,624 m^{-2} in control sites to 2,752 m^{-2} in sites with buoys.

After removal of moorings

In October 2002, 15 months after removal of selected moorings, 15 species occurred in the control sites, 19 in sites from which buoys had been removed (decommissioned) and 18 species occurred in areas that were still being scraped by buoy chains (Table 1b). Generally, percentage occurrences and average densities of most species were comparable at sites in the three treatments. There were however differences in the densities of single species. The burrowing anemone *Cereus pedunculatus* was found only in decommissioned sites where it attained a mean density of 35 m^{-2} (Table 1b). Although cockles, *Cerastoderma edule*, were on average two to three times more abundant at decommissioned sites compared to controls or extant moorings (Table 1b), significant variation was at the scales of Patches and Sites, rather than among treatments (Treatment: $F_{2,3} = 1.33$, $P > 0.38$). Of the common species considered important as food for birds, there were no differences among treatments in the abundances of *Tubificoides* spp. (Treatment: $F_{2,3} = 2.05$, $P > 0.47$) or *Cirriformia tentaculata* (Treatment: $F_{2,3} = 0.14$, $P > 0.87$). The burrowing amphipod *Corophium*

Table 1 Summary of mean densities of species present and the percentage of samples in which they occurred (a) prior to removal of mooring buoys and (b) after removal of mooring buoys

Taxon	Buoys present			Control areas		
	Occurrence (% samples)	Mean density (m^{-2})	95% CI	Occurrence (% samples)	Mean density (m^{-2})	95% CI
(a)						
Sagartia troglodytes	20	25.48	22.91	15	31.85	35.66
Nemertea						
(*Lineus* sp.)	10	12.74	17.18	5	12.74	24.97
Anaitides mucosa	0	0	0	30	261.15	288.39
Ampherete sp.	5	6.37	12.48	10	12.74	17.18
Cirriformia tentaculata	100	3974.57	1260.40	100	2770.73	1065.32
Nereis (Neanthes) virens	85	248.41	77.86	90	229.30	58.97
Nephtys hombergii	10	12.74	17.18	5	6.37	12.48
Tubificoides benedii	100	5687.96	1233.79	95	3681.57	1252.21
Tubificoides sp.	100	8019.20	4062.49	100	7445.95	3798.74
Carcinus maenas	5	6.37	12.48	5	6.37	12.48
Corophium volutator	100	2751.62	660.95	100	4624.26	675.36
Cyathura carinata	5	6.37	12.48	0	0	0
Elminius modestus	25	783.45	1444.28	0	0	0
Gammarus sp.	5	6.37	12.48	0	0	0
Melita palmata	5	6.37	12.48	0	0	0
Cerastoderma edule	40	63.70	38.43	25	31.85	24.80
Hydrobia ulvae	0	0	0	10	38.22	54.64
Lepidochitona cinereus	15	19.11	20.45	0	0	0
Littorina littorea	5	6.37	12.48	0	0	0
Macoma balthica	55	76.43	33.40	20	25.48	22.91
Bryozoa indet.	10	12.74	17.18	0	0	0

Table 1 continued

Taxon	Buoys present			Control areas			Buoys removed		
	Occurence (% samples)	Mean density (m^{-2})	95% CI	Occurence (% samples)	Mean density (m^{-2})	95% CI	Occurence (% samples)	Mean density (m^{-2})	95% CI
(b)									
Cereus pedunculatus	0	0	0	0	0	0	10	35.37	47.71
Nematoda	15	70.74	81.09	20	61.89	57.75	50	335.99	221.93
Nemertea	0	0	0	5	17.68	34.66	15	53.05	56.79
Ampharete acutifrons	0	0	0	5	17.68	34.66	40	159.15	93.75
Anaitides mucosa	5	17.68	34.66	0	0	0	10	53.05	75.85
Tubificoides benedi	80	1167.14	605.79	80	592.41	258.92	95	3713.62	1458.86
T. pseudogaster	90	5110.64	2367.12	85	2749.84	1343.86	95	3890.45	3824.07
Cirriformia tentaculata	100	15066.67	3981.67	100	14169.21	3846.86	100	12767.76	2770.05
Caulleriella sp.	100	2581.85	609.95	70	618.94	300.43	100	1768.39	548.61
Nereis (Neanthes) virens	10	35.37	47.71	0	0	0	5	17.68	34.66
Mediomastus fragilis	5	17.68	34.66	0	0	0	5	17.68	34.66
Cossura longocirrata	5	17.68	34.66	5	17.68	34.66	0	0	0
Capitella capitata	5	17.68	34.66	10	22.10	35.28	0	0	0
Streblospio shrubsolli	35	141.47	92.73	65	579.15	251.29	0	0	0
Carcinus maenas	10	35.37	47.71	0	0	0	35	123.79	75.85
Melita palmata	0	0	0	0	0	0	25	212.21	221.51
Ampharete baltica	0	0	0	5	35.37	69.32	0	0	0
Magelona mirabilis	5	17.68	34.66	0	0	0	0	0	0
Melinna palmata	10	35.37	47.71	5	17.68	34.66	0	0	0
Cerastoderma edule	35	371.36	268.36	80	477.46	161.69	90	1131.77	364.74
Macoma balthica	10	35.37	47.71	20	84.00	82.90	5	17.68	34.66
Abra tenuis	10	35.37	47.71	0	0	0	5	17.68	34.66
Lepidochitona cinerea	0	0	0	0	0	0	10	35.37	47.71
Hydrobia ulvae	90	1697.65	536.01	95	2055.75	536.50	95	2723.32	1030.77
Crepidula fornicata	0	0	0	0	0	0	5	17.68	34.66

Data based on a total of 20 samples taken from patches and sites in each treatment. Densities converted to m^2

CI confidence interval

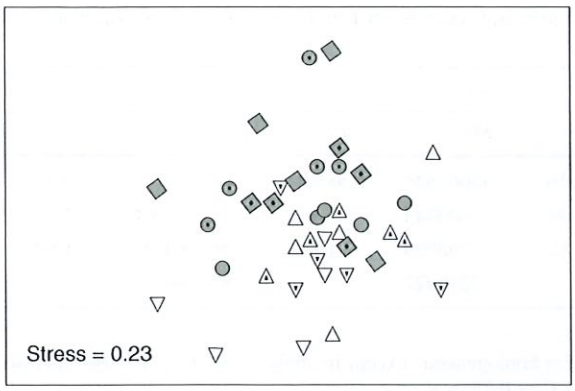

Fig. 3 MDS ordination of assemblages in all samples collected prior to removal of moorings. Each point represents a single sample. White *triangles* and *inverted triangles* represent samples from buoys 1 and 2, respectively. *Grey circles* and *diamonds* represent samples from control sites 1 and 2, respectively. *Symbols* with and without *black centres* distinguish samples from different patches within each site. See text for further details

Table 2 PERMANOVA analyses of differences between patches, sites and treatments: (a) prior to removal of moorings (Treatments = buoys versus controls) and (b) after removal of moorings (Treatments = extant buoys versus controls versus buoy removal areas)

Source of variation	df	MS	Pseudo-*F*	*P*(MC)
(a)				
Treatments = Tr	1	1622.6	4.04	0.024
Sites = Si(Tr)	2	401.7	0.88	0.554
Patches = Pa(Si(Tr))	4	454.2	1.09	0.378
Residual	32	415.2		
Source of variation	df	MS	Pseudo-*F*	*P*
(b)				
Treatments = Tr	2	5194.9	2.47	0.033
Sites = Si(Tr)	3	3172.5	1.03	0.469
Patches = Pa(Si(Tr))	7	7211.7	2.38	0.001
Residual	47	20,333		

Data were square-root transformed. Analyses were done on Bray–Curtis similarity matrices using 999 permutations of residuals under a reduced model. In analysis (a), Monte Carlo tests (MC) were used given the limited number of unique permutations for factor 1

volutator, which was less abundant in areas affected by the original moorings in September 2000, was not recorded at any site during this sampling.

After removal of moorings, there was considerable variation in assemblage structure at the scale of

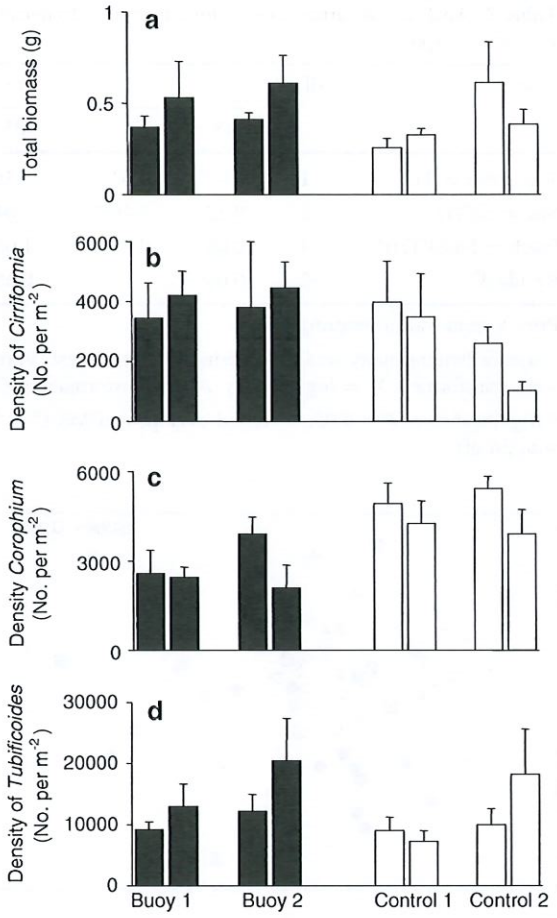

Fig. 4 **a** Mean total biomass of macrofauna per core, **b** density of *Cirriformia tentaculata*, **c** density of *Corophium volutator* and **d** density of *Tubificoides* spp. at the sites sampled prior to the removal of mooring buoys. In each graph, each site is represented by two *bars*. Each *bar* represents a single patch at which five replicate cores were taken. Mean + SE shown. Note different scales on the *y* axes

Patches and among Treatments (Fig. 5, Table 2b), although the stress is again >0.2, so the specific placement of the points should be interpreted with caution (Clarke, 1993). Assemblages in areas from which moorings had been removed were distinct from those in control areas in which buoys had never been present (PERMANOVA post hoc pairwise comparisons). SIMPER analysis indicated that this difference was underpinned by reduced abundances of *Cirriformia tentaculata* in areas from which moorings had been removed and increased abundances of *Tubificoides benedi*, *T. pseudogaster*, *Caulleriella* sp. and *Hydrobia ulvae*. Assemblages in control areas and

Table 3 Analyses of variance of (a) total biomass, (b) density of *Cirriformia*, (c) density of *Corophium volutator* and (d) density of *Tubificoides* spp.

Source	df	(a)		(b)		(c)		(d)	
		MS	*F*	MS	*F*	MS	*F*	MS	*F*
Treatment = Tr	1	0.07	0.62	2.35	2.26	35067544	58.40*	66545812	0.42
Site = Si(Tr)	2	0.12	1.46**	1.04	0.98	600443	0.16	1.57×10^8	1.78***
Patch = Pa(Si(Tr))[a]	4	0.08	0.97	1.06	1.60	3790099	1.69	96140391	1.09
Residual[b]	32	0.08		0.66		2249027		87498057	

Prior to removal of mooring buoys

Variance heterogeneity was tested using Cochran's test. Variances were homogeneous except in analysis (b). Data for that analysis were transformed, $X' = \log(X + 1)$. After transformation, Cochran's $C = 0.25$, n.s.

* Significance at $P < 0.05$; ** tested over pooled MS ($^a + ^b = 0.08$ with 36 df); *** tested over pooled MS ($^a + ^b = 88458316$ with 36 df)

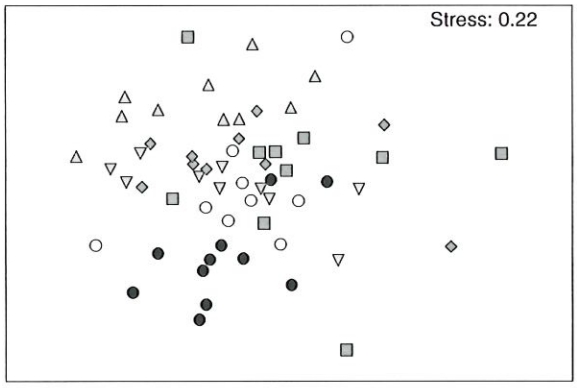

Fig. 5 MDS ordination of assemblages in all samples collected after removal of moorings. Each point represents a single sample. *Pale grey triangles* and *inverted triangles* represent samples from extant buoys (P1 and P2); *dark grey squares* and *diamonds* represent samples from control sites (C1 and C2); *black circles* and *open circles* represent samples from sites from which buoys had been removed (R1 and R2)

areas with buoys still in place were not distinguishable from each other.

Biomass of macrofauna varied significantly from patch to patch and from treatment to treatment (Patch: $F_{6,48} = 5.59$, $P < 0.001$; Treatment: $F_{2,3} = 19.58$, $P < 0.05$). Mean biomass at decommissioned sites was significantly greater than at control sites and sites at which buoys were still present (78.5 g m^{-2} v 13.3 g m^{-2} v 14.6 g m^{-2} respectively; SNK procedure, $P < 0.05$). In control areas, densities of several species, notably *Cerastoderma edule*, *Hydrobia ulvae*, *Cirriformia tentaculata* and *Tubificoides* spp., were considerably different to the initial survey in September 2000 prior to removal of buoys.

Discussion

This study has revealed variation in the impact of mooring buoys relative to control areas at two different times of sampling. In the first sampling programme (prior to removal of buoys), there were clear differences between areas with and without mooring buoys. In the second sampling programme (15 months after removal of buoys), the impact of the buoys was not detectable. After the removal of buoys, the total biomass in areas from which buoys had been removed was far greater than in control areas which had never had mooring buoys and from extant mooring buoys. Assemblage structure in areas from which buoys had been removed also diverged from that in other areas and was statistically distinct from control areas which had never had buoys. The removal of mooring buoys has clearly affected the assemblage. At the time of sampling, however, the assemblage had not converged with control areas, suggesting that if recovery is underway it was not complete after 15 months.

For individual species and assemblage structure, variability was evident at a range of spatial scales, from individual cores separated by tens of centimetre, through patches separated by metres to sites separated by tens of metre. Such variation is common in sedimentary habitats (Morrisey et al., 1992; Hall et al., 1994; Kendall & Widdicombe, 1999). In some cases variation was related to the presence, absence or removal of buoys and in others it was not. Mooring buoys clearly have some impact on the macrofauna of the Medina Estuary, but there are other sources of

spatial and temporal variation which sometimes have a greater impact (Summers, 1980; Thistle, 1981; Savidge & Taghon, 1988; Cadée, 1990; Raffaelli et al., 1990). Moreover, deposition and erosion of sediment are likely to vary over at least annual time scales. Although the number of sediment samples was limited, it is suggested that the effect of the swinging mooring chains scraping over the mud surface may modify sediment composition favouring the greater prominence of larger particles such as gravel and shell fragments. These were certainly more evident in the sediment samples obtained from within the chain radius of the buoys.

Some larger polychaete and bivalve species may have been undersampled with a 10-cm diameter corer. Because of this potential size-bias, densities of some species may have been calculated as significantly higher or smaller than those commonly found in UK estuaries. The abundance of many species, e.g. *Tubificoides* spp., *Nereis (Neanthes) virens*, *Cirriformia tentaculata*, which are likely to be important prey items for wading birds (Prater, 1981), tends to be greater amongst the buoys. However, the tube dwelling amphipod *Corophium volutator*, a filter and deposit feeder on the upper 2 cm of mud surface (Meadows & Reid, 1966; Mermillod-Blondin et al., 2005), was significantly less abundant amongst the buoys compared to control areas. It is possible that frequent scraping by chains could damage burrows or modify sediments preventing adequate construction. *Corophium* was not recorded at any sampling site after removal of buoys; vagaries of life cycle are probably responsible for what it is likely to be only a temporary absence of this generally common species, although interactions with other species and/or changes in background sediment composition are also possible (Hughes & Gerdol, 1997; McCurdy et al., 2005). Differences in the abundance of particular species may be due to changes in the chemical and physical properties of the mud, such as the degree of anoxia and drainage, caused by particle size variability. They could also be due to competition between and within species or to differential predatory activity by birds and fish (Cadée, 1990; Raffaelli et al., 1990). For example, populations of some species may be higher due to reduced predation: fish may be deterred by the movement of chains and some birds may avoid the brightly coloured mooring buoys. Within the chain radius of the buoy, there may be temporal variability in the extent of disturbance and rate of recovery due to the interaction of wind direction, tidal movement and use of the mooring. More complex interactions may be occurring whereby localised small-scale disturbances on mudflats, caused by foraging by predators within areas of high prey density, accentuate the degree of patchiness (Hall et al., 1994). However, in the initial analyses, small-scale patchiness is approximately similar in the vicinity of both buoys and controls: there were no significant differences in the abundance of particular species between sites or patches within either of the treatments. Prior to the cessation of use of these moorings, disturbances of the mud surface may have affected benthic assemblages within control areas outside the chain radius of the buoys and it is possible that these areas may still be recovering.

Although convergence between areas from which buoys had been removed and control areas was not apparent 15 months after decommissioning, there was evidence that assemblages are changing in areas from which buoys had been removed. It is not clear whether convergence will occur or within what time frame. In a study of the recovery of soft sediment assemblages, following physical disturbances of different intensity (Dernie et al., 2003), the fauna within experimental plots took between 64 and 208 days to converge to that of surrounding control areas. The Medina appears to be on a slower trajectory. Given the high level of temporal variation in the system, indicated by the changes observed in the control areas over the two year period, it would be necessary to collect data on a number of occasions prior to and after removal of buoys over an extended period to generate clear-cut evidence of recovery (Chapman, 1998).

Many of the invertebrate species found in this study are important prey items for wading birds (Prater, 1981). The amphipod shrimp *Corophium volutator* and oligochaete worms (*Tubificoides* spp.) are especially favoured by smaller waders such as Redshank and Dunlin. Polychaetes, such as *Cirriformia tentaculata*, *Nereis* (*Neanthes*) *virens* and *Nepthys hombergii*, and molluscs, *Cerastoderma edule* and *Macoma balthica*, are also regarded as essential prey items for larger species such as Oystercatchers, Curlew and Godwits (Burton, 1974; Prater, 1981). A 40% reduction in abundance of *Corophium* in the vicinity of moorings reduces the potential food resource for various species

within the marine protected area. Personal observations suggest that foraging does occur in close proximity; Turnstone (*Arenaria interpres*) was observed feeding both within and beyond areas affected by mooring buoys. In September, when the samples were obtained, there were intermittent large flocks of wading birds on passage in the vicinity. Prater, (1981) suggests depletion of invertebrate stocks occurring from July onwards; however, it would be surprising if significant reduction in prey density within these areas had occurred so early when bird numbers were still relatively low.

The scope of this study was limited to the immediate vicinity of the buoys. The overall ecological impact of chain-scouring on the quality of designated habitat is difficult to quantify without more detailed sediment maps, and there could be interactions with a variety of other disturbances. Even if the locally exaggerated disturbances caused by chain-scouring result in habitat modification, these habitat types may be commonplace in undisturbed parts of the Medina Estuary and elsewhere in the marine protected area. If this is the context, then the impact of the buoys may be considered to be negligible. However, human-induced disturbances of the kind examined may not be acceptable in terms of maintaining favourable habitat or for the protection of scarce species. For example, while these habitats may encourage some birds, they may not be attractive to Black-tailed godwits (*Limosa limosa*), for which the Solent and Medina Estuary have been specially designated, that require a variety of food items including *Corophium* (West et al., 2007).

Scouring caused by anchor chains is just one of several possible impacts of a swinging mooring. The disturbance impact caused by movement of the hull and keel of tethered boats has not been examined and will vary considerably depending on vessel size, hull shape and keel type. The type of impact will also depend on substrate and tidal regime. With increasing pressure for space within designated conservation areas, the impact of different boat mooring configurations may need to be examined and mitigation approaches considered. On the Medina, six intertidal swinging moorings from the inner mooring line and three from the outer mooring line (Fig. 1) were re-laid below extreme low water spring tide mark to offset reclamation of mudflat and dredging disturbances in the upper estuary. In areas where swinging moorings are scattered throughout the intertidal region, zoning schemes that concentrate moorings within defined areas would create larger areas of undisturbed mudflats. Holding boats in line between fixed buoys or 'trot' type moorings would significantly reduce scour effects where this might be considered a problem.

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A simple mooring modification reduces impacts on seagrass meadows

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Moorings can have a detrimental impact on seagrass, fragmenting the meadows, resulting in the habitat degradation. To reduce contact of the moorings with the seabed we attached small floats along the chain of a traditional swing mooring and monitored the ecological impacts of this modified mooring, with reference to a standard swing mooring, in a seagrass meadow under high tidal influence. After three years, seagrass density surrounding the modified mooring was over twice as high as that of the standard mooring, with blade length surrounding the modified mooring also found to exceed that of the standard mooring. Seagrass-associated epifaunal species richness was twice as high surrounding the modified mooring compared to the standard mooring. Sediment composition was considerably finer at the modified mooring, indicative of increased disturbance surrounding the standard mooring. A simple modification to existing swing moorings can mitigate some of the impacts of moorings on seagrass meadows, whilst accommodating for tidal fluctuations. The scale of the differences observed between the mooring types demonstrates the susceptibility of seagrass meadows to damage from swing moorings. Given the ecological importance of these habitats, it is crucial that action is taken to reduce further degradation, such as that demonstrated here.

Shallow, sheltered coastal bays provide ideal conditions for the growth of temperate seagrass meadows, but are also attractive mooring and anchorage sites for boating communities. Anchoring and mooring causes physical disturbance to the seagrass that has a number of deleterious consequences. However, the ecological importance of seagrass habitat is widely recognized, and seagrasses are protected by law in many countries[1]. Therefore, it is often problematic for environmental managers to balance the needs of the maritime leisure industry and conservation obligations, especially when maritime safety is paramount. The most common solution is to provide fixed moorings that negate the need for anchoring, but moorings also cause lasting damage to seagrass[2].

The most commonly used mooring system is the swing mooring, a system that consists of a sinker block on the seafloor, and a heavy chain reaching a surface buoy, on which the boat is secured. The buoy and chain pivot as the boat moves with the changing tide and wind, dragging the chain across the seafloor, resulting in scouring and the creation of 'mooring scars', circular areas of bare ground surrounding the mooring, which can be seen in satellite imagery. Impacts from mooring infrastructure on seagrass meadows have been widely studied, although few studies are undertaken in areas of increased tidal fluctuation, or focus on the seagrass species *Zostera marina*[2].

Seagrass meadows provide key ecological services, these include sediment stabilization and natural coastal defenses during extreme weather, carbon sequestration, nutrient cycling, the provision of fish nurseries and enhancement to biodiversity[3]. Anthropogenic activities including anchoring, mooring, propeller scaring, vessel grounding and dredging have been found to negatively affect the rhizomes and bury seeds thus inhibiting germination and reduce the provision of these ecological services[3]. Impacts to seagrass can also result from extreme weather, invasive species, overgrazing and algal blooms[3]. Physical impacts to seagrass bed substrates can influence microbial communities within the sediments, often leading to the release of CO_2 from blue carbon sinks in the meadow, acting as a contributor to global warming[4]. In addition to this, sediment disturbance can also result in the loss of seagrass meadow stability, leading to increased fragmentation of the meadow, erosion, and a reduction in sedimentation, often resulting in the decline of seagrass cover and a loss of resilience, leaving the seagrass meadows prone to impacts from other stressors[2,5]. Seagrass loss has also been found to effect associated fauna, with negative impacts observed on species density and richness, alongside changes to species assemblage[6,7].

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Impacts on seagrass ecosystems are also expected to have an effect on local fisheries dependent on the high diversity of commercial species supported by seagrass meadows[5,8]. A study by Jackson *et al.*[9] estimated that seagrass associated species contributed approximately 30–40% to the value of commercial fisheries landings, highlighting the economic value of seagrass meadows.

As an approach to reduce anthropogenic impacts on seagrass, various 'environmentally friendly moorings' or 'eco-moorings' have been designed to reduce the detrimental impacts of mooring chains on seagrass meadows. Eco-moorings are primarily designed to reduce chain abrasion on the seafloor, whilst ensuring a secure mooring for vessels in prevailing conditions. The moorings typically consist of two common features; a rode and buoy system designed to reduce contact and scouring of the seafloor, and an anchorage; both features vary in design across different moorings. The rode is often either rope, chain or an elastic tether, a preferred option in areas of increased tidal range. The anchorage can be a concrete block such as those used in swing moorings, or a substrate embedment anchor, which is often preferable due to its reduced ecological impact[10].

A frequently used eco-mooring system is the Ezyrider design, this consists of a chain rode with an elastic riser system, and a displacement buoy that moves up and down a stainless-steel shaft with movement of the vessel. The system also uses ground weights as anchorage, although can be installed with an alternative 'Offset Anchor System' (a three-pronged structure) for more sensitive habitats such as seagrass meadows[10].

An alternative eco-mooring system is the Seaflex mooring buoy, an elastic mooring system that can be used in conjunction with any anchorage, and if used alongside a seagrass friendly anchor could reduce scouring of the seafloor. An example of a seagrass friendly anchor is the Helix anchor, a corkscrew type substrate embedment anchor which boasts minimal disturbance during deployment and use[11]. To date, few eco-mooring trials have been conducted, with limited peer reviewed literature available on the subject, highlighting the novelty of the designs. Furthermore, few are undertaken in areas with large tidal ranges which pose additional threats to trials, and further stressors to the ecosystems; these include seabed exposure during low tide increasing the likelihood of seagrass entanglement and UV degradation of the meadows[10].

Trials of eco-mooring systems undertaken in the UK are typically of Seaflex moorings, due to Seaflex already being an established UK provider and because of the design's reported ability to endure variable tidal conditions. The trials have provided mixed results; with a Seaflex mooring installed in the waters surrounding Lundy island, showing positive results (although their effectiveness was deemed dependent on wave exposure and water depth)[10], and in Mylor Harbour, Falmouth, UK, showing no improvement in the reduction of mooring scars, which was concluded a result of tidal influence[10]. Collectively, these studies emphasize the need for condition specific eco-moorings specifically designed for use in areas with a high tidal range.

To date most eco-mooring trials have been undertaken in Australia, in *Posidonia australis* meadows. These trials have had an overall higher success rate than those in the UK, which may reflect the reduced tidal ranges in the trial locations. A range of eco-mooring designs were tested and showed positive results against their traditional swing mooring counterparts. Screw moorings in Jervis Bay[12], Ezyrider and Seaflex mooring systems all showed a considerable reduction in seagrass meadow scaring. The only design that showed negative results was a Cyclone seagrass friendly mooring, installed in Jervis Bay; which did little to reduce mooring scars[12].

One downside associated with eco-moorings is the potential difficulty of finding an insurance policy to cover the system; a recent report by Amec Foster Wheeler Environment & Infrastructure UK Limited[13] investigated the feasibility of using eco-moorings as management options for Marine Protected Areas (MPAs) in the UK. The study highlighted the lack of an established insurance market for the moorings. It was suggested that eco-moorings would fall under the definition of a swing mooring, and become insured under an existing policy, however the moorings may be assigned a premium for 'new technology' that insurers could be reluctant to cover or charge higher rates for.

In contrast to previous studies detailed above that assessed whether swing moorings could be replaced with new mooring designs, this study examines the effectiveness of simply modifying existing moorings. The study was designed to compare the impacts of a standard swing mooring and a modified swing mooring ("Stirling Mooring", Community Seagrass Initiative) on seagrass density and blade length, species richness, species density, assemblage composition and sediment composition. The study was conducted in a dense seagrass meadow situated in the Salcombe ria, with seagrass typically growing to approximately 1.5 m in length in deeper parts of the channel, with shorter blades in shallower areas of the ria. We hypothesized that increased seagrass shoot density and blade length will be apparent proximal to the modified mooring, compared with the standard mooring, with recovery in areas absent of mooring chain disturbance over time. Significant differences in species assemblage between the moorings was predicted, with increased species richness and density apparent surrounding the modified mooring. Sediment composition was expected to reflect disturbance surrounding the standard mooring, with coarser particles sizes present. The development of this study, which demonstrates a viable mooring modification and quantifies the associated seagrass ecosystem recovery is fundamental in the evolution of seagrass conservation and management.

Results

Cost comparison for installation and maintenance. The mooring was modified at a total cost of £740 (£120 for modifications, £620 for new mooring tackle), which is considered to be a substantially lower cost than alternative eco-mooring designs on the market (cost model estimates of £1,620–£3,200 for components, and installation costs of £600[13]). There would be no anticipated additional maintenance costs for the modified mooring design than for a standard swing mooring, with annual checks required to monitor chain thickness and corrosion, with only additional buoy attachments to check and maintain. The modified mooring design also met the criteria of the existing insurance policy held by the Salcombe Harbor Authority[13].

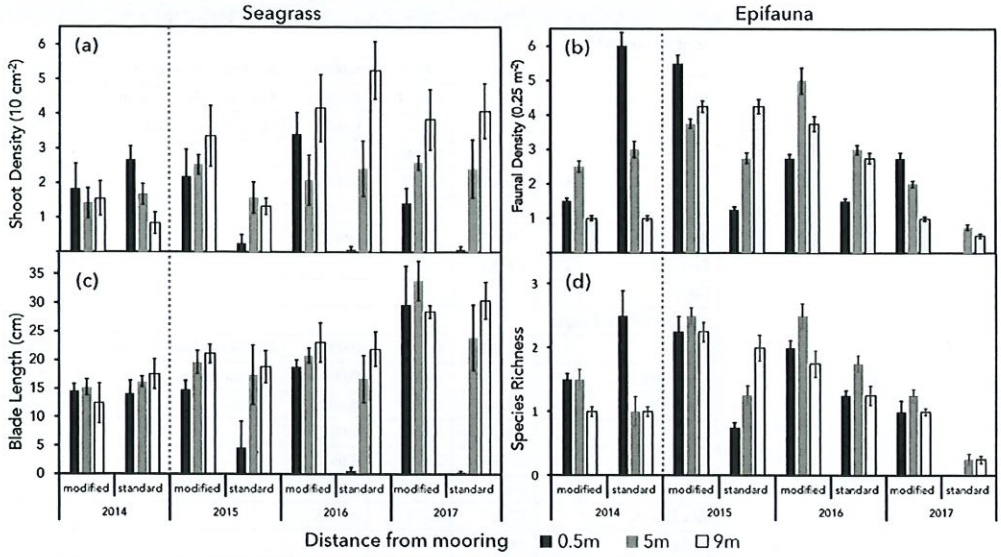

Figure 1. Seagrass (**a**,**c**) and epifauna (**b**,**d**) indicators before (2014) and after (2015–2017) installation of standard and modified moorings in a seagrass meadow, measured at increasing distance from the sinker block: (**a**) seagrass shoot density; (**b**) epifaunal abundance; (**c**) seagrass blade length; (**d**) epifaunal species richness

Seagrass Shoot Density. The average number of shoots in a 10×10 cm quadrat ($0.01\ m^2$) surrounding the standard mooring increased with distance from the sinker block across all years following installation (2015–2017). In the baseline year of 2014, the average number of shoots 0.5 m from the standard mooring sinker block was 2.16 ± 0.39 in $0.01\ m^2$ ($216 \pm 39\ m^{-2}$), with 1.66 ± 0.3 shoots in $0.01\ m^2$ ($166 \pm 30\ m^{-2}$) 5 m from the sinker block. Following the deployment of the standard mooring, the number of shoots at 0.5 m declined to 0.083 ± 0.08 in $0.01\ m^2$ ($8.3 \pm 8\ m^{-2}$) in 2017 and showed a slight increase 5 m from the block to 2.41 ± 0.8 shoots in $0.01\ m^2$ (241 ± 84 shoots m^{-2}) (Fig. 1a).

In comparison, the density of shoots surrounding the modified mooring showed some fluctuation, however, as expected no association with distance can be made. In the baseline year, the average number of shoots 0.5 m from the sinker block was 1.83 ± 0.7 shoots in $0.01\ m^2$ ($183 \pm 72\ m^{-2}$), with 1.41 ± 0.4 shoots in $0.01\ m^2$ ($141 \pm 43\ m^{-2}$) 5 m from the block. After the mooring installment, little change can be observed with 1.42 ± 0.4 ($142 \pm 44\ m^{-2}$) shoots 0.5 m from the mooring, and 2.58 ± 0.2 shoots in $0.01\ m^2$ ($258 \pm 20\ m^{-2}$) 5 m from the mooring in 2017.

At 9 m from the sinker blocks of both moorings, treatments showed a slight incline in seagrass density over time; the standard mooring treatment increased from 0.83 ± 0.3 shoots in $0.01\ m^2$ ($83 \pm 32\ m^{-2}$) in 2014 to an average of 4.08 ± 0.79 shoots in $0.01\ m^2$ ($408 \pm 79\ m^{-2}$) in 2017, with the modified mooring treatment rising from 1.42 ± 0.5 shoots in $0.01\ m^2$ ($142 \pm 50\ m^{-2}$) to 3.83 ± 0.9 shoots in $0.01\ m^2$ ($383 \pm 90\ m^{-2}$).

Differences in seagrass density between treatments ($p = 0.0068$), distances ($p = 0.0001$) and years ($p = 0.0001$) were all statistically significant (Table 1). Pairwise tests conducted on the significant factors revealed a significant difference between the moorings 0.5 m from the sinker block ($p = 0.0004$), with an average shoot density of 0.64 ± 0.3 in $0.01\ m^2$ ($64 \pm 30\ m^{-2}$) 0.5 m from the standard mooring, and 2.21 ± 0.4 shoots in $0.01\ m^2$ ($221 \pm 40\ m^{-2}$) 0.5 m from the modified mooring.

Seagrass Blade Length. At the standard mooring treatment, there was a general increase in blade length with distance from the sinker block; in the baseline year of 2014 (prior to mooring deployment), the mean blade length measured 14.02 ± 2.3 cm at a distance of 0.5 m from the sinker block, and 16.15 ± 0.9 cm at 5 m from the block. Three years after the deployment of the standard mooring, the mean blade length had dropped to 0.25 ± 0.3 cm at 0.5 m from the block and increased to 23.95 ± 5.8 cm at 5 m from the sinker block (Fig. 1c).

The modified mooring treatment blade length remained relatively stable across all distances, whilst showing an increase in blade length over time (2014–2017). In the baseline year of 2014, the mean blade length measured 14.5 ± 1.2 cm at 0.5 m, and 15.18 ± 1.4 cm 5 m from the sinker block. 3 years after deployment, the average blade length of the modified mooring measured 29.72 ± 6.8 cm 0.5 m from the sinker block and 33.9 ± 3.4 cm 5 m from the block (Fig. 1c). Quadrat samples 9 m from the sinker block (away from influence from the chain) remained relatively stable over time, with an increase observed in 2017 in both conditions. Within the standard mooring treatment, 9 m from the sinker block, a mean blade length of 17.51 ± 2.9 cm was observed in 2014, which increased to 30.5 ± 3.2 cm in 2017, and a blade length of 12.41 ± 3.5 cm in 2014 was observed in the modified mooring treatment, which increased to 28.47 ± 1.1 cm in 2017.

Observed differences in blade length between the treatments ($p = 0.0001$), distances ($p = 0.0001$) and over time ($p = 0.0002$) were significant (Table 1). Pairwise tests between the significant factors revealed a significant difference between the moorings 0.5 m from the sinker block, with an average blade length of 4.86 ± 1.9 cm 0.5 m from the standard mooring and 19.46 ± 2.3 cm 0.5 m from the modified mooring.

Source	d.f	MS	F	P	Pairwise Comparison	F	P		
Seagrass Density									
Year (Yr)	3	8.481	5.8947	**0.0001**	Modified Mooring, 0.5 m	4.4474	**0.0004**		
Treatment (Tr)	1	10.845	7.5379	**0.0068**	Modified Mooring, 5 m	0.33883	0.7418		
Distance (Di)	2	20.81	14.464	**0.0001**	Modified Mooring, 9 m	0.62402	0.5304		
Yr x Tr	3	2.8841	2.0046	0.1208					
Yr x Di	6	8.0529	5.5971	0.0001					
Tr x Di	2	4.8466	3.3686	0.0392					
Yr x Tr x Di	6	2.9637	2.0599	0.0685					
Residual	72	1.4388							
Total	95								
Seagrass Blade Length									
Year	3	446.53	11.273	**0.0002**	Modified Mooring, 0.5 m	6.6133	**0.0001**		
Treatment	6	817.37	20.635	**0.0001**	Modified Mooring, 5 m	1.55	0.1342		
Distance	2	864.58	21.827	**0.0001**	Modified Mooring, 9 m	0.47481	0.6359		
Yr x Tr	6	216.31	5.461	**0.0022**					
Yr x Di	72	91.096	2.2998	**0.0418**					
Tr x Di	95	506.9	12.797	**0.0001**					
Yr x Tr x Di		75.005	1.8935	0.0943					
Residual	72	29.611							
Total	95								
Sediment Particle Size									
Treatment	1	14.143	12.196	**0.0042**	Modified Mooring, 0.5 m	6.4589	**0.0286**		
Distance	2	6.5242	5.626	**0.0156**	Modified Mooring, 5 m	1.3583	0.2522		
Tr x Di	2	4.2924	3.7015	**0.0444**	Modified Mooring, 9 m	0.35731	0.7974		
Residual	18	1.1597							
Total	23								
Epifauna Diversity									
Year	3	7.2877	9.1573	**0.0001**					
Treatment	1	10.714	13.463	**0.0005**					
Distance	2	0.36905	0.46372	0.6363					
Yr x Tr	3	1.0258	1.289	0.2862					
Yr x Di	6	0.83532	1.0496	0.3983					
Tr x Di	2	0.46429	0.5834	0.5638					
Yr x Tr x Di	6	0.35913	0.45126	0.8473					
Residual	60	0.79583							
Total	83								
Abundance									
Year	3	7.2877	9.1573	**0.0001**					
Treatment	1	10.714	13.463	**0.0005**					
Distance	2	0.36905	0.46372	0.6363					
Yr x Tr	3	1.0258	1.289	0.2862					
Yr x Di	6	0.83532	1.0496	0.3983					
Tr x Di	2	0.46429	0.5834	0.5638					
Yr x Tr x Di	6	0.35913	0.4126	0.8473					
Residual	60	0.79583							
Total	83								
Assemblage					**SIMPER Test**	**Av.Diss**	**Diss/SD**	**Contrib%**	**Cum %**
Year	3	5691	5.5277	**0.0001**	*Pagurus bernhardus*	39.26	1.27	51.32	51.32
Treatment	1	8118.4	7.8854	**0.0007**	*Gibbula umbilicalis*	22.76	0.91	29.75	81.07
Distance	2	1008.1	0.97919	0.4377	*Tritia reticulata*	7.86	0.5	10.27	91.34
Yr x Tr	3	1935.2	1.8796	0.0608	*Echinus esculentus*	3.36	0.35	4.4	95.74
Yr x Di	6	1151	1.1179	0.3323	*Macropodia spp*	1.4	0.22	1.83	97.58
Tr x Di	2	1293.2	1.2561	0.2862	*Pomatoschistus minutus*	0.61	0.22	0.8	98.37
Yr x Tr x Di	6	695.67	0.6757	0.8198	*Maja brachydactyla*	0.6	0.21	0.78	99.15
Residual	60	1029.5			*Calliostoma zizyphinum*	0.32	0.15	0.42	99.58
Total	83								

Table 1. PERMANOVA examining differences in biological and physical parameters with year, mooring treatment, and distance from mooring, with pairwise tests for mooring treatments and distances where the main test showed a significant interaction. Simper analysis of species contribution to dissimilarity is also included. Bold type denotes a significant result.

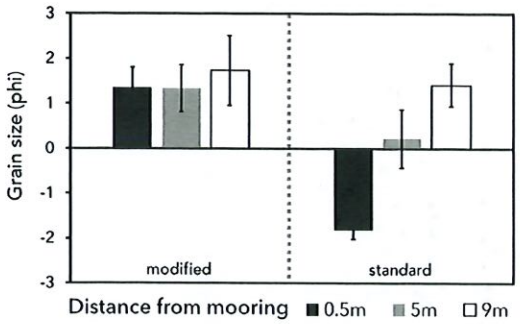

Figure 2. Sediment particle sizes (phi) at increasing distances from each mooring treatment (Udden-Wenworth scale).

Sediment Particle Size. Grain size distribution at the standard mooring was very poorly sorted, dominated by medium to fine sand (53.3%) and fine to coarse gravel (40.8%) (Fig. 2). Mean grain sizes were shown to decrease with distance from the sinker block; samples taken at 0.5 m had a mean phi grain size of $-1.807\ \varphi$, (very fine to fine gravel on the Udden-Wentworth scale), which decreased to $0.221\ \varphi$ (coarse sand) 5 m from the block.

The modified mooring treatment was poorly sorted, with the sample dominated by fine to medium sand (72.8%) (Table 1; Fig. 2). The samples showed minimal fluctuations in grain size with distance, with grain sizes of $1.357\ \varphi$ at 0.5 m and $1.339\ \varphi$ 5 m from the block (medium sand, medium sand).

Quadrats located away from chain abrasion (9 m) showed similar grain sizes; with an average grain size of $1.415\ \varphi$ (medium sand) 9 m from the standard mooring, and $1.739\ \varphi$ (medium sand) 9 m from the modified mooring.

These differences in grain size distribution between treatments were statistically significant ($p = 0.0042$, $p = 0.0156$) (Table 1). Pairwise testing between the significantly different factors showed a significant relationship between the modified and standard mooring treatments 0.5 m from the sinker block ($p = 0.0286$), with the standard mooring having a mean grain size of $-1.807 \pm 1.8\ \varphi$ (very fine to fine gravel), and the modified mooring with $1.357 \pm 0.5\ \varphi$ (medium sand) 0.5 m from the sinker block.

Faunal Density. Epifaunal density surrounding the standard mooring increased with distance from the mooring sinker block and showed an overall decline over time (2015–2017).

Prior to the deployment of the moorings (2014), the standard mooring had an average abundance of 6 ± 0.4 individuals 0.5 m from the sinker block, and 3 ± 0.2 5 m from the block. Following the deployment of the standard mooring, the average number of individuals per 0.25 m2 quadrat declined to 0, 0.5 m from the mooring sinker block in 2017, and 0.75 ± 0.08 5 m from the block (Fig. 1b).

The average number of individuals per quadrat surrounding the modified mooring also showed variation over time, although little relationship with distance can be observed. In the baseline year of 2014 the modified mooring had an average abundance of 1.5 ± 0.09 individuals 0.5 m from the sinker block, and 2.5 ± 0.2 5 m from the block. After the deployment of the modified mooring the species abundance increased in the years 2015 and 2016, peaking in 2015 0.5 m from the block at 5.5 ± 0.2 individuals, followed by a decline in 2017 to 2.75 ± 0.2 individuals 0.5 m from the sinker block, and 2 ± 0.09 individuals 5 m from the block (Fig. 1b). Despite this, the average faunal density remained consistently higher surrounding the modified mooring than the standard mooring post deployment.

Quadrat samples 9 m from the sinker block (away from influence of the chain) showed low faunal density in 2014 for both treatments (standard, modified, 1 ± 0.08, 1 ± 0.08), followed by an increase in faunal density with both samples peaking in 2015 (standard, modified, 4.25 ± 0.2, 4.25 ± 02), and declining in 2017 (standard, modified, 0.5 ± 0.1, 1 ± 0.1) (Fig. 1b).

Species Richness. The number of species surrounding the standard mooring treatment was shown to fluctuate over time following the deployment of the moorings (2015–2017), with the average number of species 0.5 m from the sinker block remaining consistently lower than quadrats 5 m and 9 m from the sinker block.

Prior to the deployment of the moorings (2014), the standard mooring had an average species richness of 2.5 ± 0.4 species per quadrat 0.5 m from the sinker block, and 1 ± 0.2 species 5 m from the block. Following the deployment of the moorings, the average species richness surrounding the standard mooring dropped to 0 species 0.5 m from the mooring sinker block in 2017, and 0.25 ± 0.08 species 5 m from the block (Fig. 1d).

The average species richness surrounding the modified mooring also fluctuated over time, whilst remaining consistently higher than the standard mooring across all distances.

In the baseline year of 2014, the modified mooring had an average species richness of 1.5 ± 0.09 per quadrat, 0.5 m from the block, and 1.5 ± 0.2, 5 m from the mooring sinker block. Three years after the mooring deployment (2017), the average number of species at 0.5 m from the sinker block had declined to 1 ± 0.2 species per quadrat, and 1.25 ± 0.1 species at 5 m from the block (Fig. 1d).

The average species richness 9 m from the standard mooring sinker block (away from chain disturbance) showed a slight decline over time, from 1 ± 0.08 species per quadrat in 2014, to 0.25 ± 0.05 species in 2017.

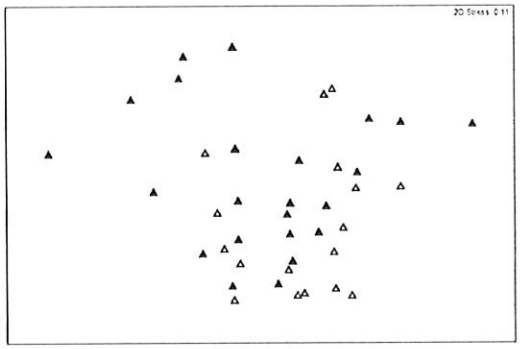

Figure 3. Multidimensional scaling plot based on Bray-Curtis similarity resemblance matrix of epifaunal assemblages around the standard (filled) and modified (unfilled) mooring treatments.

The species richness 9 m from the modified mooring peaked at 2.25 ± 0.2 species in 2015, then dropped to 1 ± 0.06 species in 2017.

Assemblage. The assemblage composition significantly differed between mooring Treatment ($p = 0.0007$) and Year ($p = 0.0001$) (Table 1). The assemblage composition was more dispersed for the standard mooring than the modified mooring (MVDISP: Standard 1.091, Modified 0.909, Fig. 3). The species driving the differences between treatments were *Anemonia viridis*, *Pagurus* spp. and *Gibbula umbilicalis*. *G. umbilicalis* and *Calliostoma zizyphimum* were the only species with greater abundance in the standard mooring compared to the modified mooring, two species were found in similar abundances between treatments (*Tritia reticulata*, *Pomatoschistus minutus*), while the majority (six species: *Anemonia viridis*, *Pagurus bernhardus*, *Echinus esculentus*, *Macropodia* spp, *Maja brachydactyla*) were found in greater abundances in the modified mooring.

Discussion

This study confirms the negative impacts that standard swing moorings can have on sensitive seagrass ecosystems[2], but also shows that these impacts can be mitigated through simple modification of existing moorings. A new and relatively simple modification to a swing mooring has proven successful in the reduction of chain contact with the seafloor, leading to reduced environmental impacts across multiple biological and physical parameters. The study was conducted within an established dense seagrass meadow in the Salcombe ria; the data collected indicates the Salcombe ria seagrass meadow to be a typical dense meadow, with species density, richness and assemblage characterizing the typical ecology representative of a seagrass meadow in the UK.

The mooring modifications and installation costs were considered substantially lower than for alternative designs, costing a minimum of 67% less than alternative eco-mooring designs on the market (cost model estimates of £1,620 - £3,200 for components, and installation costs of £600[13]). The modified mooring design also met the criteria for the existing insurance policies[13] suggesting that a modified swing mooring design may instill increased confidence in insurance companies, due to their confidence in the traditional swing mooring. It is suggested, that alongside a targeted educational program directed towards regulators and the public, reduced costs and the availability of insurance policies for the moorings, the public would be encouraged to modify traditional swing moorings to reduce mooring impacts on seagrass beds.

The study found that seagrass density and blade length both increase with distance from the standard mooring as hypothesized, with a weaker correlation observed in the modified mooring treatment. This indicated substantially reduced scouring impacts on seagrass in the modified mooring treatment, compared to the standard mooring. An increase with distance in both parameters was still evident in the modified mooring treatment, however to a significantly lessened extent. Seagrass recovery was evident over time (2014–2017) in the modified mooring treatment (after modification of a swing mooring) in blade length and faunal density, indicating that the replacement of current swing moorings could reduce fragmentation of seagrass meadows caused by moorings, and encourage recoverability of the ecosystem.

The highest degree of impact across both parameters (density, blade length) was observed 0.5 m from the standard mooring sinker block, as hypothesized. A lessened degree of disturbance 5 m from the block was also observed, with minimal disturbance at 9 m indicating that any acute impacts on the seagrass meadows from the standard mooring were localized. These results are reflected in a study by Unsworth, *et al.*[2], who observed a similar linear gradient with 79% of quadrats located 0 m from a swing mooring containing no seagrass. Unsworth, *et al.*[2] documented impacts up to 20 m from the mooring in the study, suggesting a larger impact area beyond the extent of the mooring chain and scarring area. However, despite this, seagrass degradation as a result of mooring impacts appears to occur on a localized scale, this is considered substantial due to damage occurring in the center of the seagrass meadows, often resulting in habitat fragmentation reducing the resilience of seagrass to additional stressors.

Sediment grain size distributions supported the hypotheses suggesting significantly different sediment compositions between treatments (S.D $p < 0.05$); the sample closest to the standard mooring showed coarser grain sizes, with finer grains in locality to the modified mooring as predicted. Disturbance from mooring chains scouring the seafloor has the potential to resuspend small grains, modifying the sediment composition favoring larger

grain sizes such as shell fragments and gravel[6]. The resuspension of fine particles can also increase water turbidity, reducing sunlight and consequently seagrass photosynthesis and growth[14].

Changes in sediment composition can also be linked to seagrass density, with reduced density resulting in a lack of sediment trapping and retention, leading to coarser sediment compositions[15]. In the present study, the sediment particle sizes 0.5 m from the standard mooring in 2017, in areas of low seagrass density were coarser than in quadrats 9 m from the mooring sinker block in areas of increased density, suggesting seagrass density may have had an influence on sedimentation rates. A similar relationship was also observed between sediment size and seagrass blade lengths 0.5 m from the moorings, with finer sediment particle sizes and longer blade lengths local to the modified mooring, compared to the standard mooring, suggesting that long seagrass blades may trap fine sediment particles, leading to an increase in sedimentation in the area. Increased sediment deposition in seagrass meadows, encourages the sequestration of organic carbon, contributing to the reduction of greenhouse gases[15,16].

It is important to note that factors such as coastal development and land use changes can also influence sediment sizes and composition, and the extent of influence would need further research. However, the current study appears to show strong correlations between mooring disturbance, sediment changes and seagrass density and blade length.

Overall, the findings indicate a high degree of disturbance surrounding the standard mooring, compared with the modified mooring, which showed little impact on the surrounding sediment. Species richness, density and assemblage were found to be statistically different between treatments as hypothesized, suggesting a difference in habitat or ecological features of the sites. Increased species richness and abundance surrounding the modified mooring were evident, implying greater biodiversity supported by increased density and blade length of seagrass surrounding the modified mooring.

Similar findings were found by McClosky and Unsworth[6], who reported increased faunal density and species richness in areas of high seagrass cover. Bowden *et al.*[17] and Collins *et al.*[18] also found a decline in species richness and density in unvegetated mooring scars.

A decline in species richness and density surrounding the standard mooring may be a result of species preference for high density seagrass, which offers increased cover from predators; McClosky and Unsworth[6] suggested that species such as Plaice were found to prefer bare substrate, due to difficulty locating prey in dense seagrass meadows.

Moreover, the effects of interspecies and intraspecies competition must be acknowledged as an influential factor in changes in species richness, this could be emphasized as a result of increased species concentration in seagrass meadow fragments[19].

Species habitat preferences may also have influenced the observed differences in species compositions between the mooring treatments. McClosky and Unsworth[6] suggested independent species preferences for bare or vegetated substratum, with observations of Sand Gobies and Plaice preferring to inhabit areas of bare substratum, whereas many juvenile commercial fish species showed a preference for dense seagrass meadows.

It is worth noting that this study was conducted in a single seagrass bed, with only one experimental unit of each mooring type, therefore it is recommended that further spatially replicated experiments are undertaken, in order to confirm the results of the current study. The challenge now is to convince managers and boat owners to modify their swing chain moorings to enable damaged seagrass meadows to recover and restore their associated ecosystem services. Local targeted education programs for regulators and the public could help to raise awareness about the importance of seagrass meadows, the damage that is being caused and how a simple modification to moorings can result in positive recovery for this important habitat. In addition, statutory legislation should be implemented to reduce further human induced degradation of seagrass meadows worldwide.

Conclusion

The current study demonstrates a cost-effective approach to reduce mooring impacts in seagrass meadows and highlights the destructive potential of traditional swing mooring systems.

In contrast to previous studies describing new 'eco-mooring' designs, this paper has offered a low-cost approach through the modification of an already existing swing mooring. The modified mooring successfully reduced chain abrasion of the seafloor, using floats to lift the mooring chain off the seabed at low tide, and greatly reduced the associated negative impacts on the seagrass ecosystem without compromising the integrity of the mooring.

Methods

The study site was situated in the Salcombe ria, UK, chosen because of its combination of established dense seagrass meadows skirting the channel, and intense boating activity all year round. The site has a strong tidal influence, with a tidal range of 5.5 m and a depth of 10 m in the deeper parts of the channel. The experimental treatments, a modified swing mooring and a standard swing mooring, were located 76 m from the shore, and 60 m apart, and installed at low tide on the 18th April 2014. The alterations to the mooring cost £120, in addition to this, mooring tackle was replaced at a maximum cost of £620. Maintenance requirements for the mooring include monitoring chain thickness, corrosion and buoy attachments, with associated costs predicted to align with those for standard swing mooring designs.

Treatment Descriptions. The first treatment comprised of a standard swing mooring, reinstalled in 2014. The mooring consisted of a 1 tonne tyre sinker block and eye, placed on the seafloor, with 1 m of 25 mm stainless-steel chain leading off it. The chain was shackled to a light 19 mm chain, which reached 12.5 m from the sinker block, and was shackled to a 90 cm surface mooring buoy (Fig. 4).

The second treatment was a swing mooring, modified to reduce impact on the seafloor from the stainless-steel chain. The mooring was configured of a 1 tonne tyre block and eye, with 0.5 m of 32 mm Old Jump that rests on

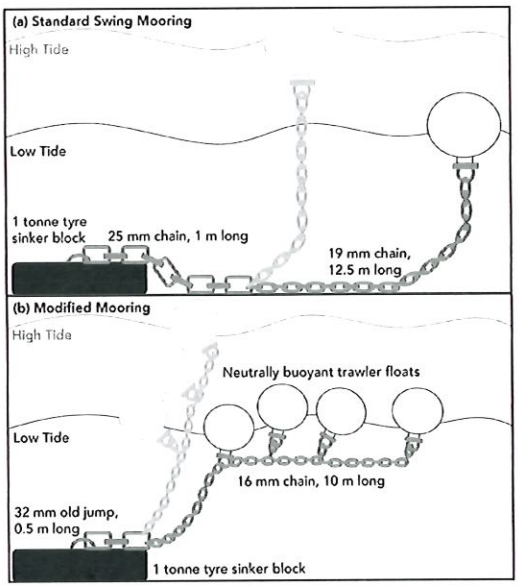

Figure 4. Diagram of a standard mooring (**a**) and modified mooring (**b**) treatments, showing position of the mooring floats and chains at high tide (light grey) and low tide (dark grey).

top of the block. Leading off this was 10 m of 16 mm chain, shackled to which were trawler floats, which kept the chain elevated during high and low tides (Fig. 4).

Sampling Procedure. Data for this study were collected through the citizen science project, the Community Seagrass Initiative[20]. To limit potential inconsistencies between divers, all Community Seagrass Initiative volunteers were subject to training beforehand.

Measurements of seagrass shoot density, blade length, and faunal density were collected around each mooring by a team of 5 dive pairs. Measurements of each variable were taken at three distances along a transect from the sinker block: 0.5 m, 5 m and 9 m. Each transect was replicated across four bearings of NE, SE, SW and NW, providing four replicates at three distances from each mooring. Data were collected from 2014 to 2017 in March of each year (to eliminate seasonal influence) except for 2017, when collections were delayed until May because of poor diving conditions. The distance of 0.5 m represented a zone of direct impact, 5 m the near impact zone, and 9 m, an area away from any influence from the chain.

At each sampling location, a 0.25 m^2 quadrat was placed over the transect line, and photographed after any disturbed sediment had settled, using a Gopro Hero 4 camera.

The following parameters were recorded in the field:

1. The length of 10 haphazardly selected seagrass blades (cm) within a 0.25 m^2 quadrat.
2. The number of seagrass shoots in 3 random 0.01 m^2 squares of the quadrat.

In 2017, additional parameters were investigated through the collection of sediment samples; samples were collected in 125 ml sample pots from the center of the quadrat, which were then sealed and chilled in a lab at 4 °C for further analysis.

Sediment Sample Particle Size Analysis. Sediment particle size analysis was undertaken in accordance to the NMBAQC's Best Practice Guidance for Marine Sediments[21]. Samples were mixed thoroughly, and subsamples of approximately 5 ml of the sample obtained with a spatula. Material >1 mm and <1 mm was separated using a 25 mm diameter 1 mm sieve, a vial funnel and a 12 ml vial. A pressurized water spray was used to aid this process.

For each sample, 5 replicate vials were made, and placed methodically in a sampling rack, with the vial locations noted. The sampling rack was then placed in the Malvern Mastersizer 2000 (general analysis model with irregular particle shape and enhanced sensitivity, reference index of 1.53) for laser diffraction. The instrument was set to run 5 replications on each sample.

Samples were refrigerated until settlement had occurred, and any excess surface water was drained from them. For each sample, a 250 ml and a 100 ml beaker were assigned labels by proxy. The 250 ml beakers were weighed to 2 dp and noted. Approximately 30 ml of the sample was sieved through a 1 mm mesh into a funnel held over the 250 ml beaker. A small sieve brush and a fine water spay were used to aid the sieving process, depositing material <1 mm into the 250 ml beaker. Any sediment >1 mm left on the surface on the sieve was deposited into the 100 ml beaker. Both beakers (250 ml and 100 ml) were then dried in an oven for 48 hours at 105 °c.

Following this, the 250 ml beaker was then reweighed, to determine the weight of the material <1 mm. The material in the 100 ml beakers was dry sieved using 16 mm to 1 mm sieves, at half phi intervals, and the weights recorded.

Epifaunal Analysis. Images taken of the quadrats were analyzed alongside diver observations, and epifaunal species identified to the lowest taxonomic level. Both sessile and mobile epifauna were recorded, and the species richness and density per quadrat noted.

Statistical Analysis. Statistical analysis was conducted using PRIMER 7 with PERMANOVA[22,23]. The threshold for determining statistical significance was set at $P < 0.05$. Variability of the data is reported as standard error about the mean.

The data for variables seagrass blade length, shoot density, and sediment composition were first calculated and arranged into a resemblance Euclidian distance matrix to show the similarity or dissimilarity between each pair of data, as coefficients. Permutational multivariate analysis of variance (PERMANOVA) was used to determine differences in variables. Pairwise tests were then conducted on the statistically significant variables to identify where the differences occurred.

The epifaunal data were subject to resemblance testing, for faunal density, species richness and assemblage variables, using the Bray Curtis technique. A dummy variable of 1 was assigned to the data to aid distinction between the treatment groups. Multivariate dispersion (MVDISP) was then used to assess dispersion of the significant factors, and the resemblance matrix data visualized in an nMDS (non-metric Multi-Dimensional Scaling) plot, providing a graphical representation of how the variables relate to one another. Next PERMANOVA tests were then performed on the resemblance data, to determine the statistical significance of the data. The statistically different ($P \leq 0.05$) factors were then further analyzed with SIMPER tests, to identify the discriminating species between the treatment (modified mooring and standard mooring) and year (2014, 2015, 2016, 2017) factors.

Data availability

The datasets generated during and analyzed during the current study will be archived in the Marine Biological Association repository (DASSH, The Archive for Marine Species and Habitats Data), and made available via the MEDIN (Marine Environmental Data and Information Network) portal (https://portal.medin.org.uk/portal/start.php).

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Author contributions
Nicholas Higgs, Mark Parry and Emma Sheehan designed the study. Mark Parry and Anna Luff collected data. Anna Luff, Nicholas Higgs and Emma Sheehan analyzed the data and wrote the manuscript.

Competing interests
The authors declare no competing interests.

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